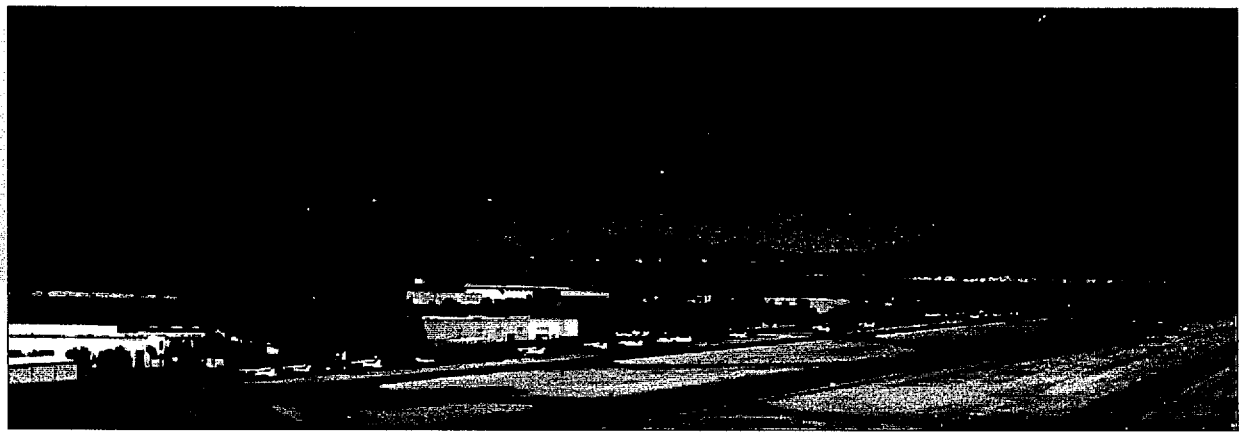
Chapter 2

AVIATION DEMAND FORECASTS

AVIATION DEMAND FORECASTS

Airport Master Plan

Chapter 2



The proper planning of a facility of any type must begin with a definition of the needs that the facility can reasonably be expected to serve over the specified planning period. At Scottsdale Airport, this involves the development of a set of forecasts that may best define the potential of future aviation demand. Forecasts of aviation activity at the airport can be used as a basis for determining the types and sizes of facilities required to meet the aviation needs of the airport's service area through the year 2015.

The primary objective of a forecasting effort is to define the magnitude of change that can be expected over time. Because of the cyclical nature of the economy, it is virtually impossible to predict with certainty aviation activity on a year-to-year basis over an extended period of time. A growth curve can be established, however, to predict the overall long-term growth potential.

While a single line is often used to express the anticipated growth, it is important to remember that actual growth may fluctuate above and below this line; actual growth in activity seldom follows a simple straight line or mathematical curve.

It is also important to recognize that forecasts serve only as guidelines, and planning must remain flexible to respond to unforeseen events. Aviation activity at an airport is influenced by many external factors, as well as by the facilities and services available. Since its inception, few industries have seen as dramatic a change as the aviation industry. Major technological advancements, regulatory and economic actions, and artificial infusions of pilots as a

result of armed conflict, have resulted in erratic growth patterns placing significant impacts upon aviation activity.

The following sections attempt to define historical aviation trends and discuss other influences which may affect the future use of Scottsdale Airport. The results of these analyses are presented as the "best estimate" or selected forecasts for the facility.

In addition, it must be realized that the forecasts presented in this chapter are "unconstrained" in nature. The existing physical or policy constraints at Scottsdale Airport will not be taken into consideration during the development of these forecast numbers. The Development Alternatives Chapter will begin to address the physical and policy constrains and will identify the "constrained" aviation forecast, if applicable.

FORECASTING METHODOLOGY

The systematic development of aviation forecasts involves both analytical and judgmental processes. A series of mathematical relationships are tested to establish statistical logic and rationale for projected growth. The judgement of the forecast analyst, based upon professional experience and knowledge of the situation, is important to the final determination of the selected forecast.

The most reliable approach to estimating aviation demand is through the utilization of more than one analytical technique. Methodologies frequently considered include: trendline projection, correlation analysis, regression analysis, and market share analysis.

The analysis begins with the assessment of historical trends as data is collected and sorted on a variety of aviation indicators at the local, regional and national level. Data on aviation related factors such as aircraft operations, based and registered aircraft, and passenger enplanements were obtained for the analyses. Similarly, socioeconomic factors such as population, income and employment are also analyzed for their effect on aviation activity. The identification and comparison of the relationships between these various indicators provides the initial step in the development of realistic forecasts of aviation demand.

Trendline projection is probably the simplest and most familiar of the forecasting techniques. By fitting classical growth curves to historical demand data, then extending them into the future, a basic trendline projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections. It is also important to remember that this methodology is time sensitive and only as accurate as the data points entered into the formula.

Correlation analysis provides a measure of direct relationship between two separate sets of historical data. An analysis is run which determines whether a

change in one data base has historically reflected a corresponding change in the other data base. Should a reasonable correlation between the two data sets be determined, a regression analysis would then be employed to forecast future changes to one of the data bases. The relationship between two data bases is considered to be reliable when the resulting R^2 value is close to 1.0. The R^2 value can be considered the relationship value: the higher the number, the stronger the correlation between the data bases, the lower the number, the weaker the relationship. Low R^2 values mean that the two data bases are not related and that changes in one data base are not reflected by changes in the other data base. Forecasters prefer to see R^2 values of greater than 0.95; however, lower numbers can be used provided that it is recognized that the reliability of the correlation is not as strong.

In *regression analysis*, values for the aviation demand element such as based aircraft, operations, etc. (the dependent variable), are projected on the basis of one or more of the other indicators such as population, per capita income, etc. (the independent variables). Historical values for all variables are analyzed to determine the relationship between the independent and dependent variables. These relationships may be used where projected values of the independent variable(s) are available, to project corresponding values of the dependent variable.

Market share analysis involves an historical review of the activity at an airport or airport system as a percentage share of a larger statewide or national aviation market. A trend analysis of the airport's historical share of the market is followed by projecting a future market share. These shares are then multiplied by forecasts of the activity within the larger geographical area to produce a market share projection. This method has the same limitations as a trendline projection, but can provide a useful check on the validity of other forecasting techniques.

In addition, another "cross-check" technique is to review and consider the forecasts made by other agencies. Although these agencies often utilize different data bases and variables, they generally use the same general techniques for forecasting aviation activity. This review of other forecasting efforts, can assist in making subjective judgments concerning short-term forecast trends.

Using a broad spectrum of local, regional, and national socioeconomic information, surveys and aviation trends, forecasts were developed for several key aviation activity categories, including the following.

- General Aviation Based Aircraft
- Based Aircraft Fleet Mix
- General Aviation Aircraft Operations
- Passenger Enplanements
- Commercial Service Operations
- Annual Instrument Approaches
- Peaking Characteristics

The forecasting process also considers various other growth elements and several intangible factors before deter-

mining the selected forecast. These additional factors include the following.

- Uses for which the forecast is being developed
- Character of the community and service area
- Potential changes in the general business environment
- State-of-the-art advances in aviation related technology
- Impact of new facilities or improved services
- Policies of the airport owner and operator

For planning purposes, two important considerations impact the finalized forecasts. First, due to both economic and technological changes, one cannot assume a high level of confidence in forecasts that extend beyond five years; however, more than five years is often needed to complete a facilities development program, and at least twenty years is necessary to adequately amortize most capital improvements. The second consideration is the level of optimism reflected in the forecasts; aviation forecasting typically indicates some growth in the use of the facility, regardless of recent historical activity. This allows for comprehensive planning of the airport facility. To counter this unrestricted growth, the planning efforts to follow (i.e. Facility Requirements) must incorporate a degree of flexibility that will be responsive to deviations from the selected forecasts (i.e. timing of facility improvement and upgrades).

TRENDS AT THE NATIONAL LEVEL

Each year, the FAA publishes a national forecast of aviation activity. Included in these projections are categories for air carriers, air taxi/commuters, general aviation, and military activity. The forecasts are prepared to meet budget and planning needs of the constituent units of the FAA, and to provide information that can be used by state and local authorities, the aviation industry, and the general public.

The current edition of the *FAA Aviation Forecasts, Fiscal Years 1994-2005*, was used as a basis for the development of a series of forecasts for Scottsdale Airport. A synopsis of the FAA report of both existing and anticipated future conditions in the aviation sector is presented in the paragraphs that follow.

GENERAL AVIATION

As World War I ended in late 1918, thousands of military aircraft were sold as surplus. These aircraft were purchased by former World War I pilots who became known as "barnstormers", putting on airshows and providing rides for the local community. The passage of the Air Commerce Act in 1926 required the licensing of pilots as well as aircraft maintenance regulations, thus ending the era of the barnstormer. A number of these former barnstormers established businesses known as fixed based operators (FBOs), providing flight instruction, aircraft sales, fueling, and maintenance.

In the 1920's, Wichita Kansas became known as the "largest natural airport" because of the vast area of flat terrain. The start of private aircraft manufacturing began here with the Weaver Aircraft Company (WACO), soon to be followed by the Travel Air Manufacturing Company. In the 1930's, Wichita became the home to the Beech Aircraft Corporation and Cessna Corporation.

After World War II, the term "general aviation" was coined to remove the imagined onus of the term "private flying" from the industry. General aviation denoted aviation used for vital, useful, general purposes, much like the private automobile. In the late 1940's, the general aviation manufacturers began to look at the development of aircraft to be used as reliable business transportation. This idea did not catch on until 1953, when the light twin engine aircraft started to become popular.

By the end of the 1950's, the light plane industry was starting to reach maturity. This continued through the 1960's with the development of a wide-range of light single and twin engine aircraft. By this time general aviation became a major part of the country's transportation system, with an inventory of light aircraft that was fully capable of flying 1,500 miles comfortably.

Today, general aviation continues to dominate the aviation industry. In 1992, there were a total of 17,846 airports/ heliports available for general aviation aircraft, of these only 664 airports were served by scheduled airlines. In terms of active aircraft, there were a total of 184,433 active general aviation aircraft in 1993, compared to 4,200 commercial jet aircraft and 6,200 military aircraft. Of the 682,959 certificated pilots in 1993, general aviation accounted for nearly 84 percent of the total. In 1992, general aviation operations accounted for approximately 100.8 million, nearly 75 percent of the total 134.7 million operations.

Since the 1960's, a number of changes have occurred in the general aviation industry which have affected and continue to affect the future growth rate of general aviation. Historically, the economic cycle of the general aviation industry closely paralleled that of the nation's economy. Theories abound as to why the numbers of aircraft sales and pilots have not responded to the recent economic growth in the early 1990's. Some cite the high aircraft costs, which have continued to increase even during periods of relatively modest inflation. Others cite high operating and increased liability costs. In addition, the Veteran's Bill (G.I. Bill), which provided financial assistance for flight training, expired resulting in the number of pilots to no longer be artificially supplemented by retired armed services personnel.

On a positive side, however, recent legislation on manufacturers liability has stimulated the interest in the resurrection of general aviation aircraft manufacturing. The last decade has seen a dramatic growth in the development of "kit" or "home-built" aircraft. In addition, use of general aviation aircraft by business is on an increase. As a result, the character of the general aviation fleet continues to change. The more

expensive and sophisticated turbine-powered component of the general aviation fleet is expected to grow much faster than piston aircraft.

According to the FAA Forecasts, Fiscal Years 1994-2005, single engine piston aircraft are projected to decrease in the short-term from 143,580 in 1993 to 131,100 in 1998 and remain relatively stable during the remaining forecast period. The short-term decline is anticipated to be due to the large numbers of retirements and/or shifts to nonactive status of many of the older aircraft in the general aviation fleet. Multi-engine aircraft are also expected to decline in the short-term from 18,536 in 1993 to 17,300 in 1998. The multi-engine fleet is, however, expected to increase slightly during the remainder of the forecast period, to 17,600 in 2005. Reflecting the increased convenience of general aviation flying to businesses and their push for technology, turbine-powered aircraft are projected to increase by an average annual growth rate of 2.4 percent, from 3,541 aircraft in 1993 to 5,800 aircraft in 2005.

AIR CARRIER AND REGIONAL/ COMMUTER AIRLINE TRENDS AND FORECAST

October 1994 marked the sixteenth anniversary of the Airline Deregulation Act, perhaps one of the most important events in aviation history. Since enactment of this legislation, we have witnessed a number of significant structural and operational changes in the commercial aviation industry. During this period, the air carrier industry has gone through three distinct phases (expansion, consolidation and concentration) and begun the fourth (globalization).

The initial phase of deregulation was characterized by the expansion of the airline industry. After the Airline Deregulation Act of 1978, a record number of new airlines entered the marketplace. The number of large air carriers grew from 30 to 105. The new airlines include America West, Southwest and USAir.

With competition among airline companies being fierce, there was a proliferation of low air fares to stimulate demand and to compete with the low fares offered by airlines such as Southwest and Morris. These low fares were partially responsible for the dramatic increase in passenger traffic in the 1980's. During this period, many smaller markets experienced improved air service with increased flight frequencies through connecting hub airports to multiple destinations. The onset of airline hubbing at an airport translated into substantial investment into communities across the nation. Although initially rejected by the flying public as inconvenient, the "hub and spoke" system of airline travel has since become the norm.

Growth in the late 1970's through mid 1980's led the airline industry to continue to invest in new aircraft, technology and the hub-and-spoke concept. These strategies were premised on continued robust airline passenger traffic demand; however, this demand began to diminish and the nation be-

came involved in an economic recession. As a result, between the late 1980's and early 1990's, 115 airline companies either ceased to exist, merged with other airlines, downsized their service to a regional/commuter status, or filed for protection under the Chapter 11 bankruptcy laws. In an effort to remain afloat in the 1980's and early 1990's several airline companies merged. This trend of consolidation among the larger airline companies in continuing.

The regional/commuter airlines have experienced similar changes as a result of industry expansion, with the number of carriers increasing from 210 in 1978 to 250 in 1981, then declining through 1993 to 136. In an effort to consolidate operational costs, the regional/commuter airlines have become increasingly integrated with the large, scheduled air carriers through code-sharing agreements. Another emerging trend is the actual acquisition of some of these regional airlines by their larger partners as they develop profitable route structures.

The latest strategy emerging from the airlines is that of "concentration." In effect, the airlines are becoming increasingly sensitive to regional, national and global passenger traffic trends, and are seeking to maximize the profitability of individual routes. With consolidation, a greater concentration of airline market share has occurred. The four largest U.S. carriers accounted for 60 percent of the domestic revenue passenger miles in 1990, compared to 52.5 percent in 1978. The three largest U.S. carriers (American, United and Delta) now carry over half of the domestic traffic.

The industry trend of concentrating on successful markets has also impacted the airlines aircraft orders, including sales and leasing. Only a few years ago, the airlines continued ordering new and larger aircraft. In part, these orders were necessary to replace the Stage 2 aircraft fleet with quieter Stage 3 aircraft by the legislated date of December 31, 2003. Many aircraft orders, however, were placed when short-term national and worldwide growth in passenger traffic was still expected to be strong.

Recently though, new orders for aircraft have focused on reducing excess seating capacity by utilizing more narrow-bodied aircraft. This trend is reflective of industry concerns over future passenger traffic demand and market concentration. As an example, the Boeing company has recently slowed production of its 777 aircraft, and McDonnell Douglas has reduced is manufacture of the MD-11.

Commuter airlines have stepped up to place new orders in the regional jet market with passenger seating capacities in the 40+ seat range. This represents a significant upscaling of the regional/ commuter fleet from the standard 19 to 40 seat range of the recent past. The Canadair Regional Jet, the Folker 70, and the EMB-145 regional jet are examples of new aircraft expected to fill a niche in regional air travel route structures.

The U.S. commercial aviation industry recently entered into a fourth phase of the deregulation process -- Globalization. This, combined with other "free market" movements around the world, such as the deregulation of the European Common Market in December 1992 and the political shift in the former Soviet Bloc Nations, opens up the possibility of the creation of multi-national "mega-carriers" throughout the world. With the dramatic increase of international mergers and alliances since 1989, some have predicted that there will only be a dozen world airlines by the twenty-first century. The race among the world's air carriers is now on to see who can put together the most effective global system.

Global airline strategies include marketing agreements, "code-sharing" and/or equity stakes in other carriers. What this means for the commercial aviation industry is currently open to speculation. One thing is certain, however, the airline industry worldwide will continue to exhibit strong growth rates well into the twenty-first century. Also, the U.S. experience with code-sharing agreements between the large air carriers and regional/commuters suggests that the smaller carriers benefit from working relationships with the larger airlines. In future years, the same could be true for competition in international markets.

OTHER AVIATION STUDIES

In order to develop aviation forecasts for Scottsdale Airport, other aviation related documents were reviewed. Each of the following studies provides an insight to the anticipated levels of various aviation related activities. Each of the studies are briefly summarized in the following sections.

1985 SCOTTSDALE AIRPORT MASTER PLAN

The last airport master plan completed for Scottsdale Airport was conducted in 1985. As was stated earlier, the aviation industry has evolved through many changes since this document was prepared; however, the projected aviation activities are described in the following paragraph.

The operations at Scottsdale Airport were anticipated to reach 310,000 annual operations by 2005, although the "unconstrained" demand was determined to be approximately 450,000. The difference in operations is due to the limited airport property and anticipated air traffic congestion in the area. The "unrestricted" forecast for the number of based aircraft was determined to be 1,000 by 2005. Once again, due to the limited amount of airport property, only 750 based aircraft could be accommodated.

The Master Plan identified a number of improvements that would be needed to meet this anticipated growth. These improvements were examined in a number of alternatives, of which the recommended alternative included the construction of additional T-hangars, tiedowns, the development of a helicopter operating area, and the development

of approximately 11 acres of commercial/industrial property.

FAR PART 150 STUDY

In 1985, in conjunction with the Master Plan, a Federal Aviation Regulation (FAR) Part 150 Noise Compatibility Study was completed for Scottsdale Airport. The purpose of this document was to determine the noise impacts on surrounding land uses and, if necessary, recommend changes to the flight patterns or operational restrictions to potentially reduce these impacts. The recommendations from this Study included both operational changes and changes to existing zoning ordinances and General Plans.

During the development of the FAR Part 150 Study, forecast of aviation activity at Scottsdale Airport was determined in the Airport Master Plan. Using 1982 as a base year, aircraft operations were projected out to the year 2005.

MARICOPA ASSOCIATION OF GOVERNMENTS REGIONAL AVIATION SYSTEM PLAN

Regional aviation planning for the Maricopa County area is accomplished by the Maricopa Association of Governments (MAG). In 1990, MAG began updating the Regional Aviation System Plan (RASP), which was completed in December 1993.

The RASP identified the forecast based aircraft and operational levels anticipated at Scottsdale Airport by the year 2015. By the year 2015, the projected number of based aircraft and operations are 475 and 300,000, respectively. This would indicate an average annual growth rate (1994 to 2015) of 0.9 percent in based aircraft and 0.5 percent in operations. These forecast numbers were also used in the 1995 "Draft" Arizona State Aviation Needs Study (SANS).

POLICIES AND ISSUES

Scottsdale Airport is owned and operated by the City of Scottsdale. As such, the airport is under the scrutiny of the City's political process. Over the years, a number of policies have been established that affect the expansion of Scottsdale Airport. These issues are briefly described in the following paragraphs.

In 1977, the potential for constructing a parallel runway at Scottsdale Airport was examined. At this same time, the proposed runway extension to the north was being debated. A majority of the City Council approved the runway extension; however, they disapproved the possibility of providing a parallel runway in the future. Since that time, major commercial/industrial development has occurred adjacent to the airport and has, for the most part, physically and economically eliminated the possibility of constructing a parallel runway at Scottsdale Airport.

Under current City Ordinance, the existing runway width is restricted from expansion. The Ordinance states that

no alterations or modifications are permitted to the runway width. As stated in Chapter One, Inventory, the runway weight bearing capacity is also restricted by city ordinance. Other sections of the City Ordinance address noise abatement restrictions which were identified in the previous chapter.

While each of these policies will need to be examined based on both demand and capacity at Scottsdale Airport, this chapter will focus on "unconstrained" aviation demand. If "unconstrained" demand can not be accommodated due to physical constraints or policy decisions, the "constrained" aviation demand will then be determined.

POPULATION TRENDS AND FORECASTS

Historical as well as forecast population data normally provide a good indication of future aviation demand at an airport. Since previous population growth of a community or service area can be tracked, past growth trends can then be correlated to airport activity. Growth of the service area population will normally produce a demand for airport services. Conversely, a service area with little growth or a net population decrease will generally not result in an increased demand for airport services. To determine the aviation demand for Scottsdale Airport, the role of the airport and the geographic extent of the area the airport serves was identified. The *Service Area* of an airport is defined by its proximity to other airports providing similar service to the public, rather than by any jurisdictional boundaries. The Scottsdale Airport is located in the northeast portion of Maricopa County; therefore, for the purposes of this study, the airport service area was generally defined as the population centers of the communities of Scottsdale, Northeast Phoenix, Fountain Hills, Carefree, Cave Creek and Paradise Valley. This area of the Phoenix Metropolitan area is expected to experience tremendous growth in population over the next 10 years. It is anticipated that Scottsdale Airport will continue to serve the needs of the residents in these areas.

Table 2A, Forecast Population Growth, indicates the population forecast for the City of Scottsdale, the City of Phoenix, Maricopa County, the State of Arizona, and the Scottsdale Airport Service Area based on the 1993 MAG population forecasts.

TABLE 2A
Forecast Population Growth

Region	1994	2000	2005	2010	2015
State of Arizona	3,551,500	4,632,875	5,132,725	5,652,525	6,212,000
Maricopa County	2,355,900	2,715,100	3,031,350	3,362,685	3,724,105
City of Phoenix	1,051,515	1,183,964	1,278,349	1,374,082	1,487,238
City of Scottsdale	154,145	186,091	212,154	236,263	256,838
Airport Service Area	N/A	386,986	446,864	509,752	575,414

Sources: Maricopa Association of Governments; Arizona Department of Economic Security

GENERAL AVIATION ACTIVITY

General aviation is defined as that portion of activity which encompasses all facets of aviation except commercial airline and military operations and constitutes the majority of aircraft activity at the Scottsdale Airport. To determine the types and sizes of facilities that should be planned to accommodate general aviation activity, certain elements of this activity must be forecast. These indicators of general aviation demand include the following.

- Based Aircraft
- Aircraft Fleet Mix
- Annual Aircraft Operations

The total number of based aircraft at an airport is one of the most basic indicators of general aviation demand. By first developing a forecast of based aircraft, the growth of general aviation operational levels can be projected in consideration of the forecast based aircraft as well as other factors characteristic to Scottsdale Airport. The rationale behind the general aviation activity forecast is presented below.

BASED AIRCRAFT

The number of based aircraft at Scottsdale Airport, both on the airport and in the adjacent airpark, is highly dependent upon the nature and magnitude of aircraft ownership in the general aviation service area. Preparation of based aircraft forecasts were initiated with a review of historical data on aircraft based at the airport, aircraft registered within Maricopa County, the State of Arizona the FAA's Western-Pacific Region (AWP), and active general aviation aircraft within the United States.

Historical data related to based aircraft was collected from several sources including FAA records and records kept by the airport sponsor, as well as previously completed studies. The based aircraft at Scottsdale Airport during the period of 1984 to 1994 has decreased from 447 in 1984 to 393 in 1994. Over this 11 year period the number of based aircraft ranged from a high of 462 in 1985, to a low of 375 in 1988. The historical based aircraft data for Scottsdale Airport is presented in **Table 2B, Historical Based Aircraft.**

TABLE 2B
Historical Based Aircraft
Scottsdale Airport

Year	Based Aircraft[1]
1984	447
1985	462
1986	432
1987	409
1988	375
1989	414
1990	410
1991	405
1992	403
1994	420
1994	393

Note: [1] Includes aircraft based in the adjacent airpark.
Source: Airport Administration

A trendline analysis of the based aircraft at Scottsdale Airport for various

time periods resulted in very poor correlation coefficients. This is generally associated with the fluctuating total based aircraft over the last 11 years. Since the correlation coefficient were very poor, trendline analysis was determined to be of no significant value in determining the based aircraft forecast demand.

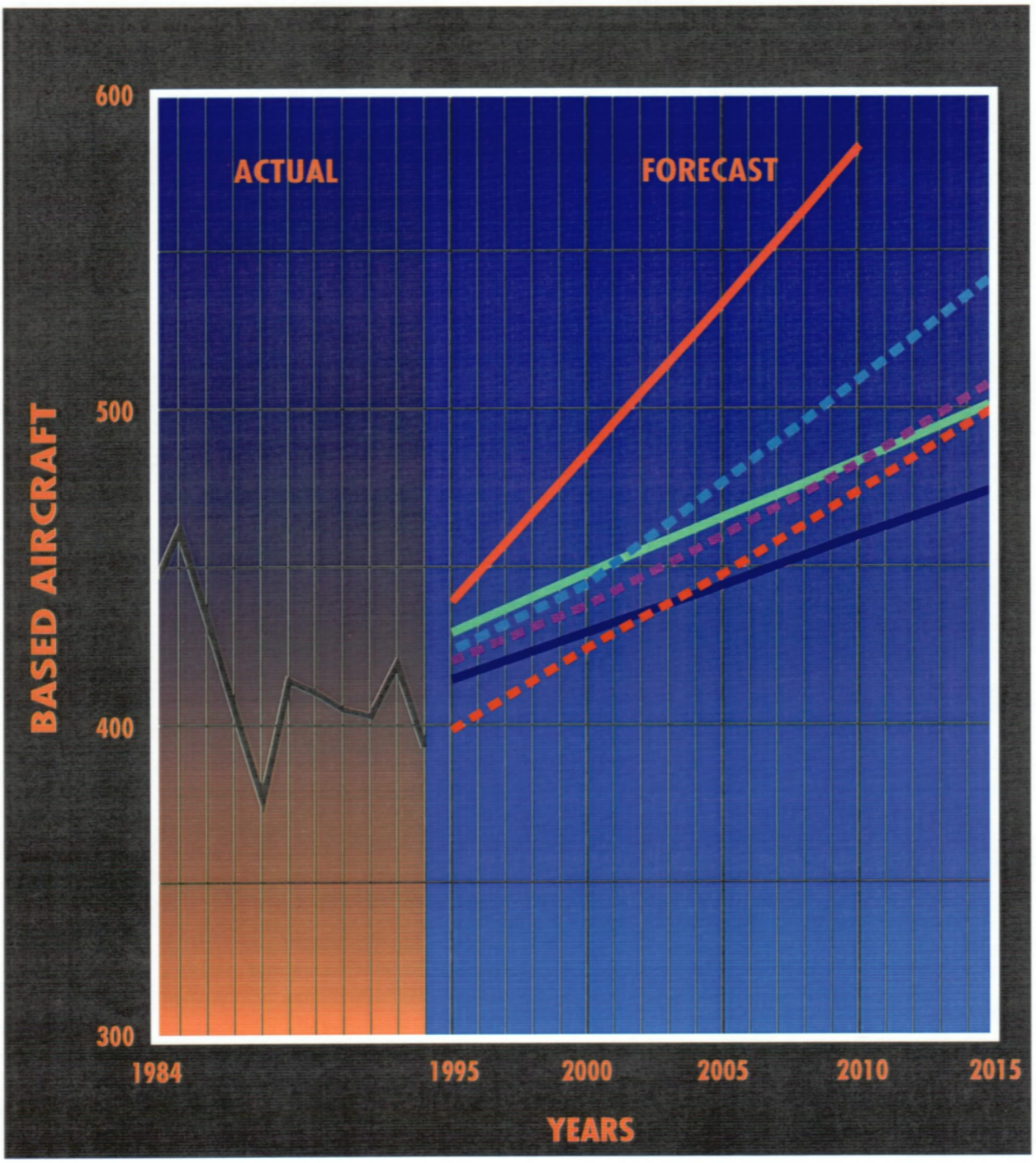
Linear regression analyzes was accomplished using population statistics for the various cities and population centers in the Scottsdale Airport Service Area. The historical and forecast population for these population centers were utilized as the independent variable, while the historical based aircraft was the dependant variable. Once again, due to poor correlation coefficients this analysis proved to be of no significant value in determining the based aircraft forecast at Scottsdale Airport.

Market share analysis was also evaluated for Scottsdale Airport. The historical and forecast based aircraft in Maricopa County, the State of Arizona and the AWP Region were compared to the historical based aircraft at Scottsdale Airport. The forecast market shares of based aircraft for Scottsdale Airport were determined by comparing the percentage of aircraft based at Scottsdale Airport to that in each market, and assuming a constant share of that market. The results of these market share analyses are included in **Table 2C, Forecast Based Aircraft.**

Forecasts from the National Plan of Integrated Airport Systems (NPIAS) was also reviewed. The forecast number of based aircraft in the NPIAS for 1995 and the year 2000 (608 and 614 respectively) were considerably higher than the existing number of based aircraft (393); therefore the data from this source was considered inflated and not used during this evaluation. Other aviation related studies that projected based aircraft numbers are also shown in **Table 2C.**

The selected based aircraft forecast indicated in **Table 2C,** illustrates an average annual growth rate of 0.12 percent during the planning period. This growth is anticipated due to the replacement of those aircraft lost to the recent closure of a major flight training school, as well as by a direct result of improved economic conditions. It is also anticipated that the existing percentage (approximately 18 percent) of the based aircraft in the airpark will remain constant throughout the planning period. **Exhibit 2A, Based Aircraft Forecast,** illustrates the selected based aircraft forecast with the results from the other forecast methods.

93MP13-2A-1/5/96



SCOTTSDALE AIRPORT

Exhibit 2A
BASED AIRCRAFT FORECASTS

TABLE 2C
Forecast Based Aircraft
Scottsdale Airport

	2000	2005	2010	2015
Market Share Analysis				
FAA Western-Pacific Region	448	466	484	502
Arizona Registered Aircraft	438	460	483	508
MAG Airports	444	N/A	N/A	542
Other Resources				
1993 MAG RASP	429	444	460	475
1988 SASP	486	533	583	N/A
Selected Forecast				
Forecast Based Aircraft	**424**	**448**	**474**	**500**

AIRCRAFT FLEET MIX

Knowing the aircraft fleet mix expected to utilize the airport is necessary to properly plan the facilities that will best serve not only the level of activity but also the type of activities occurring at the airport. The mix of based aircraft at Scottsdale Airport was determined through an analysis of the types of aircraft historically and currently based at the Airport. This was compared with the FAA existing and forecast general aviation fleet mix. The fleet mix trend at Scottsdale Airport is anticipated to be similar to that of the national trends, with a trend towards a slightly higher percentage of more sophisticated and higher performance aircraft in the future. At Scottsdale Airport, the single engine aircraft percentage is expected to decrease from approximately 70 percent to 61 percent by the end of the planning period. The multi-engine, turboprop, and turbojet percentages are expected to increase from 20.8 percent, 2.0 percent, 6.1 percent, respectively, to 21.7 percent, 6.1 percent, and 8.0 percent, respectively. Rotorcraft mix is also expected to increase from 2.3 percent to 3.1 percent. The existing and forecast fleet mix are shown in **Table 2D, Based Aircraft Fleet Mix Projections.**

TABLE 2D
Based Aircraft Fleet Mix Projections
Scottsdale Airport

	Existing	Forecast			
Aircraft	1994	2000	2005	2010	2015
Single Engine	270	284	292	299	305
Twin Engine	82	89	94	102	110
Turbo Prop	8	12	18	24	30
Jet	24	28	32	36	40
Rotorcraft	9	11	12	13	15
Total	393	424	448	474	500

GENERAL AVIATION OPERATIONS

An aircraft operation is defined as any takeoff or landing performed by an aircraft. There are two types of operations, local and itinerant. A local operation is a takeoff or landing performed by an aircraft that will operate within the local traffic pattern, in sight of the airport, or will execute simulated approaches or touch-and-go operations. Itinerant operations are all arrivals and departures other than local. Generally, local operations are comprised of training operations and itinerant operations are those aircraft with a specific destination away from or to the airport. Typically, itinerant operations increase with business and industry use of the airport since business aircraft are used primarily to move people from one location to another.

Since Scottsdale Airport has an airport traffic control tower, actual operations data was obtained and utilized for this evaluation. In addition, other historical records were available from airport records and the other related studies to verify this data.

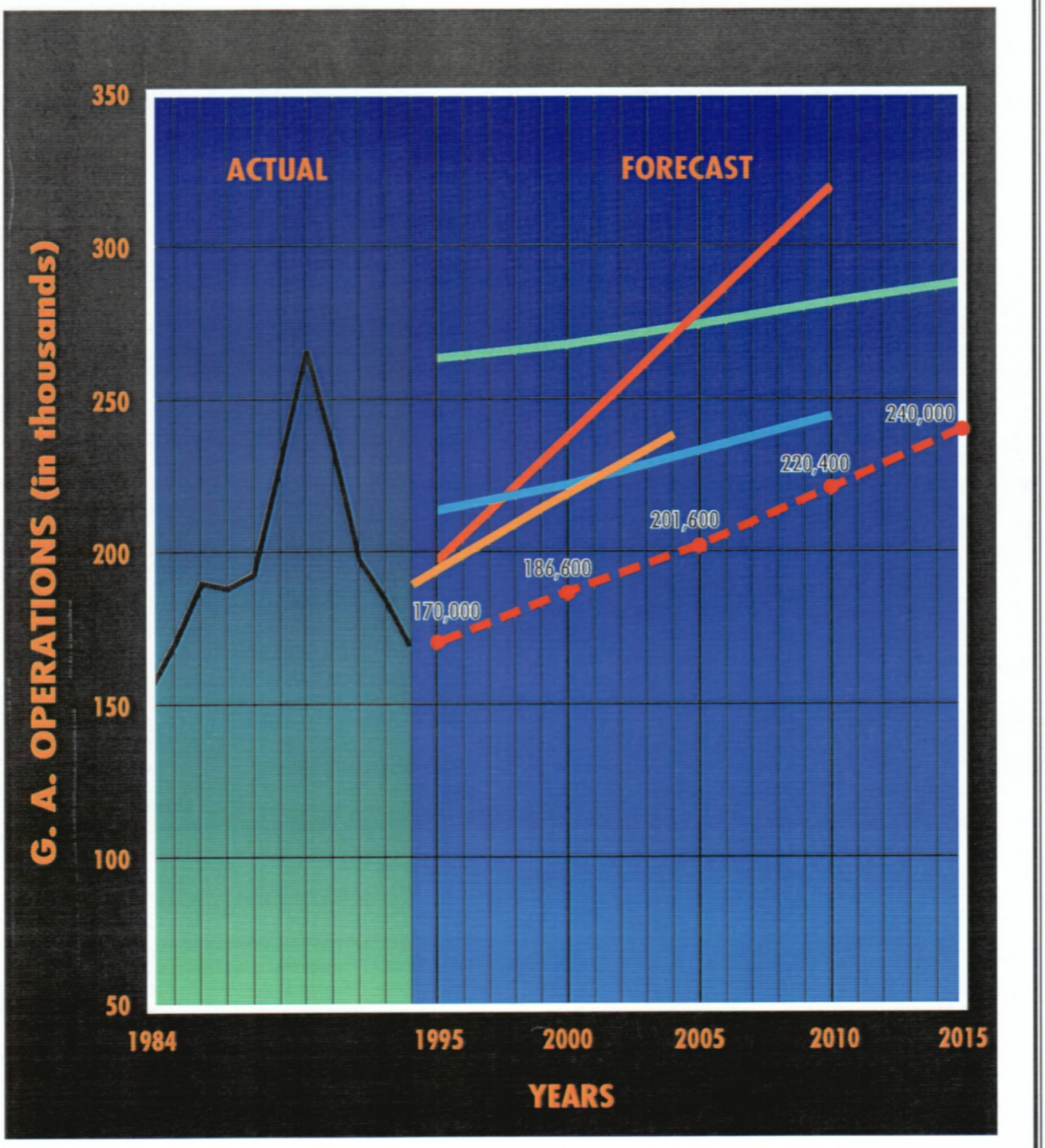
An historical trendline analysis for the period 1984-94 produced a very poor correlation coefficient; therefore, a projection of operations using the trendline analysis method was determined to be of no significant value. Likewise, linear regression analyses were also determined to be of no significant value, due again to very poor correlation coefficients.

Another commonly used forecasting method for projecting general aviation operations is the use of a ratio of operations to based aircraft. Based on the 1984-1994 based aircraft data for Scottsdale Airport, the average operation per based aircraft over this period was determined to be 480. In 1994, the operation per based aircraft ratio was determined to be 425. The general aviation operations forecast for the 20-year period assume the ratio of operations to based aircraft would increase over the planning period to the 11 year average (480). The results are presented in **Table 2E, General Aviation Operations**as well as on **Exhibit 2B, General Aviation Operations.**

Also included in **Table 2E** and **Exhibit 2B** are forecasts of operational levels produced in the National Plan of Integrated Airport Systems, 1990-1999 and the other aviation related studies.

The selected forecast of general aviation operations is predicated on the operations per based aircraft methodology. It assumes that operations per based aircraft will increase due to increased flight training by based aircraft. This forecast represents a 1.7 percent average annual growth rate.

93MP13-2B-1/5/95



LEGEND:

- 1993 MAG RASP
- 1988 SASP
- 1990-99 NPIAS
- 1995 Draft State Aviation Needs Study
- Preferred

SCOTTSDALE AIRPORT

Exhibit 2B
GENERAL AVIATION OPERATIONS

TABLE 2E
General Aviation Operations
Scottsdale Airport

	2000	2005	2010	2015
Operations per Based Aircraft				
Operations/Based Aircraft	186,560	201,600	220,410	240,000
Other Resources				
1993 MAG RASP	267,586	274,091	280,773	287,700
1988 SASP	237,341	278,226	319,111	N/A
1995 "Draft" SANS	221,600	N/A	244,200	N/A
NPIAS 1990-1999	238,000	N/A	N/A	N/A
Selected Forecast				
Annual G.A. Operations	**186,600**	**201,600**	**220,400**	**240,000**

Note: N/A - Not Available

LOCAL VERSUS ITINERANT OPERATIONAL SPLIT

As previously stated, there are two types of operations; local and itinerant. The split between these two types of operations can provide important insight to the types of facilities needed at the airport (i.e. tiedowns, hangars, navigational aids, etc).

According to the ATCT logs, the general aviation operational split at Scottsdale Airport in 1994 was approximately 68 percent itinerant and 32 percent local. Since 1985, however, these percentages have fluctuated due to changes in the local activity and economy. Due to the increasing tourism industry and the business activity in the surrounding area, it is anticipated that the current amount of itinerant operations would increase slightly to 70 percent by the end of the planning period.

The distribution of local versus itinerant operations for the planning period is illustrated in **Table 2F, Local Versus Itinerant Operations.**

TABLE 2F
Local Versus Itinerant Operations
Scottsdale Airport

	Existing	Forecast			
G.A. Operations	1994	2000	2005	2010	2015
Itinerant	110,920	128,754	138,690	153,456	168,000
Local	54,080	57,846	62,310	68,944	72,000
Total GA Operations	**165,000[1]**	**186,600**	**201,600**	**222,400**	**240,000**

Note: [1] Estimate

COMMERCIAL SERVICE FORECAST

Historically commercial service activity into Scottsdale Airport was provided by scheduled regional/commuter airlines and charter companies. At the present time, however, the airport is not being served by a scheduled airline. Numerous charter companies still serve the airport, providing sight-seeing tours and on-demand service.

In order to determine the type and size of facilities necessary to accommodate airline activity at any airport, several elements of this activity must be forecast. The two elements considered most important include *Annual Enplaned Passengers* and *Annual Commercial Service Operations*.

ANNUAL ENPLANED PASSENGERS

Enplaned passengers are those that board a commercial service aircraft for departure from the airport. This statistic is the most basic indicator of demand for commercial service activity.

The 1993 Origin-Destination Data for the Phoenix area was used to evaluate the top 25 markets. The top 25 markets for the Phoenix area are presented in **Table 2G, Origin-Destination Data.** The data was comprised from a 10 percent passenger sampling of those passengers who originated from or whose final destination was Phoenix Sky Harbor International Airport. Of the top 25, six are within a potential market that could be served by commuter aircraft from Scottsdale Airport (Los Angeles, San Diego, Las Vegas, Ontario, Burbank, and Santa Ana). These six destinations totaled approximately 29.0 percent of the total passengers to and from Phoenix Sky Harbor International Airport. Currently, the commuter airlines do not serve Scottsdale Airport; however, it would appear that these six destinations could potentially generate a demand for direct service from Scottsdale Airport.

TABLE 2G
Origin-Destination Data (1993)
Phoenix, Arizona

Ranking/Destination	Passengers	% of Total Passengers
1. Los Angeles	131,664	9.08
2. Las Vegas	84,646	5.84
3. San Diego	82,788	5.71
4. Ontario/San Bernardino	62,256	4.29
5. Chicago	54,001	3.73
6. Albuquerque	52,563	3.63
7. San Francisco	49,298	3.40
8. Burbank	41,358	2.85
9. Denver	38,119	2.63
10. Oakland	37,324	2.57
11. Minneapolis/St. Paul	30,073	2.07
12. Newark	28,173	1.94
13. Seattle	27,399	1.89
14. Dallas/Ft. Worth	26,330	1.82
15. El Paso	25,756	1.78
16. Kansas City	25,591	1.77
17. San Jose	22,945	1.58
18. St. Louis	22,788	1.57
19. Detroit	22,358	1.54
20. Sacramento	21,795	1.50
21. Salt Lake City	20,913	1.44
22. Boston	19,368	1.34
23. New York	18,138	1.25
24. Santa Ana/Laguna Beach	17,762	1.23
25. Atlanta	16,869	1.16

Note: 10 percent sampling of the 1993 passenger data
Source: USDOT; BACK Information Services

An evaluation of the potential commuter activity for Scottsdale Airport was also conducted. Based on a previous study (Scottsdale Airport Air Service Analysis, October 1987, SH&E), it can be expected that Scottsdale Airport could provide commuter service to three of the markets indicated in **Table 2G** (Los Angeles, Las Vegas and San Diego). These top three market consti-

tute approximately 21 percent of the enplanements at Phoenix Sky Harbor International Airport. The 1987 Study did not foresee the reuse of Williams Air Force Base as a civilian airport; therefore, projected enplanements at Scottsdale Airport were significantly higher than is currently anticipated.

Using the same markets as established in the 1987 Air Service Study, **Table 2H, Scottsdale Airport Commuter Enplanement Evaluation**, illustrates the estimated enplanements for Scottsdale Airport.

TABLE 2H
Scottsdale Airport Commuter Enplanement Evaluation

	2000	2005	2010	2015
PHX Domestic Enplanements[1]	15,825,313	18,559,758	21,294,203	24,028,648
PHX Commuter Enplanements[1]	206,578	280,869	355,161	429,452
Williams Gateway Enplanements[2]	(500,000)	(1,000,000)	(1,600,000)	(2,450,000)
Total Domestic/Commuter Enplanements	15,531,891	17,840,627	20,049,364	22,008,100
PHX Connecting Traffic (40%)[1]	6,212,756	(7,136,251)	(8,019,745)	(8,803,240)
PHX O&D Enplanements	9,319,135	10,704,376	12,029,618	13,204,860
LAX, LAS, & SAN Share[3]	1,922,537	2,208,313	2,481,710	2,724,163
Scottsdale Airport Share (13.1%)[4]	251,852	289,289	325,104	356,865
Scottsdale Airport Share (1.0%-3.0%)	19,225	22,083	49,634	81,725

Sources:
[1] 1995 "Draft" SANS
[2] 1993 Williams Air Force Base Master Plan
[3] 1993 O&D Report, Back Information Services
[4] 1987 Scottsdale Airport Air Service Analysis

It is assumed that 13.1 percent of the market, as anticipated in the 1987 Study, would not be reached during this planning period. It is anticipated, however, that Scottsdale Airport could support commuter service of approximately one percent of the market (in the short-term) increasing to three percent by the end of the planning period. The forecast resulting from this analyses is provided in **Table 2J, Forecast Enplanements Summary.**

To develop additional (charter/air taxi) enplanement forecasts, several of the analytical techniques outlined previously were examined for their applicability. These include historical trendline analyses, regression analyses, and a review of other sources.

A trendline forecast based upon available historical enplanement data from 1986-1990 produced a excellent correlation (R^2=0.98), which was expected considering the relatively steady in-

crease in enplanements during that period. The trendline for the period from 1986 to 1994 produced a very poor correlation (R^2=0.31). This was expected due to the decrease in enplanements over the last three years. The forecast resulting from these trendline analyses are provided in **Table 2J.**

One of the more common forecasting practices involves linear regression analysis with population as the independent variable. The populations for the City of Scottsdale and the City of Phoenix were analyzed in an attempt to obtain high correlation upon which to make future projections. The correlations proved to be very good (R^2=0.88 and 0.94, respectively), and the resulting forecasts are indicated in **Table 2J.**

Enplanement forecast from the other aviation related studies were also examined. The results from these forecasts are included in **Table 2J.**

The selected enplanement forecast indicated in **Table 2J** is predicated on the ability of Scottsdale Airport to attract a commuter airline to serve the airport. It is anticipated that this type of service would occur between the years 2000 and 2005. In the meantime, however, it is expected that the enplanements will increase due to increased charter activity (sight-seeing tours and on-demand service). **Exhibit 2C, Forecast Enplanements,** illustrates the forecast enplanement levels for the planning period.

Both the national economy and airline industry will be major factors that influence the enplanement forecast after the year 2005. Although the national, state and local economies are slowly recovering from the recent recession, the airline industry is struggling and dramatic changes in the airline structure may occur in the future. The factors that affect airline operations will directly impact enplanement forecasts. It is important to note, however, that the most stable portion of the airline industry has occurred in the regional/ commuter air carrier segment, an airline segment which has historically served Scottsdale Airport. With continued improvement in the economy and balance within the airline industry, enplanement growth at the Scottsdale Airport should be expected to occur during the planning period.

TABLE 2J
Forecast Enplanements Summary
Scottsdale Airport

	2000	2005	2010	2015
Trendline Analysis				
1986-1990 (R^2=0.98)	36,104	48,464	60,823	73,183
1986-1994 (R^2=0.31)	13,432	16,544	19,656	22,768
Linear Regression Population (1986-1990)				
City of Scottsdale (R^2=0.88)	38,346	51,884	64,407	75,095
City of Phoenix (R^2=0.94)	28,620	37,825	47,162	58,198
Other Studies				
1993 MAG RASP	51,650	N/A	N/A	98,900
1988 State Aviation Needs Study	16,000	N/A	N/A	25,000
Selected Forecast				
Annual Enplanements	**11,200**	**36,300**	**65,100**	**98,000**

Note: N/A - Not Available

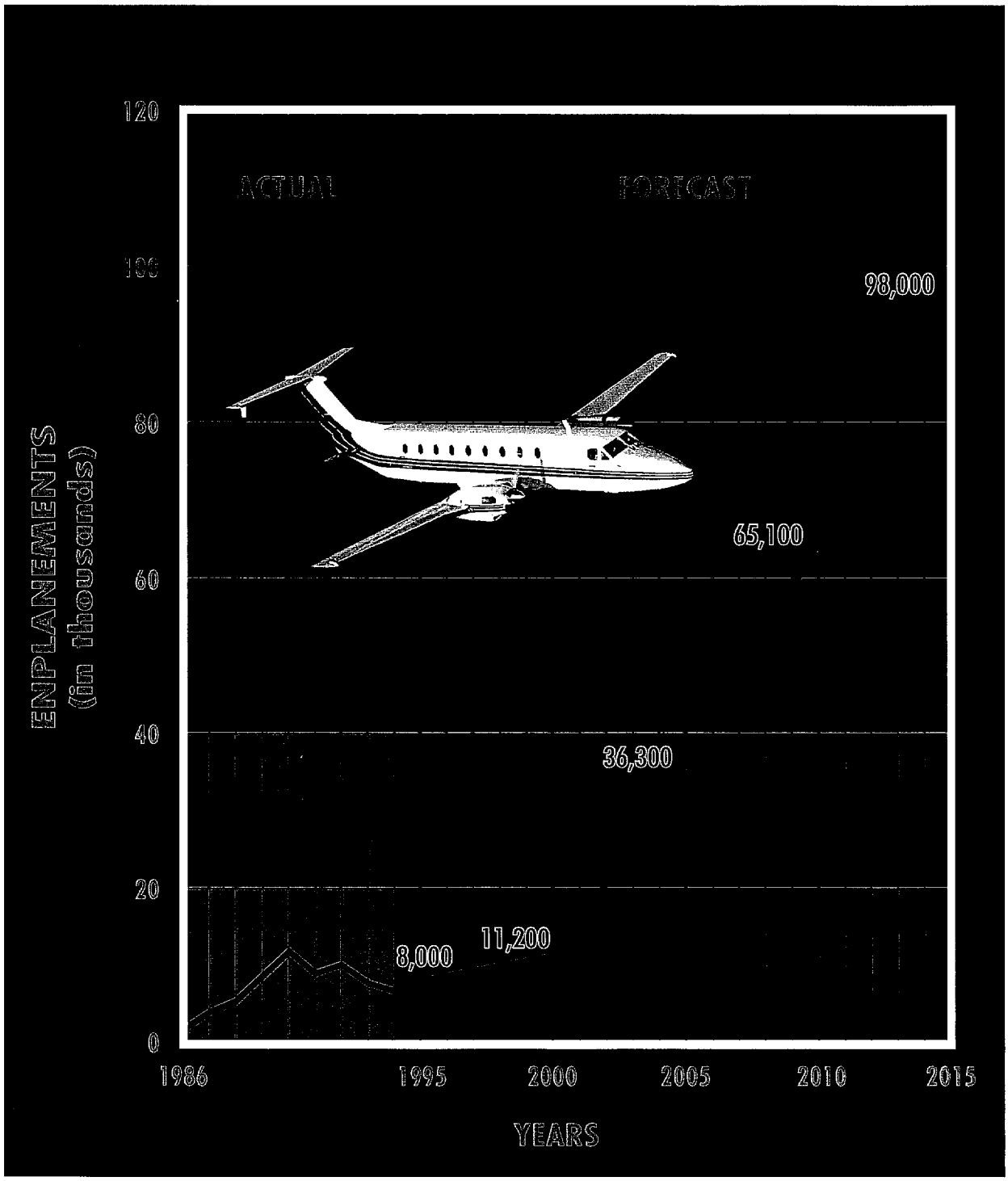
ANNUAL COMMERCIAL SERVICE OPERATIONS AND FLEET MIX

In addition to passenger enplanements, there are other factors which affect forecasts of airline facilities. The number of airline operations can be determined from the average ratio of passenger enplanements per departure. This ratio is dependent upon the size of the aircraft and the average percentage of seats that are filled for each departure. The percentage of enplanements to available seats is called the *Boarding Load Factor* (BLF).

The BLF is important to airline companies because it serves as a measure of airline profit from a given market. When the BLF is high, an airline will often consider increasing the number of seats or the number of flights available. The BLF, the type of aircraft and the number of aircraft available, determine an airline's marketing strategy.

According to the *FAA Aviation Forecasts, 1994-2005*, between 1993 and 2005, the average number of seats per aircraft for regional/commuter airlines in the United States is forecast to be between 22.9 and 35.5, with an average BLF between 48.7 and 49.8 percent. This would result in an average 7.5 percent growth in annual enplanements by regional/commuter airlines in the United States. The BLF for Scottsdale Airport has historically been significantly higher than the national average due to the nature of charter activity. Scottsdale Airport charter companies have historically had a 69 percent BLF.

93MP13-2C-1/5/95



LEGEND:

---- Selected Enplanement Forecast

SCOTTSDALE AIRPORT

Exhibit 2C
FORECAST ENPLANEMENTS

Commuter service at Scottsdale Airport is anticipated to have a BLF of approximately 50 percent throughout the planning period. **Table 2K, Commercial Service Fleet Mix and Operations,** depicts the anticipated commercial operations based on various seating capacities of aircraft. **Exhibit 2D, Operations Forecast Summary,** presented at the end of the chapter illustrates the projected commercial service operations throughout the planning period.

TABLE 2K
Commercial Service Fleet Mix and Operations
Scottsdale Airport

	Existing	Forecast			
	1994	2000	2005	2010	2015
Seating Capacities					
<19 (Cessnas, Twin Otter)	100%	100%	50%	35%	20%
±19 (Beech 1900)	0%	0%	50%	25%	5%
±30 (Brazilia)	0%	0%	0%	30%	50%
±70 (Regional Jet)	0%	0%	0%	10%	25%
Total	100%	100%	100%	100%	100%
Average Seats, Enplanement and Commercial Operations Forecasts					
Average Seats/Departure	5	5	12	23	34
Boarding Load Factor (%)	69	69	60	57	54
Enplanements/Departures	3.45	3.45	7.20	13.10	18.40
Annual Enplanements	6,900	11,200	36,300	65,100	98,000
Annual Departures	2,000	3,250	5,000	5,000	5,350
Annual Commercial Operations	**4,000**	**6,500**	**10,000**	**10,000**	**10,700**

ANNUAL INSTRUMENT APPROACHES

Forecasts of annual instrument approaches (AIA) provide guidance in determining an airport's requirements for navigational aid facilities. An instrument approach is defined by FAA as *"...an approach to an airport with intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when the visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude."*

In determining the number of AIA's conducted at the airport, the number of instrument operations needed to be examined. Utilizing the 1994 Airport Traffic Control Tower activity logs, it was determined that 10 percent of the total operations were logged as instrument operations. These operations

included actual instrument operations and instrument training activity.

Instrument weather condition in the Scottsdale Airport area occur less than two percent of the time. Utilizing the number of annual operations, the number of AIA's were calculated for the planning period. The number of AIA's are expected to increase gradually throughout the planning period as commercial operations increase and more sophisticated general aviation aircraft operate at the airport. The forecast of AIA's at the airport are described in **Table 2L, Annual Instrument Approach Forecast.**

TABLE 2L
Annual Instrument Approach Forecast
Scottsdale Airport

	Existing	Forecast			
	1994	2000	2005	2010	2015
Annual Operations	169,000[1]	193,100	211,000	232,400	250,700
Annual Instrument Approaches[2]	349	386	422	465	501

Notes: [1] Estimate
[2] Based on weather conditions

PEAKING CHARACTERISTICS

Many airport facility needs are related to the levels of activity during peak periods. The periods used in developing facility requirements for this Master Plan are:

- **Peak Month** - The calendar month when peak aircraft operations occur.
- **Design Day** - The average day in the peak month. Normally, this indicator is easily derived by dividing the peak month operations by the number of days in the month.
- **Busy Day** - The busy day of a typical week in the peak month. This descriptor is used primarily to determine general aviation ramp space needs.
- **Design Hour** - The peak hour within the design day. Design hour is used particularly in airfield demand/capacity analysis as well as for terminal building and access requirements.

It is important to note that only the peak month is an absolute peak within a given year. All the others will be exceeded at various times during the year. However, they do represent reasonable planning standards that can be

applied without over-building or being too restrictive.

GENERAL AVIATION PEAKING CHARACTERISTICS

The general aviation peaking characteristics at Scottsdale Airport were estimated from an analysis of monthly operations in the year 1994. The peak month, March, was approximately 10.3 percent of annual general aviation operations. For planning purposes, the peak month has been projected to remain at 10.3 percent of annual general aviation operations throughout the planning period.

The Design Day will vary depending on the number of operations during the peak month. At Scottsdale Airport, the average day was determined by dividing the peak month operations by 31 (the number of days in the peak month).

General aviation Design Hour operations typically range between 10 and 15 percent of the average day depending on the total activity. The Design Hour activity has been projected to remain at a constant 15 percent throughout the planning period due to the large amount of training activity at Scottsdale Airport.

The definition of general aviation passengers (Design Hour Passengers), as used in this section, refers to the average number of pilots and passengers expected to utilize the airport's general aviation terminal facilities during a given time. Touch-and-go operations would be an exception to the higher passenger levels anticipated. Pilots conducting touch-and-go operations may only use the terminal facilities at the start and finish of their training activity. According to Airport Traffic Control logs, approximately 32 percent of the general aviation operations are training in nature. In order to ensure that space requirements are not overestimated in the planning effort, these operations were not considered in determining design hour passengers. In calculating the design hour passengers, an average of 2.5 passengers per design hour operation, excluding training operations, was assumed for the existing condition. It is anticipated that this factor would remain constant throughout the planning period.

COMMERCIAL SERVICE PEAKING CHARACTERISTICS

For this analysis, commercial service peaking characteristics has been divided into two sections: enplanements and operations. The commercial service peaking characteristics are described in the following paragraphs.

Enplanement Peaking Characteristics

According to 1994 enplanement data, the peak month for enplaned passengers occurs in the month of May with approximately 13.8 percent. For plan-

ning purposes, the peak month is projected to remain constant at 13.8 percent throughout the planning period.

The Design Day, also referred to as the average day of the peak month, will vary from year to year depending on the number of enplanements during the peak month. At Scottsdale Airport, the design day enplanements were determined by dividing the peak month enplanements by 31 (the number of days in the peak month).

Design Hour enplanements are used to establish peak hourly demand affecting terminal facilities. The Design Hour enplanements at Scottsdale Airport are affected by the airline schedules. By the end of the planning period, Design Hour is expected to be 15 percent of the Design Day.

The forecast of enplanement peaking characteristic at Scottsdale Airport are presented in **Table 2L, Forecast Peaking Characteristics.**

Commercial Service Operation Peaking Characteristics

According to the 1994 operational data, the peak month for commercial service operations occurred in the month of April with approximately 14.2 percent of the total operations. As with the enplanement peaking characteristics, this percentage is expected to remain relatively constant at 14.2 percent throughout the planning period.

The Design Day percentage was determined by dividing the peak month commercial operations by 30 (the number of days in the peak month).

Current Design Hour operations were estimated to be 10.0 percent of the Design Day operations. This percentage is expected to remain constant throughout the planning period. The operation peaking characteristics for commercial service are depicted in **Table 2L.** A summary of the total, commercial service, and general aviation peaking characteristics are presented in **Table 2L.**

TABLE 2L
Forecast Peaking Characteristics
Scottsdale Airport

	Existing[1]	Forecast			
	1994	2000	2005	2010	2015
Total Operations (including Commercial Service and General Aviation)					
Annual	169,000	193,100	211,000	232,400	250,700
Peak Month	17,541	20,143	22,185	24,121	26,239
Design Day	565	650	717	779	848
Design Hour	84	96	105	115	125
General Aviation Operations					
Annual	165,000	186,600	201,600	220,400	240,000
Peak Month	16,972	19,220	20,765	22,701	24,720
Design Day	547	620	670	732	797
Design Hour	82	93	100	110	120
General Aviation Pilot/Passengers					
Design Hour Pilot/Passengers	140	158	171	187	203
Commercial Service Operations					
Annual	4,000	6,500	10,000	10,000	10,700
Peak Month	569	923	1,420	1,420	1,519
Design Day	18	30	47	47	51
Design Hour	2	3	5	5	5
Passengers Enplanements					
Annual	6,900	11,200	36,300	65,100	98,000
Peak Month	949	1,546	5,009	8,984	13,524
Design Day	31	50	162	290	436
Design Hour	5	7	24	43	65

Note: [1] Estimate

SUMMARY

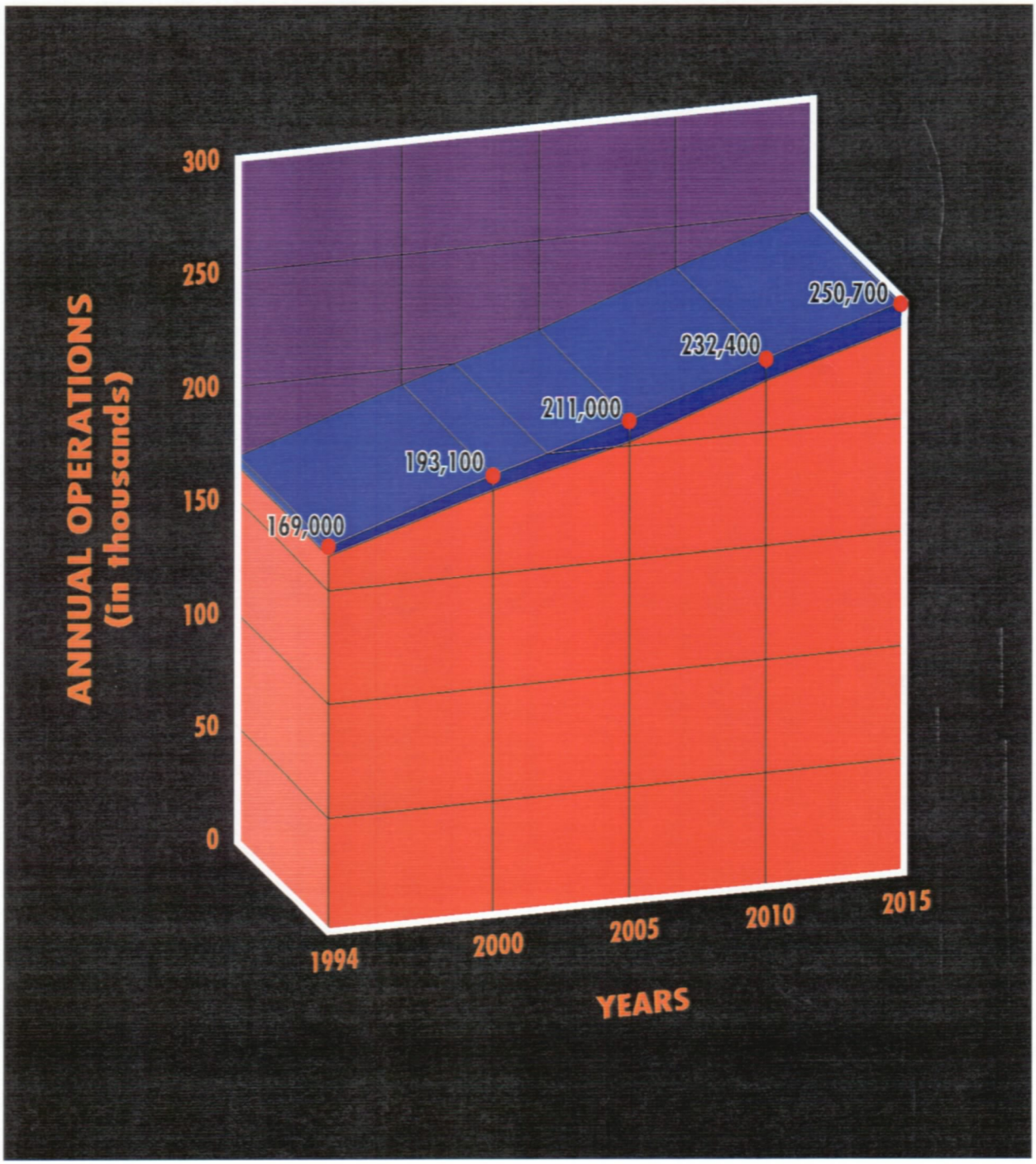
This chapter has provided forecasts for those indicators of aviation demand that are essential to effective analysis of future facility needs of the Scottsdale Airport. The next step in the master planning process is to assess the capacity of the existing facilities and to determine what facilities will be necessary to meet future aviation demands. **Table 2M, Forecast Summary**, is provided as a summary of forecast information for referral in later portions of the study. **Exhibit 2D, Operations Forecast Summary**, graphically illustrates the forecast operations by category.

TABLE 2M
Forecast Summary
Scottsdale Airport

	Existing	Forecast			
	1994	2000	2005	2010	2015
Based Aircraft					
Single Engine	270	284	292	299	305
Multi Engine	82	89	94	102	110
Turbo Prop	8	12	18	24	30
Jet	24	28	32	36	40
Rotorcraft	9	11	12	13	15
Total Based Aircraft	**393**	**424**	**448**	**474**	**500**
Annual Itinerant Operations					
Commercial	4,000	6,500	10,000	10,000	10,700
General Aviation	110,920	128,754	138,690	153,456	168,000
Itinerant Ops Subtotal	**114,920**	**135,254**	**148,690**	**163,456**	**178,700**
Annual Local Operations					
General Aviation	54,080	57,846	62,310	68,944	72,000
Local Ops Subtotal	**54,080**	**57,846**	**62,310**	**68,944**	**72,000**
Total Annual Operations	**169,000[1]**	**193,100**	**211,000**	**232,400**	**250,700**
Passenger Enplanements					
Annual Enplanements	**6,900[1]**	**11,200**	**36,300**	**65,100**	**98,000**
Annual Instrument Approaches	338	386	422	465	501

Note: [1] Estimate

93MP13-2D-1/5/95



SCOTTSDALE AIRPORT

Exhibit 2D
OPERATIONS FORECAST SUMMARY