

Section 4

GENERAL AVIATION FORECASTS

The general aviation forecasts presented herein represent estimates of demand for facilities and services at Window Rock Airport. They are forecasts of aircraft and activity associated with the transportation of persons via the general aviation air mode. General aviation activity is comprised of business and executive flying, air taxi, flight instruction, personal flying, patrol and air ambulance.

Forecasts presented in this report include based aircraft, aircraft movements, fuel flowage, terminal area relationships, and instrument approaches. These forecasts are designed to satisfy the needs of long-range airport master planning. Forecasts are presented for a planning horizon ending in the year 2000.

Documentation of the aviation forecasts begins with an executive summary, followed by a brief discussion on general aviation transportation. Subsequently, the individual general aviation forecasts are presented.

4.1 EXECUTIVE SUMMARY

The number of general aviation aircraft based at Window Rock Airport is forecast to increase from 25 in 1979 to 74 in 2000. In 1979, 72 percent of based aircraft were single-engine 4+ place. This percentage is forecast to stay relatively constant throughout the planning horizon.

Based and transient aircraft are forecast to conduct 38,780 movements in 2000. This figure is up from 12,820 in 1979. Local (based) landings and takeoffs are expected to comprise a majority of all general aviation aircraft movements.

A summary of the general aviation forecasts is presented in Exhibit 4-1.

Exhibit 4-1

FORECAST SUMMARY
WINDOW ROCK AIRPORT

<u>General Aviation</u>	Actual	Forecast		
	<u>1979</u>	<u>1985</u>	<u>1990</u>	<u>2000</u>
Based Aircraft	25	34	47	74
Aircraft Activity				
Annual Local Movements	8,430	11,400	15,790	24,960
Annual Itinerant Movements	<u>4,390</u>	<u>6,110</u>	<u>8,820</u>	<u>13,820</u>
Annual Total Movements	12,820	17,510	24,610	38,780
Terminal Area Relationships				
Peak Month	2,346	3,212	4,520	7,120
Average Day	76	103	145	230
Peak Hour	8	9	14	22
Instrument Approaches	3	4	6	9
Fuel Flowage	36,000	50,100	72,000	113,100

Instrument approaches are projected to remain below a level of 50 annually.

Fuel flowage is forecast to increase substantially, from 36,000 gallons in 1979 to 113,100 in 2000. This represents an annual growth rate of approximately 6 percent.

4.2 GENERAL AVIATION TRANSPORTATION

General aviation air transportation results in demand primarily for Window Rock Airport's aircraft storage facilities and airfield capacity. The most commonly referenced measures of this demand are based aircraft and aircraft movements, respectively.

General aviation air transportation is one of three transportation modes commonly used for transporting people. The other two are scheduled air transportation (airlines) and automobile transportation. The distinguishing characteristics of general aviation air transportation are its speed of travel and non-scheduled on-demand characteristics. Consequently, general aviation air transportation is attractive to individuals who are time sensitive. Individuals who utilize general aviation air transportation either own an aircraft or share the use of an aircraft, much the same as people own or lease automobiles.

The approach utilized herein to forecast based aircraft involves analyzing the historical trend of aircraft ownership within the airport's market area, and from that, preparing an estimate of based aircraft. The political boundary of Apache County is used to represent Window Rock Airport's market area. This market area definition is based upon information contained in aircraft registration records, and consideration of economic data requirements.

4.2.1 Market Area Aircraft

An exhaustive attempt was made to construct econometric models for all aspects of general aviation demand projected. However, due to the small

amount of historical based aircraft in the market area, in conjunction with data limitations (particularly for 1977 and 1978), forecasting by this method proved unsuccessful.

The alternative forecasting technique utilized involves applying a growth rate to based aircraft at Window Rock Airport. This forecast rate is comprised of two projected growth rates, and is based upon historical data from Apache County. These rates include those for total personal income (TPI), and modal shift. The TPI rate is derived from projections for Apache County published by the Arizona Department of Economic Security, for the years 1978 to 2000. The projections forecast total personal income to increase from \$160,020,000 in 1978 to \$190,745,000 in 1985, \$240,382,000 in 1990, and \$347,982,000 in the year 2000. All dollar amounts are stated in constant 1972 dollars for the purposes of analyzing real growth rates. The respective compound growth rates are 2.5 percent annually from 1978 to 1985, 4.7 percent from 1985 to 1990, and 3.8 percent from 1990 to 2000.

Modal shift growth rates are derived from relationships identified as a result of previous econometric simulation modeling projects conducted by PRC Speas. There are many parameters which affect a modal shift value. The most influential factors in modal shift growth rates include changes in an individual's value of time, relative price changes of aircraft ownership over that of the automobile, as well as comparable speeds of travel, and fuel consumption rates. The forecast shows modal shift growth rates increasing 2 percent annually from 1978 to 1985, 1.7 percent from 1985 to 1990 and 1.0 percent from 1990 to 2000. Therefore, modal shift to general aviation aircraft from the automobile is forecast to increase over the years analyzed, but at a decreasing rate.

As previously mentioned, the forecasting techniques utilized for projecting based aircraft includes a combination of TPI and modal shift growth rates. Their sum equals 4.5 percent annually from 1978 to 1985, 6.4 percent from 1985 to 1990, and 4.8 percent from 1990 to 2000.

Presented in Exhibit 4-2 is a historical breakdown of active based aircraft in Apache County. Historical data reveal that the number of aircraft increased from 12 in 1960 to 54 in 1978. The annual breakdown into aircraft type indicates that the majority of active based aircraft has historically been single-engine with a 4+ seating capacity.

4.2.2 Aircraft Based at Window Rock Airport

Several factors influence an owner's decision as to where the aircraft is based (stored). A survey conducted by the Department of Transportation revealed that the most influential factor is accessibility. Other significant factors include the quality of the airport, the quality of fixed base operators, airport and FBO prices, and aircraft operational requirements.

FAA records (Form 5010 - Airport Inspection) show that there were 17 aircraft based at Window Rock Airport at the end of calendar year 1977. This number represents 42.5 percent of the market share, when compared to the 40 aircraft based in the airport's market area as of 1977. This percentage has remained relatively constant throughout the historical years analyzed. Because Window Rock Airport is at the center of the Navajo Nation, it is reasonable to expect the Airport's market share to be quite large. The principle components of G.A. aviation activity at Window Rock include the Navajo government and U.S. government visitations. Exhibit 4-3 presents a historical breakdown of based aircraft at Window Rock Airport.

Exhibit 4-4 presents the forecast of based aircraft for the airport. The forecast shows the number of total based aircraft increasing from 25 in 1979 to 74 by the year 2000. The number of single-engine 1-3 place aircraft is forecast to more than double: from 3 in 1979 to 8 in 2000. Most significant, however, is the forecast growth of single-engine 4+ place based aircraft to triple from 18 in 1979 to 53 by the year 2000.

Exhibit 4-2

AIRPORT MARKET AREA--APACHE COUNTY
ACTIVE BASED AIRCRAFT

Year	Aircraft				Total
	Single-Engine		Multi-Engine	Other	
	1-3	4+			
1960	0	6	1	5	12
1961	0	10	2	2	14
1962	0	10	2	0	12
1963	0	13	0	4	17
1964	0	10	0	2	12
1965	0	10	0	1	11
1966	0	12	3	3	18
1967	0	13	1	4	18
1968	0	13	2	7	22
1969	0	11	3	6	20
1970	5	11	2	1	19
1971	3	13	2	0	18
1972	9	18	2	0	29
1973	9	21	3	3	36
1974	4	12	3	2	21
1975	6	14	2	3	25
1976	7	17	0	2	26
1977	12	26	2	0	40
1978	13	37	4	0	54

Exhibit 4-3

HISTORICAL BASED AIRCRAFT
WINDOW ROCK AIRPORT

Year	Aircraft					Total
	Single-Engine		Multi-Engine	Rotorcraft	Other	
	1-3	4+				
1960	--	--	--	--	--	--
1961	--	--	--	--	--	--
1962	--	--	--	--	--	--
1963	0	6	1	0	0	7
1964	0	4	1	0	0	5
1965	--	--	--	--	--	--
1966	0	3	2	0	0	5
1967	0	3	2	0	0	5
1968	0	1	0	0	0	1
1969	0	1	3	1	0	0
1970	0	1	2	0	0	3
1971	2	10	2	0	0	14
1972	--	--	--	--	--	--
1973	--	--	--	--	--	--
1974	--	--	--	--	--	--
1975	--	--	--	--	--	--
1976	2	10	2	1	0	15
1977	2	10	4	1	0	17
1978						
1979	3	18	3	1	0	25
1980 ^{1/}	3	18	3	1	0	25

^{1/} Estimate.

Exhibit 4-4

BASED AIRCRAFT FORECAST
WINDOW ROCK AIRPORT

<u>Aircraft Type</u>	<u>Actual</u>	<u>Forecast</u>		
	<u>1979</u>	<u>1985</u>	<u>1990</u>	<u>2000</u>
Single-Engine--1-3 Place	3	4	5	8
Single-Engine--4+ Place	18	24	33	53
Multi-Engine--1-6 Place	1	2	3	4
Multi-Engine--7+ Place	2	2	3	5
Turboprop--1-12 Place	0	1	1	1
Turboprop--13+ Place	0	0	0	0
Turbojet	0	0	0	0
Rotorcraft	<u>1</u>	<u>1</u>	<u>2</u>	<u>3</u>
Total Based Aircraft	25	34	47	74

4.3 AIRCRAFT MOVEMENTS

The total number of general aviation aircraft movements at Window Rock Airport is comprised of aircraft movements performed by based aircraft plus those performed by transient aircraft. These movements are further classified as itinerant or local aircraft movements. Itinerant movements are landings and take-offs performed at Window Rock Airport by aircraft in transit between Window Rock and another airport. Local movements are other landings and take-offs such as those associated with training or sightseeing flights.

The following basic forecasting methodology is utilized to forecast aircraft movements: Based aircraft movements are projected to equal the product of the number of based aircraft, the hours flown by based aircraft, the percent of hours flown and the percent of movements performed at Window Rock Airport, all by flight and aircraft type. On the average, 60 percent of itinerant movements are performed by transient aircraft. The number of movements performed by transient aircraft are shown to equal the number of itinerant movements performed by based aircraft multiplied by 1.5 for each aircraft type.

Annual utilization, percent of hours flown in local itinerant flight by aircraft type, the number of movements performed per hour in local itinerant flight by aircraft type, and the percentage of movements performed at the base airport by aircraft type, are derived from various industry and FAA surveys, and ongoing research conducted by PRC Speas.

The estimate of aircraft for the base year and the forecast of aircraft movements are presented in Exhibit 4-5. The computation leads to a base year estimate of 12,820 total aircraft movements.

The forecast shows aircraft activity growing 5.4 percent annually, from 12,820 movements in 1979 to 38,780 total movements by the year 2000. The majority of aircraft activity is expected to be conducted in local flight.

EXHIBIT 4-5

GENERAL AVIATION
AIRCRAFT MOVEMENTS
WINDOW ROCK AIRPORT

<u>Aircraft Type</u>	<u>1979</u>	<u>1985</u>	<u>1990</u>	<u>2000</u>
Single-Engine 1-3 Place	2,390	3,180	3,980	6,360
Single-Engine 4+ Place	7,250	10,090	13,860	22,260
Multi-Engine 1-6 Place	680	910	1,360	2,070
Multi-Engine 7+ Place	1,120	1,510	2,270	3,380
Turboprop 1-12 Place	300	580	620	880
Turboprop 13+ Place	0	0	0	0
Turbojet	0	160	380	640
Rotorcraft	1,080	1,080	2,140	3,190
Local				
Based	8,430	11,400	15,790	24,960
Transient	0	0	0	0
Itinerant				
Based	1,750	2,440	3,520	5,520
Transient	2,640	3,670	5,300	8,300
Total Movements	<u>12,820</u>	<u>17,510</u>	<u>24,610</u>	<u>38,780</u>

The forecast shows local aircraft movements increasing from 8,430 in 1979 to 24,960 in 2000; decreasing slightly, however, as a percentage of total movements from 66 percent in 1979 to 64 percent in 2000. Limited Turbojet and Turboprop 1-12 place aircraft activity is foreseen in the near future.

"Best estimate" forecasts for general aviation operations at Window Rock Airport are published by the Arizona Department of Transportation in the 1978 Arizona State Airport System Plan. Forecasts of general aviation operations in this report increase from 4,000 in 1977 to 7,000 in 1985, 9,000 in 1990, and 12,000 in 2000. This represents an annual growth rate of 4.9 percent over the forecast period. Although this rate is fairly close to the 5.4 percent figure projected in this report, there exists a significant discrepancy in absolute amounts. The Arizona Department of Transportation forecasts for movements are lower due to its lower base year estimate.

4.4 FUEL FLOWAGE

Fuel flowage refers to the number of gallons of aviation fuel sold at Window Rock Airport. The forecast of fuel flowage is provided to allow projections of fuel flowage fee revenues.

A documented history of fuel flowage at Window Rock Airport is not available. Discussions with on-site personnel, however, suggest that fuel flowage has been fairly constant over the last five to ten years. On the average, 12,000 gallons were sold annually to non-tribe (outside) users. Tribe purchasers averaged 18,000 gallons of fuel purchased per year.

Current fuel consumption data indicates 12,000 gallons of fuel purchased by non-tribe users and 24,000 gallons sold to Tribe Air Service (government travel). The sum of these figures, totalling 36,000, represents the estimated fuel flowage for 1979. This is depicted in Exhibit 4-6.

EXHIBIT 4-6

GENERAL AVIATION

FUEL FLOWAGE

WINDOW ROCK AIRPORT

<u>Calendar Year</u>	<u>Gallons</u>
Estimated -	
1979	36,000
Forecast -	
1985	50,100
1990	72,000
2000	113,100

Projections of fuel flowage were made on the basis of percentage increase relationships in aircraft movements. That is, annual percentage increases in transient itinerant movements were used to project transient fuel flowage. Based itinerant movement increases, on an annual percentage basis, were applied to forecast based aircraft fuel flowage. The total fuel flowage forecast per year was then determined, and is presented in Exhibit 4-6. Fuel flowage is projected to increase from 36,000 gallons in 1979 to 113,100 in 2000. This represents an annual growth rate of 5.6 percent.

4.5 TERMINAL AREA RELATIONSHIPS

Data for towered airports located within the State of Arizona reveal that approximately 19.5 percent of general aviation itinerant movements, and 17.7 percent of general aviation local movements, occur during the peak month of the year. Additionally, FAA survey data reveal that approximately 10 percent of annual local activity and 9 percent of itinerant activity occur during the peak hour of the average day of the peak month.

The above mentioned relationships are applied to the annual movement forecasts as a basis for preparing the general aviation terminal area relationships.

4.6 INSTRUMENT APPROACHES

Instrument approaches are the number of annual approaches to an airport with an intent to land, by an aircraft flying in accordance with an 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. This number is used in determining air navigation aid requirements.

The forecast of instrument approaches is calculated by applying the ratio of approaches to itinerant arrivals to forecast itinerant arrivals, by air transportation category. The computed ratio of 1.4×10^{-3} for

EXHIBIT 4-7

GENERAL AVIATION
 TERMINAL AREA RELATIONSHIPS
 WINDOW ROCK AIRPORT

<u>Description</u>	<u>1979</u>	<u>1985</u>	<u>1990</u>	<u>2000</u>
<u>Based Aircraft</u>				
Local Movements				
- Peak Month	1,490	2,020	2,800	4,420
- Average Day	48	65	90	143
- Peak Hour	5	6	9	14
Itinerant Movements				
- Peak Month	341	476	686	1,080
- Average Day	11	15	22	35
- Peak Hour	1	1	2	3
<u>Transient Aircraft</u>				
Itinerant Movements				
- Peak Month	515	716	1,034	1,620
- Average Day	17	23	33	52
- Peak Hour	2	2	3	5
<u>Total</u>				
- Peak Month	2,346	3,212	4,520	7,120
- Average Day	76	103	145	230
- Peak Hour	8	9	14	22

Window Rock Airport appears reasonable when compared to data for other airports in the vicinity. The forecast of instrument approaches projects an increase from 3 in FY 1979 to 4 in calendar year 1985, 6 in calendar year 1990, and 9 in calendar year 2000.