Financial Needs: Aviation

In scenarios B and C total financial needs identified in the long-range are considerably lower than those over the first ten years due to the difficulty of projecting the need and extent of future projects with as much detail as in the early stages of the planning program. The SANS, therefore concentrates more on the short and intermediate planning periods.

Figure 12:
Total 10-Year Financial Need for
Two Performance Scenarios B&C
2000-2010

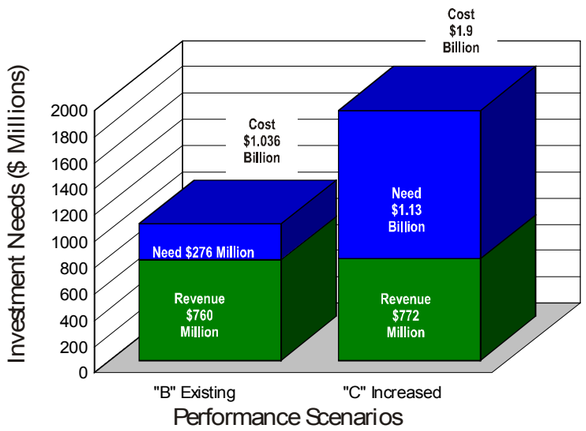
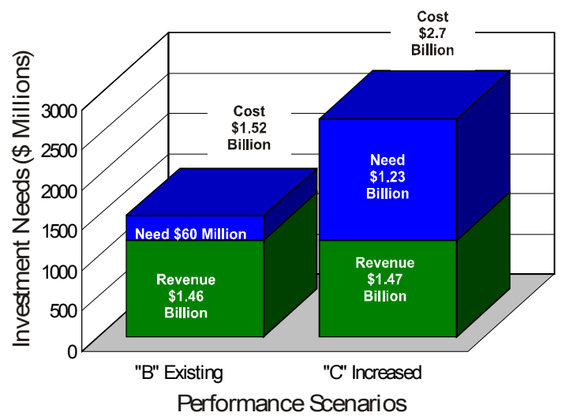


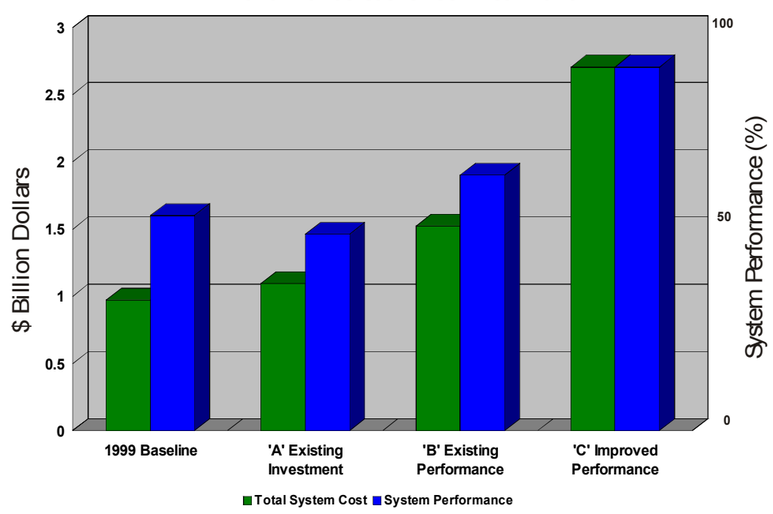
Figure 13:
Total 20-Year Financial Need for
Two Performance Scenarios B&C
2000-2020



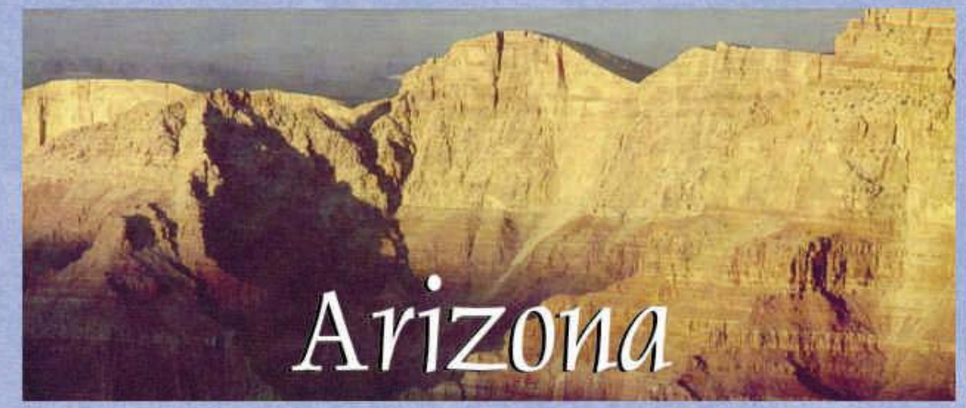
Investment and Performance

The concept selected for assessing the Needs for the SANS 2000 is one based on the application of objective performance measures for evaluating alternative system funding scenarios. The value of this methodology is that the results from various levels of investment in the system can be clearly determined and identified relative to the goals, objectives and performance measures utilized. A key assumption of the methodology is that the overall system performance should take precedence over the individual airports. Figure 14, which follows, graphically shows the relationship between the recent investments which have been made to the Arizona system of airports since 1995 and the effects on system-wide facility performance. Since 1995 the level of investment to the airport system has resulted in an overall deterioration in system performance. A continuation of the existing funding level will result in a continued decline in services and could affect aviation safety across the state. While significant improvements have been made at several larger airports across the state, the aviation system as a whole and many of the smaller facilities continue to have significant needs.

Figure 14:
Investment and Performance
Performance Scenarios - Year 2020



Executive Summary



State Aviation Needs Study (SANS) 2000

Prepared for the

Arizona Department of Transportation
Aeronautics Division

Volume I, II, III

Introduction

The Arizona Department of Transportation, Aeronautics Division, through its State System Planning Process and special studies, has developed an extensive and highly effective statewide aviation system. Consisting of nearly 85 public use facilities, the system moves over 20 million passengers per year and provides an estimated 28.1 billion dollars in direct, indirect, and induced economic impact annually for the State in 1998. The aviation system supports the tourist industry and other business opportunities, enhances the quality of life in the state through the delivery of health care and social services to rural areas, and facilitates the provision of emergency medevac flights throughout the state.

From a systemwide perspective, the condition of the existing system relative to the basic airport infrastructure, runway capacity, and the level of service provided to the citizens of the state is generally good. Overall, most airports in the state have better than average airside and landside facilities, adequate runway capacity, and well maintained pavements. The system also performs well in fulfilling its fundamental mission of the movement of people and goods. When compared to national standards, the system has very few gaps in the provision of convenient access to both commercial passenger airline service and general aviation services.

However, continued growth in both commercial service and general aviation activity will put a strain on the system. Significant increases in delay will occur at the state's busiest airports and system-wide performance will decline without continued investment in the system. Increased delays for both air carrier and general aviation airports would substantially reduce the significant positive economic impact of aviation to the state.

SANS Assessment Process

Aviation needs are estimated using a performance based needs model originally developed for the 1990 State Aviation Needs Study. The methodology, which is illustrated in Figure 1, evaluates the performance of all airports in the state aviation system and determines needs relative to the state aviation system's goals and objectives. Three aviation needs scenarios were developed corresponding to the capital investment levels required to maintain and to improve system performance over the next twenty years.

The first Scenario (A) was designed to explore a scenario in which the existing funding level (in current dollars) would remain unchanged over the next twenty year period. The goal was to examine the types of improvements that could be done in circumstances in which funding for maintenance and construction does not keep up with increasing demand.

The second Scenario (B) determines the financial investment required to maintain the present performance level of Arizona's airport system into the future. Investment is sufficient only to keep pace with projected demand.

The third Scenario (C) assesses the financial investment needed to improve all State Aviation System facilities sufficiently to meet the Federal Aviation Administration and ADOT's minimum planning and design guidelines for airports. In this scenario, existing airports are expanded to meet forecast demand, and new airports are constructed to meet access or capacity deficiencies.

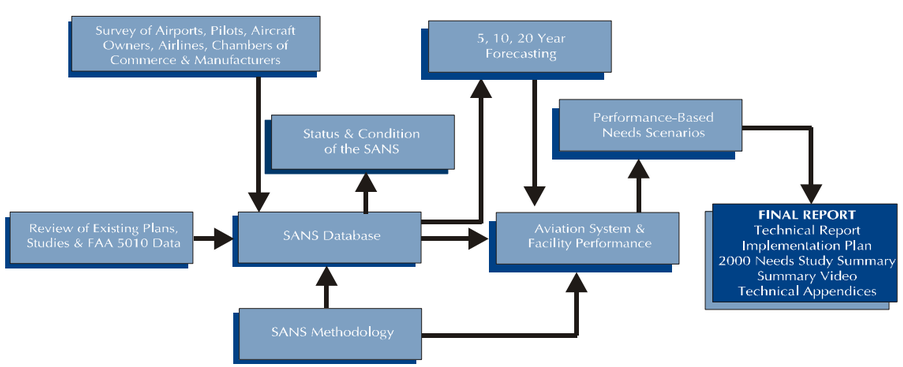


Figure 1: SANS Methodology Flow Chart

Aviation Cost Estimates

For this summary, we have primarily concentrated on only two of the investment scenarios -- maintaining existing performance and increased performance of the system. Because the existing investment scenario (A) results in a dramatic decrease in overall system performance, it was determined that this would be an undesirable course of action for the future. Figure 9 shows the estimated cost to **maintain** the existing level of performance of the aviation system. In this scenario, the total cost for the next five years is $539 million and for the next ten years is $1.04 billion. Nearly one-third of all expenditures are required by commercial service airports, with about sixty percent invested in other state primary airports.

Figure 9:
Cost Estimates to Maintain Existing Level
of Aviation System Performance 2000-2010
Ten-Year Total Cost = $1.04 Billion

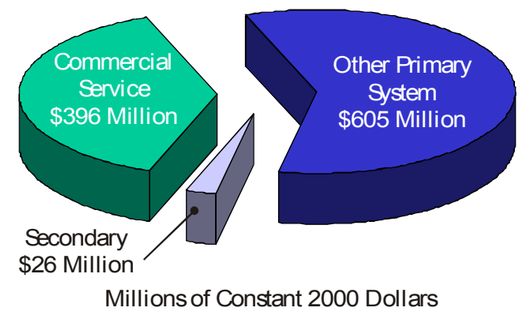
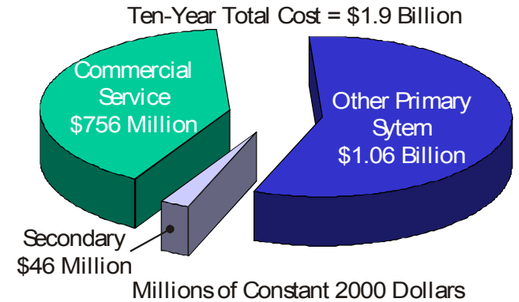


Figure 10 shows the estimated cost to bring all system airports up to the minimum Federal Aviation Administration and ADOT guidelines for airport planning and design. For the next five years, costs are estimated at $1.123 billion and for the next ten years, estimated expenditures are $1.9 billion. Again, the majority of expenditures would be used to upgrade commercial service and other primary system airports.

Figure 10:
Cost Estimates to Bring All Airports
to Minimum Guidelines 2000-2010
Ten-Year Total Cost = $1.9 Billion



Aviation Revenue

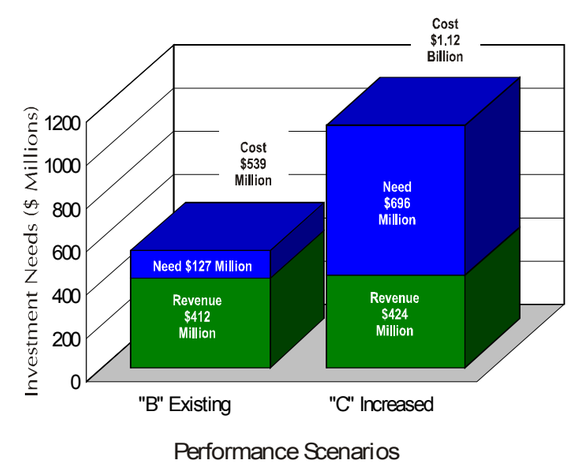
From the year 2000 forward, aviation revenue is forecast to average about $72 million per year based on current revenue sources. If averaged over the next five years, total revenue is forecast to total about $360 million. For the ten-year period, total aviation revenue would reach about $760 million. Of that ten-year total, $592 million is estimated from the federal government, $129 million from the state, and nearly $39 million from local governments and private sources. Private contributions for private airports vary with each scenario.

Financial Needs: Aviation

Financial needs are defined as the difference between costs and revenues. Figures 11-13 show the estimated financial needs for each Scenario. For example, over the next five years, to maintain the existing level of performance, an additional $127 million is needed to meet expenditures. Over the next ten years that figure rises to more than $276 million, and about $604 million in additional funding is needed over the next two decades.

To bring all the system airports to minimum guidelines, an additional $696 million, $1.12 billion, and $1.5 billion is needed over the five-, ten- and twenty- years, respectively.

Figure 11:
Total 5-Year Financial Need for
Two Performance Scenarios B&C
2000-2005



System Performance

The performance-based needs scenarios are the focus of this study. Needs scenarios were developed to evaluate the various alternative future aviation system development strategies. They were matched against performance measures that reflected the desired level of service that the state aviation system should provide. As indicated, three alternative development strategies were considered. By comparing each system development scenario to the performance measures, State decision makers can determine the level of performance that each scenario will provide, as well as the associated costs of that scenario.

To adequately assess the system, three general categories of performance measures were developed: Facility, Service Level, and Economic Measures.

- Facility Performance - Primary measures are physical condition and airfield capacity.
- Service Level Performance - Measures of the adequacy of the system in fulfulling the fundamental mission of the movement of people and goods.
- Economic Performance - Primary measures are costs of delay, economic impacts, and return on investment.

In total, 17 performance measures were selected for the SANS 2000. Figure 7 shows the existing performance level of 12 of the measures, those addressing only facility and service level performance. Figure 8 provides a comparison of the State aviation system performance since the previous SANS prepared in 1995. As can be seen, some areas of performance have improved over the past five years including the resulting total economic impact of the system which has increased from $4.1 billion to $6.3 billion annually. At the same time, while many of the larger, more active airports in the system have kept up with demand, the system, as a whole, due to lack of available funding, has experienced a decline in overall performance.

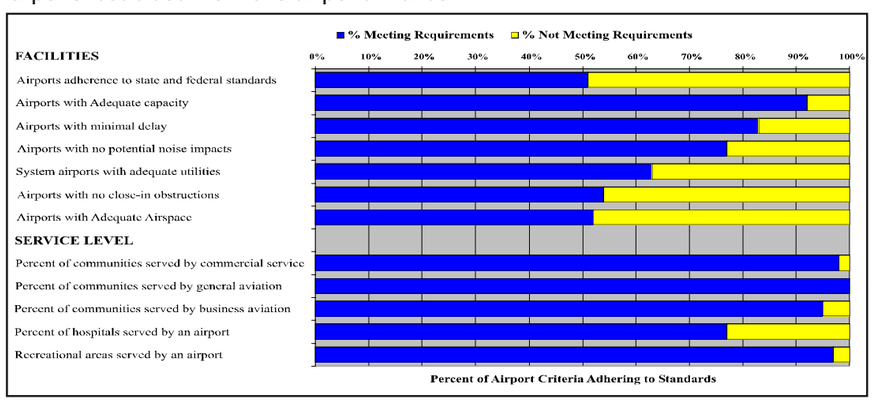


Figure 7:
Facility and Services Level Performance for the Existing System

PEFORMANCE MEASURE		1995 SANS	2000 SANS	% - CHANGE
Facilities				
1	Airports meeting Planning Standards	57%	51%	-6%
2	Airports with adequate capacity	92%	92%	No Change
3	Airports with minimal aircraft delay	2639 hrs	2253 hrs	7%
4	Airports with no/minimal Noise Impacts	84%	77%	-8%
5	Airports with adequate Utilities	65%	64%	-1%
6	Airports with no close-in Obstructions	38%	73%	35%
7	Airports with no significant/restricted shared airspace	N/A	54%	N/A
Service Level				
8	Percent of communities with commercial air service	98%	94%	-4%
9	Percent of communities served by general aviation	100%	100%	No Change
10	Percent of communities served by business aircraft	95%	90%	-5%
11	Percent of hospitals served by an airport	80%	82%	2%
12	Recreational areas served by an airport	97%	97%	No Change
Economic				
13	Cost of Average Aircraft Annual Delay	$28.5 Million	$39.1 Million	25%
14	Aviation Economic Impact	$4.1 Billion	$6.3 Billion	35%
15A	Cost ratio of enplaned passengers	5:1	4:1	Decreased
15B	Cost of ratio of annual aircraft operations	17:1	15:1	Decreased
16	Cost of Aircraft delays	N/A	$8.2 Million	N/A
Total System Cost		$45.0 Million	$60.0 Million *	25%

Figure 8:
Performance Measure Comparison of the State Aviation System 1995 to 2000

Advisory Committee

In order to get input from users of the system, groups representing both aviation and non-aviation interests were invited to participate in the SANS as a Planning Advisory Committee (PAC). The following is a listing of organizations that took part:

- Arizona State Legislature (Representative)
- 56th Fighter Wing (Luke Air Force Base)
- Arizona State University
- Arizona Air National Guard
- Vision 21 Task Force
- Embry-Riddle Aeronautics University
- Maricopa Association of Governments (MAC)
- Office of the Governor
- Federal Aviation Administration (FAA)
- Aircraft Owners and Pilots Association (AOPA)
- Honeywell Computer
- Kingman Airport
- Arizona Flyways
- Glendale Municipal Airport
- American West Airlines
- Tucson Airport Authority
- Arizona Pilots Association
- MD Helicopters
- Pima Association of Governments (PAG)
- Arizona Airports Association
- Yuma International Airport
- Southwest Airlines
- Navajo Nation
- Phoenix Sky-Harbor Airport
- Arizona DOT, Aeronautics Division

Goals and Objectives

The primary goal of the SANS 2000 was to determine the existing status, condition and performance of Arizona's aviation system and to evaluate the improvement needs of the system on a five-, ten- and twenty-year basis. The study provides guidance for the structured development of aviation facilities necessary to meet the State's needs through the year 2020. The SANS 2000 incorporates the requirements of the ADOT, Aeronautics Division and the Federal Aviation Administration (FAA) into the analysis and planning program.

Goals and objectives are the essential bridge between technical evaluation of alternative plans and the needs of the state, regions within the state, individual communities, and special interest groups. The evaluation process combines quantitative standards or relatively precise criteria with qualitative judgements. Setting goals and objectives in the planning process directs the quantitative ranking judgements towards conformity with overall statewide and community values.

Ultimately, the success of this study effort largely depends on identifying the long-term policies of the state and developing an overall strategy that will guide the planning effort in the desired direction. In support of overall state social, economic and environmental policies, the following goals were identified as relating to the future development of Arizona's state air transportation system.

- Provide for the timely development of aviation facilities adequate to meet the air transportation needs and economic goals of the State of Arizona.
- Maintain a system of public use airports and heliports that assures a high degree of safety to the users while at the same time providing better than adequate levels of service, in terms of reliability and efficiency.
- Maximize the economic benefits and return on investment from development of Arizona's air transportation system.
- Develop an air transportation system that is consistent with Arizona's long range comprehensive planning policies and plans, particularly with respect to surface transportation and land use.

Status and Condition

Arizona's aviation facilities range from small rural unpaved airstrips to large long-haul commercial service airports. Three hundred and nine Arizona airports are registered with the Federal Aviation Administration (FAA), of which 92 are open to the public and included in the State Aviation System. Fifty-nine facilities are recognized by the FAA as nationally significant by inclusion in FAA's National Plan of Integrated Airport Systems (NPIAS). These airports are eligible for federal funding for airport planning and capital improvements. Included in this group are eight primary commercial service airports, five non-primary commercial airports, 33 general aviation airports and nine reliever airports. Figure 2 shows the State Aviation System facilities (public use) by type. Figures 3 and 4 identify the State's Primary and Secondary System Airports.

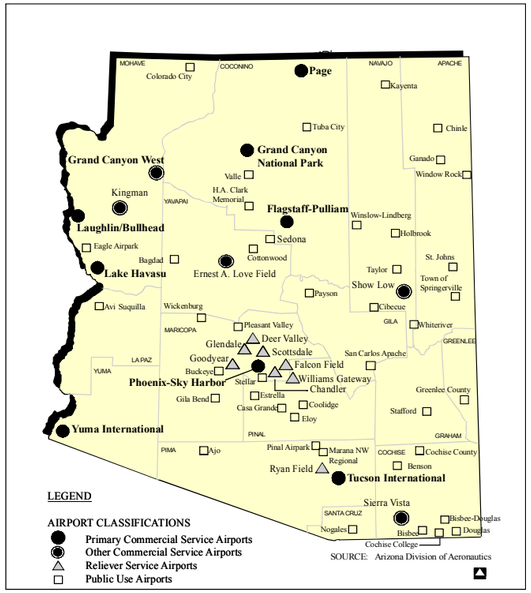


Figure 3:
Arizona State Primary Airport System

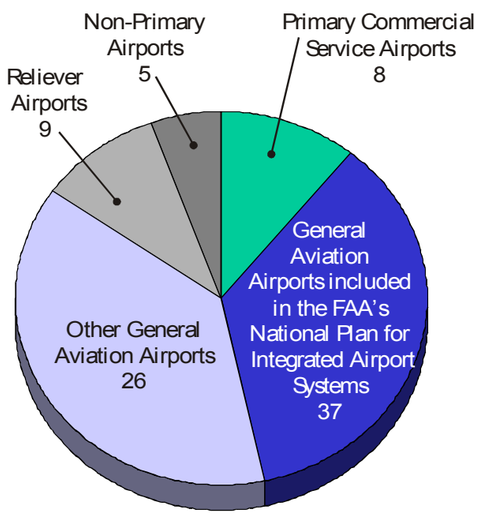


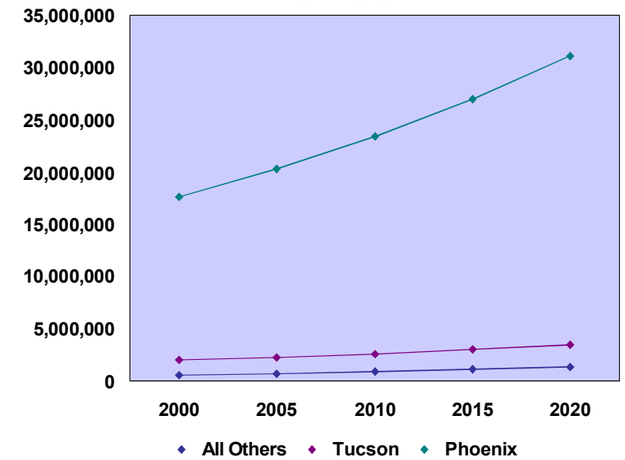
Figure 2:
Classification of Aviation Facilities
Total State System Airports: 85

Figure 4:
Arizona State Secondary Airport System

Aviation Activity: Commercial Air Passengers

Arizona's aviation industry is a catalyst for economic expansion and continues to grow rapidly. The state has witnessed tremendous growth over the past twenty years and the next twenty promise to be filled with equal potential as the state epitomizes "sun belt" attractiveness. The forecast for commercial passenger enplanements is shown on Figure 5. Between 2000 and 2020, total passenger enplanements are expected to increase by 79 percent, to nearly 36 million annually. Phoenix and Tucson carry worldwide recognition and will account for the majority of this activity. In addition, however, the Grand Canyon and Colorado River communities remain top draws for tourism, old West towns perpetuate Arizona's appeal, and the state's diversified climate and scenery create an unmatched variety of travel experiences.

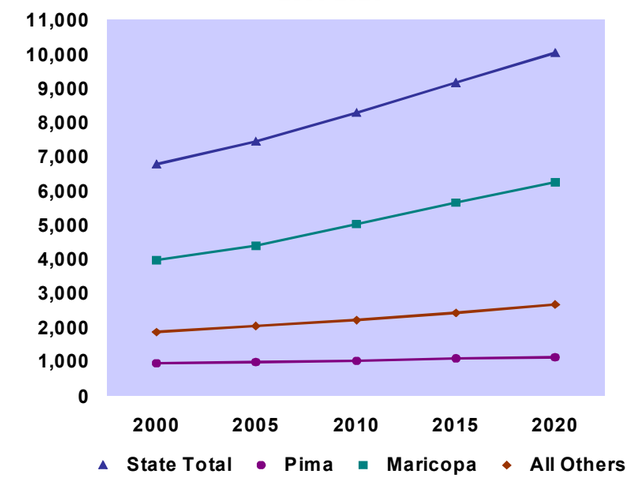
Figure 5:
Forecast Commercial Passenger Enplanements
2000-2020



General Aviation Activity

General aviation includes every type of civil flying other than the certificated air carriers and, often the system is characterized by a relatively low profile. Most of the general public enjoys the benefits of the system while many remain unaware of its existence or misunderstand its use and importance. Nationally, general aviation accounts for 96 percent of all hours flown and provides access to more than 12,000 communities, while commercial air carriers provide service to about 350 airports. In Arizona, while the commercial air carriers provide service to only 20 communities within the state, general aviation public use airports provide quick, efficient access to nearly 100 communities statewide. Over the past five years, total general aviation based aircraft within Arizona has increased by 9.7 percent. As illustrated in Figure 6, this sustained growth in general aviation usage is expected to continue in the state with an estimated increase of more than 40 percent in total-based aircraft over the next 20 years. In terms of aircraft operations, or landings and takeoffs, activity is expected to increase by nearly 64 percent over this same period which will result in even greater demand and need for improvement to airfield facilities.

Figure 6:
Forecast General Aviation Based Aircraft
2000-2020



ELEMENT ONE: INTRODUCTION GOALS AND OBJECTIVES REVIEW OF EXISTING PLANS

Element One is the first in a series of seven elements that have been established to facilitate the development of the 2000 Arizona State Aviation Needs Survey (SANS). The SANS has been sub-divided into these elements to allow for the periodic review of the study findings by other concerned parties. Suggested revisions from these periodic reviews will be incorporated into the final SANS documentation.

The focus of Element One is to provide an overview of the study process as well as to define the goals and objectives of the SANS. Element One is divided into the following sections:

- Project Description
- Issues
- Goals and Objectives
- Review of Existing Plans

Each of the above referenced sections will provide adequate details to better understand the procedures, definitions, assumptions, constraints, and information sources utilized in the SANS report.

1.1 PROJECT DESCRIPTION

The Arizona Department of Transportation (ADOT), Aeronautics Division reassesses the needs of the state's aviation system every five years. The previous needs assessment was completed in 1995. Given the significant population increases that Arizona has witnessed in recent years, it is imperative to develop an accurate assessment that can address this blossoming population and the growth associated with it. As the population bulges, the strains placed on the airport system become more evident. Needs increase not only for commercial service but also for improved cargo services, as well as medical and recreational support services. Population projections indicate this trend will continue throughout the state. Therefore, it is necessary for Arizona to approach the SANS study with a more unique methodology. Many factors that will have to be considered may not be critical in studies where population trends are stagnant.

Airports and aviation facilities in the state are considered to be part of a ***system*** with each reaping benefits of the other facilities in some manner. The primary goal of the SANS 2000 is to determine the existing status, condition and performance of this system and to evaluate the improvement needs of the system on a five-, ten- and twenty-year basis. Facilities considered in the SANS include all public and private (those open to public) airports, and heliports, as well as recreational and Native American airports. A listing of all public use facilities with their associated cities and counties is presented in Table 1-1.

TABLE 1-1: ***Arizona State Public Use Airports***

AIRPORT NAME	ASSOCIATED CITY	COUNTY
Ajo Municipal	Ajo	Pima
Apache Junction (New)	Apache Junction	Pinal
Avi Suquilla (NA)	Parker	La Paz
Bagdad	Bagdad	Yavapai
Benson Municipal	Benson	Cochise
Bisbee Douglas International	Douglas/Bisbee	Cochise
Bisbee Municipal	Bisbee	Cochise
Bowie	Bowie	Cochise
Buckeye Municipal	Buckeye	Maricopa
Casa Grande Municipal	Casa Grande	Pinal
Cascabel Airpark (Note 1)	Tucson	Pima
Chandler Municipal	Chandler	Maricopa
Chinle Municipal	Chinle	Apache
Cibecue Municipal (New)	Cibecue	Navajo
Cochise College	Douglas	Cochise
Cochise County	Willcox	Cochise
Colorado City Municipal	Colorado City	Mohave
Coolidge Municipal	Coolidge	Pinal
Cottonwood Municipal	Cottonwood	Yavapai
Douglas Municipal	Douglas	Cochise
Eagle Airpark	Aguila	Mohave
Eloy Municipal	Eloy	Pinal
Ernest A. Love Field	Prescott	Yavapai
Estrella Sailport	Maricopa	Pinal
Falcon Field	Mesa	Maricopa
Flagstaff-Pulliam	Flagstaff	Coconino
Flying J Ranch	Pima	Graham
Forepaugh	Wickenburg	Maricopa
Ganado (NA)	Ganado	Apache
Gila Bend Municipal	Gila Bend	Maricopa
Glendale Municipal	Glendale	Maricopa
Grand Canyon Bar-Ten	Whitmore	Mohave
Grand Canyon Caverns	Peach Springs	Coconino
Grand Canyon National Park	Grand Canyon	Coconino
Grand Canyon West	Meadview	Mohave
Grande Valley	Maricopa	Pinal
Greenlee County	Clifton/Morenci	Greenlee
H.A. Clark Memorial Field	Williams	Coconino
Holbrook Municipal	Holbrook	Navajo
Kayenta (NA)	Kayenta	Navajo
Kearny	Kearny	Pinal
Kingman	Kingman	Mohave
Lake Havasu City Municipal	Lake Havasu City	Mohave
Laughlin/Bullhead International	Bullhead City	Mohave
Marana NW Regional	Marana	Pima
Marble Canyon	Marble Canyon	Coconino

TABLE 1-1: ***Arizona State Public Use Airports (continued)***

AIRPORT NAME	ASSOCIATED CITY	COUNTY
Memorial Airfield (NA) (Note 1)	Chandler	Maricopa
Mogollon Airpark (Note 1)	Overgaard	Navajo
Nogales International	Nogales	Santa Cruz
Page Municipal	Page	Coconino
Payson	Payson	Gila
Pearce Ferry	Meadview	Mohave
Phoenix Deer Valley	Phoenix	Maricopa
Phoenix Goodyear	Goodyear	Maricopa
Phoenix Sky Harbor Int'l	Phoenix	Maricopa
Pinal Airpark	Marana	Pinal
Pleasant Valley	Peoria	Maricopa
Polacca (NA)	Polacca	Navajo
Quartzsite (New)	Quartzsite	La Paz
Rolle Airfield	Somerton	Yuma
Ryan Field	Tucson	Pima
Safford Regional	Safford	Graham
St. Johns Industrial Airpark	St. Johns	Apache
San Carlos Apache	Globe	Gila
San Manuel	San Manuel	Pinal
Scottsdale	Scottsdale	Maricopa
Sedona	Sedona	Yavapai
Seligman	Seligman	Yavapai
Sells (NA)	Sells	Pima
Show Low Municipal	Show Low	Navajo
Sierra Vista Muni/Libby AAF	Ft. Huachuca	Cochise
Stellar Airpark	Chandler	Maricopa
Sun Valley	Bullhead City	Mohave
Superior Municipal	Superior	Pinal
Taylor	Taylor	Navajo
Temple Bar	Temple Bar	Mohave
Tombstone Municipal	Tombstone	Cochise
Town of Springerville Municipal	Springerville	Apache
Tuba City (NA)	Tuba City	Coconino
Tucson International	Tucson	Pima
Tuweep	Tuweep	Mohave
Valle Airport	Grand Canyon	Coconino
Whiteriver (NA)	Whiteriver	Navajo
Wickenburg Municipal	Wickenburg	Maricopa
Williams Gateway	Phoenix	Maricopa
Window Rock (NA)	Window Rock	Apache
Winslow-Lindberg Regional	Winslow	Navajo
Yuma International	Yuma	Yuma

LEGEND:
NA = Native America
Note 1: Airport changec to "Private Use"

As we progress toward a more global economy, the impact of aviation cannot be understated. Efficient and safe access to and from a multitude of geographic locations is essential for maintaining pace in an ever-changing world. Growth in the 21st century will depend heavily on technology and transportation capabilities. Aviation facility improvements will be critical to Arizona continuing its remarkable growth rate. In all likelihood, new facilities will become necessary. Planning now for these improvements and new facilities is the key to success. Time is required to develop budget items and associated appropriations. Alternative funding mechanisms have to be considered and evaluated for viability in the event of a budget shortfall.

Decisions of this nature mandate that the information provided for decision making be comprehensive and accurate. Given the time restrictions associated with these decisions, the information must also present a concise picture of the overall statement. Cost projections must be realistic. Findings must be substantiated by adequate proof to prevent second-guessing. The SANS 2000 has been developed with these vital aspects in mind. While it is necessary to analyze a large volume of data, it is even more crucial to focus the conclusions in the areas with the greatest needs.

1.2 ISSUES

The SANS 2000 is designed to assess the needs of the aviation community as a whole. It presents an opportunity to consider numerous issues that impact aviation throughout the state. It also creates a forum to consider input from airport managers, pilots, economic development agencies, air service providers, and other potentially affected parties. Among the issues that will be considered in the development of SANS 2000 are the following:

- Differences in existing information in aviation data such as airport master plans, Regional Aviation System Plans (RASP), and the State Aviation System Plan (SASP)
- Needs study methodologies used in other states
- Educational and training needs of current and future system users
- Planning, engineering, construction costs, and cost trends
- Impact of advanced technological improvements
- Land-use compatibility issues
- Impact of environmental issues and constraints
- Potential return-on-investment of tax dollars
- Revenue and funding sources
- Identification of specific needs to improve existing facilities and to develop new facilities
- Medical aviation needs
- Aviation safety throughout the system

The order of listing of these issues does not reflect relative priorities. All of the issues are paramount in developing the SANS.

1.3 GOALS AND OBJECTIVES

The establishment of goals and objectives is essential in any data collection and interpretation task. The desired end product must be confirmed before the collection effort is initiated in order to prevent needless research. Defined goals and objectives are the key to this. The data evaluation process combines quantitative measures with qualitative interpretations. Setting goals and objectives at the onset allows the evaluation process to maintain focus and not become encumbered.

As previously stated, the primary goal of the SANS 2000 is to determine the existing status, condition and performance of Arizona's aviation system and to evaluate the improvement needs of the system on a five-, ten- and twenty-year basis. This study will provide guidance for the structured development of aviation facilities necessary to meet the State's needs through the year 2020. The SANS 2000 shall further incorporate requirements of the ADOT, Aeronautics Division and the Federal Aviation Administration (FAA).

To be an effective evaluation of the aviation system, it is essential to consider the "big picture." Becoming entangled in the needs of a particular facility or in short-term needs of the system will not benefit the entire system. It is necessary to consider long-range ideology. What will the needs of the system be in twenty years or fifty years? Laying effective groundwork in the present will prevent future difficulties. Having foresight now can result in significant savings down the road. As Federal funding becomes tighter and tighter, it is even more critical to budget and spend effectively. It is also necessary to address issues regarding environmental and social impacts of aviation facilities. To this cause, the following developmental goals have been established for Arizona's aviation system:

- Provision of adequate aviation facilities that can meet the transportation and economic needs of the state

- Maintenance of a system of airports and other aviation facilities that can ensure user safety while supplying better than adequate levels of service in terms of reliability and efficiency

- Amplification of the economic rewards and return on investment by improving Arizona's aviation facilities

- Cultivation of an air transportation system that is consistent with the long-term planning policies, land use issues, and surface transportation goals.

The specific objectives of the SANS 2000 can be stated in terms suited for the use of performance standards. The objectives listed below have been deemed significant to the State's aspiration of effective development of its aviation system.

- Facilitate commercial air service in both urban and rural areas throughout Arizona
- Ensure conformance with physical development standards established by Federal, state and local agencies
- Provide a system of aviation facilities within reasonable access time to all system users
- Promote the use of aviation facilities for the delivery of emergency and rural health care services
- Encourage economic development opportunities through the utilization of an effective aviation system
- Maintain compatibility with local land use patterns and plans
- Raise the efficiency of the aviation system
- Maximum the return on investment for aviation dollars
- Foster input from potentially impacted parties through a variety of means including public forums and questionnaires

1.4 REVIEW OF EXISTING PLANS

Numerous studies have preceded the SANS 2000. These studies have been conducted by a variety of entities including individual airports, regional planning agencies, and the ADOT, Aeronautics Division. These studies provide valuable information that must be considered during the compilation of the SANS 2000. Operations data, forecasting information, budget figures, and physical characteristics are just a few of the items that can be ascertained from these existing plans.

It is necessary to evaluate these extensive planning efforts for their applicability to the current study. Many times the previous studies are not current enough to consider the data valid. Other times their objectives are too site-specific to be beneficial to the study of the aviation system as a whole. In general, however, these studies have been conducted through the expenditure of a great deal of time that is not possible when assessing the needs of the entire state. It is this fact that makes reliance on these documents mandatory. Several aspects of the SANS 2000 accept the information in the existing plans "as is" with no exceptions. This is a necessary step in order to achieve the timeliness required.

The following sub-sections detail the background and sources of the existing planning efforts. In all cases the most recent study available has been reviewed.

Background

Aviation planning efforts in Arizona are conducted at multiple levels: national, state, regional, and local. The emphasis at each level varies as do the priorities. Different goals and objectives of the sponsors create this variance.

At the national level is the National Plan of Integrated Airports Systems (NPIAS) which is produced by the FAA. The NPIAS is based on information developed as a result of state and metropolitan/regional system planning and individual facility master planning as well as national forecasts and planning. It is a ten-year plan that is continually updated by the FAA. It lists the development of public use airports that are considered to be of national interest and are thus eligible for financial assistance for airport planning, maintenance, and development under the Federal Airport Improvement Program (AIP). To be considered for AIP funding, an aviation facility must be included in the NPIAS.

State level planning efforts are performed by ADOT. These efforts generally target the assessment of needs for new aviation facilities and the need for improvement of existing facilities. Studies at this level include the Continuous Aviation System Planning Process (CASPP) and a variety of special interest studies.

Regional planning efforts are conducted to identify the needs of larger regional/metropolitan areas that may have more specific interests. The needs are generally stated within the context of regional priorities and are normally incorporated into state planning efforts. Regional plans have been developed by Cochise County, the Maricopa Association of Governments (MAG), and the Pima Association of Governments (PAG).

Local planning efforts are reflected by individual airport master plans. These master plans are undertaken by local airport sponsors and operators. They detail the specific long-range plans of the facility within the framework of local community goals and objectives as well as statewide and regional/metropolitan system plans.

National Plan of Integrated Airport Systems (NPIAS)

As previously stated, NPIAS is an airport system plan developed by the FAA to indicate aviation facilities of national significance. NPIAS airports are eligible for federal grants for airport planning and various capital improvements. The NPIAS defines the status of an airport by its service level. The service level of a facility is reflective of the type of public service that the facility provides to the community. The service level is further indicative of the funding categories established by Congress to assist in airport development. The service levels categories identified by the NPIAS are as follows:

- Primary Service (PR) – Primary service airports are public use airports receiving scheduled airline passenger service which also enplane 10,000 or more passengers per year.

- Commercial Service (CM) – Commercial service airports are public use airports receiving scheduled airline passenger service which also enplane 2,500 or more passengers per year.

- General Aviation (GA) – General aviation airports are either publicly or privately owned public use airports that serve general aviation users.

- Reliever (RL) – Reliever airports are general aviation (RL) airports which have the function of relieving congestion at a Primary Service airport and which provide the

general aviation user or small commercial operator with an alternative for access to the overall community. Reliever airports receive higher priority for funding assistance than other general aviation or commercial service airports.

The most recent NPIAS, March 2000, lists 57 airports in Arizona. This includes ten primary airports, five non-primary commercial service airport, 33 general aviation airports and nine reliever airports.

Arizona State Aviation System Planning

The initial State Aviation System Plan (SASP) was prepared in 1973 and was updated in 1978 and 1988. The purpose of the SASP was to provide policy guidelines that would promote and maintain a safe aviation system in the State while providing an assessment of the needs of the system on a five-, ten-, and twenty-year basis.

In 1988 the SASP was replaced by the Continuous Aviation System Planning Process (CASPP). The components of the CASPP are stated below:

Volume I	Economic Impact of Aviation in Arizona (1990)
Volume II	Inventory of Aviation Activities (1988)
Volume III	Forecasts of Aviation Activity (1988)
Volume IV	Commuter Air Service Feasibility Study (1988)
Volume V	Land Use Compatibility (1992)
Volume VI	The Future of Aviation in Arizona (1988)

Other studies initiated by the State and identified in the 1995 SANS include a 1988 report on the needs of Native American airports, secondary airports, and other airports; a study in 1988 on the feasibility of a new regional airport facility in the Verde Valley area; the Arizona Recreational Airports System Plan conducted in 1992; a Pavement Management System Study from 1992; and the Arizona Regional Airport Feasibility Assessment Study done in 1993.

Studies performed by the state subsequent to these include the *Feasibility Study and Environmental Review for a Regional Rescue and Firefighter Training Facility (ARFF)* completed in 1995, *The Economic Impact of Aviation in Arizona* from 1998, and the *Navigational Aids and Aviation Services Special Study* completed in 1998. Completion of the *Arizona Rural Air Service Study* is still pending.

<u>Past Aviation Needs Study Efforts</u>
The previously stated goals of the SANS 2000 were similar to those of the past SANS studies. The SANS 2000 will be the fourth in a series of these broad spectrum analyses of the aviation system in Arizona.

The first SANS was developed in 1985. Its purpose was to address the five-, ten-, and twenty-year capital improvements needs for the aviation system in Arizona. Various performance levels were considered and projected revenues were compared to costs at each performance level. This process is very similar to the task at hand for SANS 2000.

A particularly unique aspect of the 1985 SANS was the use of comparison ratings to evaluate performance levels. This rating scheme compared an airport's overall ability to accommodate demand versus the total aviation demand in the State both at 1985 levels as well as future projection levels. Once a benchmark rating was determined, it was possible to evaluate numerous scenarios that could impact the benchmark. Cost projections could be made for various performance levels.

The SANS 1990 further refined the SANS 1985 rating methodology. The goal of SANS 1990 was to correlate the aviation system needs with state economic, social and environmental policies. Planners were able to gauge the level of attainment of various goals and objectives complying with these policies, thereby assuring effective management of taxpayer funds. An additional variable implemented into SANS 1990 was 50-year projection information.

The SANS 1995 evaluated needs projections on a five-, ten-, and twenty-year basis. The performance levels measured and the scenarios considered are similar to those utilized in SANS 2000. SANS 1995 promoted a methodology that would allow for an evaluation of the relationship between the performance of the system and capital investments placed into various parts of the system. This created the ability to interchange multiple capital investment scenarios and subsequently provide valuable insight into funding decisions.

All of the SANS efforts have attempted to encourage the input of a variety of individuals. The usage of questionnaires, the establishment of Planning Advisory Committees (PAC), and the public forums have fostered the development process.

Regional Airport System Plans (RASP)

At this time there are three RASP's in effect in Arizona. Entities undertaking RASP efforts include Cochise County, the Maricopa Association of Governments (MAG), and the Pima Association of Governments (PAG). These RASP's further define the goals and objectives of the airport system on a localized basis above and beyond the individual facility master plan goals. Unique goals of the various RASP's promote the development of somewhat dissimilar data than that obtained at the state level, but their evaluation is essential in the preparation of SANS 2000. The ability to minimize the study population increases the volume of information that can be considered. Brief descriptions of the current RASP efforts are detailed in the following paragraphs.

<u>Cochise County</u>
Two primary RASP efforts have been prepared for Cochise County. The initial RASP was done in 1982. The most recent effort was completed in 1994. Information from the 1994 Cochise County RASP was considered for SANS 1995. There were 13 airports evaluated by the RASP. The facilities included in the 1994 report are:

Public Use Airports		Private Airports
Sierra Vista Muni/Libby AAF	Douglas Municipal	Benson
Bisbee Municipal	Tombstone Municipal	Whetstone
Bisbee-Douglas Int'l	Bowie	San Simon
Cochise College	Benson (proposed in 1994)	McNeal
Cochise County		

The 1994 RASP considered inventory data from each airport; input from pilot/owners as well as the public; operations and aircraft forecasts; and socio-economic data. It also compared the existing facilities to the development guidelines established by ADOT planning efforts.

From the RASP, a listing of priority projects was produced. Among those projects identified by the 1994 RASP included additional taxiways and PAPIs at Sierra Vista/Libby AAF, a paved taxiway and navigational lighting at Cochise County, and the construction of the new Benson Municipal Airport.

Maricopa Association of Governments (MAG)

The first Maricopa Association of Governments RASP was completed in 1979 and was updated in 1986. Rapid development in Maricopa County prompted another revision of the plan in 1993. The data from the 1993 RASP was utilized in the SANS 1995. There has been no update of the MAG RASP since 1993, but the MAG recently received funding to initiate an update in 2001.

In 1996 MAG completed an Implementation Study of the RASP. This study identified over 100 aviation facilities in the region including 47 airports, 67 heliports, and three ultralight fields. Of this number, 16 were identified as important in meeting the aviation needs of the community and were designated System Airports. These 16 airports are as follows:

- Buckeye Municipal
- Chandler Municipal
- Estrella Sailport
- Falcon Field
- Gila Bend Municipal
- Glendale Municipal
- Memorial Airfield
- Phoenix Deer Valley
- Phoenix Goodyear
- Phoenix Sky Harbor
- Pleasant Valley
- Scottsdale
- Sky Ranch-Carefree
- Stellar Airpark
- Wickenburg Municipal
- Williams Gateway

Six primary data categories were identified by the Implementation Study: airport sketches, database, capital improvement program, intermodal needs, noise contours, and land use compatibility. Forecasting data utilized in the 1993 RASP was also utilized for this report. This forecasting information was previously considered in the SANS 1995.

Much of the focus of the 1996 RASP was to define potential projects under the capital improvement program. The RASP enumerates some 634 projects with an estimated cost of slightly under $1,000,000,000. Projects were categorized under such criteria as local interest, pavement maintenance, safety issues, design standard upgrades, navigational aids, and airport capacity, among others. The largest percentage of projects from a cost standpoint ($381 million) were proposed for Phoenix-Sky Harbor, which is not unexpected, given its crucial role in the state aviation system. Williams-Gateway also had numerous projects proposed ($297 million) to increase its capabilities.

Pima Association of Governments (PAG)

The Pima Association of Governments (PAG) adopted their initial RASP in 1985. The PAG RASP was updated in 1995. Projections were made through 2020 in the 1995 RASP.

The public use airports identified by the RASP include the following: Ajo Municipal, Marana NW Regional, Ryan Field, Sells, and Tucson International. LaCholla Airpark, which is privately-owned but allows limited public access, was also included. Pinal Airpark was included as well as Davis-Monthan Air Force Base.

The RASP identified numerous projects for each of the system facilities. The general conclusion of the RASP indicated if the proposed projects were implemented the system would be adequate to meet future needs of Pima County. It further recommended that the RASP be updated periodically to ensure that changes in existing needs or conditions could be considered.

Airport Master Plans

Several airport sponsors have prepared Master Plans for their facilities. These plans attempt to identify long-term development schemes on a localized basis. The goals and objectives of the individual facility are much more specific than at the state or regional levels.

Master plans provide forecasting data and project implementation information in an effort to support modernization of the facility. Much more emphasis can be placed on the individual needs of the facility and the desires of the local community.

One of the key elements derived from master planning efforts is an Airport Layout Plan (ALP). The ALP is a graphic representation of the facility depicting all existing improvements, location, pertinent clearance and dimensional information and other factors that can determine an airport's compliance with applicable standards. The ALP must be updated as improvements are made to the facility.

Other data obtained from master plans include based aircraft projections, operations forecasts for general aviation and commercial services (where available), and completed projects information among others.

Of the study airports identified, 64 were found to have completed master plans for their facility. Data from these has been selectively included in the development of SANS 2000.

Summary

Table 1-2 illustrates the planning efforts that have been undertaken in the State. These efforts include NPIAS, master plans, airport layout plans, regional airport system plans, and special studies. Table 1-3 indicates the action taken on specific airports in this study that were included in the 1995 State Aviation Needs Study.

TABLE 1-2: ***Arizona State Aviation System Planning Efforts***

AIRPORT NAME	ASSOCIATED CITY	NPIAS		Master Plan		ALP		RASP		Special Studies
		Yes	Role	Yes	Year	Yes	Year	Yes	Year	
Ajo Municipal	Ajo	X	GA	X	1999	X	1999	X	1994	A, B, D
Apache Junction (New)	Apache Junction									
Avi Suquilla (NA)	Parker	X	GA	X	1997	X	1985			A, B
Bagdad	Bagdad	X	GA	X	1998	X	1998			A, B, D
Benson Municipal	Benson	X	GA	X	1990	X	1990	X	1994	A, B, D
Bisbee Douglas International	Douglas/Bisbee	X	GA	X	1997	X	1997	X	1994	A, B, D
Bisbee Municipal	Bisbee	X	GA	X	1999	X	1999	X	1994	A, B, D
Bowie	Bowie							X	1994	A, B
Buckeye Municipal	Buckeye	X	GA	X	1998	X	1998	X	1996	A, B, D
Cascabel Airpark (Note 1)	Tucson									A
Casa Grande Municipal	Casa Grande	X	GA	X	1997	X	1997			A, B, D
Chandler Municipal	Chandler	X	RL	X	1997	X	1997	X	1996	A, B, D
Chinle Municipal	Chinle	X	GA	X	1990	X	1990			A
Cochise College	Douglas			X	1983	X	1983	X	1994	A, B
Cochise County	Willcox	X	GA	X	1997	X	1997	X	1994	A, B, D
Colorado City Municipal	Colorado City	X	GA	X	1999	X	1999			A, B
Coolidge Municipal	Coolidge	X	GA	X	1997	X	1997			A, B, D
Cottonwood Municipal	Cottonwood	X	GA	X	1993	X	1993			A, B, D
Douglas Municipal	Douglas			X	1994	X	1994	X	1994	A, B, D
Eagle Airpark	Bullhead City		GA							
Eloy Municipal	Eloy	X	GA	X	1997	X	1997			A, B, D
Ernest A. Love Field	Prescott	X	CM	X	1997	X	1997			A, B, D
Estrella Sailport	Maricopa							X	1996	A, B
Falcon Field	Mesa	X	RL	X	1997	X	1997	X	1996	A, B, D
Flagstaff-Pulliam	Flagstaff	X	PR	X	1991	X	1991			A, B, D
Flying J Ranch	Pima									A, B
Forepaugh	Wickenburg									
Ganado (NA)	Ganado	X	GA							A, B
Gila Bend Municipal	Gila Bend	X	GA	X	1995	X	1995	X	1996	A, B, D
Glendale Municipal	Glendale	X	RL	X	1998	X	1998	X	1996	A, B, D
Globe-San Carlos Regional	Globe	X	GA	X	1998	X	1998			A, B
Grand Canyon Bar-Ten	Whitmore									A, B
Grand Canyon Caverns	Peach Springs									A, B
Grand Canyon National Park	Grand Canyon	X	PR	X	1991	X	1991			A, B, D
Grand Canyon West	Peach Springs	X	GA	X	1997	X	1997			A, B
Grande Valley	Maricopa									
Grapevine/Roosevelt Lake	Gila County									A
Greenlee County	Clifton/Morenci	X	GA	X	1993	X	1993			A, B, D
H.A. Clark Memorial Field	Williams	X	GA	X	1995	X	1995			A, B, D
Holbrook Municipal	Holbrook	X	GA	X	1999	X	1999			A, B, D
Kayenta (NA)	Kayenta	X	GA	X	1987	X	1987			A, B
Kearny	Kearny			X	1994	X	1994			A, B, D
Kingman	Kingman	X	GA	X	1980	X	1980			A, B, D
Lake Havasu City Municipal	Lake Havasu	X	PR	X	1999	X	1999			A, B, D
Laughlin/Bullhead International	Bullhead City	X	PR	X	1999	X	1999			A, B, D
Marana NW Regional	Marana	X	RL	X	1999	X	1999	X	1994	A, B, D
Marble Canyon	Marble Canyon									A, B
Memorial Airfield	Chandler.			X	1996	X	1996	X	1996	A, B
Mogollon Airpark (Note 1)	Overgaard									
Nogales International	Nogales	X	GA	X	1992	X	1992			A, B
Page Municipal	Page	X	PR	X	1992	X	1992			A, B, D
Payson	Payson	X	GA	X	1998	X	1998			A, B, D
Pearce Ferry	Meadview									A, B

TABLE 1-2: *Arizona State Aviation System Planning Efforts (continued)*

AIRPORT NAME	ASSOCIATED CITY	NPIAS		Master Plan		ALP		RASP		Special Studies
		Yes	Role	Yes	Year	Yes	Year	Yes	Year	
Phoenix Deer Valley	Phoenix	X	RL	X	1998	X	1998	X	1996	A, B, D
Phoenix Goodyear	Goodyear	X	RL	X	1998	X	1998	X	1996	A, B, D
Phoenix Sky Harbor Int'l	Phoenix	X	PR	X	1998	X	1998	X	1996	A, B
Pinal Airpark	Marana	X	GA	X	1991	X	1991	X	1994	A, B
Pleasant Valley	Peoria			?	?			X	1996	A
Polacca (NA)	Polacca			X	1977	X	1977			A, B
Quartzsite (New)	Quartzsite	X	GA	X	1991	X	1991			A, B
Rolle Airfield	Somerton									A, B
Ryan Field	Tucson	X	RL	X	1999	X	1999	X	1994	A, B, D
Safford Regional	Safford	X	GA	X	1998	X	1998			A, B, D
St. Johns Industrial Airpark	St. Johns	X	GA	X	1998	X	1998			A, B, D
San Carlos Apache	Globe	X	GA	X	1998	X	1998			A, B
San Manuel	San Manuel			X	1997	X	1997			A, B, D
Scottsdale	Scottsdale	X	RL	X	1997	X	1997	X	1996	A, B, D
Sedona	Sedona	X	GA	X	1999	X	1999			A, B, D
Seligman	Seligman			X	1993	X	1993			A, B
Sells (NA)	Sells							X	1994	A, B
Show Low Municipal	Show Low	X	GA	X	1991	X	1991			A, B, D
Sierra Vista Muni/Libby AAF	Sierra Vista	X	PR	X	1996	X	1996			A, B, D
Stellar Airpark	Chandler			X	1979			X	1996	A, B
Sun Valley	Bullhead City									A, B
Superior Municipal	Superior									A, B
Taylor	Taylor	X	GA	X	1995	X	1995			A, B, D
Temple Bar	Temple Bar	X	GA							A, B
Tombstone Municipal	Tombstone			X	1999	X	1999	X	1994	A, B
Town of Springerville Municipal	Springerville	X	GA	X	1995	X	1995			A, B, D
Tuba City (NA)	Tuba City	X	GA							A, B
Tucson International	Tucson	X	PR	X	1996	X	1996	X	1994	A, B
Tuweep	Tuweep									A, B
Valle Airport	Grand Canyon									
Whiteriver (NA)	Whiteriver	X	GA	X	1998	X	1998			A, B
Wickenburg Municipal	Wickenburg	X	GA	X	1992	X	1992			A, B, D
Williams Gateway	Phoenix	X	RL	X	1999	X	1999	X	1996	A, B, D
Window Rock (NA)	Window Rock	X	GA	X	1981	X	1981			A, B
Winslow-Lindberg Regional	Winslow	X	GA	X	1998	X	1998			A, B
Yuma International/MCAS Yuma	Yuma	X	PR	X	1998	X	1998			A, B, D

KEY

ALP Airport Layout Plan
CM Commercial Service Airport
GA General Aviation Airport
NA Native American
NPIAS National Plan of Integrated Airport Systems
PR Primary Commercial Service Airport
RASP Regional Aviation System Plan
RL Reliever Airport

Note 1: Airport changed to "Private Use"

SPECIAL STUDIES LEGEND

A: 1995 State Aviation Needs Study (SANS)
B: 1998 Navigational Aids and Aviation Services Special Study
C: Small Community Aviation Economic Development
D: Pavement Management Study

TABLE 1-3: 1995 SANS *Airports Modified or Removed from the SANS 2000 Study*

AIRPORT NAME	ASSOCIATED CITY	REASON
Ak-Chin Community	Ak-Chin	Private Use facility
Apache Junction (New)	Apache Junction	No longer a viable airport candidate site
Avra Valley	Marana	Airport name changed to Marana Northwest Regional
Camp Verde	Camp Verde	Airport closed
Cliff Dwellers Lodge	Marble Canyon	Private Use facility
Hualapai Triball	Peach Springs	Airport name changed to Hualapai. Private Use facility
Inscription House	Inscription House	Airport closed
Low Mountain	Low Mountain	Airport closed
Lukachukai	Lukachukai	Private Use facility
Ora Acres	Quartzite	Airport closed
Pleasant Valley International	Young	Airport name changed to Peasant Valley Airstrip. Private Use facility
Pulliam-Flagstaff	Flagstaff	Name in error. See Flagstaff-Pulliam
Quartizite (New)	Quartizite	No longer a viable airport candidate site
Rio Vista Hills	Wickenburg	Private Use facility
Rock Point	Rock Point	Private Use facility
Shonto	Shonto	Private Use facility
Sky Ranch Carefree	Carefree	Private Use facility
Springerville Babbit Field	Springerville	Airport name changed to Town of Springerville Municipal
Taylor Municipal	Taylor	Name in error. See Taylor
Toyei School	Ganado	Airport closed
Winslow Municipal	Winslow	Airport name changed to Winslow-Lindberg
Alamo Lake (ERA)	La Paz County	Dropped from study. To be re-evaluated
Big Lake/Sunrise (ERA)	Apache County	Dropped from study. To be re-evaluated
Chiricahua Mountains (ERA)	Cochise County	Dropped from study. To be re-evaluated
Cibola (ERA)	La Paz County	Dropped from study. To be re-evaluated
Leupp/Painted Desert (ERA)	Coconino County	Dropped from study. To be re-evaluated
Mogollon Airpark (ERA)	Overgaard	Private Use facility
Peach Springs (New)	Peach Springs	Dropped from study. To be re-evaluated
Sprucedale (New)	Greenlee County	Dropped from study. To be re-evaluated
Bullhead City Seaplane Base	Bullhead	Dropped from study. To ber e-evaluated
Lake Havasu Seaplane Base	Lake Havasu City	Active
Lake Mead Seaplane Landing Area	Temple Bar	Active
Lake Roosevelt Seaplane Landing Area	Globe	Active
Lake Powell Seaplane Landing Area	Page	Active

Source: ADOT Aeronautics 2000

ELEMENT TWO: METHODOLOGY

2.1 INTRODUCTION

The purpose of this element is to identify and describe the process and methodology to recognize trends, and provide decision makers with information regarding the effects of varying levels of capital investment, or shifting emphasis, from one type of development to another. The selected methodology should be able to assess the level of system performance for the various funding levels, address the issues listed in the state's original request for proposal (RFP), be easily understandable by the Planning Advisory Committee (PAC), and concur with the goals and objectives of the Governor's Vision 21 Task Force for improving transportation systems across the state.

To adequately present the SANS methodology, this element is organized in the following manner:

- Definitions;
- Desired features for the SANS 2000 Methodology;
- Concept Selected for the SANS 2000;
- Performance Criteria and Measures;
- Performance Based Needs Scenarios; and
- Summary.

2.2 DEFINITIONS

The terminology being used for the SANS is based on operational definitions of these key terms: STATUS, CONDITION, CAPACITY, PERFORMANCE, STANDARDS, and NEEDS. These terms can be explained in terms of descriptors such as runway length, registered based aircraft, aircraft mix, number of operations, number of enplaned passengers, etc.

STATUS of the aviation system is a description of its state in terms of specific administrative, economic, geometric, physical, and operational characteristics. Status represents the actual or projected state of the aviation facilities. It relates to the ***role*** that each airport/heliport and aviation system component should perform in the total State aviation system.

The STATUS of aviation facilities in the SANS is defined through three facility classifications: (1) a classification system based on the National Plan Integrated Airport Systems (NPIAS); (2) a coding system developed by the FAA used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at an airport; and (3) a classification system that segregates the State's system of airports into three subsystems--Primary, Secondary, and Other Airports systems--based primarily on level of service an airport or heliport currently provides, or is intended to provide, to a community or region.

CONDITION represents the physical state of the aviation facilities. The condition of the aviation facilities measures the various levels of fitness of the aviation system, i.e., how that facility performs relative to a given status (role). Thus, condition indicates the level of physical

fitness of the aviation facilities. Condition is determined from surveys, existing data, and projections.

CAPACITY is used to designate the processing capability of an aviation facility over some period of time. Capacity is defined as the maximum physical capability of a runway system to process aircraft. It is expressed in this report as Annual Service Volume (ASV). As annual aircraft operations approach annual service volume, the average delay to each aircraft throughout the year may increase rapidly with relatively small increases in aircraft operations, thereby causing levels of service on the airfield to deteriorate. Capacity can be compared with the existing and forecast demand to ascertain whether improvements to increase Capacity will be needed.

PERFORMANCE is the measurement of the system against a standard. A Performance Measure is the "yardstick" utilized to assess how effectively the aviation system functions; for example, how aviation demand factors relate to airport facility factors, etc. Two primary measures of Performance are condition and capacity, explained above. They are primary, because they are essential for an aviation facility to accomplish its fundamental mission--the movement of people and goods--and other measures have been derived from or are related to these primary measures.

PERFORMANCE MEASURES will be used to select needed improvements, and to evaluate both the positive and negative impacts of improvements at aviation facilities.

PERFORMANCE LEVEL is defined as the actual or proposed Performance of the aviation system determined by specific values for a selected Performance measure. The performance levels are established to reflect attainable (not necessarily desirable) performance; for example, maintain only the existing facilities, maintain existing system performance level by providing for 15 percent added growth, etc.

STANDARDS are the minimum tolerable values of the performance measures established by an authority, such as FAA, ADOT, the Technical Advisory Committee, etc.

NEEDS are defined as specific improvements and the dollar amount required to achieve a given level of aviation system PERFORMANCE. Various levels of needs will be developed for the SANS 2000, reflecting differing levels of performance and investment.

2.3 DESIRED FEATURES FOR THE SANS 2000 METHODOLOGY

In selecting a methodology for use in the SANS 2000, a number of specific features are desired. Foremost, the selected methodology must provide a relatively simple procedure that can be used to evaluate the relationships between the performance of aviation system and capital investments made in various parts of the system. This will allow decision makers to realize the trade-offs involved in selecting one alternative over another.

Secondly, and related to the above feature, it is important that the selected methodology be able to define the state aviation system needs relative to stated system goals and objectives. Goal and objective statements are developed early in the process and are refined through an extensive public involvement process. It is important that the selected methodology be able to measure the

achievement of the various goals and objectives in order to ensure that the taxpayers wants and needs are being addressed.

Lastly, the selected methodology should allow for the synthesis of a large volume of data and information such as population, access measures, activity measures, environmental impacts, etc., into a manageable form for purposes of analysis.

2.4 CONCEPT SELECTED FOR THE SANS 2000

The concept selected for assessing the needs for the SANS 2000 is one based on the application of performance measures for evaluating alternative state aviation system needs scenarios. The primary elements of this concept include: (1) the identification of quantifiable measures needed to assess the existing performance of the Arizona aviation system; (2) the determination of the status, condition and performance of the existing system; (3) the development of a forecast of future system demand and available revenues; (4) the development of alternative needs scenarios to meet forecasts of demand; and (5) the determination of the cost of facilities and the performance of the system under each scenario. This concept provides an objective approach to a process which is largely subjective, through the development of quantifiable performance measures.

It is felt that the use of performance measures in Arizona aviation system planning will improve the process in several important ways:

- Performance measures will enable the State to quantify as well as qualify system plan objectives. Aviation system plan goal and objective statements tend to be general rather than specific. By using performance measures, the State will be able to sharpen and clearly define the precise meaning of each objective statement. On occasion, objective statements may have to be clarified, modified, or restated to make them useful for aviation system planning.

- Performance measures provide a quantitative link between system goal and objective statements and the performance of the aviation system. Performance measures provide for the scaling of how far each objective is achieved in an existing or proposed aviation system, or collectively, how far an existing or proposed aviation system meets all the system objectives.

- Performance measures are a beneficial tool for evaluation of alternative aviation systems as part of the initial assessment of needs and development or a major update for a state aviation system plan. Performance measures can be used to clearly quantify the trade-offs among a broad range of system plan alternative scenarios and to assist in narrowing the number of alternative scenarios to be studied in greater detail.

- Performance measures will enable the State to synthesize a large volume of data and information--population, access measures, activity measures, environmental impacts, etc. --into a manageable form for analyses purposes and for presentation to decision makers. One of the more difficult tasks of preparing a plan is to present to elected officials and government administrative staff the results of a comprehensive analysis in a simple,

straightforward, understandable manner. Performance measures can be used to clearly illustrate the interrelationships between the various objectives of a plan and the performance of the system.

- Performance measures can be combined into a single numerical value through weighting of the individual measures to reflect public policy, although weighting tends to mask important parts of the analysis and may, in effect, transfer to others choices which more properly should be made by the appropriate decision makers.

Once the aviation system needs have been identified and implemented, the performance measures can be used to improve the process for programming federal and state airport grant funds. System performance measures can be used to support budget requests to the state legislature by defining system needs and definitions relative to stated system goals and objectives.

All of the publicly-funded transportation modes--highways, transit, and aviation--are in need of increased funding. Budget requests need to be supported by return-on-investment analysis which is both comprehensive and easily understood. Aviation system performance measures can be used to strengthen agency budget requests in Arizona.

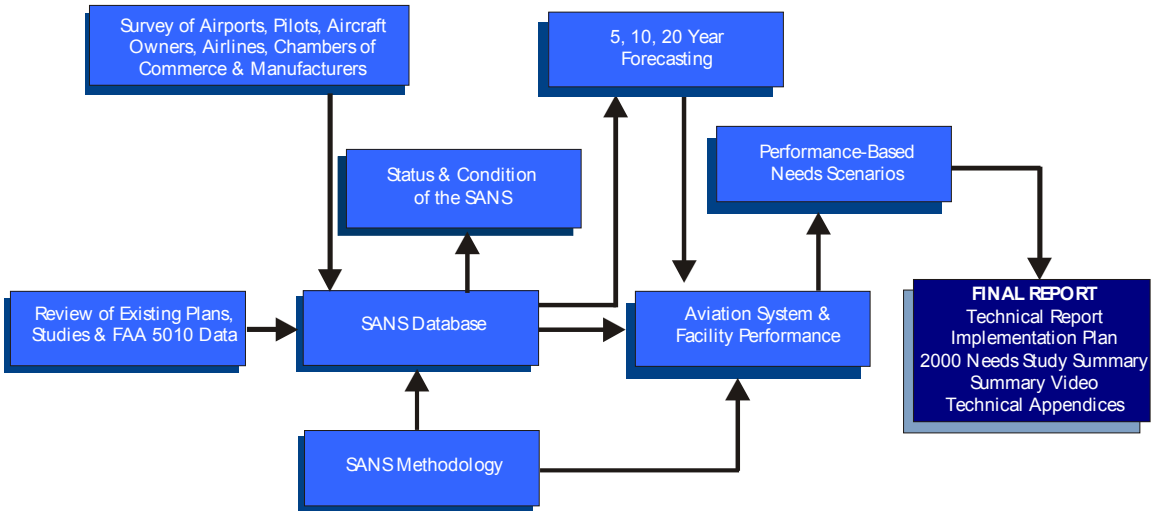
Description of Methodology

A step-by-step description of the methodology to be employed in performing the 2000 Needs Study is relatively straightforward conceptually and in application. The decision maker is the primary user of the analysis produced.

Shown in Exhibit 2-1, the first step of the process is to formulate the goals, objectives, and priorities that represent the desired set of conditions for the State system of airports. The goals and objectives were formed through a public input process that utilized comments of the Planning Advisory Committee (PAC). From the goals and objectives, performance measures are identified and defined.

The next major step in the process is to create a data base to provide the information needed to determine the status and condition of the existing system. The status of the system relates to the role that each aviation facility performs in the total State aviation system. It is based on specific administrative, economic, geometric, physical, and operational characteristics. The condition represents the physical state of the aviation system; that is, how the facility performs relative to a given status. Creation of the data base is an on-going process and will continue throughout the course of the SANS study as new information is received from airport sponsors.

EXHIBIT 2-1: ***SANS Methodology Flow Chart***



Another important aspect of the data base was to generate enough information to perform a forecast of aviation activity and system capacity for the next five-, ten-, and twenty-year time frames. The forecast of statewide aviation activity was used to determine future demand on the statewide system and be central to the development of the future scenarios.

The performance-based needs scenarios were the focus of the study. Needs scenarios were developed to evaluate the various alternative future aviation system development strategies. They were matched against the performance measures that reflected the desired condition and level of service the state aviation system should provide. Three alternative development strategies were considered. By comparing each system development scenario to the performance measures, State decision makers can determine the level of performance that each scenario will provide, as well as the associated costs of that scenario.

Alternative development scenarios were based on various ways of achieving a high level of systemwide performance, such as accommodating future demand and provision of rural health care services, given limited financial resources. Comparing investment strategies with performance measures clearly shows where systemwide performance trade-offs will occur. Since the weighting of performance measures is always subjective, no relative weights were considered. All the performance measures taken together reflect the profile of each scenario.

Constraints, Assumptions, and Limitations

As with every methodology, there are some constraints and limitations to the use of performance measures, as well as some general assumptions that must be noted. A discussion of these follows.

Perhaps the key assumption of the methodology is that overall system performance should take precedence over the individual facilities. System performance measures are not particularly sensitive, on an annual basis, to programming decisions involving individual airport projects. The definition of programming is the matching of available funds to satisfy the needs of a given time period. The reason for this is that improvements in a single airport or even a small number of airports will have only a small impact on the performance of the aviation system for an entire state. Viewed over a longer period of time, for example, a five-year period, performance measures will prove beneficial in evaluating alternative programming policies and for evaluating the improvements in system performance anticipated from a five-year capital improvement program.

Additionally, system performance measures are more sensitive to needs to provide increased access and to forecast demand than they are to deficiencies in the structural integrity of existing airports. As the proportion of reconstruction and standards type projects decreases, the sensitivity of the performance measures to programming decisions will increase. The SANS is a macro-level analysis and leads to system wide needs. Priority programming, on the other hand, is a micro-level evaluation and leads to specific project improvements.

The performance measure components for each airport being considered for a grant can aid in determining the relative contribution that each airport makes to the performance of the total aviation system. Performance measures selected for assessing system needs are not sufficient criteria for priority programming decisions related to specific airport improvement projects, as many other factors must be considered. Performance measures may, however, provide a basis for first cut in selective airport projects on the basis of their relative contribution to the State's aviation system.

2.5 PERFORMANCE CRITERIA AND MEASURES

In the previous section, it was concluded that the use of performance measures can improve the aviation system planning process by quantifying as well as qualifying system objectives, linking system objectives and system performance, clarifying trade-offs among system alternatives, and by synthesizing information for decision makers. This section will provide a more detailed description and role of performance measures, apply performance measures and standards to the study objectives, explain the use of future scenarios, and discuss the determination of minimum acceptable levels of performance.

Role of Performance Measures

Goal and objective statements are used to define the desired condition to be achieved in the development and operation of the Arizona aviation system. They are broadly stated in general terms. For example, a primary goal of the SANS is to provide for the timely development of

aviation facilities adequate to meet the needs and economic goals of the state. An objective related to the above goal is to facilitate the provision of convenient commercial air service to both urban and rural communities. A performance measure is used to clarify and define the meaning of the goal or objective statement and provide for a scaling of how well the goal or objective is attained in any defined system.

As an example, in the above objective statement, the definition of "convenient" could be defined as 60 minutes driving time; the term "commercial air service" could be defined as scheduled passenger service operating a minimum of two flights a day, five days a week; and "community" could be defined as an incorporated town with a minimum population of 5,000. By defining these terms, the objective statement now lends itself to quantification. Thus, the measure of performance related to the provision of convenient commercial air service would be: the percentage of communities within the state, with a minimum population of 5,000, that are within 60 minutes driving time of an airport that provides regularly scheduled passenger service.

The performance measure now can be used to assess the existing system in terms of the provision of commercial service, measure future system performance under varying conditions, and provide a way of evaluating among system plan alternatives. Also, once an alternative has been selected and implementation initiated, the process of that alternative can be tracked.

Performance Measures

To adequately assess the system, three general categories of performance measures were developed: Facility, Service Level, and Economic Measures. The first relates to the performance of the individual facilities making up the system, the second to the level of service provided by those facilities, and the third to the efficiency of the system and return on investment.

Facility Performance

The facility performance measures are general measures designed to assess the condition, or fitness, of the region's existing airport infrastructure. The two primary measures of facility performance are condition and capacity. They are primary because they are essential for an aviation facility to function in a safe and efficient manner. The performance criteria listed below were designed to reflect the current and desired condition and performance of the existing and future aviation infrastructure relative to basic recognized standards.

Facility Performance Measures

1. The extent to which system airports meet FAA and ADOT Transportation Board minimum aviation development and planning standards.

2. The number of airports with an annual demand less than 60 percent of runway annual service volume.

3. The number of airports experiencing delay to aircraft operations: the maximum and average delay in minutes an aircraft experiences due to airside congestion.

4. The number of airports that generate INM noise contours greater than 65 DNL that extend off airport property.

5. The number of system airports without adequate utilities (electricity, telephone, water, sewer, and gas).

6. The number of airports with no close-in obstructions (within the 200 feet primary surface) and where all FAR Part 77 approach obstructions are marked (not including trees and roads).

7. The number of total airports in the state with no or minimal shared airspace and/or restrictions under visual/instrument flight rules.

Service Level Performance

Service level performance measures, in relation to facility performance measures, were designed to measure the adequacy of the system in fulfilling its fundamental mission of the movement of people and goods. Listed below are performance measures that measure the provision of aviation services to the residents of the State of Arizona in relation to some general national standards.

Service Level Performance Measures

1. Percent of communities in the State with a population greater than 5,000 within 60 minutes of a commercial service airport.

2. Percent of communities in the State with a population greater than 1,000 within 30 minutes of a general aviation airport.

3. Percent of communities in the State with a population greater than 15,000 within 30 minutes of a general aviation airport that can accommodate large general aviation aircraft (ARC B-II) and has Instrument Meteorological Conditions (IMC) capability.

4. Percent of hospitals in the State within 30 minutes of a general aviation airport with Instrument Meteorological Conditions (IMC) capability, with on-site weather reporting, and jet fuel availability.

5. The number of major recreational areas in the state within 30 minutes of a general aviation airport.

Economic Performance

Economic Performance Measures

1. The dollar cost of aircraft delay to Arizona airport system users.

2. Dollars of direct and indirect economic impact on the state from aviation.

3. The cost ratio of annual aviation infrastructure to total number of statewide annual enplaned passengers and annual aircraft operations.

4. The total dollar cost from aircraft delays associated with airspace congestion.

2.6 DEVELOPMENT SCENARIOS

To facilitate the understanding and appreciation of the financial needs of the State's aviation system, it is important to assess the system performance changes that the investment of these funds may induce. Once a performance-based needs model is available, a theoretically infinite number of scenarios can be developed. For a given level of financial investment it is possible to achieve a given performance level with a range of funding levels. There are operations research tools (e.g., dynamic programming, linear programming, simulation) available, which can help planners and decision makers determine the optimal investment strategy for achieving a given performance level, and vice versa. That effort is, however, beyond the scope of the current study.

In this project, three scenarios were developed. It should be noted that the level of investment and system performance gradually improves from Scenario A to Scenario C.

Each scenario will be evaluated by forecasting demand of statewide aviation activity over the next five-, ten-, and twenty-year periods and applying the performance measures identified in the previous section to determine the performance level of the state aviation system.

This method will allow decision makers to clarify trade-offs among system funding commitments through the comparison of performance levels of each system alternative for each of the three scenarios. Comparison of performance levels for each scenario will also link levels of funding to the achievement of public policy as represented by the State's goals and objectives for the Arizona aviation system, inherent in the development of the performance measures.

Scenario A - Existing Investment: This scenario was designed to explore a possible situation/state in which the existing funding level (in current dollars) will be assumed to remain unchanged over the next five-, ten-, and twenty-year periods. The goal was to examine the types of improvements that can be done in the circumstances in which the funding for maintenance and construction of aviation facilities does not keep up with the increasing demand. In this scenario, status, condition, and performance of the system at the fixed level of funding are evaluated.

Scenario B - Existing Performance (Facility Preservation): This scenario was designed to explore a possible situation/state in which the existing system performance level will remain unchanged. The goal is to estimate a level of funding which can help the state aviation system keep up with the increasing demand in the future. A funding level for each of the five-, ten-, and twenty-year periods is estimated. In this scenario, the financial needs to maintain the existing system status, condition, and performance are estimated.

Scenario C - Increased Performance (Facility Upgrade): The third scenario examines a possible situation/state in which all existing public-use airports are brought up to meet minimum State airport development standards, existing airports are expanded to meet forecast demand, and new airports are constructed to meet access or capacity deficiencies. This is essentially an unconstrained growth scenario and determines the costs of expanding

and increasing the efficiency of the existing system to meet the expected growth in future State aviation activity.

For each of the above scenarios, it is possible to have thousands of strategies to achieve the stated goals. However, we are only identifying one of several situations/states for each of the three scenarios in this study. The performance-based needs model developed in this study would be capable of exploring other situations/states and additional scenarios as may be desired by the state planners and decision makers. The model is flexible enough to allow modification of decision variables based on input from public or alternative forecasts.

2.7 SUMMARY

The concept for assessing the needs for the SANS 2000 is one based on the use of performance measures for evaluating alternative state aviation needs scenarios. The primary elements of this system include (1) the identification of quantifiable measures needed to define the performance of the state aviation system; (2) the determination of the status, condition, and performance of the existing system; (3) the development of a forecast of future system demand and available revenues; (4) the development of alternative needs scenarios to meet forecast of demand; (5) the determination of the cost of facilities and the performance of the system under each scenario; and (6) the selection of a recommended course of action.

ELEMENT THREE: DATABASE

3.1 INTRODUCTION

The development of SANS 2000 considers extensive volumes of data from various sources. The compilation of an effective database is a key element in preparing SANS 2000. To determine the aviation needs and subsequent improvement/new projects to fulfill those needs, a comprehensive set of statistics must be analyzed. It is necessary to sort through a variety of data and extract the relative facts that impact aviation in Arizona. The extracted data can then be utilized to compile each of the different elements in the SANS.

A great deal of data was collected and abridged during the Arizona SANS 1995 preparation. Much of the SANS 2000 effort has been directed toward updating this existing database as opposed to creating a new one. For the most part the objective of the data collection was to provide new baseline numbers for various criteria and to obtain any projected information up to the year 2020.

The SANS 1995 data was generally segregated into six categories. SANS 2000 has retained this previous formatting. The data categories are:

- Socioeconomic
- Environment and Land Use
- Surface Transportation
- Aviation
- Finance
- Study Survey Results

Sources that have been used in the data collection effort include the Federal Aviation Administration (FAA), the Arizona Department of Transportation (ADOT), the Arizona Department of Economic Security, regional airport system plans, various airport master plans, and other published reports. Another significant source of information includes questionnaires submitted to pilots, aircraft owners, airport sponsors, airlines and local chambers of commerce. Specific sources are identified with each data table.

The following sub-sections are presented to summarize the general findings of the SANS database update.

3.2 SOCIOECONOMIC

Population trends, employment characteristics, and personal income levels are generally referred to as socioeconomic factors. These factors have significant impact on aviation as many facets of aviation are driven by the economic situation at a given time. An improved economic situation, both at the personal and business level, is directly related to increased aviation usage. A stagnant or declining economic picture will tend to result in less air travel and system usage. Increased usage creates the need for improvements to existing facilities and the consideration of new facilities to meet the demand. Decreased demand observably has the reverse effect. While the correlation between socioeconomic issues and aviation may not always be directly proportional,

it is an important driving element. Each of the key socioeconomic factors is discussed in detail in the subsequent paragraphs.

Population

Arizona's population continues to be one of the fastest growing in the nation. In the period between 1960 and 1998, the population of Arizona more than tripled. Projections indicate that between 1998 and 2020 the population will almost double again from the current 4.7 million to an estimated 7.3 million residents. Growth of this nature will no doubt require supplemental aviation services.

The population growth in Arizona continues to be heavily centered in Maricopa and Pima Counties. Maricopa County is routinely considered one of the fastest growing counties in America. Statistics from 2000 indicate that 60% of the Arizona population resides in Maricopa County, of which Phoenix is the county seat. Residents of Pima County, for which Tucson is the county seat, account for another 16% of the state's population. Forecasts suggest that these areas will remain the major population centers for the state.

Table 3-1 illustrates Arizona's historical population on a county-by-county basis from 1960 to 1990. Table 3-2 illustrates the population forecasts for 1998, 1999 and 2000 and then in five-year increments thereafter through the year 2020.

TABLE 3-1: ***Arizona Historical Population 1970 to 2000***

County	1970	1980	1990	2000
Apache	32,118	52,108	61,591	69,423
Cochise	63,910	85,686	97,624	117,755
Coconino	48,326	75,008	96,591	116,320
Gila	28,885	37,080	40,216	51,335
Graham	16,578	22,862	26,554	33,489
Greenlee	10,330	11,406	8,008	8,547
La Paz	-	12,557	13,884	19,715
Maricopa	971,228	1,509,262	2,122,101	3,072,149
Mohave	25,857	55,865	93,497	155,032
Navajo	47,715	67,629	77,658	97,470
Pima	351,667	531,443	666,880	843,746
Pinal	67,916	90,918	16,379	179,727
Santa Cruz	13,966	20,459	29,676	38,381
Yavapai	36,733	68,145	107,714	167,517
Yuma	60,727	76,205	106,895	160,026
TOTAL	**1,775,956**	**2,716,633**	**3,565,258**	**5,130,632**

Note: Until 1980, La Paz was part of Yuma County.
Population figures are as of April 1 for years reported. Numbers may not sum due to differences between county figures and statewide figures.
Source: Arizona Department of Economic Security, April 1, 2000.

TABLE 3-2: ***Arizona Forecast of Population 1998 to 2020***

County	1998	1999	2000	2005	2010	2015	2020
Apache	66,350	67,069	67,925	72,236	76,645	81,173	85,766
Cochise	123,750	120,179	121,837	129,680	137,035	143,793	149,990
Coconino	121,625	120,848	123,329	135,595	147,352	158,753	169,343
Gila	49,175	47,898	48,614	51,644	54,603	57,613	60,757
Graham	34,700	34,245	35,164	39,427	43,499	47,181	50,673
Greenlee	9,125	8,908	8,984	9,297	9,605	9,923	10,271
La Paz	19,000	19,821	20,341	22,799	25,096	27,193	29,078
Maricopa	2,806,100	2,879,492	2,954,157	3,329,561	3,709,566	4,101,784	4,516,090
Mohave	138,625	142,600	147,529	171,504	194,403	215,988	236,396
Navajo	92,500	87,775	88,898	94,395	99,979	105,843	111,946
Pima	823,900	836,153	854,329	943,795	1,031,623	1,119,342	1,206,244
Pinal	157,675	157,413	161,630	181,487	199,715	216,215	231,229
Santa Cruz	37,800	37,439	38,225	42,154	46,246	50,556	55,111
Yavapai	148,500	148,428	152,966	175,693	198,052	219,614	240,849
Yuma	135,200	134,719	138,025	154,582	171,689	189,783	209,861
TOTAL	**4,764,025**	**4,842,987**	**4,961,953**	**5,553,849**	**6,145,108**	**6,744,754**	**7,363,604**

Note: Projections subsequent to the 2000 Census were not available.
Source: Arizona Department of Economic Security, August, 1997.

Employment

Arizona's recent employment history and the forecast for the immediate future portray a bright outlook. In 1998 Arizona added over 93,000 jobs, which correlates to a 4.8% increase in new jobs. In fact, Arizona's job growth rate ranked number one in the nation for seven out of the twelve months in 1998, while finishing second in the other five months. It is anticipated that over the next two years the state will add another 148,000 jobs, at a somewhat slower rate than the recent growth. Employment sectors with the best performance were manufacturing, construction, finance and real estate, transportation, utilities, and communication. A key sector among those sectors experiencing a downturn was the mining industry.

Since 1995 unemployment in the state of Arizona has hovered in the 4.0-5.5% range. The unemployment rate for 1998 was 4.1%, and numbers through May 1999 indicate it to be approximately 4.2%. While this is a desirable goal, continued lowering of the unemployment rate will normally result in some sort of labor shortage. With a labor shortage, economic growth will become inhibited as employers will not be able to find an adequately trained/skilled work force. Issues such as education and re-training of current employees and the utilization of personnel displaced as a result of corporate downsizing will become critical in maintaining an adequate workforce.

Table 3-3 depicts Arizona's recent historical employment data for the entire state and for the larger metropolitan areas of Phoenix and Yuma.

TABLE 3-3: ***Arizona Historical and Forecast Employment***

County/Region	1980	1990	1997	1998	1999	2000
Arizona	**1,017,705**	**1,498,660**	**1,976,785**	**2,072,726**	**2,150,538**	**2,220,712**
Phoenix-Mesa	641,767	987,097	1,393,530	1,467,766	1,530,048	1,580,155
Tucson	178,198	246,827	296,785	308,281	317,406	328,426
Yuma	N/A	39,000	50,158	52,839	52,966	52,415
Rest of State	197,740	225,736	236,312	243,840	250,118	259,716
Apache	13,101	14,194	17,097	18,745	19,546	18,575
Cochise	21,212	25,791	29,193	29,457	30,217	31,467
Coconino	28,265	39,812	46,763	46,987	48,327	51,040
Gila	11,556	11,244	13,473	13,596	13,573	13,645
Graham	4,842	5,710	6,172	6,162	6,440	6,510
Greenlee	3,838	2,929	4,502	4,337	3,975	4,453
La Paz	N/A	4,492	5,389	5,489	5,524	5,738
Maricopa	641,767	987,097	1,355,775	1,431,060	1,494,051	1,544,971
Mohave	15,495	26,549	34,797	35,912	37,773	39,591
Navajo	16,974	20,443	22,457	23,582	24,200	24,550
Pima	178,198	246,827	296,785	308,281	317,406	328,426
Pinal	26,037	33,323	37,755	36,707	35,997	35,184
Santa Cruz	7,576	10,614	11,250	11,287	11,516	11,906
Yavapai	16,892	27,492	42,618	45,030	45,782	48,166
Yuma	29,135	39,000	50,158	52,839	52,966	52,415
Undefined	2,099	3,142	2,601	3,257	3,245	4,075

N = Not Available
*Undefined includes employment within the state not connected to individual counties or MSA's.
Source: U.S. Department of Labor – Bureau of Labor Statistics Database (1975-2000)

Income

Coincident with the population increase, Arizona has seen a steady rise in per capita income (PCI). Historical data obtained through the Arizona Department of Economic Security shows a continuing growth trend throughout the State. While PCI growth is more noticeable in some areas of the state, no areas have seen decreases in PCI.

Table 3-4 illustrates historical PCI by county for the years of 1991-1997. Greenlee County has experienced the most significant increase in PCI during this period ($13,572 to $19,119 or 41%) while the PCI in Yuma County has seen the lowest increase ($13,512 to $15,629 or 16%). The PCI in Maricopa and Pima Counties have exhibited similar growth during this period (approx. 31% increase).

The succeeding Table 3-5 depicts the percent change in PCI by county for the same period, 1991-1997. Using the average of these percent changes, a projection through the year 2000 is also supplied. The projection assumes a continuous increase based on the average percent change for the years 1991-1997.

TABLE 3-4: ***Arizona Per Capita Income 1991-1997 (in dollars)***

County/Region	1991	1992	1993	1994	1995	1996	1997
Arizona	16,971	17,583	18,270	19,127	20,078	21,071	21,998
Phoenix-Mesa	18,484	19,103	19,832	20,779	21,887	23,025	24,137
Apache	8,803	9,779	9,995	10,335	10,257	10,894	11,044
Cochise	13,556	14,351	14,647	14,739	15,088	15,984	16,532
Coconino	13,804	14,793	15,199	15,942	16,704	17,608	18,180
Gila	13,375	14,003	14,795	15,437	15,338	16,290	16,569
Graham	10,326	10,957	11,239	11,834	11,919	12,518	12,835
Greenlee	13,572	14,592	14,845	15,369	16,990	18,207	19,119
La Paz	15,258	15,351	17,279	16,538	17,175	18,125	19,352
Maricopa	18,799	19,430	20,151	21,145	22,274	23,435	24,601
Mohave	14,692	14,925	15,416	16,215	16,408	17,185	17,985
Navajo	10,030	10,682	10,787	11,216	11,493	11,947	12,166
Pima	16,337	16,942	17,756	18,684	19,375	20,375	21,068
Pinal	12,707	13,096	13,947	13,965	14,646	15,330	15,372
Santa Cruz	11,857	12,217	12,615	12,929	13,111	13,670	14,312
Yavapai	15,216	15,713	16,241	17,326	17,780	18,585	19,362
Yuma	13,512	13,803	14,538	14,334	16,889	15,511	15,629

Source:
1. Arizona Department of Economic Security, May, 1999

TABLE 3-5: ***Arizona Historical Change in Per Capita Income 1991-1997 (in dollars)***

County/Region	1991-92 (%)	1992-93 (%)	1993-94 (%)	1994-95 (%)	1995-96 (%)	1996-97 (%)	2000 (Dollars)
Arizona	3.61	3.91	4.69	4.97	4.95	4.40	$22,970
Phoenix-Mesa	3.35	3.82	4.78	5.33	5.20	4.83	$25,235
Apache	11.09	2.21	3.40	-0.75	6.21	1.38	$11,477
Cochise	5.86	2.06	0.63	2.37	5.94	3.43	$17,091
Coconino	7.16	2.74	4.89	4.78	5.41	3.25	$19,036
Gila	4.70	5.66	4.34	-0.64	6.21	1.71	$17,176
Graham	6.11	2.57	5.29	0.72	5.03	2.53	$13,311
Greenlee	7.52	1.73	3.53	10.55	7.16	5.01	$20,250
La Paz	0.61	12.56	-4.29	3.85	5.53	6.77	$20,159
Maricopa	3.36	3.71	4.93	5.34	5.21	4.98	$25,730
Mohave	1.59	3.29	5.18	1.19	4.74	4.66	$18,604
Navajo	6.50	0.98	3.98	2.47	3.95	1.83	$12,566
Pima	3.70	4.80	5.23	3.70	5.16	3.40	$21,981
Pinal	3.06	6.50	0.13	4.88	4.67	0.27	$15,872
Santa Cruz	3.04	3.26	2.49	1.41	4.26	4.70	$14,769
Yavapai	3.27	3.36	6.68	2.62	4.53	4.18	$20,157
Yuma	2.15	5.32	-1.40	17.82	-8.16	0.76	$16,059

Sources:
Arizona Department of Economic Security, May, 1999

3.3 ENVIRONMENT AND LAND USE

Physical Setting

Arizona has the sixth largest land area (113,417 square miles) in the United States. It is bordered by the states of California, Nevada, New Mexico, and Utah, as well as the country of Mexico. The state terrain is highlighted by large desert areas, high mountainous regions, numerous mesas and buttes, and an array of canyons. This varied terrain creates lengthy surface transportation routes, thereby further substantiating the need for a more than adequate aviation system.

The climate in Arizona varies along with the terrain. From the hot and arid conditions in the southwest part of the state to the cool and moist conditions at the higher elevations, climate changes are an important consideration in the aviation needs assessment. Such issues as pavement design, takeoff and landing distances, and navigational aids can all be impacted by these drastic climatic differences.

Land Use

A large portion of the state is uninhabited and undeveloped. The focus of the state's economic activity and population is centered in two metropolitan areas: Phoenix and Tucson. Several smaller urban communities are scattered throughout the state and support various mining, military, agricultural and recreational activities. Communities fitting this category include Douglas-Bisbee, Flagstaff, Lake Havasu City, Prescott, Sierra Vista, and Yuma. Numerous Native American reservations are present in the state. Exhibit 3-1 shows the predominant land use patterns in Arizona.

Note: The "Urbanized Areas" as defined by the 1990 census are Flagstaff, Phoenix, Tucson, and Yuma.

Land Use Ordinances

Table 3-6 lists the existing land use ordinances relative to aviation development in the state. As shown, several Arizona counties have enacted some sort of ordinance that must be considered for system improvement.

3.4 SURFACE TRANSPORTATION

Highway System

According to the 1998 Arizona State Highway System Status and Condition Report, the Arizona system route has 6,142 miles and a lane mileage of 15,895. There are 4,169 bridges on the system. The state is navigated by four major interstates, two smaller interstate sections, and a vast array of state highways. A complex freeway system is also in place in the larger metropolitan areas of the state. Exhibit 3-2 illustrates the existing system.

EXHIBIT 3-1: ***Predominant Land Uses***

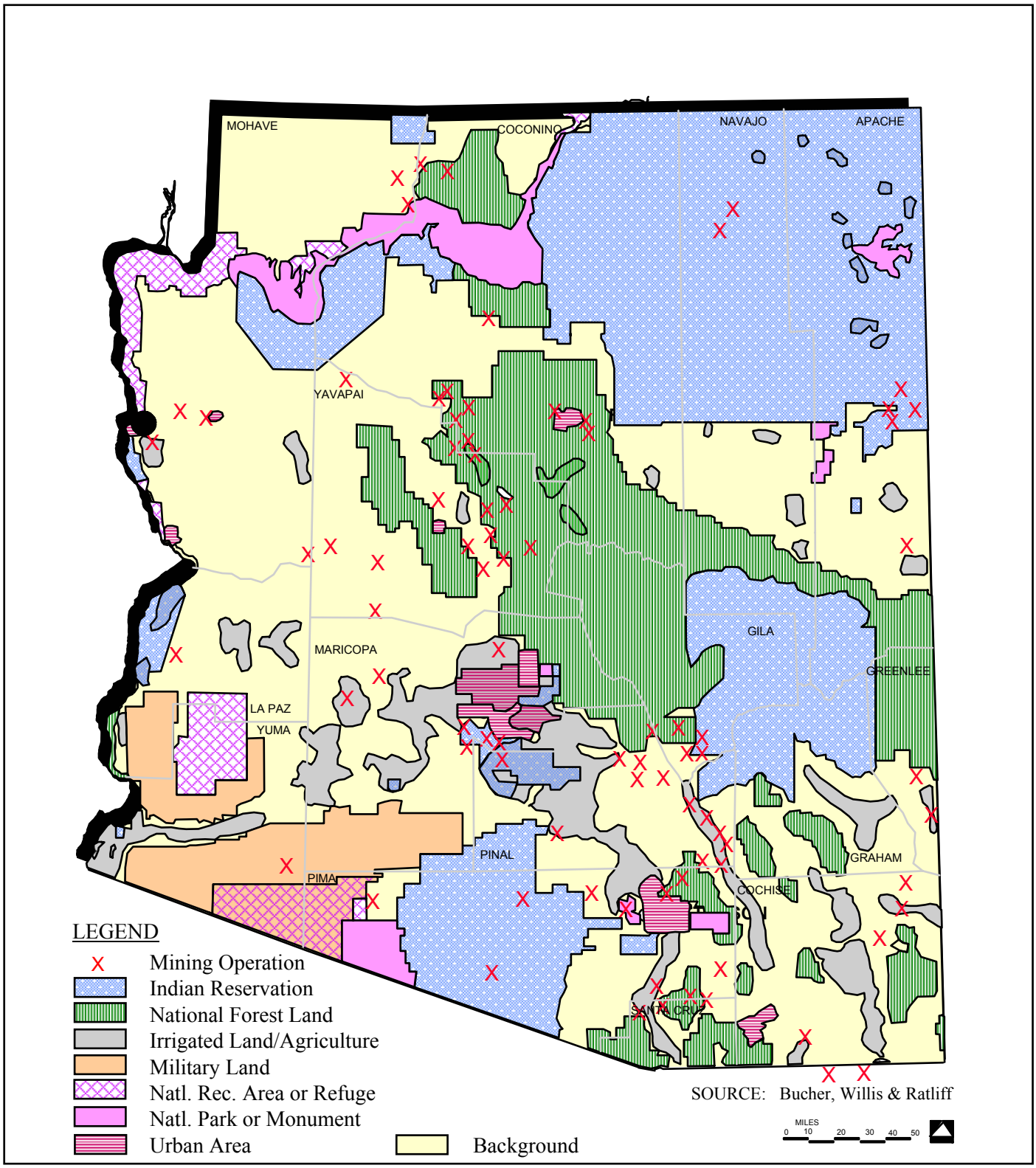
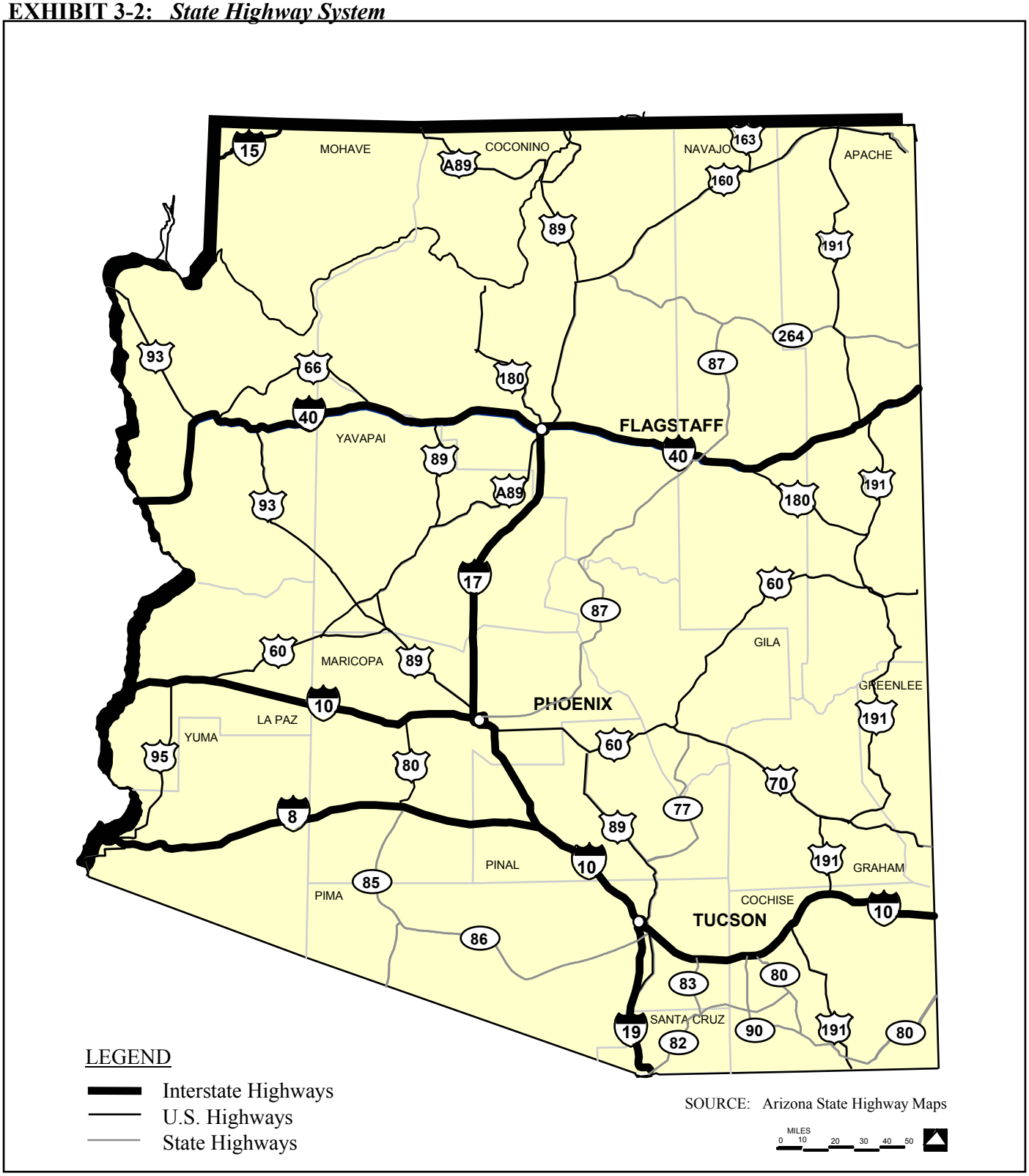


TABLE 3-6: ***County Ordinance Review Summary***

COUNTY	ORDINANCES
Apache	County has regulations which govern only typical land use zoning practices.
Cochise	County-wide height hazard zoning.
Coconino	No active county-owned airport.
Gila	Only typical zoning.
Graham	Only typical zoning.
Greenlee	County has traditional height hazard zoning for Greenlee County Airport.
La Paz	Controls both height of structures and land use. Land use based on noise contours, modeled after military ordinance
Maricopa	County has military base land use zoning ordinance. County has height and hazard zoning adopted for military bases.
Mohave	The county has an Airport District zone which addresses both height of structures and land use.
Navajo	Controls height of structures along center line of runway.
Pima	Overlay zoning for height and land use zoning.
Pinal	The county has no ordinances or regulations regarding the control of object height or land use compatibility.
Santa Cruz	County is in process of developing an Airport Master Plan and County Development Code.
Yavapai	County is in process of reviewing and adopting proposed ordinances.
Yuma	City and County zoning essentially the same. Both height hazard and land use compatibility.

Source: Arizona Airport Land Use Compatibility Study, 1992, ADOT Aeronautics

EXHIBIT 3-2: ***State Highway System***



Rail

There are numerous main rail lines navigating the state as well as multiple branch lines connecting to these. Amtrak is the only company offering passenger rail service in the state. Amtrak does not own rail lines in the state; they merely utilize the lines of others that provide cargo service. Several other companies offer such cargo service.

There are two basic passenger routes offered by Amtrak. One route runs through Kingman, Flagstaff, and Winslow in both directions. This is part of the Southwest Chief route that runs from Los Angeles to Chicago through Albuquerque. The other route goes through Yuma, Tucson and Benson, again in both directions. It is part of the Sunset Limited that goes from Los Angeles to San Antonio, then to New Orleans and on to Orlando. Amtrak also provides a connecting service between Flagstaff and Phoenix to facilitate passenger travel between the two routes.

Amtrak railroad stations are present in the following locations in Arizona.

- Benson
- Camp Verde
- Flagstaff
- Grand Canyon
- Kingman
- Lake Havasu
- Munds Park
- Phoenix Amtrak Station
- Phoenix North
- Phoenix Sky Harbor Airport
- Tucson
- Williams
- Williams Junction
- Winslow
- Yuma

A recreational rail system is also offered for round-trip service between Williams and the Grand Canyon.

Bus Service

Bus service, while offered by a variety of carriers, is not widely used in the state. The geographic isolation in some portions of Arizona make establishing routine service to these locations cost-prohibitive. Numerous charter operators provide service for tour groups and, in the larger metropolitan areas of Phoenix and Tucson, mass transit by bus is provided. Greyhound fills the need for state-to-state travel by bus to and from Arizona.

The Maricopa Association of Governments (MAG) Regional Public Transportation Authority makes available to Phoenix and Maricopa County a bus service area of 585 square miles. This service area includes some 56 local routes that allow almost 85% of the Maricopa County population to live within one mile of an established bus route.

Sun Tran is the primary provider of public transportation in the Tucson area. Sun Tran operates almost 40 routes that cover approximately 240 square miles. The average daily passenger volume for Sun Tran is approximately 60,000.

As mentioned, several small urban and rural transit entities provide service on fixed routes to other areas of the state. Their overall service is limited in nature, but they still provide key transport mechanisms to these under served locations.

3.5 AVIATION

Aviation is more important in Arizona relative to other states for a few reasons. Key among these are the following:

- A very large tourist population that travels primarily by air
- A vast expanse of area much of which is isolated by its landscape
- Ideal flight weather conditions for 98% of the year that increase usage

The aviation industry continues to be one of the fastest growing components of the Arizona economy. The estimated economic impact of aviation in Arizona for 1997-98 was over $15 billion dollars. The industry employed 167,325 people in that same period. Its $4.3 billion dollar payroll was also a major component for the state.

Given Arizona's burgeoning economy and population, aviation can only continue to thrive. Global economics and the need for businesses to maintain a fast, competitive pace will be driving factors for the aviation industry. Transportation speed capabilities in our technologically advanced world will feed the need for instant gratification. Aviation is the only mode that can optimize that benefit.

The state's aviation system can generally be organized in the following manner:

- Aviation Facility Classification
- Airport Facilities
- Heliport Facilities
- Seaplane Facilities
- Air Carrier Activity
- Scheduled Airline Routes
- Air Taxi
- General Aviation
- Rural Health Care Delivery/Air Ambulance Service
- Military
- Airspace and NAVAIDs

Aviation Facility Classifications

Arizona has a variety of aviation facilities. Some are small rural unpaved airstrips serving isolated portions of the state. Some are busy rooftop heliports facilitating the needs of corporate America. Others are large, long-haul commercial service airports moving people and cargo back and forth. Because of this diversity of facilities with broad ranges of operating parameters and design standards, a means of facility classification is necessary.

Four basic aviation facility classifications are used by the FAA and the Arizona Department of Transportation. The first is a classification system, mentioned in Element One, utilized in the National Plan of Integrated Airport Systems (NPIAS). The second is a coding system used by the FAA to relate airport design criteria to the operational and physical characteristics of the

airplanes operating at an airport. The third is a hierarchical classification used by the Arizona Aeronautics Division that segregates the state's airports into a Primary System, a Secondary System, and Other Airports. The fourth was developed by the ADOT, based on former FAA airport classification categories, to assist in setting minimum development standards and planning guidelines for airport facility development in the state.

National Plan of Integrated Airport Systems (NPIAS)

The NPIAS is a national airport system plan developed by the FAA to indicate aviation facilities of national significance. NPIAS airports are eligible for federal grants for airport planning and various capital improvements. The NPIAS defines an airport's status by its service level. The service level of an airport reflects the type of public service the airport provides to the community. The service level also reflects the funding categories established by Congress to assist in airport development. These categories are:

- **Primary Service** (PR) – Primary Service airports are public use airports receiving scheduled airline passenger service which also enplane 10,000 or more passengers per year.

- **Commercial Service** (CM) - Commercial Service airports are public use airports which receive scheduled airline passenger service and which annually enplane 2,500 or more passengers.

- **General Aviation** (GA) – General Aviation airports are either publicly or privately owned, public use airports which serve general aviation needs.

- **Reliever** (RL) – Reliever airports are general aviation or commercial service airports which have the function of relieving congestion at a Primary Service airport and which provide the general aviation user or small commercial operator with an alternative for access to the overall community. Reliever airports receive higher priority for funding assistance than other general aviation or commercial service airports.

Airport Reference Code (ARC)

The ARC is a coding system developed by the FAA used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at an airport. The ARC has two components related to the airport design aircraft. The first component, depicted by a letter, is the aircraft approach category and relates to aircraft approach speed. These aircraft categories are as follows:

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

The second component, depicted by a Roman numeral, is the airplane design group and relates to airplane wingspan. This grouping links an airport's dimensional standards to aircraft wingspans. The categories are as follows:

- Design Group I: Wingspan up to but not including 49 feet.
- Design Group II: Wingspan 49 feet up to but not including 79 feet.
- Design Group III: Wingspan 79 feet up to but not including 118 feet.
- Design Group IV: Wingspan 118 feet up to but not including 171 feet.
- Design Group V: Wingspan 171 feet up to but not including 214 feet.
- Design Group VI: Wingspan 214 feet up to but not including 262 feet.

Generally, aircraft approach speed applies to runways and runway related facilities. Airplane wingspan primarily relates to separation criteria involving taxiways and taxilanes.

Airports expected to accommodate single-engine airplanes normally fall into Airport Reference Code B-I. Airports serving larger general aviation and commuter-type planes are usually Airport Reference Code B-II or C-II. Small to medium-sized airports serving air carriers are usually Airport Reference Code C-III, while larger air carrier airports are usually Airport Reference Code D-VI.

Primary and Secondary Airport Classifications

Arizona State's aviation system is segregated by the ADOT, Aeronautics Division into two subsystems ~ a Primary system and a Secondary system category. System airports are divided into these two categories primarily by size and usage. In order for an airport to be included under the primary system, it must be open to the public and meet at least one of the following criteria:

- Have 10 or more based aircraft and/or 2000 or more yearly operations; or
- Have scheduled air carrier service; or
- Receive commuter service regularly; or
- Projected to meet any of the above criteria within 10 years.

Primary system airports serving scheduled air carrier service must be certified under Federal Aviation Regulation Part 139 (Certification and Operations: Land Airports Serving Certain Air Carriers).

There are 62 airports included in the Primary Airport System based on ADOT Aeronautics Division's 1999 records. Secondary airports are different in character from the State's Primary airports. Since these airports are normally located in rural areas, population size does not generate sufficient aviation activity to warrant the level of airport facilities generally associated with Primary airports. Secondary airports do provide facilities that can be utilized by single-engine and light-twin aircraft (e.g., FAA Stage I type aircraft). These Secondary airports are not designed to serve business jets, heavy twin-engines, large commuter aircraft, or commercial airlines.

The State's definition of a Secondary airport is one that satisfies both of the following criteria: (1) recognized by the FAA as an airport per Form 5010, and (2) open to the public. There are 20 Secondary airports identified in the 1999 Fiscal Year listing.

Previously, a category of airports called Emerging Rural Airports were included by ADOT as part of the State's system of airports that did not meet the requirements of either a Primary or Secondary facility, but existed in areas that were not adequately served by aviation facilities. The concept of Emerging Rural Airports was described in detail in a special study of Secondary, Native American, and Other Rural Airports produced by ADOT in 1988. This special study identified nine airports as potential State aviation network facilities. This category of airport is no longer identified as a special category in the Arizona Aviation system.

Airport Categories

The following definitions are applicable to the State Primary and Secondary Systems.

1. Commercial Service Airport: a publicly owned airport which enplanes 2,500 or more passengers annually and receives scheduled passenger air service.

2. Reliever Airport: an airport that serves as a "relief of General Aviation traffic congestion for a Commercial Service airport, providing more general aviation access to the overall community. The Reliever Airport should have a current or forecast activity level of 50 based aircraft and a minimum of 25,000 annual itinerant operations (or 35,000 local operations).

3. General Aviation Airports: the remaining airports that do not fall into either the Commercial Service or Reliever status are referred to as General Aviation airports. This category includes privately owned and/or private use airports/heliports. For system planning purposes, the General Aviation Airports may be divided into the following types:

    a. Community Airport: an airport within the State of Arizona serving an incorporated community with a population more than 1,000 people.

    b. Rural Airport: an airport within the State of Arizona serving an incorporated community with less than 1,000 population.

    c. Emergency Airport: an airport/facility or area within the State of Arizona that currently has, or can demonstrate, a need for an emergency or "air evacuation" airport. These airports may serve general aviation, recreation, and/or emergency services.

4. New Urban Airport: the construction of a new airport within 24 statute miles of the Urbanized Area Boundary of Phoenix, Tucson, Yuma, and Flagstaff requires the approval of the State Transportation Board (A.R.S. 28-8205).

Airport Facilities

This section provides a summary of existing aviation facilities in the state. Facilities included in this section include all public-use facilities regardless of ownership. Arizona's system of public-use airports is very comprehensive. Airports are among the most heavily used means of public transportation throughout the state. Maintaining and updating the aviation system is a critical element to effectively fulfill the transportation needs of Arizona.

The subsequent series of maps and tables on the next few pages to summarize the available aviation resources. Exhibit 3-3 and Table 3-7 shows the State's public-use airport system, both commercial and general aviation. Military airports that are publicly owned but restricted in use are also depicted. Exhibit 3-4 illustrates only Arizona's Primary airports while Exhibit 3-5 presents only the Secondary airport system.

A summary of existing airfield facilities that lists runway data and taxiway information is provided as Table 3-8. Existing airport lighting and terminal navigational aids are detailed in Table 3-9.

Heliport Facilities

Helicopters provide a vital resource to the aviation system, particularly for the corporate and medical communities in Arizona. There are well over 100 heliports located throughout the state. The vast majority are privately owned with restricted use. Some facilities are publicly owned, (Glendale Heliport and Helistop, Mesa Heliport) but required prior permission in order to use the facility. In addition to the numerous heliports, many airports have routine helicopter service.

Helicopters are also a key element in the tourist industry. Numerous flights are available in the Grand Canyon and Sedona areas. Most of these operate out of the Grand Canyon National Park and Sedona Airports.

Seaplane Facilities

Seaplane facilities are of two types: seaplane bases and seaplane landing areas. Seaplane bases have a resident operator who provides commercial services such as flight instruction, sight seeing flights, aviation fuel, and /or aircraft maintenance. Seaplane landing areas are designated bodies of water on which seaplanes can operate but where no seaplane-specific facilities are available.

The following are seaplane facilities in Arizona.

<u>Cocoino National Forest</u>
Mormon Lake, Flagstaff, AZ
Lake Mary, Flagstaff, AZ
Upper Lake Mary, Flagstaff, AZ

<u>Tonto National Forest</u>
Roosevelt Lake, Roosevelt, AZ

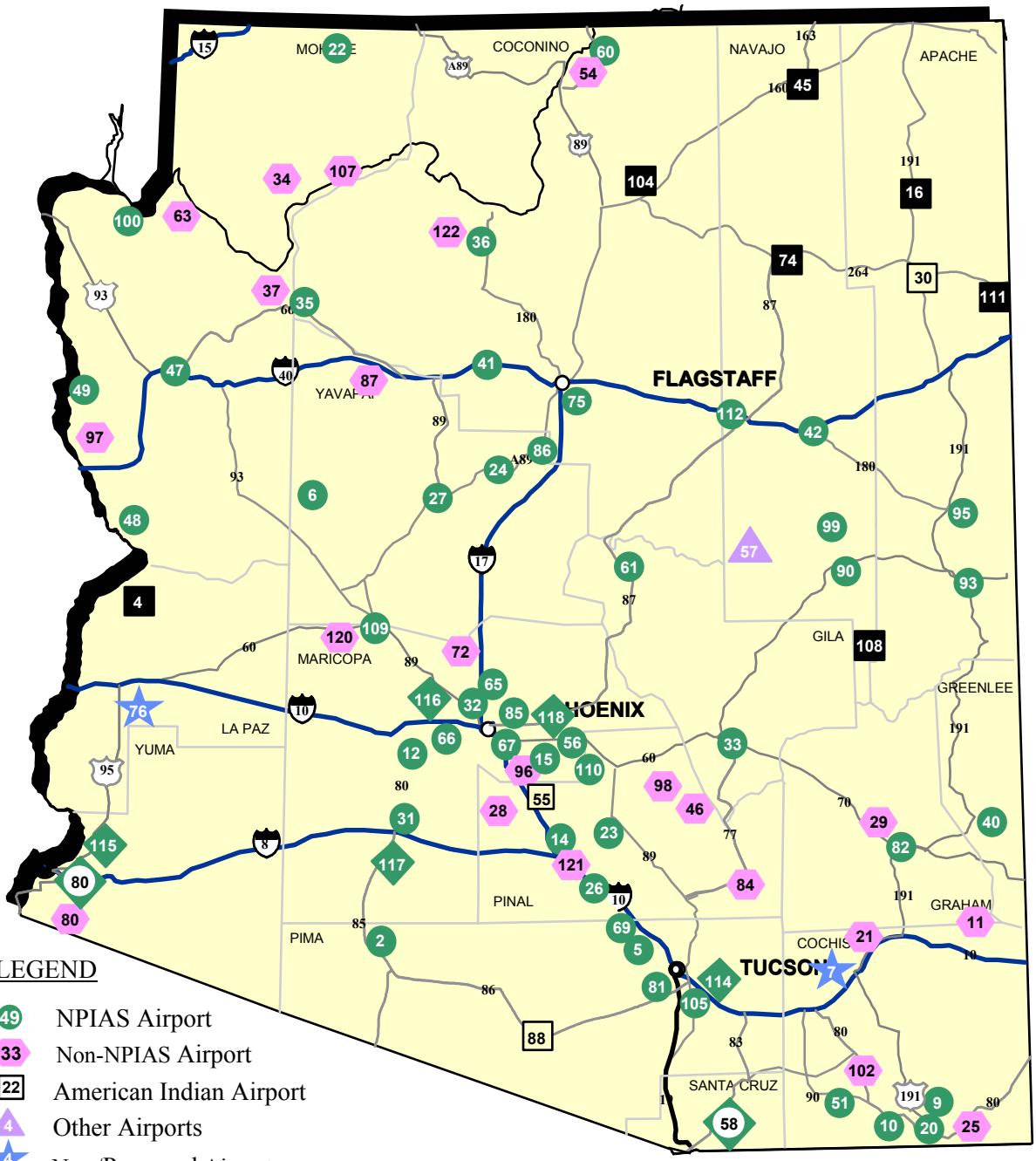
<u>U.S. National Park Service</u>
Lake Mead, Temple Bar, AZ
Lake Mohave, Bullhead City, AZ

<u>Glen Canyon National Recreation Area</u>
Lake Powell

<u>Lake Havasu City</u>
Lake Havasu, Lake Havasu City, AZ

EXHIBIT 3-3: *Existing Arizona State Public Use Airport System - 2000*

NOTE: * Phoenix-Sky Harbor, Tucson International and Libby AFB are currently used by the Arizona Air National Guard (AANG).



SOURCE: ADOT, Division of Aeronautics; Bucher, Willis & Ratliff

TABLE 3-9: ***Listing of Public Use Airports***

Legend		
1. Ak-Chin Community (1)	39. Greasewood (3)	77. Rio Vista Hills (1)
2. Ajo Municipal	40. Greenlee County	78. Rock Point (1)
3. Apache Junction *	41. H.A. Clark Memorial Field	79. Rocky Ridge (1)
4. Avi Suquilla	42. Holbrook Municipal	80. Rolle Airfield
5. Avra Valley (Marana Reg'l)	43. Hualapai (1)	81. Ryan Field
6. Bagdad	44. Inscription House (3)	82. Safford Regional
7. Benson Municipal	45. Kayenta	83. Sampley (1)
8. Big Lake/Sunrise (2)	46. Kearny	84. San Manuel
9. Bisbee Douglas International	47. Kingman	85. Scottsdale
10. Bisbee Municipal	48. Lake Havasu City Municipal	86. Sedona
11. Bowie	49. Laughlin/Bullhead Int'l	87. Seligman
12. Buckeye Municipal	50. Leupp/Painted Desert (3)	88. Sells
13. Camp Verde (3)	51. Sierra Vista Muni/Libby AAF	89. Shonto (1)
14. Casa Grande Municipal	52. Low Moutain (3)	90. Show Low Municipal
15. Chandler Municipal	53. Lukachukai (1)	91. Sky Ranch Carefree (1)
16. Chinle Municipal	54. Marble Canyon	92. Somerton Field (1)
17. Chiricahau Mountains (2)	55. Memorial Airfield (1)	93. Town of Springerville Municipal
18. Cibola (2)	56. Falcon Field	94. Sprucedale (2)
19. Cliff Dwellers Lodge (1)	57. Mogollon Airpark (1)	95. St. Johns Industrial Airpark
20. Cochise College	58. Nogales International	96. Stellar Airpark
21. Cochise County	59. Ora Acres (3)	97. Sun Valley
22. Colorado City Municipal	60. Page Municipal	98. Superior Municipal
23. Coolidge Municipal	61. Payson	99. Taylor
24. Cottonwood Municipal	62. Peach Springs *	100. Temple Bar
25. Douglas Municipal	63. Pearce Ferry	101. Three Point (3)
26. Eloy Municipal	64. Petrified Forest (3)	102. Tombstone Municipal
27. Ernest A. Love Field	65. Phoenix Deer Valley	103. Toyei School *
28. Estrella Sailport	66. Phoenix Goodyear	104. Tuba City
29. Flying J Ranch	67. Phoenix Sky Harbor Int'l	105. Tucson International
30. Ganado	68. Pearce Ferry	106. Tucson Mercury (3)
31. Gila Bend Municipal	69. Pinal Airpark	107. Tuweep
32. Glendale Municipal	70. Pine Springs (1)	108. Whiteriver
33. San Carlos Apache	71. Pinon (1)	109. Wickenburg Municipal
34. Grand Canyon Bar-Ten	72. Pleasant Valley	110. Williams Gateway
35. Grand Canyon Caverns	73. Pleasant Valley Airstrip (1)	111. Window Rock
36. Grand Canyon National Park	74. Polacca	112. Winslow Lindberg Regional
37. Grand Canyon West	75. Flagstaff-Pulliam	113. Yuma International/MCAS Yuma
38. Grapevine/Roosevelt Lake (1)	76. Quartzsite *	119. Alamo Lake (2)
		120. Forepaugh
		121. Grande Valley
		122. Valle Airport
	MILITARY:	
	114. Davis-Monthan AFB	
	115. Laguna AAF	
	116. Luke AFB	
	117. Gila Bend-AF Aux.	
	118. Papago AAF	

Airport candidates no longer viable and dropped from study = *
Airports that are active, private use airports = (1)
Recreational Study Airports, dropped from the SANS = (2)
Airports that have been closed/abandoned = (3)
Airports not included in Exhibit 3-3

EXHIBIT 3-4: ***Arizona State Primary Airport System***

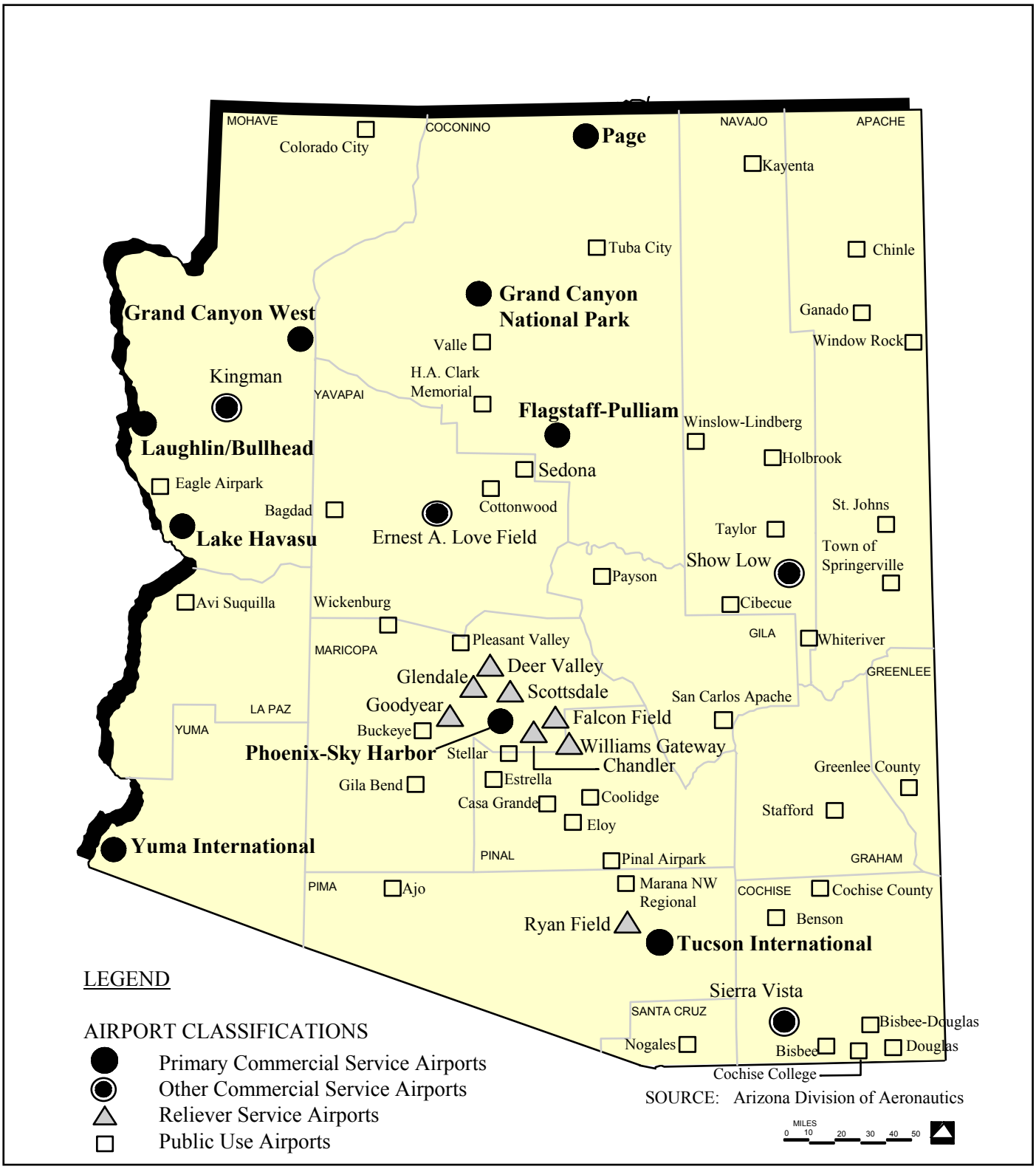


EXHIBIT 3-5: ***Arizona State Secondary Airport System***

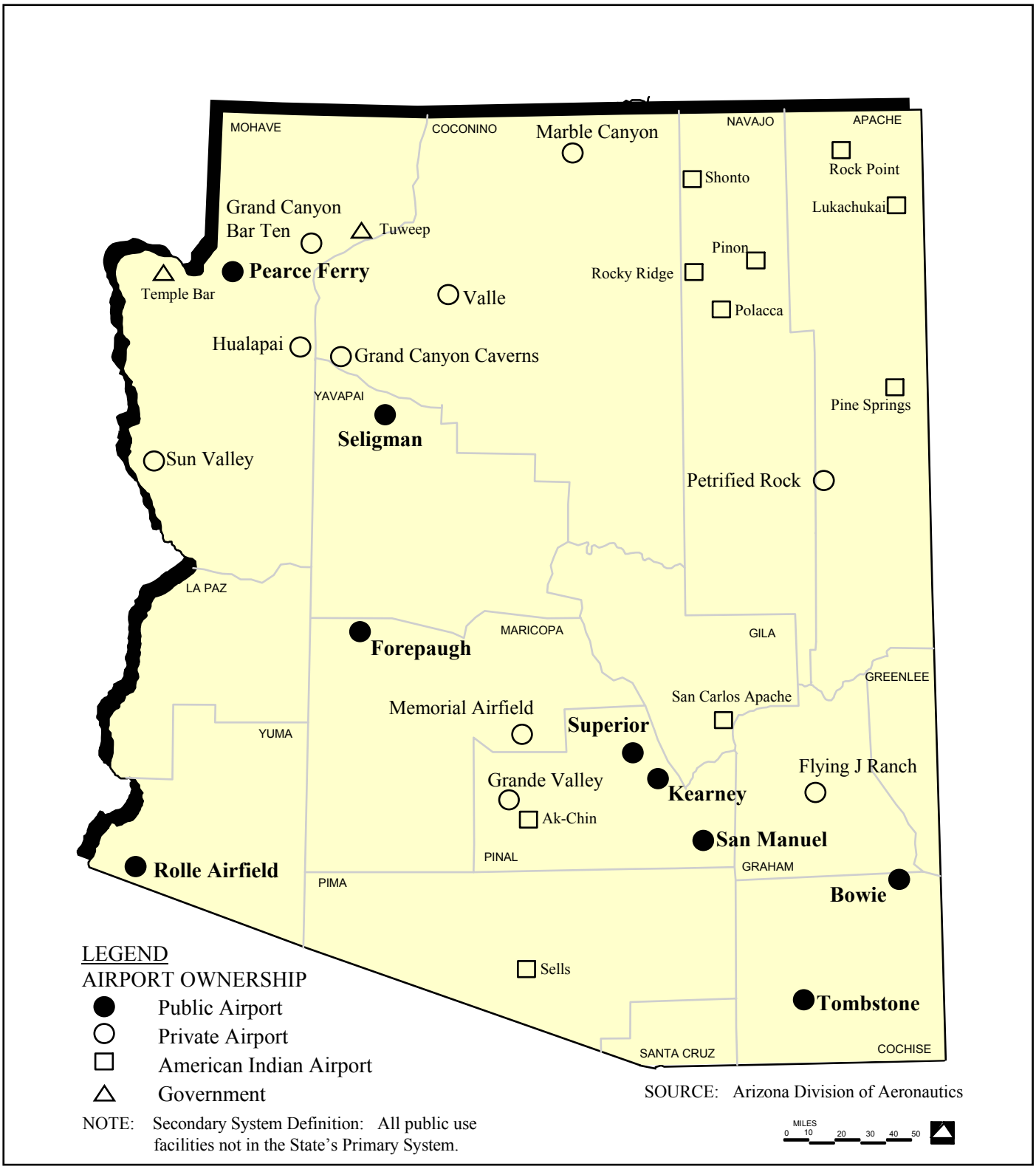


TABLE 3-8: *Existing Facilities*

AIRPORT NAME	Elev. MSL [ft.]	Runway	Length [ft.]	Width [ft.]	Surface	Strength (1000) lbs.	Parallel Taxiway	ASV
Ajo Municipal	1458[5]	12-30[5]	3800[5]	60[5]	Asphalt[5]	12.5-S[5]	No[4]	175,000[1]
Avi Suquilla (NA)	452[8]	01-19[5]	4780[5]	75[5]	Asphalt[5]	20-S[5]	Full[4]	175,000[1]
Bagdad Airport	4183[5]	05-23[5]	4575[5]	60[5]	Asphalt[5]	4-S[5]	No[4]	143,300[1]
Benson	4183[5]	05-23[5]	4575[5]	60[5]	Asphalt[6]	13-S[5]	No[5]	123,284[2]
Bisbee Douglas Int'l*	4154[5]	08-26[5]	7002[5]	75[5]	Asphalt[5]	30-S[5] 95-D[5] 155-DT[5]	No[4]	325,360[1]
		17-35[5]	7311[5]	150[5]	Asphalt[5]	30-S[5] 160-D[5] 250-DT[5]	Partial[9]	
Bisbee Municipal*	4780[5]	17-35[2]	5929[2]	60[5]	Asphalt[5]	12.5-S[5]	Full[4]	147,600[1]
		02-20[2]	2650[2]	110[5]	Dirt[5]	NA[5]	No[4]	
Bowie	3737[5]	08-26[2]	3925[2]	70[2]	Dirt[2]	NA[5]	No[2]	120,000[1]
Buckeye Municipal Airport	1021[5]	17-35[5]	4300[5]	75[5]	Asphalt[5]	12.5-S[3]	Full[3]	245,000[1]
Casa Grande Municipal	1464[5]	05-23[2]	5200[2]	100[2]	Asphalt[2]	19.5-S[5] 65-D[5]	Full[4]	285,000[1]
Cascabel Airpark (Private Use Facility)	3374[5]	01-19[5]	2750[5]	50[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Chandler Municipal*	1243[5]	4L-22R[2]	4401[2]	75[2]	Asphalt[2]	30-S[5]	Full[4]	269,000[2]
		4R-22L[2]	4850[2]	75[2]	Asphalt[2]	30-S[5]	Full[4]	
Chinle Municipal	1760[5]	17-35[5]	4200[5]	60[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Cibecue	5037[5]	07-25[5]	4200[5]	100[5]	Gravel[5]	NA[5]	NA	
Cochise College	4124[5]	05-23[5]	5303[5]	72[5]	Asphalt[5]	NA[5]	Full[4]	267,000[1]
Cochise County	4183[8]	03-21[2]	6095[8]	75[8]	Asphalt[2]	50-S[5] 75-D[5] 135-DT[5]	Full[2]	230,000[1]
Colorado City Municipal*	4874[5]	02-20[5]	5099[3]	60[3]	Asphalt[5]	13-S[5]	Full[9]	110,700[1]
		11-29[5]	6300[3]	75[3]	Asphalt[5]	30-S[5]	Full[9]	
Coolidge Municipal*	1587[8]	05-23[3]	5528[8]	150[8]	Asphalt[3]	80-S 115-D[3]	Partial[4]	347,600[1]
		17-35[3]	3861[8]	75[8]	Asphalt[3]	17-S[3]	Full[4]	
Cottonwood Municipal	3550[5]	14-32[2]	4250[2]	75[2]	Asphalt[2]	4-S[5]	Full[4]	295,100[1]
Douglas Municipal*	4173[5]	03-21[5]	5760[5]	75[5]	Asphalt[5]	12.5-S[3]	Partial[4]	155,200[1]
		18-36[5]	4095[5]	100[5]	Dirt[5]	NA[5]	No[4]	
Eagle Airpark	485[5]	17-35[5]	4800[5]	50[5]	Asphalt[5]	NA[5]	Full[4]	225,400[1]
Eloy Municipal	1513[5]	02-20[5]	3900[5]	60[5]	Asphalt[5]	12.5-S[3]	Full[4]	285,400[1]

LEGEND:
ASV – Annual Service Volume
S – Single Wheel Gear
D – Dual Wheel Gear
DT – Dual Tandem Wheel Gear
DDT – Double Dual Tandem Wheel Gear
NA – Native American
* Airport with Multiple Runways

FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
6. Call to Airport
7. Jeppesen Airway Manual
8. FAA Data Sheet
9. AOPA Airport Directory (2001-2002)

TABLE 3-8: *Existing Facilities (Continued)*

AIRPORT NAME	Elev. MSL [ft.]	Runway	Length [ft.]	Width [ft.]	Surface	Strength (1000) lbs.	Parallel Taxiway	ASV
Ernest A. Love Field*	5045[5]	3R-21L[5]	7550[8]	150[8]	Asphalt[5]	63-S[5] 80-D[5] 100-DT[5]	Full[4]	326,400[1]
		3L-21R[5]	4846[8]	60[8]	Asphalt[5]	13-S[5]	Full[4]	
		12-30[5]	4408[8]	75[8]	Asphalt[5]	13-S[5]	Full[4]	
Estrella Sailport*	1273[5]	6R-24L[5]	2520[5]	30[5]	Asphalt[5]	NA[5]	No[4]	120,000[1]
		6C-24C[5]	1995[5]	25[5]	Dirt[5]	NA[5]	No[4]	
		6L-24R[5]	1910[5]	25[5]	Dirt[5]	NA[5]	No[4]	
		07-25[5]	3740[5]	20[5]	Dirt[5]	NA[5]	No[4]	
Falcon Field	1394[8]	4L-22R[8]	3801[8]	75[8]	Asphalt[8]	13-S[5]	Full[9]	381,800[0]
		4R-22L[8]	5102[8]	100[8]	Asphalt[8]	38-S[5] 60-D[5] 90-DT[5]	Full[9]	
Flagstaff - Pulliam	7014[8]	03-21[5]	6999[5]	150[5]	Asphalt[5]	30-S[5] 95-D[5] 140-DT[5]	Full[9]	274,000[0]
Flying J Ranch	3100[5]	01-19[5]	2580[5]	50[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Forepaugh	2428[5]	03-21[5]	4671[5]	80[5]	Dirt[5]	NA[5]	No[5]	120,000[1]
Ganado (NA)	6662[5]	18-36[5]	4500[5]	130[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Gila Bend Municipal	778[5]	04-22[2]	5200[2]	75[2]	Asphalt[2]	13-S[5]	Full[2]	174,900[1]
Glendale Municipal	1066[5]	01-19[2]	5351[8]	75[8]	Asphalt[5]	30-S[5] 38-D[5]	Full[4]	275,000[1]
Grand Canyon Bar Ten	4100[5]	16-34[5]	4600[5]	40[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Grand Canyon Caverns	5386[5]	05-23[5]	5100[5]	45[5]	Gravel[5]	NA[5]	No[4]	120,000[1]
Grand Canyon National Park	6609[8]	03-21[5]	8999[5]	150[5]	Asphalt[5]	88-S[5] 108-D[5]	Full[4]	156,000[1]
Grand Canyon West	4775[5]	17-35[5]	5200[5]	60[5]	Asphalt[2]	NA[5]	Partial[2]	120,000[1]
Grande Valley	1290[5]	03-21[5]	3000[5]	50[5]	Dirt[5]	NA[5]	No[4]	120,000[1]
Greenlee County	3811[5]	07-25[2]	4970[2]	75[2]	Asphalt[2]	21-S[5]	No[2]	126,300[1]
H.A. Clark Memorial Field*	6680[5]	18-36[5]	5992[5]	75[5]	Asphalt[5]	15-S[3]	No[4]	137,400[1]
Holbrook Municipal*	5262[8]	03-21[2]	6698[8]	75[2]	Asphalt[2]	12.5-S[2]	Full[4]	267,400[1]
		11-29[2]	3200[2]	120[2]	Dirt[2]	NA[5]	No[4]	

LEGEND:
ASV – Annual Service Volume
S – Single Wheel Gear
D – Dual Wheel Gear
DT – Dual Tandem Wheel Gear
DDT – Double Dual Tandem Wheel Gear
NA – Native American
* Airport with Multiple Runways

FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
6. Call to Airport
7. Jeppesen Airway Manual
8. FAA Data Sheet
9. AOPA Airport Directory (2001-2002)

TABLE 3-8: *Existing Facilities (Continued)*

AIRPORT NAME	Elev. MSL [ft.]	Runway	Length [ft.]	Width [ft.]	Surface	Strength (1000) lbs.	Parallel Taxiway	ASV
Kayenta (NA)*	5262[5]	05-23[5]	7140[5]	75[5]	Asphalt[5]	12.5-S[5]	No[4]	120,000[1]
		11-29[5]	3200[8]	120[8]	Dirt[2]	NA[5]	No[5]	
Kearny	1833[5]	08-26[5]	3400[5]	60[5]	Concrete[5]	13-S[5]	No[4]	120,000[1]
Kingman*	3449[8]	03-21[2]	6831[8]	150[2]	Asphalt[2]	45-S[5] 85-D[3]	Full[2]	347,600[1]
		17-35[2]	6725[8]	75[2]	Asphalt[2]	22-S[5] 60-D[5]	Partial[4]	
Lake Havasu City Municipal	781[8]	14-32[5]	8000[8]	100[5]	Asphalt[5]	100-S[5]	Full[4]	307,900[1]
Laughlin/Bullhead International	695[8]	16-34[5]	7520[8]	150[5]	Asphalt[5]	75-S[5] 200-D[5] 400-DT[5]	Full[2]	267,000[1]
Marana NW Regional*	2031[5]	03-21[5]	4201[5]	75[5]	Asphalt[5]	12.5-S[3]	Full[2]	267,000[1]
		12-30[5]	6901[5]	100[5]	Asphalt[5]	30-S[5] 60-D[5] 140-DT[5]	Full[2]	
Marble Canyon	3603[5]	03-21[5]	3715[5]	35[5]	Asphalt[5]	NA[5]	No[2]	100,000[1]
Memorial Airfield (NA)*(Private Use Facility)	1185[5]	03-21[5]	5200[5]	200[5]	Asphalt[5]	NA[5]	No[2]	100,000[1]
		12-30[5]	8560[5]	300[5]	Asphalt[5]	NA[5]	Full[2]	
Mogollon Airpark (Private Use Facility)								
Nogales International	3955[5]	03-21[5]	7199[8]	90[8]	Asphalt[5]	21-S[5]	Full[2]	267,100[1]
Page Municipal*	4313[8]	15-33[5]	5499[8]	150[8]	Asphalt[5]	65-S[5] 90-D[5] 190-DT[5]	Full[2]	294,600[1]
		07-25[5]	2200[5]	75[5]	Dirt[5]	NA[5]	No[2]	
Payson	5157[5]	06-24[5]	5500[5]	75[5]	Asphalt[5]	13-S[5],	Full[2]	267,000[1]
Pearce Ferry	2941[5]	01-19[5]	2810[5]	90[5]	Asphalt[5]	NA[5]	No[2]	120,000[1]
Phoenix Deer Valley*	1478[8]	7L-25R[8]	4500[8]	75[8]	Asphalt[5]	20-S[8]	Full[9]	336,400[1]
		7R-25L[8]	8208[8]	100[8]	Asphalt[5]	40-S 50-D[8]	Full[9]	
Phoenix Goodyear	959[8]	03-21[5]	8500[5]	150[5]	Asphalt[5]	75-S[5] 200-D[5] 270-DT[5]	Full[5]	276,100[1]

LEGEND:
ASV – Annual Service Volume
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* Airport with Multiple Runways

FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
6. Call to Airport
7. Jeppesen Airway Manual
8. FAA Data Sheet
9. AOPA Airport Directory (2001-2002)

TABLE 3-8: *Existing Facilities (Continued)*

AIRPORT NAME	Elev. MSL [ft.]	Runway	Length [ft.]	Width [ft.]	Surface	Strength (1000) lbs.	Parallel Taxiway	ASV
Phoenix Sky Harbor International*	1135[8]	7L-25R[8]	10300[8]	150[8]	Asphalt[8]	30-S[5] 200-D[5] 400-DT[5] 620-DDT[5]	Full[5]	475,000[1]
		7R-25L[8]	7800[8]	150[8]	Concrete[8]	30-S[5] 200-D[5] 400-DT[5] 620-DDT[5]	Full[5]	
		8-26[8]	11492[8]	150[8]	Concrete[8]	30-S[5] 170-D[5] 280-DT[5] 620-DDT[5]	Full[5]	
Pinal Airpark	1892[8]	12-30[5]	6850[5]	150[5]	Asphalt[5]	68-S[5] 100-D[5] 150-DT[5]	Full[5]	195,000[1]
Pleasant Valley*	1580[5]	5C-23C[5]	4200[5]	100[5]	Dirt[5]	NA[5]	No[5]	120,000[1]
		5L-23L[5]	4200[5]	100[5]	Dirt[5]	NA[5]	No[5]	
		5R-23R[5]	4200[5]	100[5]	Dirt[5]	NA[5]	No[5]	
		14-32[5]	2400[5]	100[5]	Dirt[5]	NA[5]	No[5]	
Polacca (NA)	5573[5]	04-22[5]	4200[5]	50[5]	Asphalt[5]	NA[5]	No[5]	120,000[1]
Quartzite -No longer a viable candidate	NA	NA	NA	NA	NA	NA	NA	NA
Rolle Airfield	163[5]	17-35[5]	2800[5]	60[5]	Asphalt[5]	NA[5]	No[5]	120,000[1]
Ryan Field*	2403[8]	6R-24L[5]	5500[5]	75[5]	Asphalt[5]	13-S[5] 30-D[5]	Full[5]	355,000[1]
		6L-24R[5]	4900[5]	75[5]	Asphalt[5]	13-S[5] 30-D[5]	Partial[5]	
		15-33[5]	4000[8]	75[8]	Asphalt[8]	NA[5]	Partial[5]	
Safford Regional*	3177[8]	12-30[5]	6015[5]	100[5]	Asphalt[5]	33-S[5]	Full[5]	286,700[1]
		08-26[5]	4800[5]	75[5]	Asphalt[5]	23-S[5]	Full[9]	
St. Johns Industrial Airpark*	5736[8]	03-21[8]	3400[5]	60[5]	Asphalt[5]	55-S[5]	Full[6]	286,700[1]
		14-32[8]	5322[8]	75[8]	Asphalt[8]	90-S[5]	Full[6]	
San Carlos Apache	3235[5]	09-27[5]	5804[5]	75[5]	Asphalt[5]	12.5-S[5]	Full[4]	285,400[1]
San Manuel	3274[5]	11-29[5]	4214[5]	55[5]	Gravel[5]	NA[5]	No[5]	120,700[1]
Scottsdale	1510[5]	03-21[5]	8249[8]	100[8]	Asphalt[5]	45-S[5] 75-D[5]	Full[5]	294,600[1]

LEGEND:
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* Airport with Multiple Runways

FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
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8. FAA Data Sheet
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TABLE 3-8: *Existing Facilities (Continued)*

AIRPORT NAME	Elev. MSL [ft.]	Runway	Length [ft.]	Width [ft.]	Surface	Strength (1000) lbs.	Parallel Taxiway	ASV
Sedona	4830[8]	03-21[8]	5132[8]	75[8]	Asphalt[5]	15-S[5] 30-D[5]	Full[2]	267,100[1]
Seligman	5235[5]	04-22[5]	4800[5]	75[5]	Asphalt[5]	NA[5]	Partial[4]	120,000[1]
Sells (NA)	2409[5]	04-22[5]	5830[5]	48[5]	Asphalt[5]	13-S[5]	No[2]	130,000[1]
Show Low Municipal*	6415[8]	03-21[5]	3937[8]	60[8]	Asphalt[5]	NA[5]	Partial[2]	378,400[1]
		06-24[5]	7200[5]	75[5]	Asphalt[5]	35-S[5] 60-D[5]	No[2]	
Sierra Vista Muni / Libby AAF*	4719[5]	03-21[5]	4285[8]	75[5]	Asphalt[5]	NA[5]	No[9]	367,400[1]
		08-26[5]	12001[8]	150[8]	Concrete[8]	70-S[5] 70-D[5] 70-DT[5] 70-DDT[5]	Full[2]	
		12-30[8]	5366[8]	100[8]	Asphalt[8]	46-S[5] 106-D[5] 137-DT[5] 172-DDT[5]	Full[3]	
Stellar Airpark	1177[8]	17-35[5]	4295[8]	60[8]	Asphalt[5]	NA[5]	Partial[4]	120,000[1]
Sun Valley	725[5]	18-36[5]	3700[5]	42[5]	Asphalt[5]	NA[5]	No[2]	120,000[1]
Superior Municipal	2646[5]	4-22[5]	3500[5]	75[5]	Dirt[5]	NA[5]	No[2]	120,000[1]
Taylor	5280[8]	03-21[8]	7200[8]	75[8]	Asphalt[5]	12.5-S	No[2]	137,400[1]
Temple Bar	1549[5]	18-36[5]	3500[5]	50[5]	Asphalt[5]	10-S[5]	No[2]	120,000[1]
Tombstone Municipal	4743[5]	06-24[5]	4610[5]	65[5]	Dirt[5]	NA[5]	No[2]	105,900[1]
Town of Springerville Municipal*	7051[8]	03-21[5]	8417[8]	75[8]	Asphalt[5]	4-S[5]	Full[2]	286,700[1]
		11-29[5]	4589[8]	60[8]	Asphalt[5]	NA[5]	No[2]	
Tuba City (NA)	4513	15-33[5]	6230[5]	75[5]	Asphalt[5]	13-S[5]	No[2]	120,000[1]
Tucson International*	2643[8]	03-21[5]	7000[5]	150[5]	Asphalt[5]	105-S[5] 137-D[5] 230-DT[5] 500-DDT[5]	No[2]	380,000[1]
		11L-29R[5]	10996[5]	150[5]	Asphalt[5]	160-S[5] 200-D[5] 350-DT[5] 585-DDT[5]	Full[2]	
		11R-29L[5]	8408[5]	75[5]	Asphalt[5]	120-S[5] 140-D[5] 220-DT[5]	Full[2]	
Tuweep	4682[5]	02-20[5]	3400[5]	40[5]	Dirt[5]	NA[5]	No[2]	120,000[1]

LEGEND:
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FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
6. Call to Airport
7. Jeppesen Airway Manual
8. FAA Data Sheet
9. AOPA Airport Directory (2001-2002)

TABLE 3-8: ***Existing Facilities (Continued)***

AIRPORT NAME	Elev. MSL	Runway	Length	Width	Surface	Strength	Parallel	
Valle Airport	5999[5]	01-19[5]	4199[8]	45[8]	Asphalt[8]	NA[5]	Partial[6]	120,000[1]
Whiteriver (NA)	5152[5]	01-19[5]	6288[5]	75[5]	Asphalt[5]	16-S[5]	No[2]	230,000[1]
Wickenburg Municipal	2386[5]	05-23[5]	5050[5]	75[5]	Asphalt[5]	16-S[5]	Full[2]	267,000[1]
Williams Gateway*	1382[8]	12C-30C[5]	10201[8]	150[5]	Asphalt-Concrete[5]	55-S[5] 95-D[5] 185-DT[5] 550-DDT[5]	No[2]	410,000[1]
		12L-30R[5]	9300[5]	150[5]	Asphalt-Concrete[5]	75-S[5] 210-D[5] 590-DT[5] 850-DDT[5]	Partial[4]	
		12R-30L[5]	10400[5]	150[5]	Asphalt-Concrete[5]	55-S[5] 95-D[5] 185-DT[5] 550-DDT[5]	Full[2]	
Window Rock (NA)	6742[8]	02-20[5]	7000[5]	75[5]	Asphalt[5]	30-S[5] 45-D[5] 75-DT[5]	No[2]	120,000[1]
Winslow-Lindberg Regional*	4941[8]	04-22[5]	7499[8]	150[8]	Asphalt-Concrete[5]	50-S[5] 80-D[5] 125-DT[5]	Full[2]	286,700[1]
		11-29[5]	7100[8]	150[8]	Asphalt-Concrete[5]	60-S[5] 70-D[5] 110-DT[5]	Full[2]	
Yuma International/MCAS Yuma*	215[8]	3L-21R[5]	13300[8]	200[8]	Concrete[8]	103-S[5] 200-D[5] 400-DT[5]	No[2]	347,600[1]
		3R-21L[5]	9241[8]	150[5]	Asphalt-Concrete[5]	162-S[5] 200-D[5] 400-DT[5]	Full[2]	
		08-26[5]	6146[8]	150[5]	Asphalt-Concrete[5]	63-S[5] 137-DT[5] 206-DT[5]	Full[2]	
		17-35[5]	5711[8]	150[5]	Asphalt-Concrete[5]	72-S[5] 171-D[5] 255-DT[5]	No[2]	

LEGEND:
ASV – Annual Service Volume
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NA – Native American
* Airport with Multiple Runways

FOOTNOTES:
1. ADOT Aeronautics
2. Survey Questionnaires – 1999
3. A.L.P.'s - Airport Layout Plans
4. Aerial Photographs (1998) – ADOT Aeronautics
5. 5010 Forms
6. Call to Airport
7. Jeppesen Airway Manual
8. FAA Data Sheet
9. AOPA Airport Directory (2001-2002)

TABLE 3-9: *Navigational, Lighting, Landing, and Weather Aids*

AIRPORT NAME	ILS	NPI	ALS	REIL	HIRL	MIRL	LIRL	MITL	REFLECTORS	APRON LTG.	BEACON	PAPI	VASI	WIND SOCK	DME	LOC	NDB	RNAV	VOR	GPS	WRS
Ajo Municipal							◆[1]				◆[1]		◆[5]	◆[1]							◆[6]
Apache Junction (New) No longer a viable candidate																					
Avi Suquilla (NA)						◆[1]					◆[1]	◆[7]		◆[1]	◆[7]				◆[6]	◆[7]	
Bagdad							◆[8]				◆[1]			◆[1]							
Benson Municipal				◆[1]		◆[1]					◆[1]	◆[1]		◆[1]							
Bisbee Douglas International		◆[7]				◆[3]					◆[1]		◆[3]	◆[1]	◆[7]				◆[3]	◆[7]	
Bisbee Municipal						◆[2]					◆[3]	◆[2]		◆[1]			◆[3]				◆[9]
Bowie														◆[2]							
Buckeye Municipal Airport						◆[1]		◆[3]			◆[1]	◆[3]		◆[1]					◆[3]		
Casa Grande Municipal	◆[2]	◆[1]	◆[1]			◆[2]		◆[2]			◆[2]		◆[2]	◆[2]	◆[8]	◆[1]			◆[2]	◆[2]	◆[2]
Cascabel Airpark (Private Use Facility)														◆[1]							
Chandler Municipal		◆[1]		◆[2]		◆[2]		◆[2]			◆[2]	◆[2]		◆[2]			◆[2]	◆[10]	◆[2]	◆[2]	◆[2]
Chinle Municipal														◆[1]							
Cibecue																					
Cochise College							◆[8]				◆[1]	◆[2]		◆[1]							
Cochise County		◆[3]				◆[2]					◆[2]			◆[2]						◆[2]	
Colorado City Municipal		◆[1]		◆[1]		◆[1]					◆[1]	◆[1]		◆[1]			◆[7]			◆[7]	◆[7]
Coolidge Municipal		◆[9]				◆[1]		◆[3]			◆[3]		◆[1]	◆[1]	◆[3]	◆[10]			◆[3]	◆[3]	
Cottonwood Municipal				◆[2]		◆[2]					◆[2]	◆[2]		◆[2]							
Douglas Municipal						◆[1]					◆[1]	◆[3]		◆[1]							
Eagle Airpark									◆[1]		◆[2]			◆[2]							
Eloy Municipal			◆[1]			◆[3]			◆[1]		◆[1]			◆[1]							

LEGEND:

ILS	Instrument Landing System
NPI	Non Precision Instrument
ALS	Approach Lighting System
REIL	Runway End Identifier Lights
HIRL	High Intensity Runway Lights
MIRL	Medium Intensity Runway Lights
LIRL	Low Intensity Runway Lights
MITL	Medium Intensity Taxiway Lights
PAPI	Precision Approach Path Indicator
VASI	Visual Approach Slope Indicators
DME	Distance Measuring Equipment
LOC	Localizer
NDB	Non Directional Beacon
RNAV	Area Navigation
VOR	Very High Freq. Omnirange
GPS	Global Positioning System
WRS	Weather Reporting System
NA	Native American

FOOTNOTES:

1. 5010 Forms
2. Survey Questionnaires – 1999
3. ALP's – Airport Layout Plans
4. Aerial Photographs
5. Airport/Facility Directory – Southwest U.S. (2000)
6. Call to Airport
7. Jeppeson Airway Manual
8. ADOT Aeronautics Division – Navigational Aids and Aviation Services Special Study (November 1998)
9. FAA Datasheet
10. U.S. Terminal Procedures (SW-1, 2001)

TABLE 3-9: *Navigational, Lighting, Landing, and Weather Aids (continued)*

AIRPORT NAME	ILS	NPI	ALS	REIL	HIRL	MIRL	LIRL	MITL	REFLECTORS	APRON LTG.	BEACON	PAPI	VASI	WIND SOCK	DME	LOC	NDB	RNAV	VOR	GPS	WRS
Ernest A. Love Field	◆[3]	◆[3]	◆[7]	◆[3]		◆[3]		◆[3]			◆[1]	◆[1]		◆[1]	◆[7]	◆[7]		◆[7]	◆[3]	◆[3]	◆[8]
Estrella Sailport														◆[1]							
Falcon Field		◆[1]		◆[2]		◆[2]		◆[2]		◆[6]	◆[2]	◆[2]		◆[2]			◆[2]			◆[2]	◆[8]
Flagstaff - Pulliam	◆[7]	◆[3]	◆[7]		◆[2]			◆[2]			◆[2]		◆[2]	◆[2]	◆[7]	◆[7]	◆[7]		◆[7]	◆[7]	◆[2]
Flying J Ranch														◆[1]							
Forepaugh														◆[1]							
Ganado (NA)														◆[1]							
Gila Bend Municipal							◆[8]				◆[2]			◆[2]					◆[2]		
Glendale Municipal		◆[9]		◆[2]		◆[2]		◆[2]			◆[2]	◆[2]		◆[2]				◆[9]		◆[10]	◆[9]
Grand Canyon Bar-Ten														◆[1]							
Grand Canyon Caverns														◆[1]							
Grand Canyon National Park	◆[3]	◆[3]	◆[7]	◆[2]		◆[2]		◆[3]			◆[2]		◆[2]	◆[2]	◆[7]	◆[7]			◆[3]	◆[7]	◆[2]
Grand Canyon West																					
Grande Valley																					
Greenlee County						◆[2]					◆[2]			◆[2]							
H.A. Clark Memorial Field						◆[1]					◆[3]			◆[1]							
Holbrook Municipal				◆[2]		◆[2]		◆[2]			◆[2]	◆[1]		◆[2]							
Kayenta (NA)				◆[9]		◆[5]					◆[1]		◆[5]	◆[1]							◆[9]
Kearny														◆[2]							
Kingman		◆[3]				◆[2]		◆[2]			◆[2]	◆[2]	◆[2]	◆[2]	◆[7]				◆[2]	◆[7]	◆[2]
Lake Havasu City Municipal		◆[9]		◆[3]		◆[1]			◆[3]		◆[3]	◆[3]		◆[1]	◆[7]				◆[7]	◆[7]	◆[7]
Laughlin/Bullhead International		◆[1]		◆[1]		◆[1]					◆[1]	◆[7]		◆[1]	◆[7]				◆[7]	◆[7]	◆[9]
Marana NW Regional				◆[5]		◆[5]		◆[6]	◆[6]		◆[1]	◆[5]	◆[5]	◆[1]			◆[3]				◆[3]

LEGEND:

ILS	Instrument Landing System
NPI	Non Precision Instrument
ALS	Approach Lighting System
REIL	Runway End Identifier Lights
HIRL	High Intensity Runway Lights
MIRL	Medium Intensity Runway Lights
LIRL	Low Intensity Runway Lights
MITL	Medium Intensity Taxiway Lights
PAPI	Precision Approach Path Indicator
VASI	Visual Approach Slope Indicators
DME	Distance Measuring Equipment
LOC	Localizer
NDB	Non Directional Beacon
RNAV	Area Navigation
VOR	Very High Freq. Omnirange
GPS	Global Positioning System
WRS	Weather Reporting System
NA	Native American

FOOTNOTES:

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9. FAA Datasheet
10. U.S. Terminal Procedures (SW-1, 2001)

TABLE 3-9: *Navigational, Lighting, Landing, and Weather Aids (continued)*

AIRPORT NAME	ILS	NPI	ALS	REIL	HIRL	MIRL	LIRL	MITL	REFLECTORS	APRON LTG.	BEACON	PAPI	VASI	WIND SOCK	DME	LOC	NDB	RNAV	VOR	GPS	WRS
Marble Canyon														◆[1]							
Memorial Airfield (NA)(Private Use Facility)														◆[1]							
Mogollon Airpark (Private Use Facility)											◆[1]			◆[1]							
Nogales International		◆[10]				◆[1]					◆[1]		◆[8]	◆[1]	◆[7]		◆[3]		◆[7]	◆[7]	◆[7]
Page Municipal		◆[3]		◆[2]		◆[2]		◆[3]			◆[2]		◆[2]	◆[2]					◆[2]	◆[7]	◆[2]
Payson				◆[1]		◆[1]					◆[1]	◆[3]		◆[1]				◆[9]		◆[9]	◆[5]
Pearce Ferry														◆[2]							
Phoenix Deer Valley		◆[1]		◆[1]		◆[1]					◆[1]	◆[1]		◆[1]			◆[7]			◆[2]	◆[8]
Phoenix Goodyear				◆[1]		◆[1]					◆[1]		◆[1]	◆[1]							◆[8]
Phoenix Sky Harbor Int'l	◆[7]	◆[1]	◆[7]	◆[7]	◆[1]			◆[2]		◆[2]	◆[2]	◆[1]	◆[7]	◆[2]	◆[7]	◆[7]		◆[10]	◆[7]	◆[2]	◆[2]
Pinal Airpark						◆[5]					◆[1]			◆[1]							
Pleasant Valley														◆[2]							
Polacca (NA)							◆[1]							◆[1]							
Quartzite No longer a viable candidate																					
Rolle Airfield														◆[2]							
Ryan Field	◆[2]	◆[1]		◆[2]		◆[2]					◆[2]		◆[2]	◆[2]	◆[2]	◆[2]	◆[2]			◆[2]	◆[2]
Safford Regional		◆[10]				◆[7]		◆[2]			◆[2]	◆[2]	◆[2]	◆[2]						◆[2]	◆[2]
St. Johns Industrial Airpark		◆[3]		◆[7]		◆[7]					◆[1]	◆[3]		◆[1]	◆[7]				◆[7]	◆[7]	◆[7]
San Carlos Apache		◆[9]				◆[1]					◆[1]		◆[1]	◆[1]				◆[9]		◆[7]	
San Manuel														◆[2]							
Scottsdale				◆[7]		◆[7]					◆[1]	◆[7]		◆[1]			◆[7]		◆[7]	◆[2]	◆[8]
Sedona				◆[7]		◆[7]					◆[1]		◆[7]	◆[1]						◆[7]	◆[7]
Seligman														◆[1]							
Sells (NA)														◆[1]							
Show Low Municipal				◆[7]		◆[7]					◆[1]	◆[7]		◆[1]			◆[7]			◆[7]	

LEGEND:

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TABLE 3-9: Navigational, Lighting, Landing, and Weather Aids (continued)

AIRPORT NAME	ILS	NPI	ALS	REIL	HIRL	MIRL	LIRL	MITL	REFLECTORS	APRON LTG.	BEACON	PAPI	VASI	WIND SOCK	DME	LOC	NDB	RNAV	VOR	GPS	WRS
Sierra Vista Muni/ Libby AAF	◆[7]	◆[3]			◆[1]	◆[1]	◆[1]	◆[3]			◆[1]	◆[1]	◆[1]	◆[1]	◆[9]	◆[7]	◆[7]		◆[7]	◆[7]	◆[7]
Stellar Airpark							◆[8]				◆[1]		◆[2]	◆[1]					◆[9]	◆[9]	
Sun Valley				◆[2]			◆[5]							◆[2]							
Superior Municipal														◆[1]							
Taylor				◆[7]		◆[7]					◆[1]	◆[7]		◆[1]					◆[10]	◆[7]	◆[7]
Temple Bar														◆[2]							
Tombstone Municipal														◆[2]							
Town of Springerville Municipal		◆[9]				◆[7]					◆[2]	◆[1]	◆[7]	◆[2]			◆[7]			◆[2]	
Tuba City (NA)						◆[5]					◆[1]	◆[5]		◆[1]							
Tucson International	◆[7]	◆[7]	◆[7]	◆[7]	◆[7]	◆[7]		◆[2]			◆[2]	◆[7]	◆[7]	◆[2]	◆[7]	◆[7]	◆[10]	◆[10]	◆[7]	◆[7]	◆[2]
Tuweep														◆[1]							
Valle Airport		◆[10]				◆[10]					◆[1]			◆[1]	◆[10]				◆[10]	◆[10]	
Whiteriver (NA)						◆[5]								◆[1]							
Wickenburg Municipal				◆[2]		◆[5]		◆[2]			◆[2]	◆[5]		◆[2]					◆[5]		
Williams Gateway	◆[7]	◆[1]	◆[1]	◆[3]		◆[1]					◆[1]	◆[1]		◆[1]	◆[1]	◆[7]		◆[9]	◆[7]	◆[2]	◆[1]
Window Rock (NA)		◆[10]		◆[2]		◆[7]					◆[2]	◆[2]		◆[2]	◆[7]			◆[7]	◆[7]	◆[7]	◆[2]
Winslow-Lindberg Regional		◆[9]		◆[7]		◆[7]					◆[3]		◆[7]	◆[1]					◆[7]	◆[3]	◆[7]
Yuma International/MCAS Yuma	◆[7]	◆[1]	◆[7]	◆[7]	◆[7]			◆[2]			◆[2]		◆[7]	◆[2]	◆[7]	◆[7]		◆[7]	◆[7]	◆[2]	◆[2]

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10. U.S. Terminal Procedures (SW-1, 2001)RNAV Area Navigation

Air Carrier Activity

Airports in Arizona are serviced by nine major, four national, six regional, and five international scheduled passenger airlines. These airlines are represented in Table 3-10 below. The facilities served by these airlines are designated adjacent to the carrier name. Major carriers are defined by the FAA as those having over one billion dollars in annual operating revenue; a national airline between $100 million and one billion dollars; and a regional as an airline with less than $100 million in revenue. Phoenix-Sky Harbor is considered a hub airport for two major airlines, America West and Southwest.

TABLE 3-10: ***Scheduled Airlines Serving Arizona***

Majors		Regionals	
1	American Airlines - PSH, T	1	Air Vegas - GC
2	America West Airlines - PSH, T, F, SV, LHC, LB	2	Casino Express - PSH
3	Continental Airlines - PSH, T	3	Mesa Airlines - PSH, T, K, P, Y
4	Delta Airlines - PSH, T	4	Scenic Airlines - PA, PSH, GC
5	Northwest Airlines - PSH, T	5	Sky West - T, Y
6	Trans World Airlines - PSH	6	Sunrise Airlines - SL, PSH
7	United Airlines - PSH, T		
8	US Airways - PSH		
9	Southwest Airlines - PSH, T		
Nationals		**International Carriers**	
1	Alaskan Airlines - PSH	1	Aero California - T
2	Reno Air - T, LB	2	Aerolitoral - T
3	Frontier Airlines - PSH	3	AeroMexico - PSH
4	American Trans Air - PSH	4	Air Canada - PSH
		5	British Airways - PSH
Cargo Carriers			
1	Federal Express - F, PSH, T		
2	United Parcel Service - F, PSH		
3	Airborne Express - F, T, PSH		
4	Burlington - PSH		
5			
6	Emery Air Freight - PSH, T		
7	U.S. Postal Service - F, PSH		

Airport Designations:
Flagstaff = F; Grand Canyon = G; Kingman = K; Lake Havasu = LHC; Laughlin-Bullhead = LB; Page = PA; Phoenix = PSH; Prescott = P; Show Low = SL; Sierra Vista = SV; Tucson = T; and Yuma = Y

Scheduled Airline Routes

Table 3-11 identifies all scheduled non-stop airline service to and from Arizona airports. These flights are organized into "city pairs." Each city pair represents a non-stop connection between those two. Other destinations are possible from Arizona airports, but only by connecting through another city outside the state. Exhibit 3-6 graphically summarizes these routes.

TABLE 3-11: ***Scheduled Airline Routes***

Origin	Destination	Destination
Bullhead City/Laughlin to:	Phoenix, Arizona	
Flagstaff to:	Phoenix, Arizona	
Grand Canyon to:	Phoenix, Arizona	
Havasupai to:	Grand Canyon, Arizona (Helicopter)	
Lake Havasu City to:	Phoenix, Arizona	
Nogales to:	Tucson, Arizona	
Sierra Vista to:	Phoenix, Arizona	
Page to:	Phoenix, Arizona	Las Vegas, Nevada
Phoenix to:	Acapulco, Mexico Albuquerque, New Mexico Aspen, Colorado Atlanta, Georgia Austin, Texas Bakersfield, California Baltimore, Maryland Boston, Massachusetts Bullhead City/Laughlin, Arizona Burbank, California Calgary, Alberta Carlsbad, California Charlotte, North Carolina Chicago, Illinois Cincinnati, Ohio Cleveland, Ohio Colorado Springs, Colorado Columbus, Ohio Dallas/Fort Worth, Texas Denver, Colorado Des Moines, Iowa Detroit, Michigan	Durango, Colorado El Paso, Texas Farmington, New Mexico Flagstaff, Arizona Fresno, California Ft. Huachuca / Sierra Vista, AZ Gallup, New Mexico Grand Junction, Colorado Guadalajara, Mexico

TABLE 3-11: ***Scheduled Airline Routes (continued)***

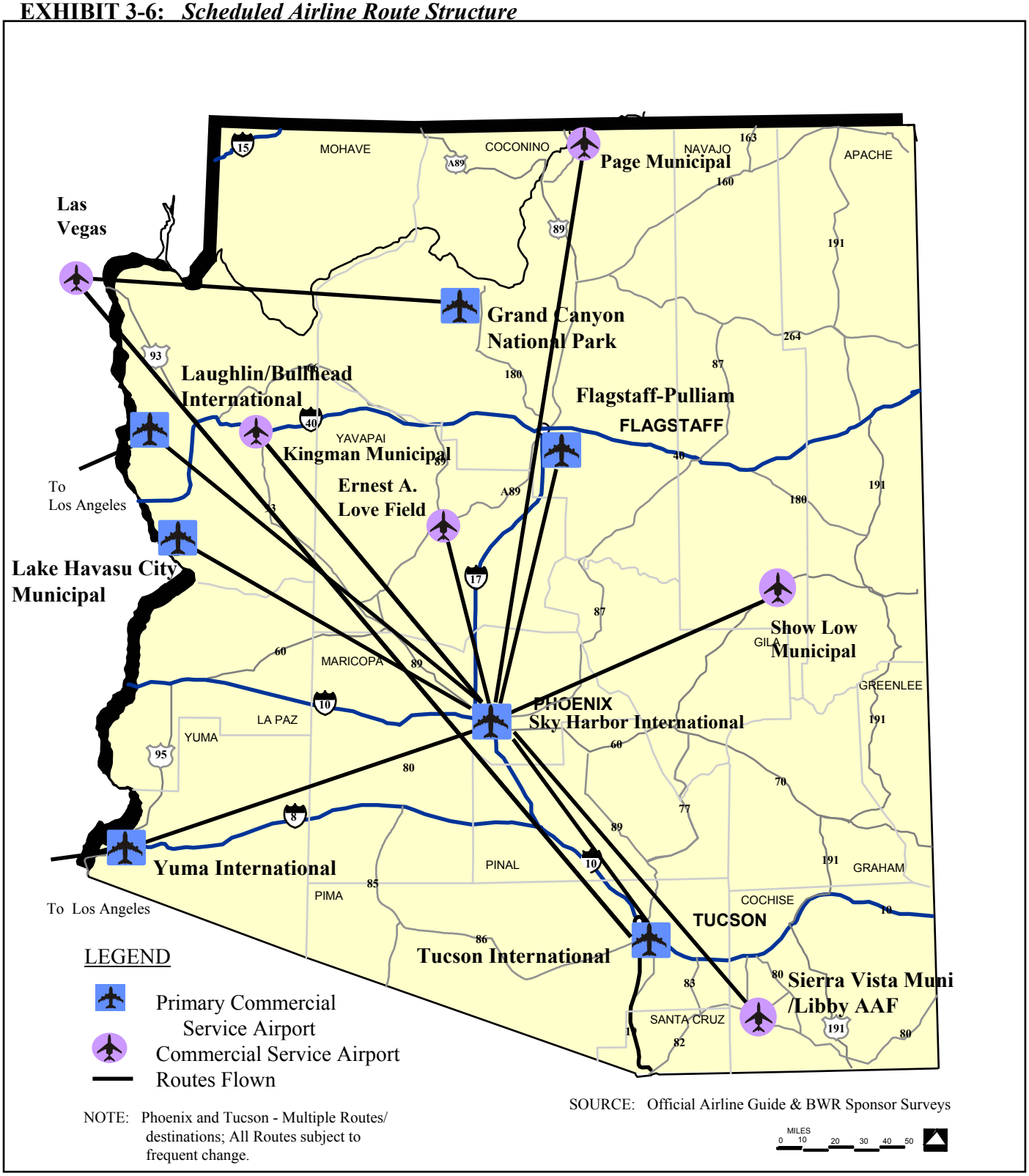
Origin	Destination	Destination
Phoenix to:	Guaymas, Mexico	Puerto Vallarta, Mexico
	Hermosillo, Mexico	Reno, Nevada
	Honolulu, Hawaii	Sacramento, California
	Houston, Texas	St. Louis, Missouri
	Indianapolis, Indiana	Salt Lake City, Utah
	Ixtapa/Zihuataneho, Mexico	San Antonio, Texas
	Kahului, Maui, Hawaii	San Diego, California
	Kansas City, Missouri	San Francisco, California
	Kingman, Arizona	San Jose, California
	Lake Havasu City, Arizona	San Luis Obispo, California
	Las Vegas, Nevada	Santa Barbara, California
	Little Rock, Arkansas	Seattle/Tacoma, Washington
	Long Beach, California	Show Low, Arizona
	Los Angeles, California	Tampa Bay, Florida
	Los Cabos, Mexico	Telluride, Colorado
	Louisville, Kentucky	Toronto, Ontario
	Mazatlan, Mexico	Tucson, Arizona
	Mexico City, Mexico	Tulsa, Oklahoma
	Miami, Florida	Vancouver, British Columbia
	Midland/Odessa, Texas	Washington, D.C.
	Milwaukee, Wisconsin	Wichita, Kansas
	Minneapolis/St. Paul, Minnesota	Yuma, Arizona
	Monterey, California	
	Montrose, Colorado	
	Nashville, Tennessee	
	New Orleans, Louisiana	
	JFK, NY/ Newark, New Jersey	
	Oakland, California	
	Oklahoma City, Oklahoma	
	Omaha, Nebraska	
	Ontario, California	
	Orange County, California	
	Orlando, Florida	
	Page, Arizona	
	Palm Springs, California	
	Philadelphia, PA	
	Pittsburgh, PA	
	Portland, Oregon	

TABLE 3-11: ***Scheduled Airline Routes (continued)***

Origin	Destination	Destination
Prescott to:	Phoenix, Arizona	
Show Low to:	Phoenix, Arizona	
Tucson to:	Albuquerque, New Mexico Chicago, Illinois Cincinnati, Ohio Dallas/Fort Worth, Texas Denver, Colorado Hermosillo, Mexico Houston, Texas Las Vegas, Arizona Los Angeles, California Minneapolis/St. Paul, Minnesota Phoenix, Arizona Salt Lake City, Utah San Diego, California	
Yuma to:	Los Angeles, California Phoenix, Arizona	

Sources: Official Airline Guide April 1999 and Airport Sponsor Questionnaires

EXHIBIT 3-6: ***Scheduled Airline Route Structure***



Passenger Enplanements

Passenger enplanements are defined as the number of revenue passengers boarding aircraft and includes originating, stop-over and transfer passengers. The total number of passenger enplanements for the state in 1998 was 18,439,667. This represents a 30% increase from the 12,870,100 enplanements from 1992 as listed in the SANS 1995. The largest percentage of these enplanements continues to occur at Phoenix-Sky Harbor. Their almost 16,000,000 enplanements account for 86% of the state's total in 1998.

Table 3-12 presents historical enplanements for the state by airport.

TABLE 3-12: ***Arizona's Historical Passenger Enplanements – Air Carrier Airports***

Year	State Total	Bullhead City/ Laughlin [1]	Flagstaff	Grand Canyon	Kingman	Lake Havasu City	Page
1988	11,325,082	29,969 [1]	47,000 [2]	179,000 [2]	1,000 [2]	13,000 [2]	4,000 [2]
1989	12,173,656	47,830 [1]	51,000 [2]	357,000 [2]	0 [2]	28,000 [2]	3,000 [2]
1990	12,802,169	45,923 [1]	47,400 [2]	381,100 [2]	2,600 [2]	22,900 [2]	4,400 [2]
1991	12,961,382	35,921 [1]	45,800 [2]	383,000 [2]	2,000 [2]	13,900 [2]	4,500 [2]
1992	12,864,915	38,068 [1]	46,600 [2]	452,900 [2]	2,900 [2]	11,200 [2]	4,700 [2]
1993	13,736,149	97,095 [1]	41,958 [3]	501,846 [3]	3,505 [3]	13,428[3]	15,133 [3]
1994	15,122,806	74,194 [1]	38,281 [3]	509,592 [3]	3,714 [3]	12,137 [3]	19,067 [3]
1995	16,258,616	118,484 [1]	37,769 [3]	507,648 [3]	3,459 [3]	11,358 [3]	19,897 [3]
1996	17,383,338	116,907 [1]	43,294 [3]	445,162 [3]	1,602 [3]	11,073 [3]	16,736[3]
1997	17,502,459	64,094 [1]	44,565 [3]	553,867 [3]	1,801 [3]	11,854 [3]	10,859[3]
1998	18,439,667	30,387 [1]	39,573	512,365	3,500	9,633	27,000

Year	Phoenix Sky Harbor	Prescott	Scottsdale	Show Low	Sierra Vista	Tucson	Yuma
1988	9,537,000	8,113 [4]	5,000 [2]	0 [2]	0 [2]	1,427,000 [2]	74,000 [2]
1989	10,269,000	8,826 [4]	11,000 [2]	0 [2]	0 [2]	1,338,000 [2]	60,000 [2]
1990	10,877,500	9,946 [4]	200 [2]	200 [2]	15,200 [2]	1,329,800 [2]	65,000 [2]
1991	11,111,400	5,714 [4]	100 [2]	0 [2]	8,500 [2]	1,218,400 [2]	60,900 [2]
1992	10,958,300	9,847 [4]	10,200 [2]	2,900 [2]	9,100 [2]	1,254,600 [2]	63,600 [2]
1993	11,657,100	12,891 [4]	7,856 [3]	2,831 [3]	12,983 [3]	1,305,100	64,423 [5]
1994	12,726,855 [3]	13,214 [4]	6,759 [3]	3,294 [3]	11,732 [3]	1,638,342	65,625 [5]
1995	13,738,433 [3]	10,256 [4]	6,368 [3]	3,151 [3]	10,286 [3]	1,720,537	70,970 [5]
1996	14,885,372 [3]	10,734 [3]	3,061 [3]	3,525 [3]	12,786 [3]	1,759,495 [3]	73,591 [5]
1997	14,940,339 [3]	8,634 [3]	254 [3]	1,300 [3]	11,938 [3]	1,775,566 [3]	76,788 [5]
1998	15,984,620	8,366	8,000	2,000	9,822	1,735,118	69,283

Sources: (1) Laughlin/Bullhead City Master Plan 1999
(2) 1995 State Aviation Needs Study
(3) FAA ACAIS Database
(4) Love Field Master Plan 1998
(5) Yuma Int'l Master Plan 1998

Air Cargo

Table 3-13 explores historical cargo volume transported through the aviation system. Most of the flow is directed through Phoenix-Sky Harbor and Tucson International. Other facilities provide cargo services on a limited basis.

Table 3-13: ***Historical Air Cargo Data – 1988-1998 in Total Tons***

Year	Phoenix Sky Harbor International	Tucson International	Yuma
1988	100,685	14,774	Not Available
1989	104,196	17,516	Not Available
1990	125,951	18,824	Not Available
1991	150,451	13,669	Not Available
1992	178,035	16,372	Not Available
1993	203,671	17,536	2,204
1994	257,418	16,398	1,179
1995	286,666	21,523	1,090
1996	312,751	20,369	788
1997	347,163	25,232	1,246
1998	366,463	26,478	1,608

Source: Years 1988-1998, Arizona Department of Transportation.
Yuma International – Personnel Interview (10-13-99)

General Aviation

The category of general aviation encompasses a wide array of civilian activity except that of air carriers certified in accordance with Federal Aviation Regulations (FAR). Many types of aircraft are used in general aviation. Corporate multi-engine jet aircraft, single piston airplanes, ultralights, balloons and gliders are a few of these types.

General aviation facilities comprise the majority of the airports in Arizona. Commercial services are offered at a limited number of sites, so general aviation facilities tend to fill the void. General aviation offers certain aviation services that commercial aviation providers cannot or will not provide. Flight schools, air taxi operators, and fixed base operators are all dependent on adequate general aviation services.

Indicators of a healthy general aviation system include the number of pilots and based aircraft, fleet mix, and annual operations. The following tables summarize these data for the past 10 years.

Pilots

Table 3-14 provides the historical numbers of Arizona registered airmen. The trend revealed in the SANS 1995, whereby the number of registered aircraft per pilot was decreasing, still continues. The rate has slowed somewhat in recent years and even seen an increase in 1996. The logic of this reduction being related to increased students at flight schools and fewer recreational pilots remains justified.

TABLE 3-14: ***Arizona's Historical Registered Airmen 1988-1998***

Year	Registered Airmen	Registered Aircraft	Registered Airmen Per Registered Aircraft
1988	15,072	6,194	2.43
1989	15,815	6,354	2.48
1990	16,219	6,307	2.57
1991	16,364	6,317	2.59
1992	15,883	6,301	2.52
1993	15,324	6,441	2.38
1994	15,493 (E)	7,059	2.19
1995	15,662	7,085	2.21
1996	15,298	7,485	2.04
1997	16,729	7,420	2.25
1998	16,828	7,794	2.16

Sources: *FAA U.S. Airmen Civil Statistics, 1997.*
ADOT Aeronautics Division Database
(E) - Estimated

Registered Aircraft

In addition to being the most populous, Maricopa and Pima Counties also are the primary base points for aircraft in Arizona. Table 3-15 provides the county-by-county breakdown of aircraft ownership in the state from 1988 to 1998.

As shown in the table, a major downturn in registered aircraft occurred in 1992 and continued in 1993. This trend seems to be reversing itself and the numbers have gradually increased over the past three years. The numbers achieved in the late 1980's have yet to be obtained, but this trend is seen as a positive step for the industry.

TABLE 3-15: ***Arizona Registered Aircraft by County 1988-1998***

Counties	Years										
	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
State	6,194	6,354	6,307	6,317	6,301	6,441	7,041	7,059	7,485	7,420	7,794
Apache	66	63	57	50	52	48	52	53	51	45	47
Cochise	199	194	181	174	175	182	194	196	210	202	220
Coconino	265	262	256	249	253	261	284	287	302	272	300
Gila	84	85	93	99	96	106	111	113	112	100	112
Graham	39	38	37	34	34	34	30	30	35	32	33
Greenlee	5	3	3	3	3	3	4	4	5	7	10
La Paz	63	71	78	79	78	73	76	75	80	74	78
Maricopa	3,366	3,361	3,422	3,407	3,372	3,435	3,733	3,736	3,997	4,071	4,216
Mohave	272	272	286	316	326	349	383	379	410	402	419
Navajo	81	85	88	106	106	100	118	120	127	124	153
Pima	919	919	918	909	932	972	1,079	1,083	1,122	1,110	1,131
Pinal	228	236	245	228	235	218	247	249	269	248	272
Santa Cruz	43	39	41	43	43	48	49	47	44	42	52
Yavapai	332	359	392	419	401	406	451	453	479	457	513
Yuma	228	224	209	200	194	205	230	233	242	234	238
Unspecified	4	143	1	1	1	1	0	1	0	0	0

Source: Census of U.S. Registered Aircraft, U.S. Dept. of Transportation
FAA Archive

Fleet Mix

Aircraft fleet mix trends for the period 1988 to 1998 are illustrated in Table 3-16. From reviewing the data, it appears the general fleet mix has remained relatively steady. Some fluctuation in the numbers of single-engine piston aircraft has occurred and there have been slight increases in multi-engine piston craft.

TABLE 3-16: ***Arizona Registered Aircraft Fleet Mix 1988-1998***

Year	Total FAA Registered Aircraft	Single-Engine Piston	Multi-Engine Piston	Turboprop	Turbojet	Rotorcraft	Others
1988	6,194	4,806	614	95	51	235	393
1989	6,354	4,931	629	108	52	245	389
1990	6,307	4,926	599	102	45	241	394
1991	6,317	4,914	623	95	51	254	380
1992	6,301	4,982	606	92	59	257	395
1993	6,441	5,006	603	99	63	281	389
1994	7,041	N/A	N/A	N/A	N/A	N/A	N/A
1995	7,059	N/A	N/A	N/A	N/A	N/A	N/A
1996	7,485	N/A	N/A	N/A	N/A	N/A	N/A
1997	7,420	N/A	N/A	N/A	N/A	N/A	N/A
1998	7,794	N/A	N/A	N/A	N/A	N/A	N/A

Source: Census of U.S. Registered Aircraft, U.S. Dept. of Transportation

Operations

The taking off or landing of an aircraft is termed an "operation." As expected, the largest number of operations occurs in Maicopa County. It has the largest population and the greatest number of based aircraft. The top ten airports in Arizona based on annual operations are listed in Table 3-17.

TABLE 3-17: ***Arizona's 10 Most Active Airports – Total Operations (1998)***

Airport	County	Annual Operations
Phoenix Sky Harbor Int'l	Maricopa	537,822
Love Field, Prescott	Yavapai	353,299
Phoenix Deer Valley	Maricopa	281,124
Tucson International	Pima	266,428
Williams Gateway	Maricopa	228,313
Falcon Field	Maricopa	220,969
Scottsdale	Maricopa	182,153
Grand Canyon National Park	Coconino	164,179
Ryan Field	Pima	157,659
Phoenix Goodyear	Maricopa	157,250

Source: SANS 2000 Airport Sponsor Surveys and FAA 5010 Forms

Rural Health Care Delivery/Air Ambulance Service

Given Arizona's vast land area and the remoteness of certain locations in the state, aviation plays an important role in the provision of ample medical services. Whether it is the delivery of health care to rural, under-served areas, patient transport between medical facilities; or the emergency transport of accident and critical patients, sufficient aviation capabilities can be the difference between life or death. Arizona's air ambulance needs are provided by both rotorcraft and fixed-wing aircraft.

Numerous healthcare facilities in the state maintain private heliports. Several airports also fulfill the need for medical services by providing landing areas for air ambulances. Those facilities offering such services are listed in Table 3-18.

TABLE 3-18: ***Air Ambulance Service***

Facility	Frequency	Provider
Bagdad Airport	Occasionally	N/A
Buckeye Municipal	Occasionally	Good Samaritan Med Evac
Cochise County	1080 times per year	Critical Air Medicine; Air Cart
Colorado City	6 times per year	Air Ambulance; Guardian Air
Douglas Municipal	50 times per year	Air Care
Flagstaff-Pulliam	1000 times per year	*C-421, PC-12, King Air*
Glendale Municipal	N/A	Air Evac, Life Net
Greenlee	N/A	Ai Ambulance
Kearney	N/A	Life Net
Phoenix Sky Harbor Int'l	N/A	Air Evac
Page Municipal	200 times per year	N/A
Pleasant Valley Airstrip	N/A	N/A
Safford Regional	600 times per year	King Air
Sedona	N/A	Air Evac
Scottsdale	N/A	Air Evac
Show Low Municipal	210 times per year	Life Rescue, King Air, Medical Express
Sierra Vista Municipal	100 times per year	Tucson Medical Group
Seligman	N/A	N/A
Temple Bar	N/A	N/A
Wickenburg Municipal	Occasionally	Med-Evac
Williams Gateway	N/A	Native American Air Ambulance
Window Rock Airport	N/A	All providers in AZ & NM
Yuma International/MCAS Yuma	1000 times per year	Advanced Life Support Transport

Source: SANS 2000 Airport Sponsor Surveys

LEGEND:
N/A = Not Appplicable

Military Activity

There are four active military air bases in Arizona and two joint civilian/military use facilities. These facilities are listed in Table 3-19. In addition to these sites, the Arizona Air National Guard utilizes Libby AAF/Sierra Vista, Phoenix-Sky Harbor, and Tucson International.

TABLE 3-19: ***Arizona Military Facilities***

Facility	Location
Davis / Monthan Air Force Base (AFB)	Tucson
Laguna Army Air Field (AAF)	Yuma
Libby Army Air Field (AAF) / Sierra Vista Municipal	Fort Huachuca / Sierra Vista
Luke Air Force Base (AFB)	Glendale
Papago Army Air Field (AAF)	Phoenix
Yuma Marine Corps Air Station (MCAS) / Yuma International	Yuma

Airspace and NAVAIDs

The airspace structure in the United States is either uncontrolled (Class G Airspace) or controlled (Class A, B, C, D, or E Airspace). Uncontrolled airspace is defined as all airspace that has not been designated as controlled, and within which Air Traffic Control (ATC) has neither the authority nor responsibility for control. Controlled airspace, however, is supported by ground/air communications, navigational aids, and air traffic services. Controlled airspace consists of those areas designated as *Positive Control Area (Class A), Terminal Control Areas (Class B), Airport Radar Service Areas (Class C), Airport Traffic Areas and Control Zones (Class D), and General Controlled Airspace and Transition Areas (Class E),* within which some or all aircraft may be subject to ATC. Virtually all air space above 18,000 feet mean sea level is considered Class A controlled. Airspace under that altitude can be either controlled or uncontrolled, depending on the air traffic density, proximity to an airport, and geographic factors.

Class D airspace has a radius of 4.3 nautical miles and a ceiling of 2,500 feet, and requires all aircraft to be subject to ATC clearances and instructions.

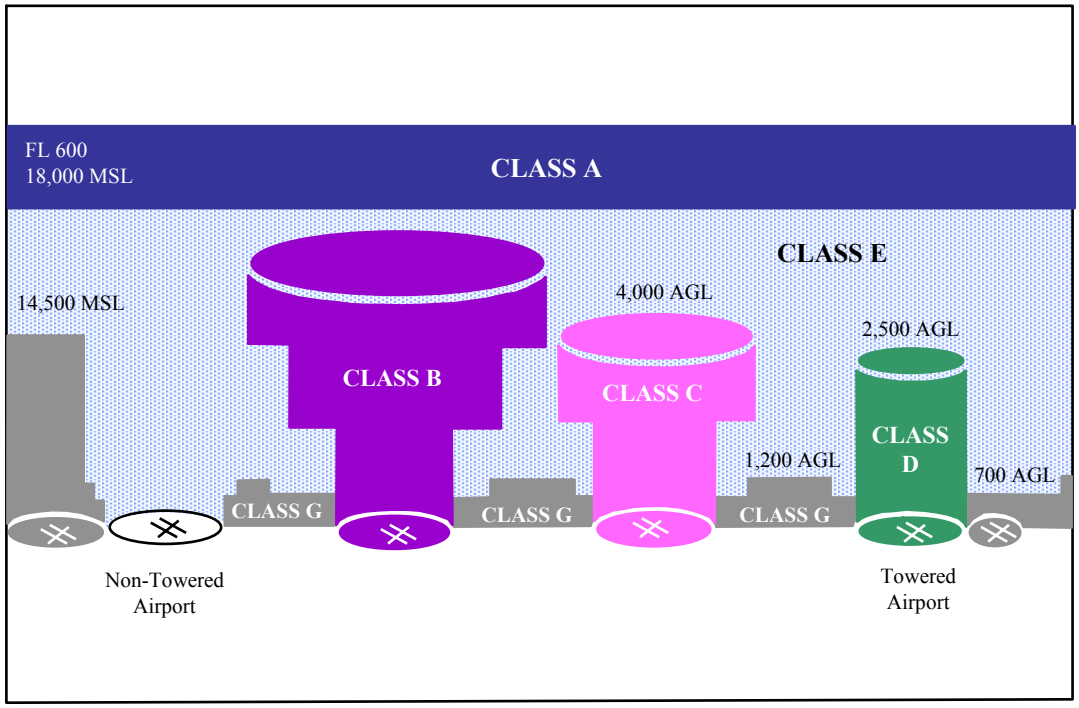
In Class E airspace, operations may be conducted under Instrument Flight Rules (IFR), Visual Flight Rules (VFR), or special VFR (SVFR). Air Traffic Control (ATC) separation is provided only to aircraft operating under IFR and SVFR within surface areas.

Another category of controlled airspace is designated ***Special Use***. Special use airspace consists of that airspace where limitations are imposed on aircraft operations usually because of military activity. Special use airspace is classified as Restricted Areas, Military Operation Areas, and Prohibited Areas. Restricted Areas are military related or have tethered radar balloons and related equipment. When active, Restricted Areas are closed to over-flight up to specified flight levels. Military operating areas (MOA) are also associated with military training, but can allow through-flight when in use. Extreme caution is advised when traversing an active MOA.

SFAR No. 50-2 *Special Flight Rules In The Vicinity Of The Grand Canyon National Park, AZ*. This rule pertains to the Grand Canyon National Park, which prohibits all persons operating aircraft inside the boundary of the restricted airspace, and extends upward from the surface to 14,500 feet MSL.

Exhibit 3-7 presents an illustration of Controlled Airspace, while Exhibit 3-8 shows the state's airways and special use airspace.

EXHIBIT 3-7: *Controlled Airspace - U.S. Airspace Classes*



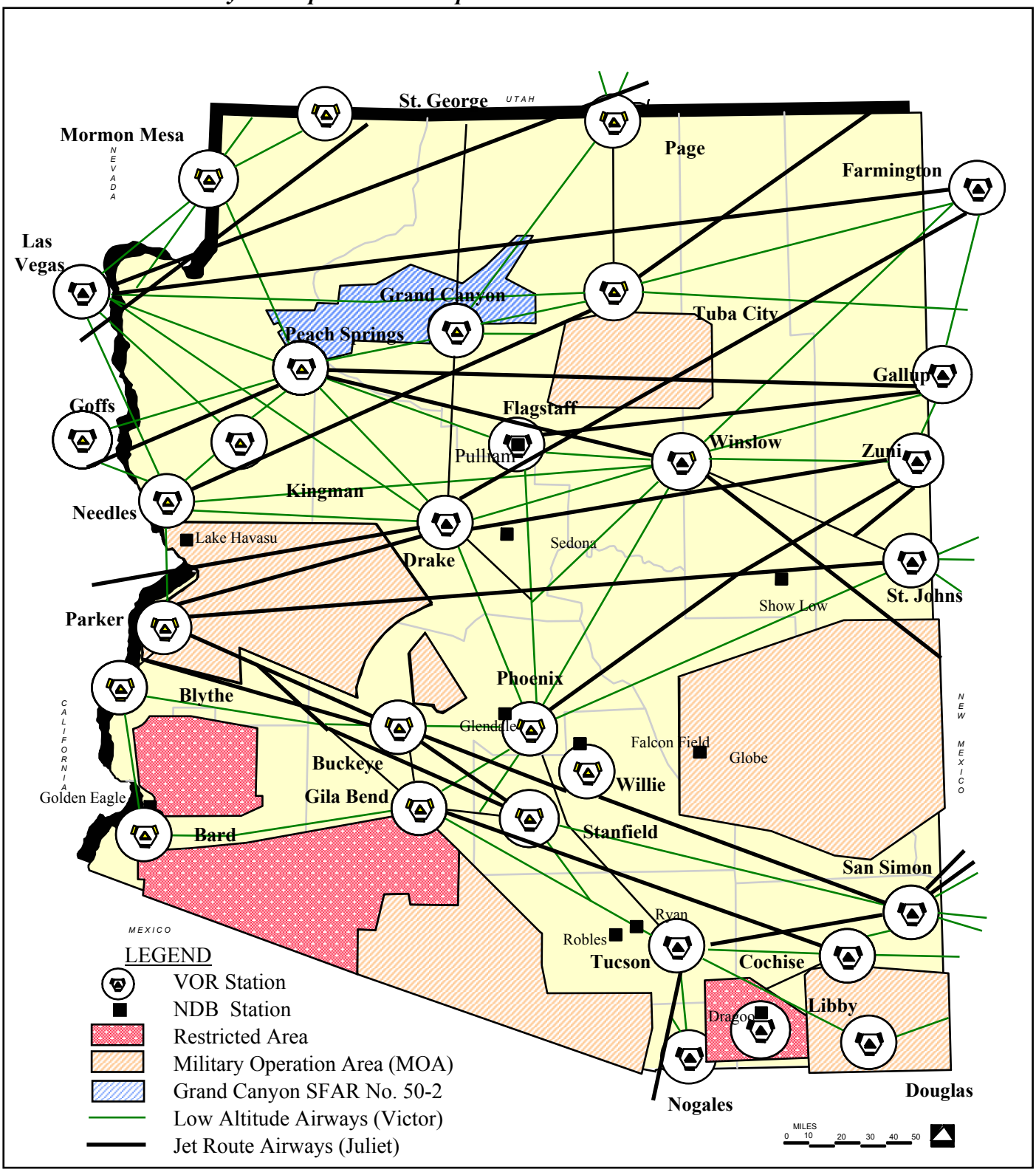
Airspace Classes	Former Airspace Equivalents	Changes
A	Positive Control Area (PCA)	None
B	Terminal Control Area (TCA)	VFR: Clear of Clouds
C	Airport Radar Service Area (ARSA)	None
D	Airport Traffic Area (ATA) and Control Zone (CZ)	Upper Limits 2,500' AGL
E	General Controlled Airspace	None
G	Uncontrolled Airspace	None

LEGEND

AGL Above Ground Level
FL Flight Level
MSL Mean Sea Level

SOURCE: *Federal Aviation Administration*

EXHIBIT 3-8: ***Airways and Special Use Airspace***



SOURCE: *Aeronautical Charts; U.S. Department of Commerce*

Protected Airspace Areas

Separations between aircraft under both VFR and IFR conditions and obstructions are normally provided for around each airport. The areas of protected airspace and the obstruction clearance requirements vary according to the type of approach or missed approach, the category of aircraft involved, the location and type of navigational aids, and other factors. In addition, airspace for airwaves, holding patterns, and transition and departure routes must be protected.

The FAA provides recommended planning guidelines for establishing areas of protected airspace for airport traffic patterns. Where these areas overlap, procedures and restrictions for sharing the overlapping airspace between the airports and resolving potential airspace interactions may need to be developed. For airports with control towers, the necessary procedures are specified in letters of agreement between the facilities. For airports without towers, traffic pattern altitudes and directions and various arrival and departure procedures (including noise abatement procedures) may be specified in various FAA and airport management directives and publications.

Typical IFR traffic patterns require a rectangle of protected airspace that may be as much as 8 miles by 20 miles for aircraft Categories A and B, and 10 miles by 30 miles for aircraft Categories C and D. Traffic pattern dimensions are not specified for approach Category E aircraft.

The recommended protected airspace areas for VFR traffic patterns are much smaller, but also vary according to the type of aircraft. For example, Category B aircraft require a rectangle of protected airspace 1.75 nautical miles (nm) by 4 nm, whereas Category D aircraft require a rectangle of protected airspace 4.5 nm by 8 nm.

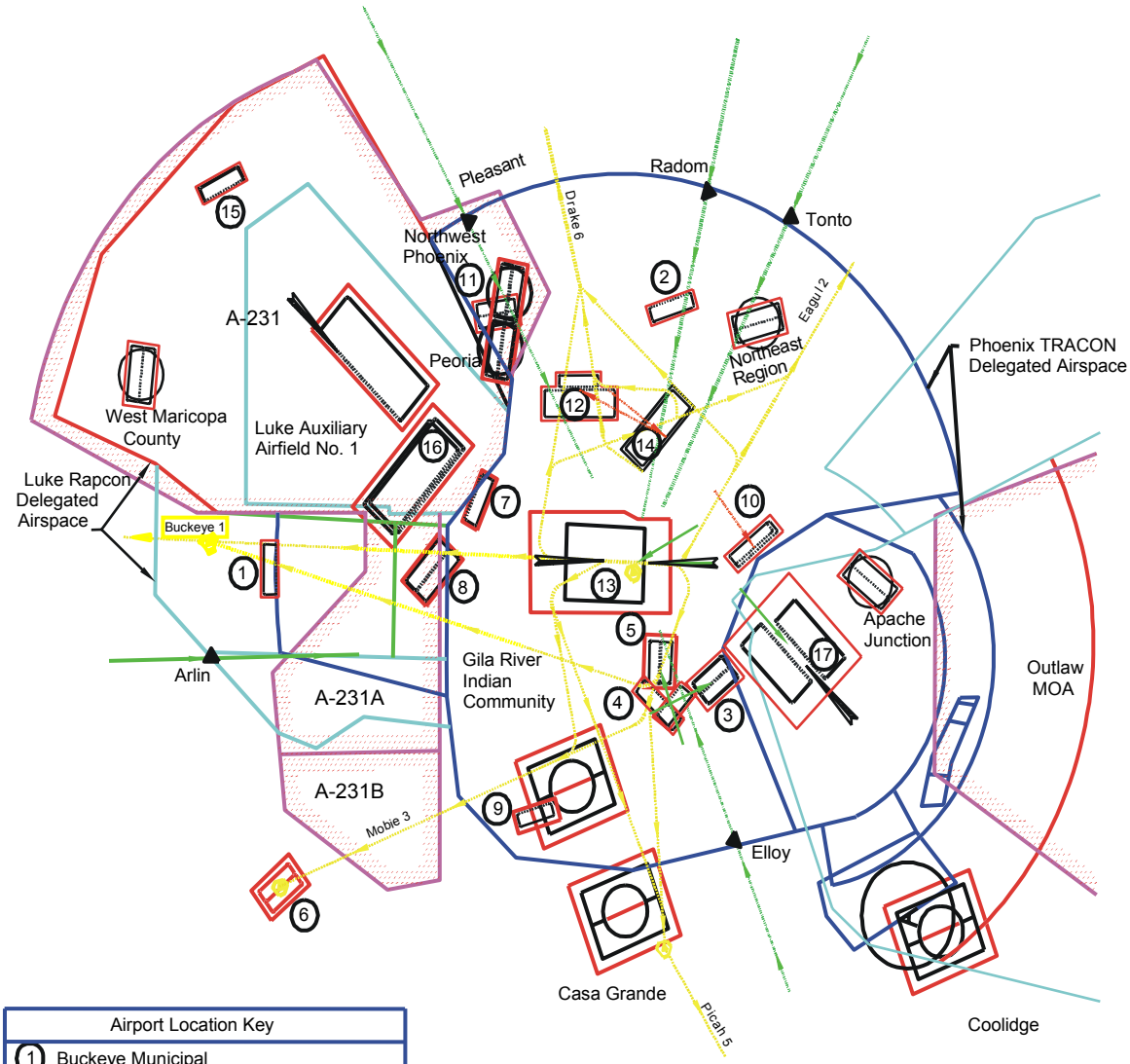
<u>Phoenix Airspace</u>
By far the most complex airspace environment in the state is that within the Phoenix area. The airspace over Phoenix accommodates a wide range of aircraft types and aviation activities, both civilian and military.

Within the Phoenix area, there are three major jurisdictional categories of airspace for ATC purposes, each with its own designated volume of airspace. These categories of airspace and the facilities that control them are as follows:

- Air Route Traffic Control Center (ARTCC) Airspace (Albuquerque Center)
- Terminal Radar Approach Control (TRACON) Airspace (Phoenix TRACON)
- Airport Traffic Control Tower Airspace (Phoenix-Deer Valley Airport, Mesa-Falcon Field, Phoenix-Goodyear Municipal Airport, Luke Air Force Base, Phoenix Sky Harbor International Airport, and Scottsdale Municipal Airport.

ATC facilities control aircraft within their delegated airspace, in accordance with rules prescribed in various Federal Aviation Regulations (FAR), FAA Handbook 7110.65C, and other directives, letters of agreement, notices, and order. Exhibit 3-9 graphically details the Phoenix airspace.

EXHIBIT 3-9: *Phoenix Airspace*



Airport Location Key	
1	Buckeye Municipal
2	Sky Ranch at Carefree
3	Chandler Municipal
4	Memorial
5	Stellar Airpark
6	Gila Bend Municipal
7	Glendale Municipal
8	Phoenix Goodyear
9	Estrella Sailport
10	Mesa-Falcon Field
11	Pleasant Valley
12	Phoenix Deer Valley
13	Phoenix Sky Harbor International
14	Scottsdale Municipal
15	Wickenburg Municipal
16	Luke Air Force Base
17	Williams Gateway

Legend			
	Phoenix Radar Airspace		Standard Terminal Arrival Route (STAR)
	Luke Radar Airspace		
	Alert Area\Military Operating Area (MOA)		Standard Instrument Departure (SID)
	Existing Airport Traffic Pattern Airspace		ILS Instrument Approach
			BC Instrument Approach
	Potential New Airport Traffic Pattern Airspace		VOR\TACAN Instrument Approach
			NDB Instrument Approach

SOURCE: *Federal Aviation Administration*

Enroute Airways System and NAVAIDs

Flights within the United States are normally channeled along navigational routes that are as well defined as the surface road system. These airspace structures are a key element in state traffic flows in that the preponderance of operations is related to the transitioning of aircraft between these airways and the study area airports. Three route systems are now in use:

- VOR Airway System,
- Jet Route System,
- Area Navigation (RNAV) System, and
- Global Positioning System.

VOR Airway System

VOR (very high frequency omni-directional range) airways, also known as Victor airways, are a low-altitude system consisting of airways from 1,200 feet above the surface up to, but not including, 18,000 feet above mean sea level (MSL). The VOR system uses an alphanumeric code, with V followed by a number, for example, V21. These airways use only VOR/VORTAC navigational aids. Victor airways are a minimum of eight nautical miles wide. When the distance between VOR stations is greater than 120 miles, the airway width increases to the envelope encompassed by planes at an angle of 4-1/2 degrees about the centerline joining the two ground stations.

The Jet Route System

Airways from 18,000 feet above mean sea level (MSL) to 45,000 feet, or flight level (FL) 450, designed for aircraft that customarily operate at these altitudes compose the jet route system. These routes also operate using VOR ground navigation stations, but the system requires significantly fewer stations, since line-of-sight operation gives the VORs substantially greater range when serving aircraft at high altitudes. The width of the airways of the jet route system is similar to that of the Victor airways. Navigation through the jet route system requires the use of Enroute High Altitude Charts.

Area Navigation (RNAV) System

RNAV is a method of navigation that permits aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability, between waypoints defined in terms of latitude/longitude coordinates, degree/ distance fixes, or offsets from published or established routes/airways at specified distances and directions. Major types of equipment include VORTEC, OMEGA/VCF, INS, MLS/RNAV, and LORAN-C.

Global Positioning System

The global positioning system (GPS) uses a constellation of many satellites orbiting the earth to instantly and accurately determine the position of users on or above the surface. By using satellite-transmitted radio signals and triangulation algorithms in the receiver, the exact position of the user can be determined to 100 meters or less, depending upon the type of receiver used. With this newly available technology, GPS will soon replace ground based navigation systems in a transition that is already starting. When GPS has achieved full operational capacity, it will provide non-precision approach capability to most airports with existing instrument approaches.

3.6 FINANCIAL DATA

Airports in Arizona are funded at the federal, state, and local levels. Generally, federal funds are allocated on the condition that the state and the local community provide a certain percentage of the total anticipated project budget. For example, federal funds may pay for 90 percent of a project, while state and local funds split the remaining 10 percent. Where no federal funds are involved, the state may finance the 90 percent and the local share will be 10 percent.

Arizona's Capitol Improvement Program

Arizona's Five-Year Airport Development Program, produced by the Aeronautics Division, shows proposed projects in each county and the amount of funding at the local, state, and federal levels. Based on the current federal AIR-21 program and anticipated State funding for the five fiscal year period between 2000-2005, nearly $389 million has been programmed for Arizona's airports. Of the total, $324.3 million would come from federal government funds, and over $64.7 million will need to come from Arizona State's funds. Table 3-20 shows the programmed dollars for the 1999-2000 fiscal year by airport.

Table 3-20: ***State Capital Improvement Program 1999-2000***

Commercial Service / Reliever Airports Projects Funding					
Airport	**County**	**State Amount**	**Local Amount**	**Federal Amount**	**Total Amount**
Chandler Municipal	Maricopa	$336,436	$94,836	$1,316,728	$1,748,000
Flagstaff-Pulliam	Coconino	$556,808	$201,252	$3,194,385	$3,952,445
Glendale Municipal	Maricopa	$722,968	$179,857	$2,280,932	$3,183,756
Grand Canyon	Coconino	$1,097,959	$201,959	$1,832,583	$3,132,500
Kingman	Mohave	$23,468	$23,468	$478,065	$525,000
Lake Havasu City Muni.	Mohave	$93,078	$93,078	$1,896,124	$2,082,280
Laughlin/Bullhead Int'l	Mohave	$916,362	$132,362	$700,000	$1,748,724
Falcon Field	Maricopa	$1,007,999	$112,000	$0	$1,119,999
Page Municipal	Coconino	$69,244	$69,244	$1,410,600	$1,549,089
Phoenix Deer Valley	Maricopa	$1,070,580	$174,580	$1,274,840	$2,520,000
Phoenix Goodyear	Maricopa	$270,000	$30,000	$0	$300,000
Phoenix Sky Harbor	Maricopa	$2,002,000	$1,118,000	$6,000,000	$9,120,000
Prescott-Love Field	Yavapai	$1,078,179	$182,179	$1,429,642	$2,690,000
Scottsdale	Maricopa	$1,071,815	$175,815	$1,300,000	$2,547,630
Sedona	Yavapai	$51,629	$51,629	$1,051,743	$1,155,000
Show Low Municipal	Navajo	$729,000	$81,000	$0	$810,000
Sierra Vista Municipal / Libby A.A.F.	Cochise	$146,017	$50,017	$774,465	$970,500
Ryan Field	Pima	$1,008,000	$112,000	$0	$1,120,000
Tucson-International	Pima	$1,170,876	$274,876	$3,318,000	$4,763,751
Yuma International	Yuma	$1,032,544	$136,544	$500,000	$1,669,089
SUBTOTAL		**$14,454,962**	**$3,494,696**	**$28,758,107**	**$46,707,763**

Source: ADOT Aeronautics Division, Five Year Airport Development Program 2000-2004

TABLE 3-20: ***State Capital Improvement Program 1999-2000 (continued)***

Public Airports Projects Funding					
Airport	**County**	**State Amount**	**Local Amount**	**Federal Amount**	**Total Amount**
Benson Municipal	Cochise	$1,565	$1,565	$31,871	$35,000
Bisbee-Douglas Int'l	Cochise	$81,047	$81,047	$1,651,043	$1,813,137
Casa Grande Municipal	Pinal	$216,450	$24,050	$0	$240,500
Cochise College	Cochise	$45,000	$5,000	$0	$50,000
Cochise County	Cochise	$459,000	$51,000	$0	$510,000
Coolidge Municipal	Pinal	$9,611	$9,611	$195,799	$215,000
Cottonwood Municipal	Yavapai	$61,830	$6,870	$0	$68,700
Duncan Municipal	Greenlee	$422,750	$22,250	$0	$445,000
Eloy Municipal	Pinal	$5,717	$5,717	$116,466	$127,900
Greenlee County	Greenlee	$13,990	$13,990	$285,000	$312,980
Marana NW Regional	Pima	$1,008,000	$112,000	$0	$1,120,000
Nogales International	Santa Cruz	$172,526	$83,637	$1,477,449	$1,733,611
Payson	Gila	$26,820	$26,820	$546,360	$600,000
Safford Regional	Graham	$30,173	$30,173	$614,655	$675,000
Seligman	Yavapai	$1,008,000	$53,053	$0	$1,061,053
Town of Springerville Municipal	Apache	$99,000	$11,000	$0	$110,000
St. Johns Industrial Airpark	Apache	$27,938	$27,938	$569,125	$625,000
Taylor	Navajo	$30,396	$30,396	$619,208	$680,000
Wickenburg Municipal	Maricopa	$130,775	$130,775	$2,664,068	$2,925,618
Williams- H.A. Clark	Coconino	$760,000	$84,444	$0	$844,444
Williams-Gateway	Maricopa	$1,650,339	$754,339	$13,085,322	$15,490,000
Winslow-Lindberg Reg'l	Navajo	$20,660	$20,660	$420,879	$462,200
Subtotal		**$6,281,587**	**$1,586,335**	**$22,2277,245**	**$30,145,143**
Total FY 1999-2000		**$20,736,549**	**$5,081,031**	**$51,035,352**	**$76,852,932**

Source: ADOT Aeronautics Division, Five Year Airport Development Program 2000-2004

Federal Funds

The largest single source of airport development funds is the federal government. Through the FAA's Airport Improvement Program (AIP), airport development items such as land, runways, taxiways, and apron areas are eligible for 90 percent Federal participation at public use airports. The percentage of project costs for terminal development is 85 percent at commercial service airports. The balance of project costs are funded by local sources. In the 1997-98 fiscal year, Arizona was allocated $47.8 million in AIP funds.

The source for AIP funds is the Aviation Trust Fund which is accumulated from all federal aviation taxes. These taxes include those on airline tickets, aviation fuel, lubricants, tires and tubes, aircraft registrations, and other aviation-related fees. The funds are then distributed under appropriations from Congress to airports included in the National Plan of Integrated Airport Systems. As reported in Element One, 58 airports in Arizona are included in the NPIAS. The act that authorizes the use of monies from the Trust Fund defines four categories of airports eligible for grant monies: (1) Primary Airports, (2) Commercial Service Airports, (3) Reliever

Airports, and (4) Other Airports. Arizona has ten primary airports, five non-primary commercial service airports, eight reliever airports, and 35 airports fall that into the Other Airports category.

Historical AIP funding at the national level is presented in Table 3-21.

TABLE 3-21 ~ *Airport Improvement Program: Grant Funding Authorizations 1988-1998*

Fiscal Year	Authorizations (millions)	Grant Total (millions)	Numbers of New Projects
1988	$1,700.0	$1,278.3	1,251
1989	$1,700.0	$1,279.3	1,258
1990	$1,700.0	$1,284.5	1,152
1991	$1,800.0	$1,670.3	1,404
1992	$1,900.0	$1,765.0	1,507
1993	$2,025.0	$1,829.8	1,434
1994	$2,970.3	$1,702.2	1,318
1995	$2,161.0	$1,418.2	1,047
1996	$2,214.0	$1,450.0	941
1997	$2,280.0	$1,460.0	1,066
1998	$2,347.0	$1,503.5	1,040

Source: Grant Funding Authorizations, Obligations Limitations, and Obligations

State Funds

State monies for airport projects are also user-generated. Flight property tax now accounts for over 50% of the total state revenue. About 15 percent of the total revenue comes from aircraft lieu and taxes aircraft registration fees. The remainder of the revenue comes from an aircraft fuel tax, investment interest, and revenue of the state-owned Grand Canyon Airport. Table 3-22 shows the revenues for the state aviation fund for the past five years.

TABLE 3-22 ~ *State Aviation Fund Revenues*

REVENUE	*1993-1994*	*1994-1995*	*1995-1996*	*1996-1997*	*1997-1998*
Flight Property Tax	$12,278,607	$13,783,627	$18,564,298	$17,679,764	$7,582,939
Aviation Fuel Tax	$690,752	$254,630	$512,328	$514,687	$485,333
Aircraft Lieu Tax	$1,473,081	$1,517,470	$1,793,314	$1,852,090	$2,066,492
Aircraft Registration Fee	$26,420	$24,665	$25,395	$28,215	$30,360
Airport Loans - Interest	$0	$0	$107,263	$133,835	332768
Airport Loans - Principal	$0	$0	$343,802	$320,865	404170
Misc. & Investment	$1,080,365	$1,410,326	$1,895,329	$2,613,848	$2,507,355
Total Revenue	***$15,549,225***	***$16,990,718***	***$23,241,729***	***$23,143,304***	***$13,409,417***
Percent of Increase/Decrease	7.34%	9.27%	36.79%	-0.42%	-42.06%
Grand Canyon Airport [1]	$1,211,227	$1,364,000	$1,401,357	$1,490,138	$1,340,539
EXPENDITURES	*1993-1994*	*1994-1995*	*1995-1996*	*1996-1997*	*1997-1998*
Total Administrative	$714,508	$803,580	$727,342	$746,980	$931,026
Percent of Increase/Decrease	-1.51%	12.47%	-9.49%	2.70%	24.64%
Airport Loan Program					
Revenue Generating	$0	$0	$3,250,000	$972,000	$0
Grand Advance	$0	$0	$1,700,000	$7,333,000	$1,750,000
Total Airport Loans	$0	$0	$4,950,000	$8,305,000	$1,750,000
AIRPORT DEVELOPMENT EXPENDITURES (State $)	$12,200,261	$7,364,014	$8,567,890	$10,934,008	$16,079,749
Total Expenditures	***$12,914,769***	***$8,167,594***	***$14,245,232***	***$19,985,988***	***$18,760,775***
Net Income / (Loss)	**$2,634,456**	**$8,823,124**	**$8,996,497**	**$3,157,316**	**($5,351,358)**
Grand Canyon Airport [1]	$7,465,590	$1,880,233	$1,382,363	$1,458,984	$4,105,229

Source: Arizona Department of Transportation, Aeronautics Division Progress Report; Unaudited Financial Records.
[1] Note: Grand Canyon National Park Airport revenues and expenditures are reported but are not included in the overall Aeronautics Division income/loss data.

Summary

The information included in Element Three is provided to update the database developed for the SANS 1995. It has been collected to provide current data that can be used in the formation of the existing condition assessment of the system, the projected forecasts, and ultimately the necessary projects. Much of the data provided in Element Three relies on the information of others. Its accuracy is dependent on the accuracy of the research data provided.

ELEMENT FOUR: STATUS AND CONDITION

Status and condition are closely related, and are two basic elements utilized in assessing the future needs of the State's aviation system. As defined in Element Two, the STATUS of the aviation system is a description of the individual facilities in the system in terms of specific administrative, economic, geometric, physical, and operational characteristics. The status of a facility describes or defines the role that each airport/heliport and aviation system component should perform in the total State aviation system. The CONDITION of the system, or of an individual facility, is its level of fitness in relationship to its status.

To present the findings regarding the status and condition of the existing system of aviation facilities, this chapter is organized in the following manner:

- Status of the Existing System;
- Aviation Development and Planning Guidelines; and,
- Condition of the Existing System.

4.1 STATUS OF THE EXISTING SYSTEM

As described in Element Three, the status of aviation facilities in Arizona can be defined through four facility classifications:

1. A classification system based on the National Plan Integrated Airport Systems (NPIAS);

2. A coding system developed by the FAA used to relate airport design criteria to the operational and physical characteristics of the airplanes intended to operate at an airport referred to as the Airport Reference Code (ARC);

3. A state classification system that segregates the State's system of airports into two subsystems- -Primary and Secondary - -based primarily on level of service an airport or heliport currently provides, or is intended to provide, to a community or region; and

4. A design classification system developed by the Arizona Department of Transportation (ADOT), based on a state classification and existing and former FAA airport classification categories. While these classifications are no longer used by the FAA, they continue to be used in Arizona to assist in setting minimum development standards and planning guidelines for airport facility development in the state.

Each of these classification systems are inter-related and, when applied to an individual facility, define the administrative, economic, geometric, physical, and operational characteristics of that facility. Since various airports have differing roles within the system, defining these parameters allows for determining each facility's condition relative to its role in serving the community.

The following examples use two airports, with differing roles, to illustrate the use of the various classification systems in determining a facility's status. The first is Phoenix Sky Harbor International Airport, considered a national passenger hub airport, and the second is Kearny Airport, a small, public use landing strip.

- Phoenix Sky Harbor International Airport is classified as a Primary Commercial Service Long Haul Airport (NPIAS classification) with an Airport Reference Code (ARC) of D-V, and is recognized by the state as a Primary System Airport. These designators indicate that Phoenix Sky Harbor International Airport is considered an airport of national and state significance, that the airport has regularly scheduled commercial service enplaning over 10,000 passengers per year, with direct flights over 1,500 miles. The characteristics of the "critical" or largest groups of aircraft that use the airport have approach speeds of between 141 and 166 knots, and wingspans up to 214 feet. Its NPIAS classification indicates that the airport is also eligible to receive FAA entitlement funds, as well as federal and state airport development discretionary funds.

- Kearny Airport is classified as a state Secondary System general aviation Basic Utility airport with an Airport Reference Code of B-I. This designation indicates that the Kearny Airport is not recognized as an airport of national significance in the NPIAS and, therefore, not eligible for federal airport development funds. Its classification also indicates that the airport serves small, single engine and twin engine piston airplanes; that it has fewer than 10 based aircraft and fewer than 2,000 annual aircraft operations; and that the airport is designed to accommodate aircraft with speeds less than 121 knots with wingspans less than 49 feet.

By identifying the status of each airport in this way, the appropriate design criteria can then be applied to determine the condition of each facility relative to its role in serving the community and the state.

Current Status of Existing Facilities

Table 4-1 presents a listing of facilities included in the SANS and their status based on existing conditions. The status of each facility was based on information reported in the SANS data base, inventory review, a review of airport master plans and regional system plans, information received in airport sponsor questionnaires, and consultation with ADOT staff.

TABLE 4-1: *2000 Status Of Existing Facilities*

Facility Name	Facility Classification						
	AZ State System	NPIAS	ARC A-1	ARC B-I	ARC B-II	ARC B/C-III	Comm'l Svc. ARC C/D
Ajo Municipal	GA-C	X		■			
Avi Suquilla (NA)	GA-C	X			■		
Bagdad	GA-C	X		■			
Benson Municipal	GA-C	X			■		
Bisbee Douglas International	GA-C	X			C- ■		
Bisbee Municipal	GA-C	X			■	■	
Bowie	GA-E		□				
Buckeye Municipal	GA-C	X			■	■	
Casa Grande Municipal	GA-C	X			■	■	
Casabel Air park (Private)			□ Pvt Use				
Chandler Municipal	RL	X			■	■	
Chinle Municipal (NA)	GA-C	X	□				
Cibecue Municipal	GA-C	X			■		
Cochise College	GA-C					■	
Cochise County	GA-C	X			■	■	
Colorado City Municipal	GA-C	X	■		■		
Coolidge Municipal	GA-C	X			C-■		■
Cottonwood Municipal	GA-C	X		■			
Douglas Municipal	GA-C				□	■	
Eagle Airpark (Private)	GA-C		□				
Eloy Municipal	GA-C	X	■		■		
Ernest A. Love Field	CS	X					■
Estrella Sailport (Private)	GA-C		■				
Falcon Field	RL	X				■	
Flying J Ranch (Private)	GA-C		□				
Forepaugh	GA-R		□				
Ganado (NA)	GA-C	X	□				
Gila Bend Municipal	GA-C	X			■		
Glendale Municipal	RL	X				■	

*Note: Includes General Utility Airports with an ARC of C or D.
Key: ■ Primary System Airports □ Secondary System Airports ARC Airport Reference Code
GA-C = Community Airports with populations in excess of 1,000
GA-R = Rural Airports with populations in excess of 1,000
GA-E = Unpaved airports with emergency capability
RL = Reliever
CS = Commercial Service (L = Large; M = Medium; S = Small)
NA = Native American

TABLE 4-1: ***2000 Status Of Existing Facilities (Continued)***

Facility Name	Facility Classification						
	AZ State System	NPIAS	ARC A-I	ARC B-I	ARC B-II	ARC B/C III	Comm'l Svc. ARC C/D
Grand Canyon Bar-Ten (Private)	GA-R		□				
Grand Canyon Caverns (Private)	GA-R		□				
Grand Canyon National Park	CS-S	X					■
Grand Canyon West (Gov't.)	CS	X	□				
Grande Valley	GA-C		□				
Greenlee County	GA-C	X					
H.A. Clark Memorial Field	GA-C	X				■	
Holbrook Municipal	GA-C	X		■			
Kayenta (NA)	GA-C	X	■				
Kearny	GA-C		□				
Kingman Municipal	GA-C	X					■
Lake Havasu City Municipal	CS	X					■
Laughlin/Bullhead International	CS	X					■
Marana-NW Regional	RL	X					■
Marble Canyon (Private)	GA-R		□				
Memorial Airfield (NA)	GA-C				■		
Mogollon Air park (Private)			□ Pvt Use				
Nogales International	GA-C	X				■	
Page Municipal	CS	X					■
Payson	GA-C	X				■	
Pearce Ferry (Gov't)	GA-R		□				
Phoenix Deer Valley Municipal	RL	X					
Phoenix Goodyear Municipal	RL	X				■	
Phoenix Sky Harbor Int'l	CS-L	X					■
Pinal Airpark	GA-C	X					
Pleasant Valley (Private)	GA-C		■				
Polacca (NA)	GA-R	X			□		
Quartzsite No longer a viable candidate							
Rolle Airfield	GA-R		□				

*Note: Includes General Utility Airports with an ARC of C or D.
Key: ■ Primary System Airports □ Secondary System Airports ARC Airport Reference Code
GA-C = Community Airports with populations in excess of 1,000
GA-R = Rural Airports with populations in excess of 1,000
GA-E = Unpaved airports with emergency capability
RL = Reliever
CS = Commercial Service (L = Large; M = Medium; S = Small)
NA = Native American

TABLE 4-1: ***2000 Status Of Existing Facilities (Continued)***

Facility Name	Facility Classification						
	AZ State System	NPIAS	ARC A-I	ARC B-I	ARC B-II	ARC B/C-III	Comm'l Svc. ARC C/D
Ryan Airfield	RL	X				■	
Safford Regional	GA-C	X				■	
St. Johns Industrial Airpark	GA-C	X				■	
San Carlos Apache	GA-C	X				■	
San Manuel	GA-C		□				
Scottsdale	RL	X				■	
Sedona	GA-C	X		■			
Seligman	GA-R		□				
Sells (NA)	GA-C			□			
Show Low Municipal	CS	X					■
Sierra Vista Muni/Libby AAF	CS	X					■
Steller Airpark	GA-C			■			
Sun Valley (Private)	GA-C		□				
Superior Municipal	GA-C		□				
Taylor	GA-C	X			■		
Temple Bar (Gov't.)	GA-R	X	□				
Three Point (Closed)							
Tombstone Municipal	GA-C		□				
Town of Springerville Municipal	GA-C	X				■	
Tuba City (NA)	GA-C	X		■			
Tucson International	CS-M	X					■
Tuweep (Gov't.)	GA-R		□				
Valle Airport (Private)	GA-C		□				
Whiteriver (NA)	GA-C	X				■	
Wickenburg Municipal	GA-C	X		■			
Williams Gateway	RL	X					■
Window Rock (NA)	GA-C	X				■	
Winslow Lindberg Regional	GA-C	X					
Yuma International/MCAS Yuma	CS	X					■

*Note: Includes General Utility Airports with an ARC of C or D.
Key: ■ Primary System Airports □ Secondary System Airports ARC Airport Reference Code
GA-C = Community Airports with populations in excess of 1,000
GA-R = Rural Airports with populations in excess of 1,000
GA-E = Unpaved airports with emergency capability
RL = Reliever
CS = Commercial Service (L = Large; M = Medium; S = Small)
NA = Native American

4.2 AIRPORT DEVELOPMENT AND PLANNING GUIDELINES

As described above, the condition of each facility being addressed in the SANS 2000 will be determined by comparing the existing facility to basic design guidelines and standards appropriate to an airport's status. The standards to be used in determining the condition of the system are those developed by the ADOT. Those development standards and planning guidelines are based on FAA airport planning and design advisory circulars with modifications and additions relevant to conditions particular to the State of Arizona.

The State's airport standards, based on an airport's designated classification, are organized and presented as follows:

- Approach Aids
- Buildings
- Design Clearance
- Land Area
- Airport Lighting
- New Urban Airports
- Parking Aprons and Tie-Down Spaces
- Pavement Preservation
- Runways
- Taxiways
- Unlisted Items

Approach Aids

Lighted approach aids such as runway identifier lights and visual approach slope NAVAIDs (VASI, PAPI, and PLASI) should be available at the larger airports but no standards for installation have been established. Radio Aids, along with other approach facilities, are basically FAA responsibilities and the appropriate facilities would necessarily vary on an airport-by-airport basis. However, some general recommendations concerning instrument approach facilities did result from the analysis of airport NAVAIDs by ADOT personnel. These suggestions include the following:

1. Precision instrument approach facilities should be provided at all airports with scheduled air carrier service with large aircraft or with 500,000 or more annual operations;

2. Direction and distance finding non-precision approach capabilities should be provided at all airports with 100,000 or more annual operations and without severe terrain obstructions;

3. Non-precision approach facilities should be provided at all airports with 20,000 or more annual operations and without severe terrain obstructions.

Additionally, establishment of enroute NAVAIDs is suggested to accomplish two objectives:

1. VOR or VORTAC facilities within 80 miles of all points in Arizona;

2. VOR reception at all points along established airways 3,000 feet above ground level.

These suggestions are based on experience with VOR reception patterns in Arizona and are made to facilitate reliable radio navigation throughout the state.

While the items discussed in this section concern standards for approach aids, they are not intended to infringe on FAA responsibility in this area. They are presented as supplemental considerations to previously adopted State and Federal standards.

Buildings

At minimum, adequate pilot waiting areas should be provided at each airport included in the Primary System. Passenger terminal areas should also be provided where the airport is served by commuter or air carrier flights on a scheduled basis. The size of either facility should be determined by the volume of usage and peak hour passenger levels. The figures presented in Table 4-2 represent minimum areas. Since larger areas may be required in specific instances, a case-by-case analysis should be undertaken before construction.

Hangar space and administrative operating areas are examples of building space which greatly enhance the utility of the airport. FAA Advisor Circular 150/5300-13 provides the basis on which the state standards were formulated. Although the FAA recommends that hangar space be provided for every two based airplanes, this appears excessive for Arizona except at airports having large numbers of business aircraft. Because of Arizona's favorable weather patterns, the development of hangars generally is not as important as in other parts of the country. Therefore, for the lower utilization airports in Arizona, the number of based aircraft per hangar space was increased to four. The FAA criteria were followed as the standard applicable to the larger airports.

Design Clearance

Whenever constructing runways, apron areas, taxiways, and buildings, it is important to allow sufficient space between the respective structures to allow aircraft to taxi safely and to provide adequate clearance. Hence, it is important to provide minimum separation between the runways, taxiways, apron areas, and buildings. Design clearance standards are provided by the FAA and are considered to be consistent with Arizona's needs.

Land Area

The land area standards were derived from information in FAA Advisory Circular 150/5300-4B. The major requirement for land is generated by the runway and approach areas themselves, with smaller areas needed for tiedown and support facilities. Thus, the required land area varies directly with runway length, number and configuration of runways, and size of tiedown and support areas. The land areas presented in Table 4-2 should be considered minimum for reasonable facility planning. Greater land areas may be required at higher elevations due to added runway length requirements dictated by density altitude. Wherever possible, the land area should be sufficiently large to accommodate growth and to protect the airport from the undesirable effects of incompatible development in the vicinity.

Airport Lighting

FAA Advisory Circular 150/5340-24 provides information on standard airport lighting. The principles contained in the circular were followed in establishing SANS lighting standards for all classes of airports. Lighting generally enhances the utility of the airport at night, but some airports in Arizona would attract little night traffic. At these airports some radio-controlled operating devices might be advantageous.

In addition to these standards, several other suggestions were generated from an analysis undertaken by ADOT personnel concerning airport NAVAIDs. The following items, in addition to those found in the Advisory Circular, are recommended:

1. Lighted wind indicators should be provided for all airports with lighted runways to aid pilots using the airport at night (except where the airport is serviced by a 24-hour control tower).

2. A rotating beacon, runway lights, and taxiway lights or reflectors should be provided at all airports in the Primary System receiving 10,000 or more operations or are over 25 miles from another airport with runway lights and rotating beacon.

These two items would insure that pilots flying at night would be able to determine the wind direction and, under normal atmospheric conditions, find lighted landing facilities within a few minutes' flying time of any airport of destination.

New Urban Airports

The emergence of new airports in primarily metropolitan areas of the state have been considered in the SANS. Construction of additional system airports, as defined by the State Aviation System Plan, should be based on need or access to the National Transportation Network. Construction standards are not set by the FAA for secondary airports, but criteria for Minimum Standards and Planning Guidelines, as adopted by the Arizona Transportation Board, should be followed. Again, planning guidelines are included in Table 4-2. Minimum standards should be followed and include:

1. Perimeter fencing should be provided to secure the airport and runway from wildlife and intruders.

2. Install wind direction indicator.

3. Sufficient grading and drainage are needed to ensure a safe and usable runway surface.

4. A hard and level landing surface should be maintained.

Parking Aprons and Tiedown Spaces

An aircraft parking apron for permanently based aircraft, transient aircraft, and air carrier operations, if applicable, should also be part of the airport development program. For safe operation, these areas should be paved and adequate in size to handle normal operations at the airport. It is, therefore, appropriate to set standards for such aprons based on the type of aircraft (that is, square yards per aircraft) and number or aircraft.

Such standards, as developed by the FAA and presented in Advisory Circular 150/5300-13, are appropriate when space must be provided between rows of parked aircraft. However, slightly smaller areas are possible at low-volume airports where multiple rows of parked airplanes may not be required. Thus, the minimum suggested apron areas for the ARC A-I to B-II categories are slightly smaller than FAA standards. All other categories use FAA standards.

Pavement Preservation

The physical condition of the runway, taxiway, and apron pavement is critical for the safe operation of aircraft at an airport. Changes in the climate and weather, along with usage, influence the rate at which pavement deteriorates. Although the issue is not addressed in an FAA Advisory Circular, ADOT personnel recommend that all airports be monitored at a project level as well as a system level. In order to initiate and maintain this program, all master plans will be required to include a section on pavement preservation.

Runways

Runway lengths and widths for the various design classifications of airports are also specified in Advisory Circular 150/5300-13 and are for sea-level, standard-day conditions. In Arizona, with its diverse temperatures and elevations, these basic runway lengths must be adjusted for temperature, density altitude, and runway gradient. The necessary conversion tables are referenced in Advisory Circular 150/5300-13 and should be used to determine the minimum runway length required at any specific airport.

This type of surface and weight bearing strength of the runway are also specified in Advisory Circulars 150/5300-4B and 150/5300-12 and should be used to determine the minimum runway length required at any specific airport. Bearing strength should be adequate for the type of aircraft utilizing the facility and, in general, would increase with the design classification of the runway. Adequate drainage and base material should be used to insure that the runway surface will remain serviceable for the life of the asphalt.

Taxiways

Taxiways and turnarounds are constructed primarily to facilitate aircraft movements to and from the runway. The construction of full parallel taxiway facilities should be undertaken when the utilization of the individual airport reaches levels which could cause hazards or undue delay for airport users. Thus, establishing exact criteria for taxiway construction becomes difficult. The FAA, in Advisory Circular 150/5300-13, suggests that full parallel taxiways should be planned for airports having more than 20,000 annual operations. Airports having fewer operations can

safely accommodate their operations using a partial parallel taxiway or turnarounds. Based on Arizona's utilization pattern, the 20,000 operations criteria was deemed reasonable. Classes of airports receiving this level of utilization should have parallel taxiways with partial taxiways or turnarounds for airports having lower utilization.

Associated with taxiways are connector stubs joining the taxiway to the runway. A sufficient number should be provided to allow access to and from the runway. An area for aircraft to park and fuel after leaving the taxiway should also be provided. The volume of utilization and the frequency of aircraft movements are important factors in determining the size of such a facility. Again, the FAA provides guidance in Advisory Circular 150/5300-13.

Unlisted Items

Numerous miscellaneous items are included which will enhance the utilization of the airport runway and other facilities. No FAA Standards were found for most of these items, but the FAA did recognize the importance of such facilities in the Advisory Circulars referenced in the preceding paragraphs.

Fencing should be provided at Primary System airports to keep animals away from the airfield and to discourage people from entering the airport at improper locations. Restrooms, fuel facilities, auto parking facilities, aircraft maintenance, and utilities, including a telephone, should also be provided if the airport is to offer good service to the flying public. At the busiest airports, eating facilities should be available and, as a local courtesy, some form of public transportation should be available.

For those airports receiving regularly scheduled air carrier service, the FAA requires an Airport Operation Certificate or a waiver therefrom. The operating certificate requires certain crash-fire-rescue equipment, security fencing, and numerous other conditions as stated in FAR 139, thus the requirement for other items as indicated in appropriate FAA documents. Since these are required by law and since they apply to air carrier commercial service airports only, State Standards could only reflect legislative intent and would be redundant. Therefore, only the requirement for an operating certificate is indicated.

Traffic volumes at some airports may require tower facilities for safe traffic movement. The provision of such facilities is within the authority of the FAA, and the agency has developed a procedure to determine the eligibility of specific airports for control towers. This procedure is outlined in FAA documents and should be referenced, as required.

TABLE 4-2: *Airport Planning Guidelines - 2000*

STATE AVIATION SYSTEM COMMERCIAL SERVICE, RELIEVER AND GENERAL AVIATION AIRPORTS						FAA / AAIA AIRPORTS
ITEM	**Emergency Airports**	**ARC * A-I**	**ARC * B-I**	**ARC * B-II**	**ARC * B/C-III**	**PRIMARY Air Carrier**
LAND:						
Airside (Acres)	20	53	57	81	200	As Required
Landside (Acres)	4	8	12	24	30	As Required
RUNWAYS						
Length/Width	Note A	Note A	Note A	Note B	Note B	Note B
Strength (1,000 lbs.) (SWL)	5,000	12,500	12,500	12,500	30,000	Critical Aircraft
Surface	G-rating Gravel	Asphalt/Gravel	Asphalt	Asphalt	Asphalt	Asphalt
Runway Protection Zone	Note C	Note C	Note C	Note C	Note C	Note C
TAXIWAYS:						
Full Parallel (Width)		25	35	35	50	Note D
Partial Parallel (length/width)			1,500/35	As Required	As Required	As Required
Connector Stubs (#)		1	2	3	3	As Required
Turn Arounds (#)	1	2	2	None	None	None
DESIGN CLEARANCES (RWY C/L To:)						
Parallel Taxiway Centerline		150	225	240	300/400	400
Aircraft Parking		125	200	250	400/500	500
Buildings/Hangars		Note C	Note C	Note C	Note C	Note C
AIRCRAFT PARKING APRON (Paved):						
G.A. Apron (Sq. Yds./BA)	150	300	300	300	450	600
A.C. Apron (Sq. Yds./Gate)				450	450	Critical Aircraft
Transient (Sq. Yds/Aircraft)	150	360	360	360	450	600
Tiedowns	------ Generally Maintain 25% Above Number of Based Aircraft ------					
LIGHTING:						
Runway	Reflectors	Reflectors	MIRL	MIRL	MIRL	MIRL/HIRL
Taxiway			Reflectors	MITL	MITL	MITL
Apron					As Required	Yes
Beacon			Yes	Yes	Yes	Yes
APPROACH AIDS:						
REIL					Yes	Yes
Radio Communications					Yes	Yes
Runway Approach Lights				As Required	As Required	Yes
Instrument Approach	As Required	As Required	As Required	NPA	NPA/NPV **	PREC
LANDING AIDS:						
Wind Indicator	Yes	Yes	Yes			
Segmented Circle				Yes	Yes	Yes
VGSI			As Required	Yes	Yes	Yes

TABLE 4-2: *Airport Planning Guidelines - 2000(Continued)*

STATE AVIATION SYSTEM COMMERCIAL SERVICE, RELIEVER AND GENERAL AVIATION AIRPORTS						FAA / AAIA AIRPORTS
ITEM	**Emergency Airports**	**ARC * A-I**	**ARC * B-I**	**ARC * B-II**	**ARC * B/C-III**	**PRIMARY Air Carrier**
BUILDINGS:						
Pilot Waiting Area (Sq. Ft.)	As Required	450	600	600	600	As Required
Passenger Terminal, AC Only (Sq. Ft.)				450	450	As Required
Based Aircraft/Hangar		4/1	4/1	4/1	2/1	As Required
Administration Area (Sq. Ft.)		200	200	300	400	As Required
MISCELLANEOUS FACILITIES:						
Fencing	Perimeter	Perimeter	Perimeter	Perimeter	Perimeter	Note E
Restrooms	As Required	Yes	Yes	Yes	Yes	Yes
Eating Facilities	As Required	Coin Operate	Coin Operate	Coin Operate	Lunch C'nter	Full Service
Fuel	As Required		Yes	Yes	Yes	Yes
Maintenance	As Required			Yes	Yes	Yes
Utilities	As Required	Yes	Yes	Yes	Yes	Yes
Part 139 Certificate	N/A	N/A	N/A	Only if served by an AC		Yes
Auto Parking Spaces	Dependent on Local Conditions					As Required
Pavement Management	Per Aeronautics Division PMS					As Required

DEFINITIONS:

AC = Air Carrier
G-Rating = An Airport inspectors pavement evaluation rating of "G" equals Good.
GVL = Gravel, or other unpaved surface
NPA = Non precision approach without vertical guidance
NPV = Non precision approach with vertical guidance
PREC = precision approach course and vertical guidance meeting ILS/MLS/WAAS performance conditions
SWL = Single Wheel Loading criteria
VGSI = Visual Glide Slope Indicator (PAPI, PLASI, VASI, etc.)

NOTES:

* = Airport Reference Code (ARC) standards for runways with not lower than ¾ mile visibility minimums
NPV** = Airports with Commercial Service should attempt to obtain NPV approach
(A) Runway Length (Emerg, 1-A. 1-B) AC 150/5325-4A, Figure 2-1)
(B) Runway Length (ARC II-B, III-B/C) – AC 150/5300-13 or Aircraft Performance Manual
(C) In accordance with FAR Part 77 – Objects Affecting Navigable Airspace
(D) In accordance with AC 150/5300-13, Airport Design Guide
(E) In accordance with AC 107-1 and 108-1

4.3 CONDITION OF THE EXISTING SYSTEM

The condition of the existing system of airports relevant to an individual facility's status and recommended state aviation development standards and planning guidelines pertinent to that facility is shown in Table 4-3. Exhibits 4-1 and 4-2 are charts which graphically indicate the aggregate physical condition of the overall system of aviation facilities. As indicated in these two exhibits, key infrastructure components systemwide that fall below recommended planning guidelines include runway/taxiway separation distances, taxiway widths, and lighting and instrumentation.

Runway capacity is also an important indicator of system condition and performance. Capacity is used to designate the processing capability of an aviation facility over some period of time. Runway capacity is defined as the maximum physical capability of a runway system to process aircraft. It is typically expressed as Annual Service Volume (ASV). As annual aircraft operations approach annual service volume, the average delay to each aircraft throughout the year may increase rapidly with relatively small increases in aircraft operations, thereby causing levels of service on the airfield to deteriorate. Runway capacity can be compared with the existing and forecast demand to ascertain whether improvements to increase capacity will be needed. According to FAA recommendations, planning for additional runway capacity should occur when activity approaches 60 percent of the ASV. Existing runway capacity for SANS airports is shown in Table 4-4.

TABLE 4-3: ***Existing Conditions - 2000***

Facility Name	Size	Primary Runway Data				Parallel Taxiway			
	Total Acrg.	Primary Runway	Length (ft.)	Width (ft.)	Single Wheel Strength (000)	Parallel Twy	Width (ft.)	Connect. Stubs	Twy CL to Rwy CL
Ajo Municipal	■	12-30	□	□	□			■	■
Avi Suquilla (NA)	■	01-19	■	■	■	■	■	■	■
Bagdad	□	05-23	□	□	□	□	□	□	□
Benson Municipal	□	05-23	□	□	□			□	□
Bisbee Douglas Int'l	■	17-35	□	■	■	□	□	□	□
Bisbee Municipal	■	17-35	■	□	□	■	□	■	□
Bowie	■	08-26	□	■	■			□	□
Buckeye Municipal Airport	■	17-35	□	■	□	■	□	■	■
Casa Grande Municipal	■	05-23	■	■	■	■	□	■	□
Chandler Municipal	■	04R-22L	■	■	■	□	□	■	□
Chinle Municipal	□	17-35	□	■	■			□	□
Cibecue	N/A	07-25							
Cochise College	□	05-23	□	□	■	■	□	■	□
Cochise County	■	03-21	■	■	■	■	□	■	■
Colorado City Municipal	■	11-29	■	■	■			□	□
Coolidge Municipal	■	05-23	■	■	■	■	□	■	□
Cottonwood Municipal	■	14-32	□	■	□	■	□	■	□
Douglas Municipal	■	03-21	■	□	■	□	□	□	□
Eagle Airpark	□	17-35	□	□	□			□	□
Eloy Municipal	□	02-20	□	□	□	■	□	■	□
Ernest A. Love Field	■	03R-21L	■	■	■	■	■	■	■
Estrella Sailport	■	6R-24L	□	□	■	□	□	□	□
Falcon Field	■	04R-22L	■	■	■	■	□	■	□
Flagstaff - Pulliam	■	03-21	□	■	■	■	■	■	□
Flying J Ranch	■	06R-24L	□	□	■			□	□
Forepaugh									
Ganado (NA)	□	18-36	□	■	■			□	□
Gila Bend Municipal	■	04-22	□	■	□			■	□
Glendale Municipal	■	01-19	■	■	■	■	□	■	□
Grand Canyon Bar-Ten	□	16-34	□	□	■			□	□
Grand Canyon Caverns	■	05-23	■	■	■			□	□
Grand Canyon Nat'l Park	■	03-21	■	■	■	■	■	■	□
Grand Canyon West	□	17-35	□	□	□			□	□
Grande Valley									

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

TABLE 4-3: ***Existing Conditions – 2000 (Continued)***

Facility Name	Size	Primary Runway Data				Parallel Taxiway			
	Total Acrg.	Primary Runway	Length (ft.)	Width (ft.)	Single Wheel Strength (000)	Parallel Twy	Width (ft.)	Connect. Stubs	Twy CL to Rwy CL
Greenlee County	■	07-25	□	■	■			□	□
H.A. Clark Memorial Field	■	18-36	■	■	■			□	□
Holbrook Municipal	■	03-21	□	■	□	■	□	■	□
Kayenta (NA)	■	05-23	□	■	□			□	□
Kearny	□	08-26	□	□	■			□	□
Kingman	■	03-21	□	■	■	■	■	■	□
Lake Havasu City Municipal	■	14-32	□	■	■	■	□	□	□
Laughlin/Bullhead Int'l	■	16-34	□	■	■	■	□	■	□
Marana NW Regional	■	12-30	■	■	□	■	■	■	□
Marble Canyon	■	03-21	□	□	■			□	□
Nogales International	■	03-21	■	■	■	■	□	■	□
Page Municipal	■	15-33	□	■	■	■	□	■	□
Payson	□	06-24	□	■	■	■	□	■	□
Pearce Ferry	■	01-19	□	■	■			□	□
Phoenix Deer Valley	■	7R-25L	□	■	■	■	□	■	■
Phoenix Goodyear	■	03-21	□	■	■	■	□	■	■
Phoenix Sky Harbor Int'l	■	08-26	■	■	□	■	■	■	■
Pinal Airpark	■	12-30	□	■	■	■	□	□	□
Pleasant Valley	■	05-23	□	■	■	□	□	□	□
Polacca (NA)	□	04-22	□	□	■			□	□
Quartzite (New)	□	N/A	□	□	□			□	□
Rolle Airfield	□	17-35	□	■	■			■	□
Ryan Field	■	06R-24L	■	■	□	■	□	■	□
Safford Regional	■	12-30	■	■	■	□	□	■	□
St. Johns Industrial Airpark	□	14-32	□	■	■	■	□	■	□
San Carlos Apache	□	09-27	■	■	□	■	□	■	□
San Manuel	□	11-29	□	□	□			□	□
Scottsdale	■	03-21	□	■	■	■	□	■	■
Sedona	■	03-21	□	■	■	■	□	■	□
Seligman	■	04-22	□	■	□			■	■
Sells (NA)	□	04-22	■	■	■			■	□
Show Low Municipal	■	06-24	□	■	■	□	□	□	□
Sierra Vista Muni/Libby AAF	■	08-26	■	■	□	■	■	■	■
Stellar Airpark	□	17-35	□	□	□	□	□	■	□

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA - Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Size	Primary Runway Data				Parallel Taxiway			
	Total Acrg.	Primary Runway	Length (ft.)	Width (ft.)	Single Wheel Strength (000)	Parallel Twy	Width (ft.)	Connect Stubs	Twy CL to Rwy CL
Sun Valley	☐	18-36	☐	☐	☐			☐	☐
Superior Municipal	☐	04-22	☐	■	☐			☐	☐
Taylor	■	03-21	■	■	☐			☐	☐
Temple Bar	■	18-36	☐	☐	☐			☐	☐
Tombstone Municipal	■	06-24	☐	■	☐			☐	☐
Town of Springerville Muni	■	03-21	■	■	☐	■	☐	■	☐
Tuba City (NA)	■	15-33	■	■	■			☐	☐
Tucson International	☐	11L-29R	■	■	☐	■	■	■	■
Tuweep	■	02-20	☐	☐	☐			☐	☐
Valle Airport	☐	01-19	■	☐	■			■	■
Whiteriver (NA)	☐	01-19	☐	■	■			■	☐
Wickenburg Municipal	☐	05-23	■	☐	■	■	☐	■	☐
Williams Gateway	☐	12R-30L	■	■	☐	■	☐	☐	☐
Window Rock (NA)	■	02-20	☐	■	■	☐	☐	☐	☐
Winslow-Lindberg Regional	☐	04-22	☐	■	■	■	☐	■	☐
Yuma International	■	03L-21R	■	■	☐	■	■	■	■

Legend: ■ Meets Recommendations ☐ Does Not Meet Recommendations NA - Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Aircraft Parking		Airport Lighting					
	Based A/C Parking Apron	Tiedowns	HIRL	MIRL	Reflectors	Taxiway Lighting	Apron Lighting	Beacon
Ajo Municipal	■	■		□				■
Avi Suquilla (NA)	■	□		■				■
Bagdad	□	□		□				■
Benson Municipal	□	□			□			■
Bisbee Douglas International	■	■	□	■			□	■
Bisbee Municipal	□	■		■				■
Bowie	□	□			□			
Buckeye Municipal Airport	■	□		■				■
Casa Grande Municipal	□	■		■				■
Chandler Municipal	□	□		■				■
Chinle Municipal	□	□			□			
Cibecue								
Cochise College	□	□		□				■
Cochise County	□	□		■				■
Colorado City Municipal	□	■		■	□			■
Coolidge Municipal	■	■		■				■
Cottonwood Municipal	□	□		■				■
Douglas Municipal	■	□		■				■
Eagle Airpark	■	■						
Eloy Municipal	□	□		■				■
Ernest A. Love Field	■	□		■	□			■
Estrella Sailport	□	□			□			
Falcon Field	□	□		■				■
Flagstaff - Pulliam	■	□	■				□	■
Flying J Ranch	□	□			□			
Forepaugh								
Ganado (NA)	□	□			□			
Gila Bend Municipal	■	■		■				■
Glendale Municipal	■	□		■				■
Grand Canyon Bar-Ten	□	□			□			
Grand Canyon Caverns	■	□			□			
Grand Canyon National Park	■	□	□	■			□	■
Grand Canyon West	□	□			□			
Grande Valley								

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

EXHIBIT 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Aircraft Parking		Airport Lighting					
	Based A/C Parking Apron	Tiedowns	HIRL	MIRL	Reflectors	Taxiway Lighting	Apron Lighting	Beacon
Greenlee County	■	■		■				■
H.A. Clark Memorial Field	□	□		■	□			■
Holbrook Municipal	■	■		■				■
Kayenta (NA)	□	□		■	□			■
Kearny	□	■			□			
Kingman	□	■	□	■			□	■
Lake Havasu City Municipal	□	□	□	■			□	■
Laughlin/Bullhead Int'l	■	■	□	■			□	■
Marana NW Regional	□	□		■				■
Marble Canyon	□	■			□			
Nogales International	■	□		■				■
Page Municipal	■	■	□	■			□	■
Payson	□	■		■				■
Pearce Ferry	■	□			□			
Phoenix Deer Valley	■	□	■	■			□	■
Phoenix Goodyear	■	□	■	■			□	■
Phoenix Sky Harbor International	■	□	■	□			■	■
Pinal Airpark	■	■	□	■			□	■
Pleasant Valley	□	■			□			
Polacca (NA)	□	□		□				□
Quartzsite (New)	□	□			□			
Rolle Airfield	□	□			□			
Ryan Field	□	□		■				■
Safford Regional	■	■		■				■
St. Johns Industrial Airpark	■	■		■	□			■
San Carlos Apache	■	■		■				■
San Manuel	□	□			□			
Scottsdale	■	□	□	■			■	■
Sedona	□	□	□	■			□	■
Seligman	□	□			□			
Sells (NA)	□	□			□			
Show Low Municipal	■	■		■				■
Sierra Vista Muni/Libby AAF	■	□	■	■				■
Stellar Airpark	■	■		□				■

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Aircraft Parking		Airport Lighting					
	Based A/C Parking Apron	Tiedowns	HIRL	MIRL	Reflectors	Taxiway Lighting	Apron Lighting	Beacon
Sun Valley	□	□			□			
Superior Municipal	□	■			□			
Taylor	■	■		■				■
Temple Bar	□	■			□			
Tombstone Municipal	□	□			□			
Town of Springerville Muni	■	■		■				■
Tuba City (NA)	□	■		■				■
Tucson International	■	□	■	■			□	■
Tuweep	□	□			□			
Valle Airport	■	■		■				■
Whiteriver (NA)	■	■		■	□			
Wickenburg Municipal	■	■		■				■
Williams Gateway	□	□		■				■
Window Rock (NA)	□	■		■				■
Winslow-Lindberg Regional	■	■	□	■			□	■
Yuma International	■	□	■				□	■

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

EXHIBIT 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Approach Aids			Landing Aids			Buildings		
	REIL	ILS/ GPS	NPI	Wind Ind.	PAPI	VASI	Pilot Waiting	Terminal Facilities	Admin. Area (Sq. Ft.)
Ajo Municipal				■	□	■	□	□	
Avi Suquilla (NA)		■		■	■	■	□	■	
Bagdad		□	□	■	□	□	□	■	
Benson Municipal				□					
Bisbee Douglas International	■	□	■	■	□	■	□	■	
Bisbee Municipal		■	□	■	■	□	□	■	
Bowie				■	□		□		
Buckeye Municipal Airport		□	□	■	■	□	□	□	
Casa Grande Municipal		■	■	■	□	■	■	□	
Chandler Municipal	■	■	■	■	■		■	■	
Chinle Municipal				■			□		
Cibecue				□					
Cochise College		□	□	■	■	□	□	□	
Cochise County		■	■	■	□	□	□	■	
Colorado City Municipal		■	■	■	■		□		
Coolidge Municipal		■	■	■	□	■	■	□	
Cottonwood Municipal				■	■	□	■	■	
Douglas Municipal		□	□	■	■	□	□	■	
Eagle Airpark				■			■	■	
Eloy Municipal				■	□	□	□	■	
Ernest A. Love Field	■	■	■	■	■		□		
Estrella Sailport				■			□		
Falcon Field		■	■	■	■	□	■	■	
Flagstaff - Pulliam	■	■	■	■	□	■	■	■	
Flying J Ranch				■			□		
Forepaugh									
Ganado (NA)				■			□		
Gila Bend Municipal				■	□	□	■	□	
Glendale Municipal	■	■	■	■	■	□	■	■	
Grand Canyon Bar-Ten				■			□		
Grand Canyon Caverns				■					
Grand Canyon National Park	■	■	■	■	□	■	□	■	
Grand Canyon West				□					
Grande Valley									

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Approach Aids			Landing Aids			Buildings		
	REIL	ILS/ GPS	NPI	Wind Ind.	PAPI	VASI	Pilot Waiting	Terminal Facilities	Admin. Area (Sq. Ft.)
Greenlee County		☐	☐	■	☐	☐	☐	☐	
H.A. Clark Memorial Field				■			☐		
Holbrook Municipal	■	☐	☐	■	■	■	☐	☐	
Kayenta (NA)	■			■		■	☐		
Kearny				■			☐		
Kingman	☐	■	■	■	■	■	■	■	
Lake Havasu City Municipal	■	■	■	■	■	■	☐	☐	
Laughlin/Bullhead Int'l	■	■	■	■	■	☐	■	☐	
Marana NW Regional		☐	☐	■	■	■	☐	■	
Marble Canyon				■			☐		
Nogales International		■	■	■	☐	■	■	■	
Page Municipal	■	■	■	■	☐	■	■	■	
Payson		■	☐	■	■	☐	☐	■	
Pearce Ferry				■					
Phoenix Deer Valley	■	■	■	■	■	■	■	■	
Phoenix Goodyear	■	☐	☐	■	☐	■	■	■	
Phoenix Sky Harbor International	■	■	■	■	■	■	■	■	
Pinal Airpark	☐	☐	☐	■	☐	☐	■	■	
Pleasant Valley				■			☐		
Polacca (NA)				■	☐	☐	☐	☐	
Quartzsite (New)				☐					
Rolle Airfield				■			☐		
Ryan Field		■	■	■	☐	■	☐	☐	
Safford Regional		■	■	■	■	■	■	■	
St. Johns Industrial Airpark		■	■	■	■	☐	☐	■	
San Carlos Apache		■	■	■	☐	■	☐	☐	
San Manuel				■			☐		
Scottsdale	■	■	☐	■	■	■	■	■	
Sedona	■	☐	☐	■	☐	■	■	■	
Seligman				■			☐		
Sells (NA)				■			☐		
Show Low Municipal	■	■	☐	■	■	☐	■	■	
Sierra Vista Muni/Libby AAF		■	■	■	■	■	☐		
Stellar Airpark		■		■		■	☐		

Legend: ■ Meets Recommendations ☐ Does Not Meet Recommendations NA – Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Approach Aids			Landing Aids			Buildings		
	REIL	ILS/ GPS	NPI	Wind Ind.	PAPI	VASI	Pilot Waiting	Terminal Facilities	Admin. Area (Sq. Ft.)
Sun Valley				■			□		
Superior Municipal				■			□		
Taylor		■		■	■		□		
Temple Bar				■			□		
Tombstone Municipal				■			□		
Town of Springerville Municipal		■	■	■	■	■	□	■	
Tuba City (NA)				■	■		□		
Tucson International	■	■	■	■	■	■	■	■	
Tuweep				■			□		
Valle Airport		■		■					
Whiteriver (NA)				■			□		
Wickenburg Municipal	■	□	□	■	■	□	□	■	
Williams Gateway	■	■	■	■	■		□		
Window Rock (NA)	■	■	■	■	■	□	□	□	
Winslow-Lindberg Regional	■	■	■	■	■		□	■	
Yuma International	■	■	■	■	□	■	■	□	

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

EXHIBIT 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Miscellaneous						
	Fencing	Restrooms	Eating Facilities	Maint. Facilities	Utilities	Part 139 Cert.	Based A/C
Ajo Municipal							5
Avi Suquilla (NA)							18
Bagdad						■	14
Benson Municipal							0
Bisbee Douglas International							31
Bisbee Municipal							10
Bowie							3
Buckeye Municipal Airport							74
Casa Grande Municipal							59
Chandler Municipal							295
Chinle Municipal							2
Cibecue							0
Cochise College							14
Cochise County							15
Colorado City Municipal						□	11
Coolidge Municipal							1
Cottonwood Municipal							35
Douglas Municipal							29
Eagle Airpark							52
Eloy Municipal							39
Ernest A. Love Field							290
Estrella Sailport							23
Falcon Field							923
Flagstaff - Pulliam						■	120
Flying J Ranch							6
Forepaugh							
Ganado (NA)							0
Gila Bend Municipal							2
Glendale Municipal							250
Grand Canyon Bar-Ten							1
Grand Canyon Caverns							0
Grand Canyon National Park							53
Grand Canyon West							0
Grande Valley							

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native American

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Miscellaneous						
	Fencing	Restrooms	Eating Facilities	Maint. Facilities	Utilities	Part 139 Cert.	Based A/C
Greenlee County							4
H.A. Clark Memorial Field							12
Holbrook Municipal							10
Kayenta (NA)						■	3
Kearny							3
Kingman							180
Lake Havasu City Municipal							184
Laughlin/Bullhead Int'l							59
Marana NW Regional							216
Marble Canyon							1
Nogales International							23
Page Municipal							33
Payson							54
Pearce Ferry							0
Phoenix Deer Valley							918
Phoenix Goodyear							196
Phoenix Sky Harbor International						■	296
Pinal Airpark							83
Pleasant Valley							65
Polacca (NA)							
Quartzsite (New)							0
Rolle Airfield							0
Ryan Field							253
Safford Regional							28
St. Johns Industrial Airpark							9
San Carlos Apache							48
San Manuel							8
Scottsdale							400
Sedona						□	96
Seligman							4
Sells (NA)							1
Show Low Municipal						□	47
Sierra Vista Muni/Libby AAF							40
Stellar Airpark							139

Legend: ■ Meets Recommendations □ Does Not Meet Recommendations NA – Native Ameriican

TABLE 4-3: ***Existing Conditions 2000 (Continued)***

Facility Name	Miscellaneous						
	Fencing	Restrooms	Eating Facilities	Maint. Facilities	Utilities	Part 139 Cert.	Based A/C
Sun Valley							14
Superior Municipal							0
Taylor							18
Temple Bar							0
Tombstone Municipal							0
Town of Springerville Municipal							16
Tuba City (NA)							0
Tucson International						■	412
Tuweep							0
Valle Airport							4
Whiteriver (NA)							8
Wickenburg Municipal							39
Williams Gateway							60
Window Rock (NA)							8
Winslow-Lindberg Regional							15
Yuma International						■	95

Legend: ■ Meets Recommendations ☐ Does Not Meet Recommendations NA – Native American

EXHIBIT 4-1: ***Facilities Meeting Current Recommendations – 2000***

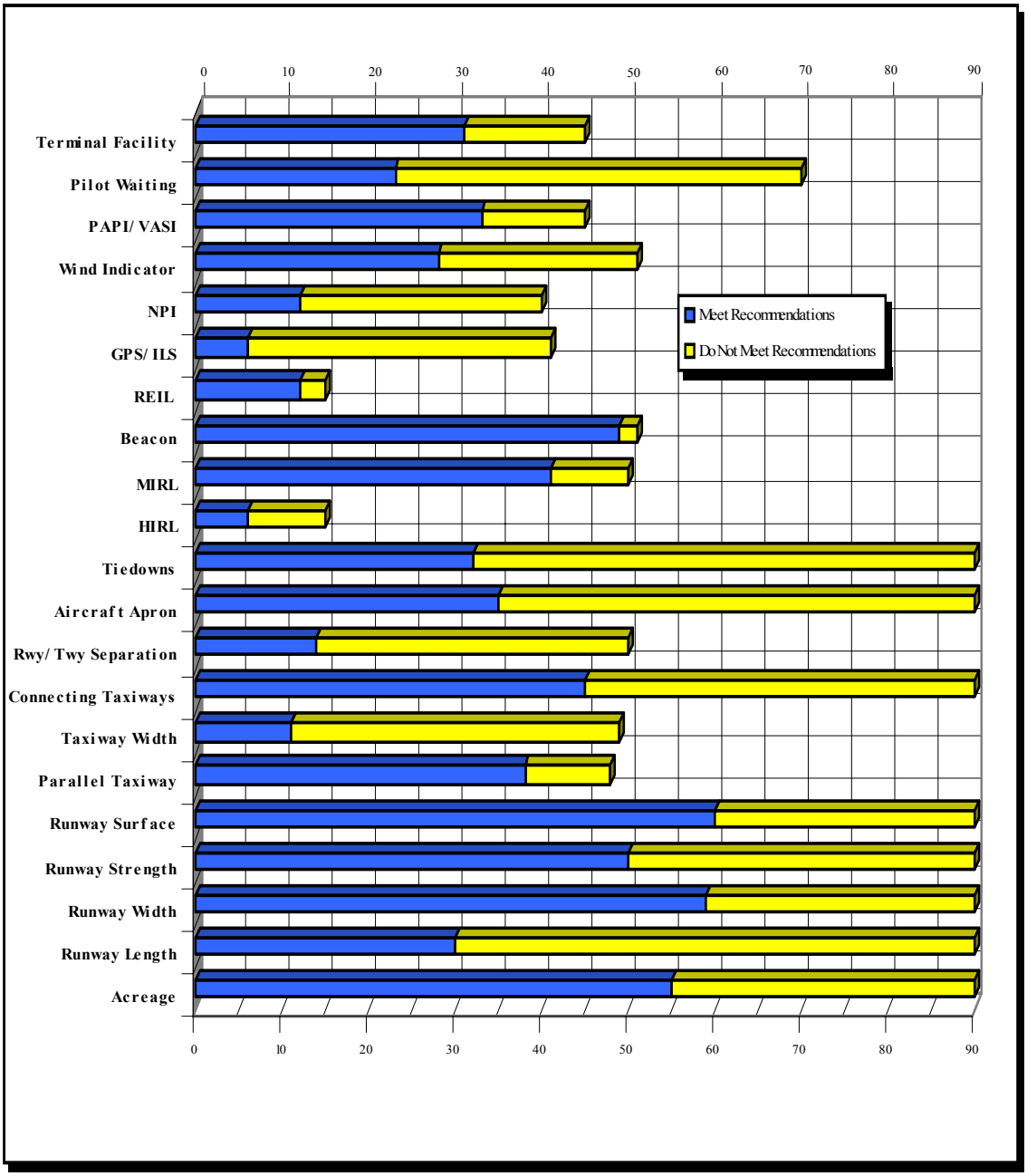


EXHIBIT 4-2: ***Facilities Meeting Recommendations By Percent - 2000***

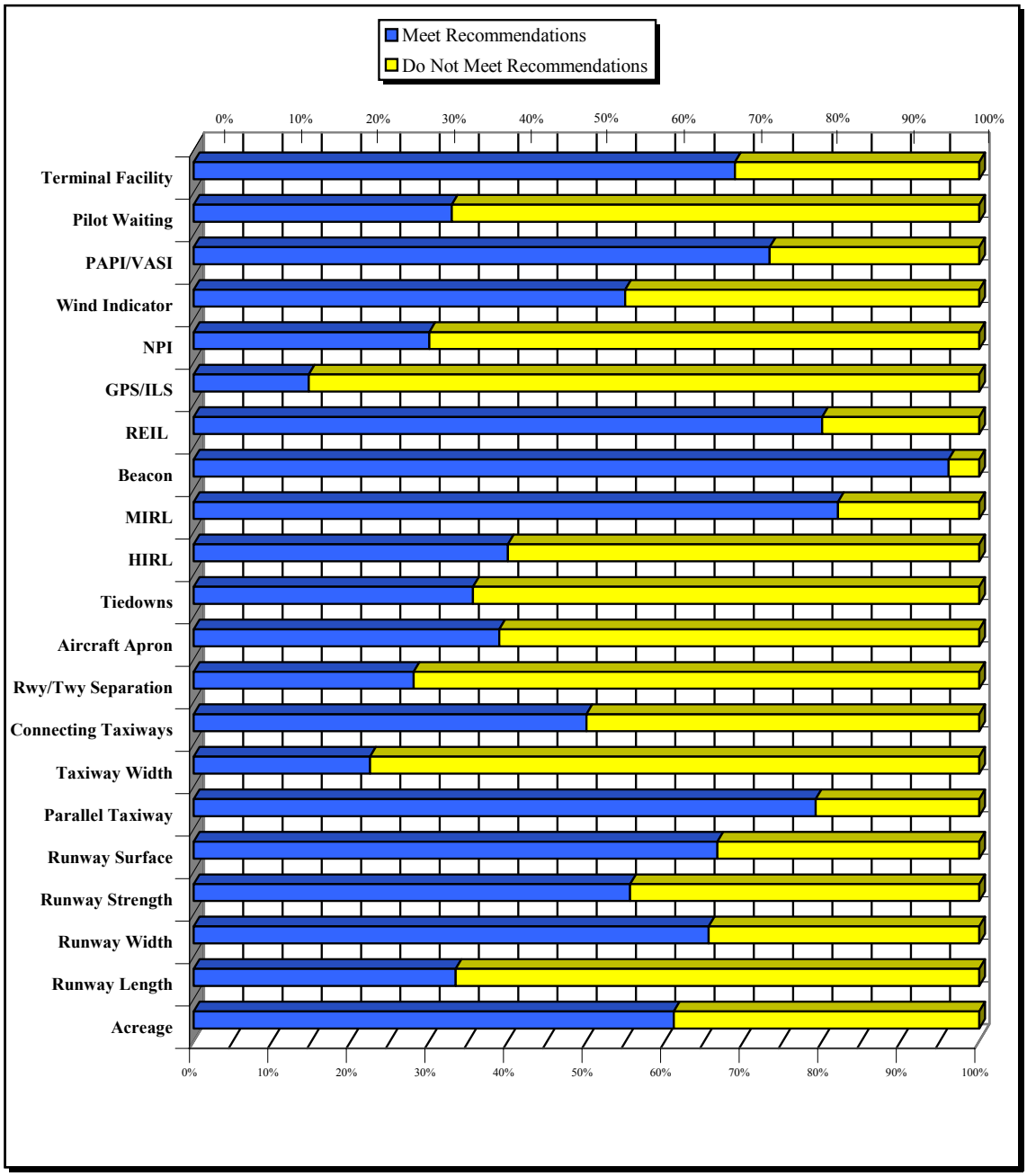


TABLE 4-4: ***Capacity Of Existing Runway Facilities - 2000***

Facility Name	1998 Operations	Annual Service Volume	Percent Capacity	Condition
Ajo Municipal *	1,900	175,000	1%	■
Avi Suquilla (NA)	14,000	175,000	8%	■
Bagdad	14,000	143,300	10%	■
Benson Municipal	0	123,284		■
Bisbee Douglas Int'l	32,000	325,360	10%	■
Bisbee Municipal *	3,020	147,600	2%	■
Bowie	850	120,000	1%	■
Buckeye Municipal Airport	16,020	245,000	7%	■
Casa Grande Municipal *	65,400	285,000	23%	■
Chandler Municipal	153,800	269,000	57%	■
Chinle Municipal	900	120,000	1%	■
Cibecue	0			
Cochise College *	45,250	267,000	17%	■
Cochise County *	7,096	230,000	3%	■
Colorado City Municipal *	3,680	110,700	3%	■
Coolidge Municipal	91,500	347,600	26%	■
Cottonwood Municipal	19,410	295,100	7%	■
Douglas Municipal	11,100	155,200	7%	■
Eagle Airpark *	5,053	225,400	4%	■
Eloy Municipal	23,100	285,400	8%	■
Ernest A. Love Field	353,299	326,400	108%	□
Estrella Sailport	16,500	120,000	14%	■
Falcon Field	220,969	381,800	58%	■
Flagstaff – Pulliam *	63,400	274,000	23%	■
Flying J Ranch	800	120,000	1%	■
Forepaugh				
Ganado (NA)	700	120,000	1%	■
Gila Bend Municipal *	4,550	174,900	3%	■
Glendale Municipal *	150,000	275,000	55%	■
Grand Canyon Bar-Ten	2,000	120,000	2%	■
Grand Canyon Caverns	700	120,000	1%	■
Grand Canyon National Park *	164,479	156,000	105%	□
Grand Canyon West	0	120,000	0%	■
Grande Valley				
Greenlee County	6,650	126,300	5%	■
H. A. Clark Memorial Field	3,600	137,400	3%	■
Holbrook Municipal	4,650	267,400	2%	■
Kayenta (NA)	4,700	120,000	4%	■
Kearny	4,200	120,000	4%	■
Kingman	33,000	347,600	9%	■
Lake Havasu City Municipal	55,344	307,900	18%	■
Laughlin/Bullhead International	47,316	267,000	18%	■
Marana NW Regional	71,300	267,000	31%	■
Marble Canyon	2,340	100,000	2%	■
Memorial Airfield (NA)	25,500	100,000	26%	■
Nogales International	22,890	276,100	8%	■

■ Less than 60% of capacity
□ More than 60% of capacity
* Indicates survey information
NA Native American

TABLE 4-4: ***Capacity Of Existing Runway Facilities – 2000 (continued)***

Facility Name	1998 Operations	Annual Service Volume	Percent Capacity	Condition
Page Municipal	31,988	294,600	11%	■
Payson	25,000	267,000	9%	■
Pearce Ferry	1,100	120,000	1%	■
Phoenix Deer Valley *	281,124	336,400	84%	□
Phoenix Goodyear *	157,250	276,100	57%	■
Phoenix Sky Harbor International *	537,822	475,000	113%	□
Pinal Airpark	10,368	195,000	5%	■
Pleasant Valley *	48,000	120,000	40%	■
Polacca (NA)	5,300	120,000	4%	■
Rolle Airfield *	4,900	120,000	4%	■
Ryan Field *	157,659	355,000	44%	■
Safford Regional *	14,750	286,700	5%	■
St. Johns Industrial Airpark	15,000	286,700	5%	■
San Carlos Apachel	16,200	285,400	6%	■
San Manuel	1,000	120,700	1%	■
Scottsdale	182,153	294,600	62%	□
Sedona	41,000	276,100	15%	■
Seligman	1,100	120,000	1%	■
Sells (NA)	1,310	130,000	1%	■
Show Low Municipal *	29,170	378,400	8%	■
Sierra Vista Muni/Libby AAF	49,651	367,400	14%	■
Springerville Airport	8,580	286,700	3%	■
Stellar Airpark	41,020	120,000	34%	■
Sun Valley	750	120,000	1%	■
Superior Municipal	400	120,000	0%	■
Taylor	4,800	137,400	3%	■
Temple Bar	1,800	120,000	2%	■
Tombstone Municipal	350	105,900	0%	■
Tuba City (NA)	7,000	120,000	6%	■
Tucson International *	266,428	380,000	70%	□
Tuweep	100	120,000	0%	■
Valle Airport		120,000		
Whiteriver (NA)	1,730	230,000	1%	■
Wickenburg Municipal	18,377	267,000	7%	■
Williams Gateway	228,313	410,000	57%	■
Window Rock (NA)	2,050	120,000	2%	■
Winslow-Lindberg Regional	27,650	286,700	10%	■
Yuma International	172,975	347,600	50%	■

■ Less than 60% of capacity
□ More than 60% of capacity
* Indicates survey information
NA Native American

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ELEMENT FIVE: FORECASTS OF AVIATION DEMAND

5.1 OVERVIEW

Arizona has witnessed tremendous growth over the past 20 years, and the next 20 promise to be filled with equal potential as the State epitomizes "sun belt" attractiveness. The State clearly enjoys an unusually strong mix of recognizable attributes that is nearly impossible to duplicate by other states across the nation. Tourism has been explosive, and business development has anchored the State with a strong outlook supported by growth in international trade.

The metropolitan areas of Phoenix and Tucson carry world-wide name recognition, the Grand Canyon and Colorado River communities remain top draws for tourism, numerous Old West towns perpetuate Arizona's appeal, and the State's diversified climate and scenery create an unmatchable variety of travel experiences. High tech industry has made Arizona its home, and the State remains well balanced with respect to employment mix and diversified sources of activity.

Forecasts of aviation demand have been prepared and are presented in this element to assist in the evaluation of the performance based needs of Arizona's aviation system over the next 20 years. The forecasts are organized in the following manner:

- Air Carrier
  - Enplanements,
  - Operations, and
  - Cargo and Mail.
- General Aviation
  - Registered Aircraft,
  - Based Aircraft, and
  - Based Aircraft Operations.

Previous Arizona Forecasts

Previous state level aviation planning efforts have been documented in Element One, *Introduction, Goals and Objectives, and Review of Existing Plans.* As reported, forecasts of statewide activity were prepared in Volume III of the 1988 State Aviation System Plan, and updated as a part of the 1995 State Aviation Needs Study. These forecasts have been an important source of background information in the development of the SANS 2000 forecasts.

Purpose of Forecasts

The State Aviation Needs Study (SANS) is a determination of the need for aviation investment in Arizona. Essential to that determination are forecasts of growth and the availability of future funds. Forecasts provide the basis for determining the type, size, location, timing, and financial feasibility of aviation facilities development. Consequently, forecasts influence virtually all phases of the system planning process. Because of the importance of the forecasting effort to the planning process, conservatism is important as exponential growth over 10-20 years can lead to unrealistic conclusions.

Philosophy of Forecasting

Forecasting is more than an extrapolation of past trends and the application of statistical measures to relate the future of aviation to the future forecasts of population and economic activity. It requires the application of judgement and an understanding of the market forces that affect and limit growth. Forecasting is particularly difficult for general aviation. Aviation activity is often influenced by the types of airport services offered for transient and based aircraft, and by the general business environment. In addition, factors such as vigorous local airport marketing, gains in sales and services, increased industrialization, changes in transportation mode preferences, or fluctuations in the national or local economy all influence aviation demand. The SANS 2000 demand forecasts are developed in accordance with national trends, and in context with the inventory findings, including local population, per capita income, and employment trends. National aviation trends and forecasts, used to provide a baseline of growth rates, are found in the FAA publication entitled *Aviation Forecast (FY 1998-2009).*

The SANS aviation demand forecasts have been developed using statistical techniques including regression analysis, market-share and trend-line series, as well as from an analysis of the Arizona general aviation pilot population. The statistical methodology was developed as part of the SANS 1995 study.

Exhibit 5-1 graphically provides an overview of the steps involved in forecasting aviation activity.

National Aviation Trends/Projections

Overall, the general aviation segment of the industry is expected to experience moderate growth (1.2% to 1.5%) during the next 10 years, and within the next 3 to 5 years is projected to return to the activity levels (fleet size, hours flown and active pilots) experienced prior to the 1990 general aviation industry downturn. The general aviation fleet, as a whole, is expected to grow in size, with future growth levels approximately proportional with the existing aircraft types (single, multi-piston, turboprop, turbine-jet).

The single-engine general aviation fleet is becoming more sophisticated, with a gradual increase in the fleet size, utilization, and pilot training. The recent infusion of new aircraft technology into general aviation has resulted in improved performance, more reliable and cost-effective single-engine airplanes, as evidence of the manufacturing of new production airplanes and various experimental aircraft.

Due to many factors, today there is a more sophisticated pilot population flying more advanced and demanding aircraft. Factors such as the recent cost escalation associated with recreational flying, coupled with higher liability and taxes for those who own, rent, and operate general aviation airplanes, has, overall, contributed to a higher proportion of business and itinerant aircraft operations relative to local pilot training and recreational activity. This trend has resulted in a reduction in private pilots, and a leveling-off of single-engine general aviation aircraft utilized used for recreational purposes.

EXHIBIT 5-1: ***Aircraft Forecasting Methodology***

DETERMINE CURRENT AIRPORT ROLE WITHIN AIRPORT SERVICE AREA
Inventory of Based Aircraft and Airport Activity
Tabulations of Pilot and Business Interviews and Reports
Statistical Analysis of Service Area Economic and Population Trends

↓

ANALYZE INVENTORY TRENDS AND COMPARE INVENTORY CORRELATIONS TO HISTORIC AVIATION ACTIVITY
Consideration of Local/Regional/National General Aviation Trends

↓

CONDUCT FORECASTS USING STATISTICAL MODELS
Correlation/Regression Analysis
Market Share Analysis
Trend Line Time-Series Analysis
RIMS-II (Induced Impacts)

↓

SELECT PREFERRED FORECAST
Based Aircraft
Annual Aircraft Operations By Aircraft Type/Peaking Characteristics
Aircraft Mix
Instrument Flight Activity
Critical Aircraft Category

↓

AIRPORT FACILITY REQUIREMENTS
IDENTIFY FUTURE AIRPORT REFERENCE CODE (ARC)
Aircraft Wingspan Dimension and Aircraft Approach Speed

↓

PLAN THE FUTURE AIRPORT DESIGN TO ACCOMMODATE THE FORECAST LEVEL OF AVIATION DEMAND AS PER THE FUTURE CRITICAL AIRCRAFT

Source: Aviation Forecast (FY 1998-2009)

There is recent optimism in the general aviation industry. More sophisticated and higher-value single and twin-engine aircraft are being manufactured, along with a corresponding increase in the number of advanced pilot ratings. The used aircraft market has remained strong, more affordable design and navigational technologies are available, experimental aircraft building has proliferated under new FAA certification, and the global sales of smaller general aviation aircraft has increased substantially.

In addition, national legislation passed in 1994 established an 18-year liability horizon for the design or manufacturing of general aviation aircraft and components. Combined, these events are anticipated to stimulate general aviation activity during the 20-year planning period.

Commercial aviation has undergone different dynamics. The structure of the commercial industry has changed, with the initiation of major airline hub-and-spoke operations, increasing numbers of code sharing regional carriers, and the continued success of no-frills operators such as Southwest Airlines and its imitators. Arizona has been in the middle of these changes, with major impacts on Phoenix, Tucson, and the other commercial airports. Phoenix has become the hub for America West, a major point for Southwest, and the focus of regional carriers, both code sharing and non-code sharing. Many of the other airports have become regional spokes for the code sharing carriers. The significant growth in enplanements during the last decade was the result.

5.2 FACTORS INFLUENCING COMMERCIAL SERVICE FORECASTS

In conjunction with SANS 2000, the Arizona DOT Aeronautics Division has been tasked with assessing the state's aviation system based on the outlook for the next five-, ten-, and twenty-year periods. The airline industry has witnessed a virtual restructuring in the 20 years since deregulation in 1978, and current events suggest that many substantial changes are yet to occur. How these changes will impact the cities within Arizona remains to be seen, so projections must be made by using both reasonable and realistic assumptions.

Given the dynamics of commercial aviation, it is critical to consider the key factors that impact passenger levels and airline operations today and into the future. In general, there are two extreme approaches to forecasting, the first being the true macro-level projections being made on a nation-wide level. These forecasts employ macro-economic factors such as growth in real GDP, propensity-to-travel factors, airline capacity expansion, disposable income, etc.

At the other end of the spectrum, detailed forecasts can be made for specific routes, by airline and by specific aircraft type. Airline planners are continually involved in this level of forecasting as they examine new route opportunities or perform analyses of aircraft fleet operations.

To meet Arizona's needs and provide guidance and direction for future planning, the SANS 2000 forecasts need to be somewhere in between. True macro projections tend to rely heavily on statistical modeling and trend analysis, often linked to nation-wide assumptions regarding growth of capacity and airline travel. Arizona's cities and commercial services probably won't follow simple national trends, nor will their futures be a simple extrapolation of their past experiences. Micro approaches will also fail to provide adequate planning guidance, since the exactness of

this method requires very specific assumptions that have a very short shelf life given changes in aircraft technology, mergers between airlines, and other significant factors.

To provide long-term forecasts that add value to the planning process, a balance between top-down and bottom-up approaches has been used. Each community deserves an independent review of air service opportunities, and ADOT requires information that is consistent with changes in the airline industry. For these reasons, forecasts were prepared reflecting the following factors.

Basic Categories of Airport and Community

Airports and their respective communities fall into approximately five or six basic categories on a widespread basis. Experience with markets across the nation suggests that within each category similar characteristics exist, as do similar challenges regarding the attraction and development of commercial air service. Likewise, the long-term outlook may also be similar within each category, reflecting unique factors that impact service and passenger activity.

Table 5-1 summarizes these categories, showing general characteristics and the factors that influence long-term expectations. For example, Phoenix Sky Harbor is listed as an international gateway, serving as a hub operation for major airlines. Phoenix shares many similarities with other hub cities, including facility constraint challenges, location in the state's largest metro area, and an ability to draw passengers who drive from smaller communities within the region. Although the mix of airlines is much different, Minneapolis-St. Paul International will largely be affected by many of the same factors long into the future, as will several other hub city airports.

At the other end of the scale, a market like Kingman also shares many traits with its peers across the nation. These cities suffer from loss of passengers driving to other airports, "competition" from other communities that are nearby (such as Laughlin-Bullhead), relatively small population masses that dictate the use of smaller turboprop aircraft, and challenges from airlines who have been systematically upgrading their fleets to larger planes. Communities in this category are facing challenges at an increasing rate even today, trying to solve current deficiencies in commercial air service through whatever creative means they can muster.

In the end, a forecast is not a personal statement of each community's relative value in the world of commercial air service - it is a summary of the challenges and factors that influence many cities in similar ways, tailored for the uniqueness of each individual situation.

TABLE 5-1: ***Commercial Airport Categories***

Category	City	Characteristics	Outlook/Forecast Factors
International Gateway	Phoenix	- Major Hub Operations - International Service - Draws drive traffic from smaller communities	- Facility Constraints - Bilateral Agreements - Airline Maturity - Local vs. Connecting Traffic - MSA Growth (Pick scenario consistent with matching factors)
Major Metropolitan	Tucson	- Strong Domestic Traffic - Multiple Carriers - Multiple Hub Services - Some Point to Point Services - Not Feeder Dependent	- Some Facility Issues - Proximity to Competition - Airline Maturity - New Route Opportunities (Possible strong growth)
Regional Commerce Centers	Flagstaff Yuma	- Possible Single Hub Today - Prop & Jet Mix Likely - Multiple Hubs in Future	- Geography - Fleet Decisions - Leakage Trends - Corporate Activity - "Tag" Operations (Guarantee of future service - More "upside" than "downside")
Small and Rural Community	Show Low Lake Havasu Prescott Sierra Vista Kingman	- Regional Service Only - "Tag" Service to Single hub - Some EAS contracts - Seasonal Markets - Tag Dependent - Often Single-Hub Service	- Vulnerable to Carrier Fleet decisions - Excessive Leakage - Carrier Reliability/Completion Factor - Alternative Transportation Modes - Proximity to Alternative Air Service - Small mass overshadows strong - business travel/high yield traffic (Results could hinge proactive efforts of community leadership)
Destination Markets	Grand Canyon Bullhead City Page	- Traffic and/or Service: - Not related to population - Primarily "in-bound" - Group Travel - Short Stays - Low Fares/Yield - Seasonal Influences	- Challenges to attracting scheduled service - Periodic charters - Tour packaging - Hotel accommodations

Source: Kiehl-Hendrickson Group - 2001

Population vs. Passengers

As a rule of thumb, it is common to expect that annual passenger enplanement demand for a given city is approximately equal to the population base being served. This one-to-one ratio is not true for all markets, but serves as a test of reasonableness across the industry. Results tend to follow the logic that a larger population base creates more passenger activities, unless factors in the environment alter that relationship.

Table 5-2 provides some examples of mid-sized markets whose populations range from approximately 100,000 to 300,000. As expected in a normal distribution of markets, some produce relatively few passengers for their size, while others clearly exceed the one-to-one relationship. One example of high passenger volumes in this group of cities is Amarillo, Texas, which enjoys some low-fare airline service and the stimulative affect that follows.

TABLE 5-2: ***Population vs. Passenger Enplanements***

City	MSA Population	Enplanements	Enplanements Per Capita
Peoria, IL	346,000	218,272	0.63
Appleton, WI	342,000	261,259	0.76
Huntsville, AL	330,000	495,474	1.50
Evansville, IN	290,000	246,686	0.85
Savannah, GA	285,000	693,871	2.43
Duluth, MN	239,000	104,028	0.44
Green Bay, WI	215,000	324,783	1.51
Ashville NC	212,000	277,731	1.31
Amarillo, TX	210,000	434,821	2.07
Springfield IL	205,000	84,903	0.41
Burlington VT	192,000	427,897	2.23
Cedar Rapids, IA	182,000	442,257	2.43
Champaign, IL	168,000	138,845	0.83
Fargo, ND	167,000	119,223	0.71
St. Cloud MN	161,000	19,732	0.12
Sioux Falls, SD	157,000	340,068	2.17
Charlottesville, VA	145,000	160,230	1.11
Bloomington IL	141,000	173,091	1.23
Wichita Falls, TX	137,000	53,397	0.39
Texarkana, AK	127,000	35,099	0.28
Sioux City, IA	122,000	89,822	0.74
Rochester, MN	114,000	154,877	1.36
Grand Forks, ND	104,000	84,944	0.82
Bismarck, ND	91,000	119,223	1.31
Dubuque, IA	89,000	41,719	0.47
TOTALS	**4,771,000**	**5,542,252**	**1.16**

Source: FAA Air Traffic Activity (0 thru 2000)

It should be noted that this one-to-one relationship is only an initial baseline, and is dependent on a community's ability to attract and retain satisfactory air service that meets the needs of business and leisure travelers. Many smaller communities struggle with this retention, as addressed by the following discussion.

For purposes of the SANS 2000 project, population projections were taken from the Arizona Department of Economic Security (DES). These forecasts are for incorporated cities, and growth rates were applied to metropolitan statistical areas where applicable for purposes of calculating enplanements per capita.

Traffic Leakage To Other Airports

Traffic "leakage" is defined as passengers who drive to another airport to begin their travel. If passengers drive from Page to Flagstaff, for example, and fly out of Flagstaff, this behavior understates the true demand from Page, overstates the demand from Flagstaff, and can influence airline planning decisions regarding service levels to both communities. Leakage tends to be more common in the smaller communities, primarily because local air service is not as attractive

to consumers as it might be from larger cities within driving distance. Local air fares and add-on amounts are also influencing factors.

Although leakage is more common in smaller cities, the following table (Table 5-3) shows that leakage occurs in a wide variety of markets across the country.

TABLE 5-3: ***Air Passenger "Leakage"***

Airport	Enplanements	Retention Rate
GRI(Grand Island, NE)	15,744	12%
GON (Groton-New London, CT)	16,190	3%
BRL (Burlington, IA)	18,996	21%
RHI (Rhinelander, WI)	35,700	41%
CAE (Columbia, SC)	117,000	78%
CMI (Champaign, IL)	125,134	49%
AVP (Wilkes Barre-Scranton, PA)	212,063	62%
AVL (Asheville, NC)	283,146	60%
SAV (Savannah, GA	635,209	74%

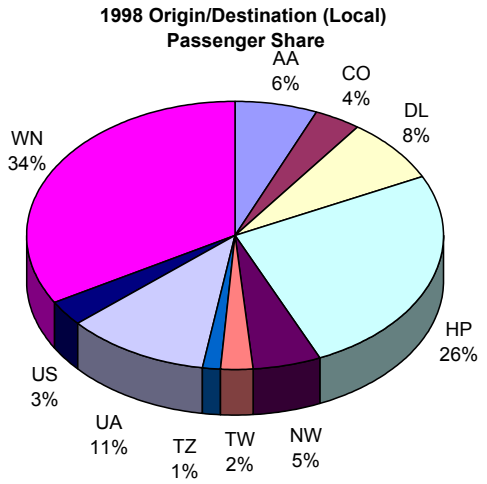
Source: Kiehl-Hendrickson Group - 2001

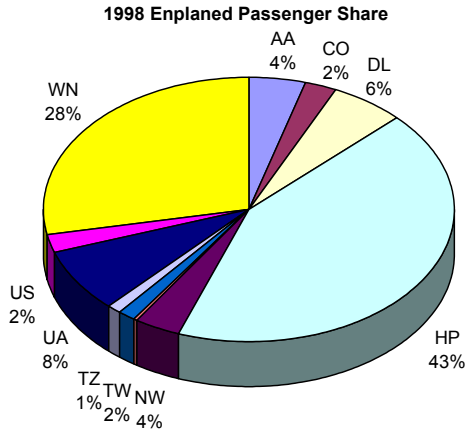
The "Phoenix Factor"

In addition to leakage between such cities as Kingman-Bullhead or Page-Flagstaff, major hub operations such as Phoenix tend to act as a regional magnet and draw passengers who drive from outlying regions of the state. Again, Arizona is not unique in this regard, as many other states witness similar patterns. Denver, Minneapolis, Detroit, Chicago, St. Louis, and Seattle each serve as air service anchors that offer hundreds of flights and nonstop destinations for both local consumers and passengers who choose to drive from the surrounding areas.

Phoenix, and to a much lesser extent Tucson, offer the additional uniqueness of being host to a very large presence of low-fare airline operations. Low fares, combined with high frequency, a multitude of destinations, and good jet service provide a very strong incentive for passengers. Exhibit 5-2 highlights the situation at Phoenix Sky Harbor.

EXHIBIT 5-2: ***Phoenix-Sky Harbor Passenger Share***





Source: Kiehl-Hendrickson Group - 2001.

Airline Aircraft Issues

In the 20 years since deregulation, "commuter airlines" have grown up to become Regional Airlines. These carriers once operated small propeller aircraft, and gradually upgraded their fleets to larger and larger equipment. Today, some have completely abandoned 19-seat aircraft entirely, opting for advanced turboprops with 30-37 seats. With the advancements in technology, regional jets of 35-70 seats have emerged as having viable operating and cost performance, and these jets are coming into the market at a rapid pace.

The good news about regional jets is that small jets are coming into the market. Over 600 of these jets have been ordered by U.S. carriers within the last three years, at values of over $12 billion. As the manufacturers fight to keep up with demand, airlines are taking delivery as fast as possible.

However, at prices of $15-$20 million PER aircraft, these jets are not generally being allocated to small markets as turboprop upgrades. In fact, as the regional airlines retire the small turboprops, smaller communities are witnessing either stagnation or actual declines in service. Although Mesa Airlines remains one of the few regionals focused on a 19-seat operation, it is unclear whether the overall trend toward larger aircraft will also impact Arizona's communities.

Table 5-4 illustrates the approximate economics of operating 19-seat aircraft, along with estimates of upgrading to larger mid-30 seat turboprops.

TABLE 5-4: ***Estimated Aircraft Economics***

	19 Seats	34 Seats
Trip Mileage	200	200
Available Seat Mile (ASM)	3,800	6,800
Trip Cost	$1,000	$1,400
Cost/ASM (cents	.26	.21
Cost/Seat	$ 53	$ 41
Annual Cost (3 daily round trips)	**$2.0 mil**	**$2.8 mil**

Source: Kiehl-Hendrickson Group - 2001

While the operating economics of the smallest commercial jets are not yet clear, it is true that airlines are allocating these jet aircraft to markets that can support the service. Beyond smaller, relatively remote communities that are not within reasonable drive distances of major airline hubs, the list quickly moves to cities of 200,000 or more, suggesting that only markets such as Flagstaff and Yuma will emerge as future candidates, even when used jets are available in the future. Table 5-5 identifies some additional markets nationwide that are currently served by regional jets.

TABLE 5-5: ***Small Markets Served by Regional Jets***

City	Population (000)	City	Population (000)
Helena, MT	53	Evansville, IN	290
Butte, MT	54	Boise, ID	377
Casper, WY	65	Appleton, WI	342
Missoula, MT	90	Des Moines, IA	429
Pasco, WA	93	Chattanooga, TN	448
Billings, MT	126	Kalamazoo, MI	450
Cedar Rapids, IA	182	Columbia, SC	493

Source: Kiehl-Hendrickson – Group - 2001

Several aircraft assumptions have been made to address the 20-year forecast period. Aircraft of 19 seats are assumed to remain in the fleet of airlines such as Mesa/America West Express to serve small communities. This assumption is consistent with Regional Airline Association (RAA) projections, which note that while 19-seaters will diminish in relative numbers, there will still be a role for such aircraft. It is also assumed that regional airlines will operate and expand their 30-37 seat turboprop fleets throughout the forecast period. Finally, with nearly 700 regional jets having already been ordered by U.S. carriers within the last two years and approximately the same number on option, it is anticipated that operations of these jets will continue to expand rapidly over the next decades. These aircraft will be more widely dispersed, to include regional commerce centers such as Flagstaff and Yuma.

The Role of Proactive Business Efforts

Cities all over the world have long fought to land new businesses of every kind. Aggressive economic development is a common way of life, and hardly a day goes by that the news does not contain information about efforts being made to bring in new business or industry.

The one common thread to these stories centers around the economic impact that will result. New jobs, increased taxes, multiplier spending, and all of the rest of the items on the list are cited as reasons for heavy recruitment efforts. Only in the last several years did communities begin, on a wide-spread basis, to recognize this same economic impact that is associated with airline service.

There appears to be three primary categories of benefits pertaining to additional air service:

1. Airport-specific benefits (airline revenues, concessions spending, funding and debt impact)
2. Competitive balance benefits (multiple suppliers, increased choices, less concentration)
3. Impact to the community (jobs, business expansion, visitor access, tourism impact, community recognition)

As a result of this increased acknowledgement and recognition of economic impact, there is increased competition between communities for scarce airline assets. Therefore, business leaders and airport officials are taking proactive actions to retain or expand commercial air service into their cities. The following examples show what some communities have outlined as challenges, and what types of actions they have taken.

TABLE 5-6: ***Air Service Challenges and Solutions***

CHALLENGES	
City	**Objective**
Mobile, Alabama	Compete with Pensacola, Panama City, & Gulfport/Biloxi
Waterloo, Iowa	Upgrade Northwest service to jets
Amarillo, Texas	Keep American jet service connections via DFW
Jackson, Mississippi	Attract ValuJet; compete with multiple cities
Newport News, Virginia	Attract additional service; compete with Norfolk & Richmond
Columbia, South Carolina	Become the base of operations for Air South
Vail, Colorado	Attract winter (and summer) visitors
St. Louis, Missouri	Support TWA during period of weakness
Sioux City, Iowa	Upgrade Northwest service to jets
Las Vegas and Reno, Nevada	Increase air service and visitor levels
SOLUTIONS	
City	**Plan**
Mobile, Alabama	Incentive package & private sector funding to attract new carrier
Waterloo, Iowa	Established Cedar Valley Jet Set program as a community support mechanism
Amarillo, Texas	Established Economic Development Corp; guaranteed payments
Jackson, Mississippi	Guaranteed funds; long-term advertising support
Newport News, Virginia	Industrial Development Authority made investment commitment
Columbia, South Carolina	City & State invested in airline start-up and operating headquarters
Vail, Colorado	Guaranteed financial support through Vail Associates group
St. Louis, Missouri	Established "Civic Progress" committee; pre-purchased tickets
Sioux City, Iowa	Provided advertising support; reduced and/or waived airline fees
Las Vegas and Reno, Nevada	Supported launch of new airline

Source: Kiehl-Hendrickson Group – 2001

In the end, the ability to attract and retain service in Arizona's communities could very well be influenced by local efforts linked to economic development. Such efforts have been shown to make a difference. For purposes of forecasting, an assumption must be made that reasonable support will exist; not record-setting subsidy contracts to bring in airline service, but not total complacency with respect to airline service opportunities. Consumers must recognize the value of access to local airline service, and recognize the challenges of attracting and retaining those services.

Service Level Build-Up Assumptions

Traditional top-down forecasting approaches provide one means of examining long-term expectations for passenger volumes and airline operations. However, extrapolation of trends or sole reliance on macro factors can produce an unrealistic picture that does not provide adequate guidance and direction for planning.

Ultimately, every airport's future passenger levels are linked to the specific airline services being provided. An estimate of 50,000 enplanements or 5,000 commercial aircraft operations doesn't have any value to the planning process unless those numbers can be meaningfully tied to realistic airline operations with real aircraft options that are matched to the size of the market.

For example, a recent evaluation of mid-west markets concluded that regardless of historical trends, the combination of geography, distance to airline hubs, availability of aircraft, and airline fleet decisions created a fairly narrow range of forecasts. For this reason, long-term projections for Arizona's communities are being examined from an airline planning perspective, given reasonable assumptions with respect to the shape of the industry over the next 20 years.

5.3 INTERNATIONAL GATEWAYS: Phoenix

Only Phoenix Sky Harbor fits the category of International Gateway:

Category	City	Characteristics	Outlook/Forecast Factors
International Gateway	Phoenix	- Major Hub Operations - International Service - Draws drive traffic from smaller communities	- Facility Constraints - Bilateral Agreements - Airline Maturity - Local vs. Connecting Traffic - MSA Growth- (Pick scenario consistent with matching factors)

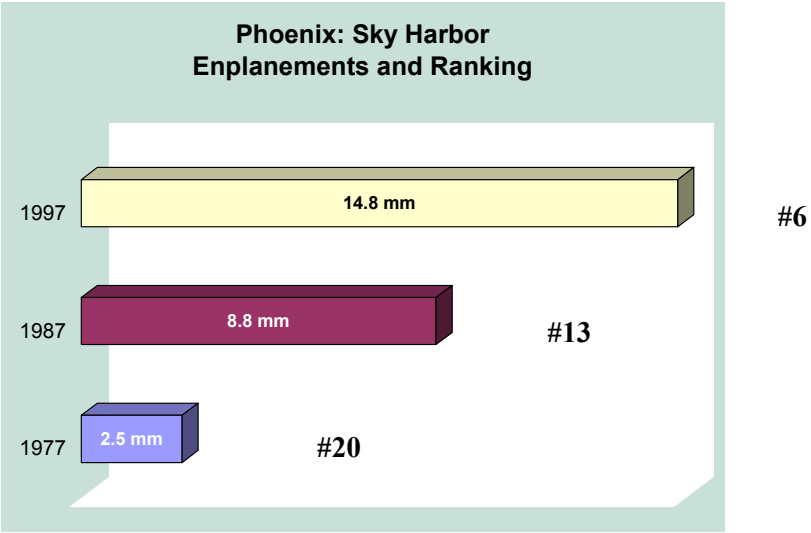
Source: Kiehl-Hendrickson Group - 2001

Buoyed by the rapid pace of sun belt growth and a mix of major employers that includes such corporations as Motorola, Intel, Allied Signal, and American Express, the Valley of the Sun continues its fast rate of expansion. Without question, the Greater Phoenix metro area has emerged as a leading commerce center for the southwest and for the nation as a whole.

From the airport perspective, Phoenix witnessed explosive increases in passengers and air service levels that outpaced the industry in the 20 years following deregulation in 1978. After Hughes AirWest merged with Republic Airlines, the newly-formed America West launched service from its headquarters in Phoenix. As the years went by, rapidly-growing Southwest Airlines also created a substantial franchise in the Valley, making Phoenix home to one of the strongest concentrations of low fare service in the U.S.

Exhibit 5-3 highlights a 20-year snapshot of Sky Harbor's enplanements. Most noteworthy is not only the traffic growth, but the relative ranking that has moved from the 20th largest airport in the nation to number 6 by 1997.

EXHIBIT 5-3: ***Sky Harbor Enplanements and Ranking***



Source: Kiehl-Hendrickson Group - 2001

In addition, traffic to and from Phoenix is widely distributed geographically, supporting nonstop airline services to virtually all domestic business centers and airline hubs. Part of the explosive traffic growth has resulted from the build-up of services in recent years to such markets as Washington, D.C., New York, and Florida destinations.

TABLE 5-7: ***Phoenix – Area Passenger Traffic, 1998***

	Annual Origin & Destination
Short-Haul, West Coast	5,398,910
Western Region	3,512,960
Mid-Continent	3,297,090
Upper Midwest/Ohio Valley	4,075,970
East Coast/Florida	3,452,210

Source: Kiehl-Hendrickson Group - 198

Reflecting on the factors that will influence Sky Harbor's traffic and service outlook over the next 20 years, the baseline forecast previously established by the Maricopa Association of Governments (MAG) creates a well-researched foundation. The MAG year-to-year growth rates appear consistent with expectations and market conditions.

Existing forecasts do appear to acknowledge the long-term opportunities and challenges of major airports in general and for this specific situation. The following additional factors will ultimately influence Sky Harbor's commercial service activities.

Headquarters and Base of America West Airlines

America West is categorized as a U.S. major airline, with annual revenues of nearly $2 billion and a fleet of approximately 110 jet aircraft. With headquarters in Tempe, America West is not only one of the predominant carriers at Sky Harbor, but a major employer in the Valley.

Current trends in the airline industry point to more and more consolidation, alliances, and potential mergers. America West has enjoyed years of success as an independent carrier, but alliances with Continental or others have been widely discussed. Within the last year, a potential acquisition of America West by United Airlines was widely publicized. Although no transaction resulted, America West's presence could be a key factor that impacts the Phoenix projections. Assumptions must be made at this time that America West will continue to operate on its current course, with no substantial change in direction or geographic focus away from the Phoenix market.

Southwest Airlines

Although Dallas is headquarters for Southwest, the over $4 billion airline holds a presence in Phoenix equal to America West. Both of these airlines have launched new routes, and Southwest clearly remains in a pattern of growth that at least doubles the rest of the major airlines.

Both airlines have already reached very strong levels of service to and from Phoenix, and rates of expansion will likely slow in the years ahead simply due to the fact that most of the major volume markets have already seen the introduction of service by one or both of these carriers.

Land, Facilities, and Growth Constraints

Clearly, Phoenix Sky Harbor has experienced growth that other major airports may never achieve. However, many factors are conspiring to constrain the airport from similar runaway growth in the future. Among the issues examined by local newspapers or other sources are the following:

- Sky Harbor now ranks third worst in the nation in departure delays caused by airport conditions, led only by Newark and LaGuardia. Delays were said to have more than doubled in 1998, up 121% and faster than any other U.S. city.
- Urban air pollution delayed more flights at Sky Harbor in 1998 than did weather in "soggy Seattle" or "smoggy Pittsburgh."
- Parking continues to be a factor, creating more pressures for off-site options.
- Noise also is a growing issue, with residents of Tempe (to the east of Sky Harbor) increasingly voicing complaints and concerns.
- The third parallel runway, a $176 million project that includes relocation of Air National Guard and aircraft hangars, will relieve some of the current pressures and absorb some level of future increases in aircraft operations. Congestion from general and corporate aviation continues to be a challenge.
- Plans for a fourth runway have been grounded. Allied Signal, Arizona's third largest employer, would be required to relocate from the airport location that it has operated for almost 50 years, and other suitable locations apparently do not exist on airport property.

Having now reached a position as the fifth-busiest airport in the nation based on number of flights, Sky Harbor will have to find creative ways to address its challenges if it is to accommodate continued high-growth expansion. Already, 24th Street is being scheduled for realignment to make room for runway extensions, 12 new gates are being added at Terminal 4 for America West, and work is under way on aprons, parking, and runway projects. In the final outlook, Sky Harbor's ability to deal with its constraints has put it in charge of its own ability to reach projections.

Emergence of Williams Gateway Airport

Williams Gateway is located southeast of Sky Harbor, and has completed the transition from the former Williams Air Force Base to a commercial operation with oversight from the cities of Mesa, Queen Creek, Gilbert, and the Gila River Indian Community. Gateway's advantages include an active Reuse Plan, three runways (10,400, 10,200, and 9,300 feet), and more than 4,000 total acres with sites offering apron access.

Officials from Williams Gateway have met with Sky Harbor leaders, and openly discussed future options and opportunities. Over the life of the 20-year forecast period, Williams Gateway Airport will no doubt emerge as a commercial service alternative to complement Sky Harbor. Many other large metropolitan areas already successfully support more than one commercial service airport, including Chicago, Dallas-Ft. Worth, and Houston, as well as the Los Angeles area, Bay Area, Washington area, etc.

While no formal air service forecast is included for Williams Gateway, this new commercial airport could, at the very least, witness the development of major cargo, corporate, and general aviation activities that allow Sky Harbor to absorb more long-term passenger growth.

International Service

The growth in global commerce has paved the way for an expanding list of open skies agreements between the U.S. and other nations. Even where true open sky agreements are not in place, bilateral agreements are allowing an increasing number of gateway cities to obtain international services.

Sky Harbor, for its part, has seen the introduction of nonstop service to London, and Phoenix's role as Arizona's premier international gateway should provide for additional opportunities in the future. Service to Mexico and Canada have certainly witnessed expansion, and it is likely only a matter of time before service to Asia will emerge to support high-tech industry and international business and leisure demand.

Scottsdale Airport

As the City of Scottsdale has grown, so has the airport. With origins as a military training airstrip, Scottsdale Municipal Airport has emerged as home to one of the Valley's main employment hubs, the Scottsdale Airpark. Proximity to the airport has made the 2,600 acres a very attractive business development center, where about 20,000 people are now employed.

Primarily serving general and corporate aviation, Sunrise Airlines has recently been operating a 19-seat Beechcraft between Scottsdale and the Grand Canyon. Whether this operation suggests that Scottsdale will attract commercial airline services in the future remains in question. Clearly, residents of the Scottsdale area and those reaching the northern and eastern growth areas are closer to Scottsdale than Sky Harbor.

However, low fares, jet aircraft, and high frequencies still make Sky Harbor the airport of choice for most of the Valley, and Scottsdale's relative inability to support larger operations will likely limit its venture into commercial service. In any event, future commercial flights at Scottsdale will not impact Sky Harbor's outlook, challenges, or planning process. What is more likely is that general aviation and corporate aviation that uses Phoenix - Sky Harbor today will gradually shift to the other Valley airports, including Scottsdale.

Valley of the Sun: Population and Growth Comments

The Valley's growth has often far exceeded expectations, and metro area expansion is projected to continue. Although the Arizona DES forecasts are for individual cities, a metro composite was built using Phoenix, Scottsdale, Tempe, Mesa, and other surrounding communities. Since suburbs often grow at faster rates than core cities, the MSA as a whole is projected to expand at a slightly faster rate than just Phoenix proper.

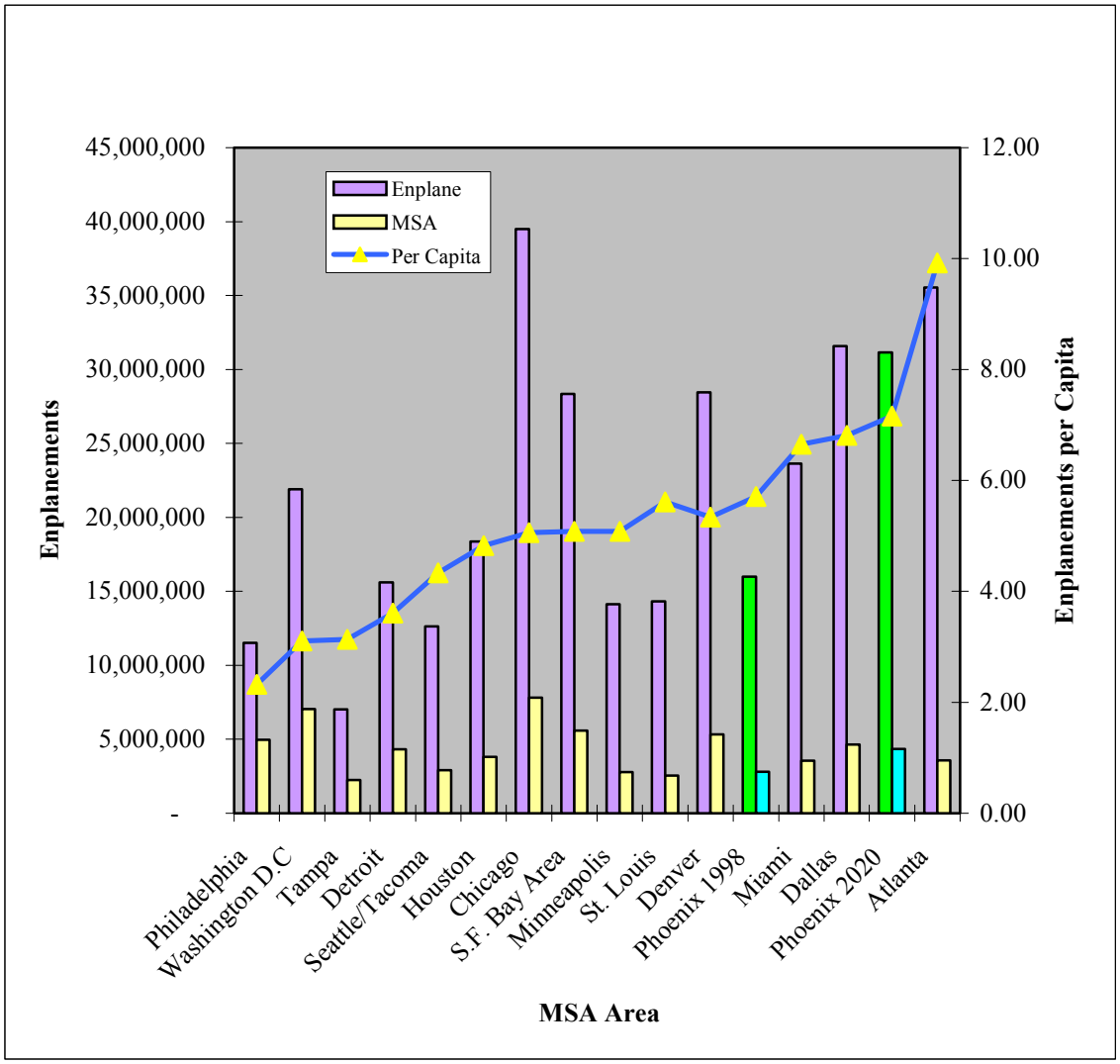
Using these metro area projections, the Valley is expected to reach a population of approximately 4.4 million by the year 2020. Applying passenger growth rates from the SANS95/MAG forecasts, enplanements would reach a level exceeding 31 million during the same period of time.

To put these passenger forecasts in perspective, the 31 million would represent over seven times the area's metro population, up significantly from the current level of 5.71 times population. As a test of reasonableness, Exhibit 5-4 shows current large metropolitan areas, many of which are currently the approximate size that the Valley is projected to become by 2020.

1998 enplanements are also shown on Exhibit 5-4, as are the enplanements per capita. Washington-Baltimore, Tampa-St. Petersburg, Detroit, Seattle-Tacoma, and Philadelphia all produce less than 4.0 annual enplanements per capita. The San Francisco Bay Area, Houston, Chicago, Minneapolis-St. Paul, and St. Louis are in the range of approximate 5 passengers per capita. Finally, Miami-Ft. Lauderdale, Denver, Dallas, and Atlanta (the busiest airport in the U.S.) all witness higher per capita figures. In fact, Atlanta's massive Delta Airlines hub helps that airport achieve nearly 10 passengers per capita. As the old saying once noted, "all flights lead to Atlanta."

To summarize, the Phoenix metro projections are certainly robust, particularly when compared to other large cities. The 2020 per capita projections for Sky Harbor would rank 3rd on this list of 16 major metropolitan areas, falling behind only Atlanta and Denver. Given that both America West and Southwest have already developed large franchises from Phoenix – Sky Harbor, it may be that growth rates diminish significantly since so many markets have already seen the introduction of high levels of service. Today, for example, over 90 daily departures (in each direction) exist between Phoenix and the Los Angeles basin. Critical mass has already been established, and high projections are dependent on an increasing propensity to travel among consumers, combined with the solving of facility and operating constraints by Sky Harbor itself over the forecast period.

EXHIBIT 5-4: ***MSA Comparison***



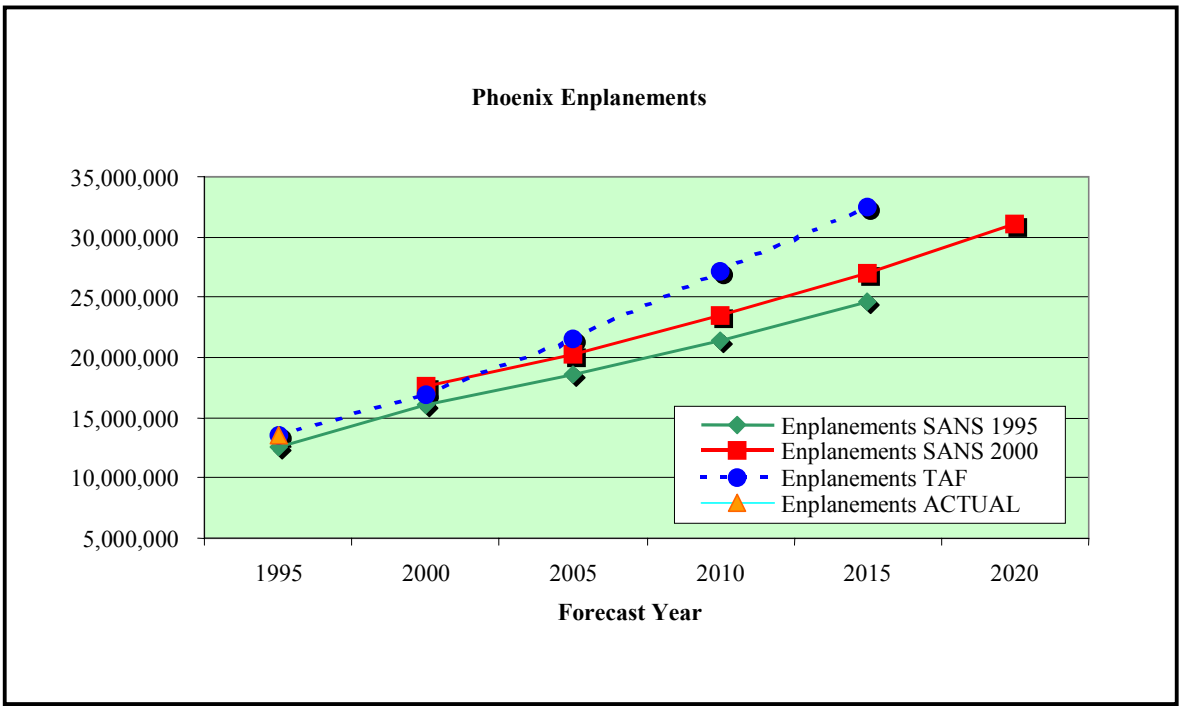
Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-5: *Phoenix Potential Service Levels*

	1998	1999	2000	2005	2010	2015	2020
Projected City Population*:	1,238,120	1,263,895	1,289,125	1,419,813	1,544,093	1,671,489	1,795,539
		2.1%	2.0%	1.9%	1.7%	1.6%	1.4%
MSA:	2,798,800	2,860,533	2,931,970	3,285,860	3,739,371	4,057,209	4,348,248
		2.2%	2.5%	2.3%	2.6%	1.6%	1.4%
SANS95/MAG Enpl Fcst:	na	na	16,114,055	18,572,040	21,407,040	24,674,798	na
			5.1%	2.9%	2.9%	2.9%	
SANS 2000 Enpl Fcst:	15,984,620	16,793,442	17,643,630	20,334,932	23,439,034	27,016,974	31,141,082
		5.1%	5.1%	2.9%	2.9%	2.9%	2.9%
Enplanements per Capita:	5.71	5.87	6.02	6.19	6.27	6.66	7.16
SANS95/MAG Ops Fcst:	na	na	352,188	413,762	439,191	461,594	na
			3.3%	3.3%	1.2%	1.0%	
SANS 2000 Ops Fcst:	452,234	458,045	473,046	552,070	583,109	615,894	650,521
		1.3%	3.3%	3.3%	1.2%	1.0%	1.0%

1. Year to year percent changes are shown. For five year increments, the rate shown is a compound annual growth rate.

2. 1998 enplanements and operations data provided by the Arizona Department of Transportation.



Source: Kiehl-Hendrickson Group – 2001

- MAJOR METROPOLITAN CITIES: Tucson

Following the discussion of Phoenix, Tucson remains as the only other major metro area in the state:

Category	City	Characteristics	Outlook/Forecast Factors
Major Metropolitan	Tucson	- Strong Domestic Traffic - Multiple Carriers - Multiple Hub Services - Some Point to Point Services - Not Feeder Dependant	- Some Facility Issues - Proximity to Competition - Airline Maturity - New Route Opportunities (Possible strong growth)

Source: Kiehl-Hendrickson Group – 2001

Categorized in this market assessment as a major metropolitan area, Tucson is not a true airline hub but, nevertheless, has a substantial number of commercial services. Anchored by several of Arizona's top employers, Tucson has followed a growth path similar to the greater Phoenix area, albeit on a smaller population and employment scale. The Pima Association of Government (PAG) analysis has also been used as a cross-check with SANS95 data, already recognizing the many factors that will keep Tucson at the forefront of commercial service growth as a non-airline hub airport serving a wide region of Arizona.

Tucson's Business Rankings – Arizona's Top Employers

Ranking	Company	Description
9	Raytheon Missile Systems	Tactical Missile Manufacturer
24	Carondelet Health Network	Hospitals
35	TMC Healthcare	Hospital
40	BHP Cooper Inc.	Copper Mining and Refining
42	ASARCO Inc.	Copper Mining
69	American Airlines	Airline
77	Bombardier Aviation Services	Aircraft Manufacturing & Service
92	Burr-Brown Corp	Integrated Circuits Manufacturer
93	First Data Teleservices	Telecommunication Center
98	Unisource Energy Corp	Electric Utility

Source: Kiehl-Hendrickson Group - 2001

Going forward, Tucson has witnessed the initial foray into what some have called the next multibillion-dollar industry, already gaining 80 optics-related companies. With the University of Arizona providing the foundation for one of the world's hottest business sectors, the city is primed to become a center for optical sciences and the rapid business expansion associated with new technologies.

Assuming that the Tucson metro area continues to grow over the foreseeable future, the current population of nearly 775,000 should easily reach one million and higher. Cities within this population range today are shown in Table 5-8, along with their 1998 enplanements. Note that these cities are not airline hubs, and, therefore, their enplanements are not reflecting high numbers of connecting/transit passengers. Clearly, the markets that enjoy low fare airline service, including Nashville, Austin, and Jacksonville, have witnessed a much greater level of passenger activities, and Tucson's growth will likely see more low fare services in its future.

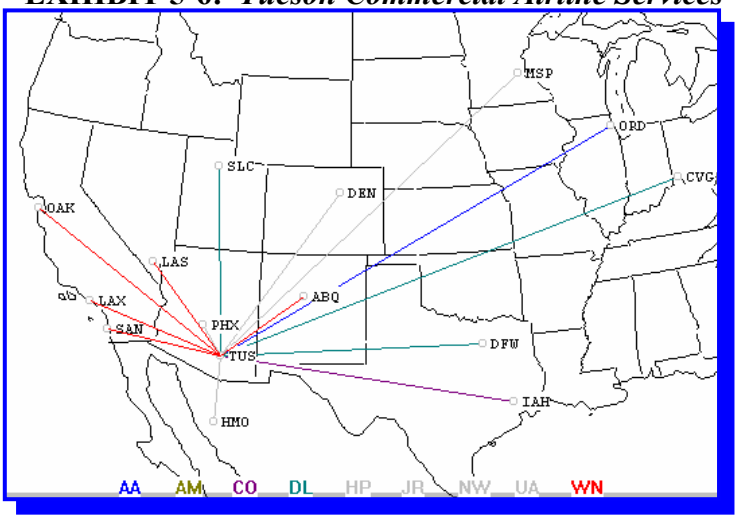
TABLE 5-8: ***Example Enplanements/Major Metro Areas***

	MSA	1998 Enplanements	Enplanements Per Capita
Greensboro	1,148,700	1,274,000	1.11
Nashville	1,128,400	3,907,000	3.46
Hartford	1,112,600	2,753,000	2.47
Austin	1,044,600	3,042,000	2.91
Oklahoma City	1,030,000	1,727,000	1.68
Jacksonville	1,025,600	2,304,000	2.25
Grand Rapids	1,021,200	896,000	0.88
West Palm Beach	1,001,100	2,931,000	2.93
Louisville	995,400	1,842,000	1.85
Dayton	949,600	1,088,000	1.15
Richmond	937,400	1,261,000	1.35
Providence	905,600	2,271,000	2.51
Total	**12,300,200**	**25,296,000**	**2.06**
TUCSON	**774,200**	**1,743,000**	**2.25**

Source: Kiehl-Hendrickson Group - 2001

Finally, Tucson's current commercial airline services, shown in Exhibit 5-6, highlight a core that is strong and growing. Tucson's level of service, shown in Exhibit 5-7, will continue to influence the southern part of Arizona, serving as a primary air service alternative for the southeastern and south-central communities that cannot generate the critical mass to attract their own services.

EXHIBIT 5-6: ***Tucson Commercial Airline Services***



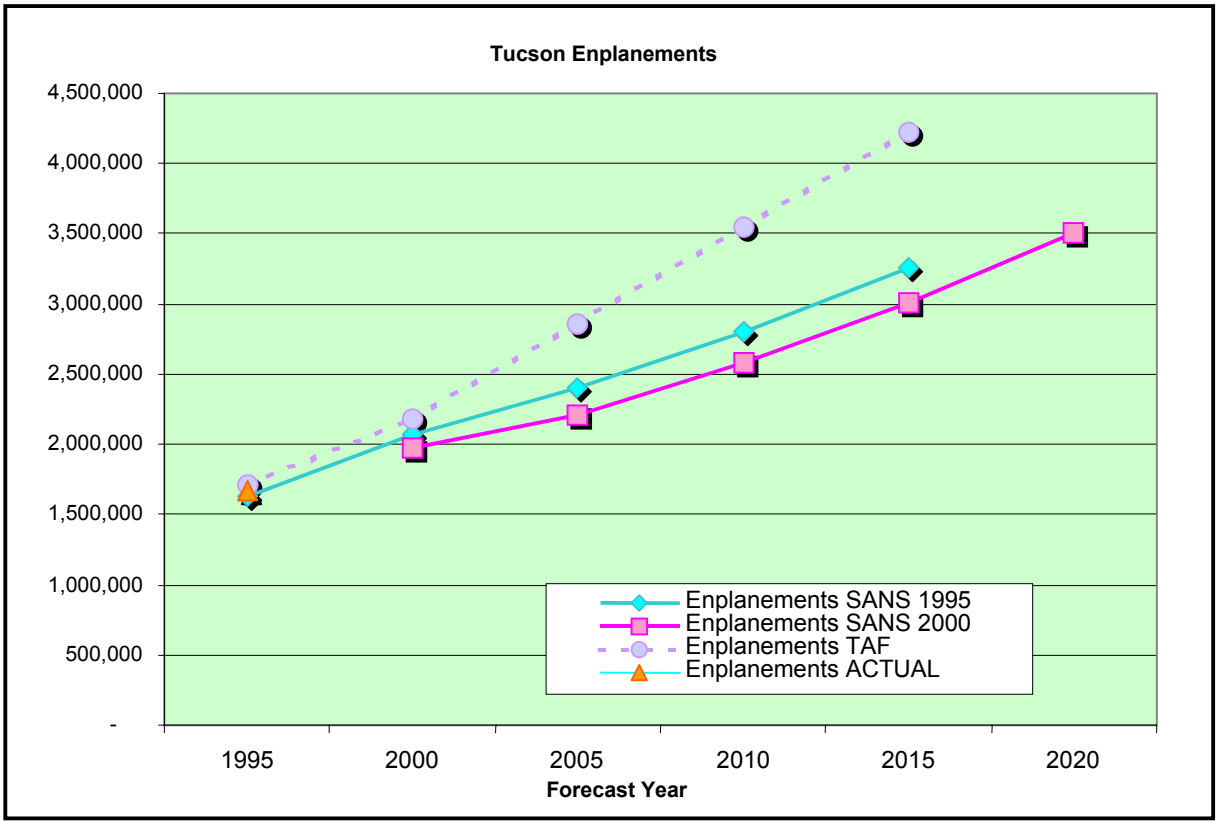
Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-7: *Tucson Potential Service Levels*

	1998	1999	2000	2005	2010	2015	2020
Projected City Population*:	461,001	467,455	474,467	510,108	540,307	565,736	589,899
		1.4%	1.5%	1.4%	1.2%	0.9%	0.8%
MSA:	774,200	785,039	796,815	856,669	907,386	950,091	990,670
		1.4%	1.5%	1.4%	1.2%	0.9%	0.8%
SANS 1995 Enpl Fcst:	na	na	2,075,000	2,400,000	2,797,282	3,260,328	na
			5.0%	3.0%	3.1%	3.1%	
SANS 2000 Enpl Fcst:	1,735,118	1,822,516	1,914,328	2,214,162	2,580,682	3,007,872	3,505,778
		5.0%	5.0%	3.0%	3.1%	3.1%	3.1%
Enplanements per Capita:	2.24	2.32	2.40	2.58	2.84	3.17	3.54
SANS 1995 Fcst Ops:	na	na	51,578	65,828	76,313	88,898	na
			2.0%	5.0%	3.0%	3.1%	
SANS 2000 Fcst Ops:	46,696	47,630	48,583	62,005	71,881	83,735	97,544
		2.0%	2.0%	5.0%	3.0%	3.1%	3.1%

1. Year to year percent changes are shown. For five year increments, the rate shown is the compound annual growth rate.

2. 1998 enplanements and operations data provided by the Arizona Department of Transportation.



Source: Kiehl-Hendrickson Group - 2001

5.5 REGIONAL COMMERCE CENTERS: Flagstaff, Yuma

Flagstaff and Yuma are the two Arizona cities that best fit the Regional Commerce Center category:

Category	City	Characteristics	Outlook/Forecast Factors
Regional Commerce Centers	Flagstaff Yuma	- Possible Single Hub Today - Prop & Jet Mix Likely - Multiple Hubs in Future	- Geography - Fleet Decisions - Leakage Trends - Corporate Activity - "Tag" Operations (Guarantee of future service - More "upside" than "downside")

Source: Kiehl-Hendrickson Group – 2001

These characteristics suggest that Flagstaff and Yuma face commercial air service opportunities over the long-term outlook, with greater growth options than many smaller communities due to their economic role within the state.

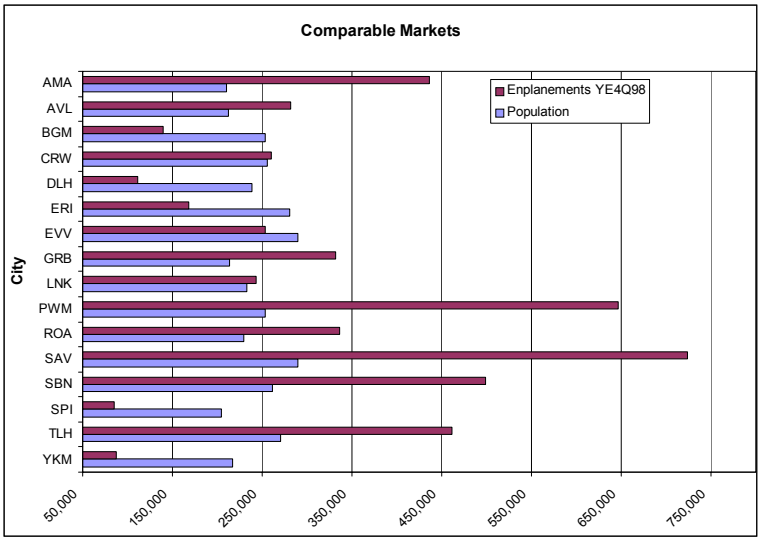
Population and Growth

Flagstaff and Yuma, with similar area populations of approximately 125,000, are not unlike many similarly-sized communities in the U.S. If they experienced approximately 3.5% annual growth over the next 20 years, these cities would double their populations.

Over time, some cities will flourish, while others will stagnate, and it is difficult to know how these two Arizona communities will engage growth, economic development, and population expansion. However, Flagstaff and Yuma appear positioned to succeed, particularly as they reside in a sun belt state that has seen steady in-migration.

As a test of reasonableness, Exhibit 5-8 shows the level of passenger enplanements being experienced today in communities that have populations of approximately 200,000 – 300,000 people (about the same size that Flagstaff and Yuma could be in the future).

EXHIBIT 5-8: ***Comparable Markets***



Source: Kiehl-Hendrickson Group – 2001

Leakage

A recent evaluation of these markets indicated that neither community retains anywhere near all of its passenger traffic. Yuma lost approximately one half of its passengers, while Flagstaff saw an even greater share drive to other airports (primarily Phoenix). With relatively low levels of commercial air service currently being provided, these leakage results are not uncommon. However, as Flagstaff and Yuma emerge as even stronger regional commerce centers over the next two decades, its is expected that service levels will improve and that leakage rates could decline significantly.

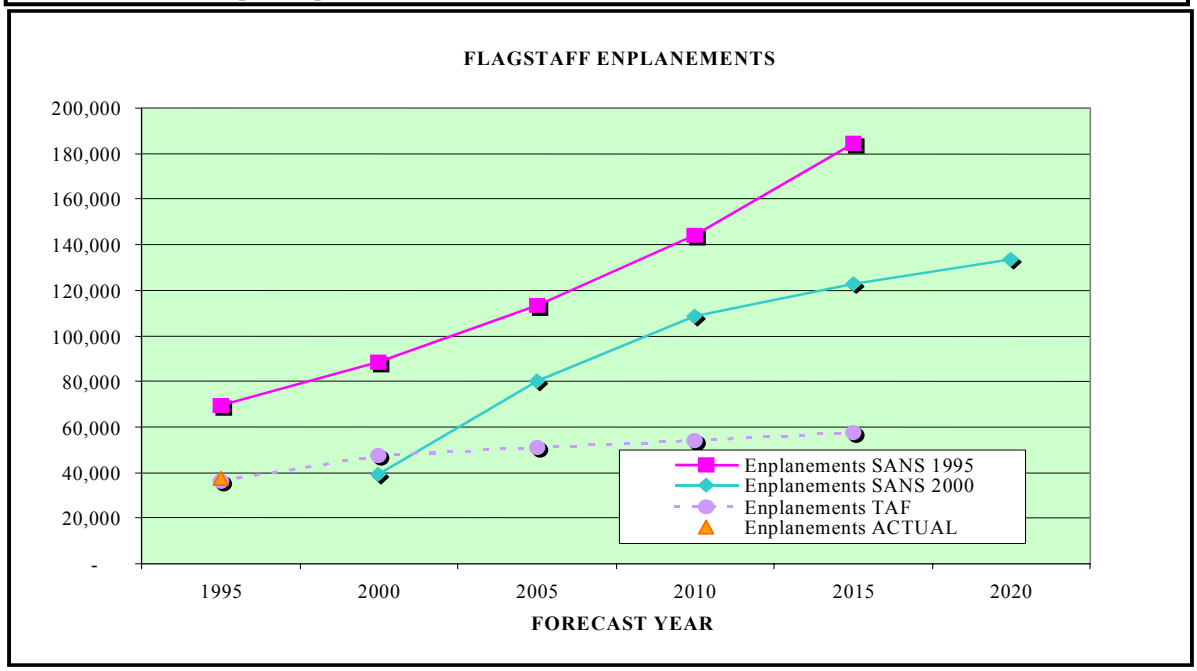
Reported Leakage Rates

Yuma	51%
Flagstaff	69%

Given their positions as regional centers and the increased future availability of small regional jet aircraft, both Flagstaff and Yuma are expected see the addition of services from airline hubs. Neither community will probably ever retain all of their passengers, largely due to the presence of Southwest Airlines in surrounding markets that include Phoenix, Tucson, and San Diego. However, these small jets will begin entering the market at an increasing rate over the next few years, bringing trip costs down and making such hubs as Salt Lake City and Denver much more viable than they are today.

EXHIBIT 5-9: *Flagstaff Potential Service Levels*

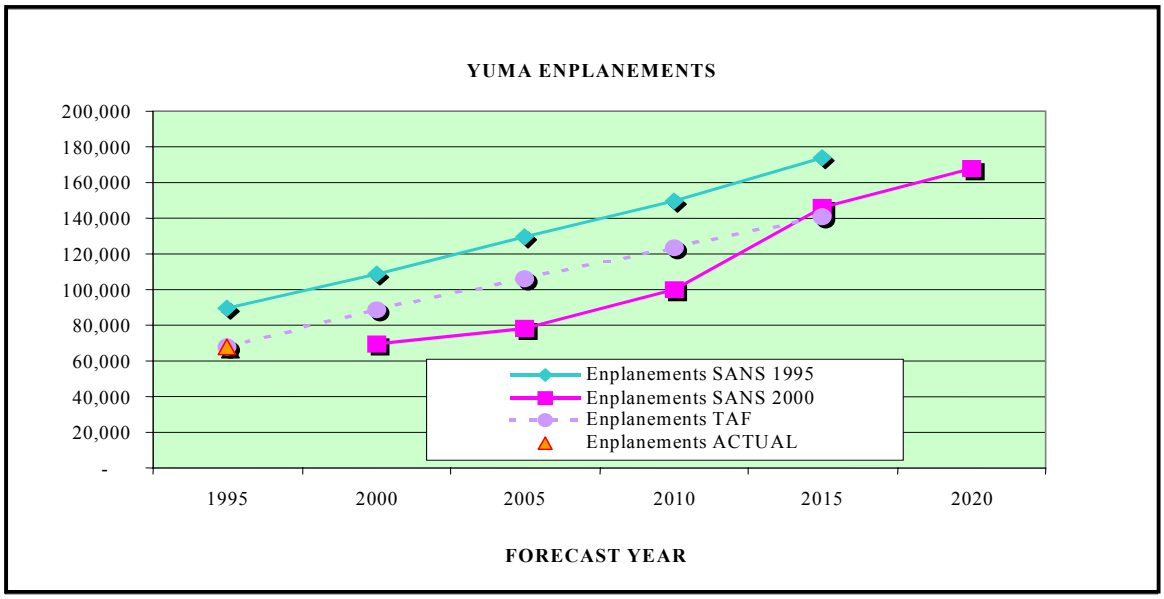
	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	7	7	7	7	7
Seat per Departure:	37	37	37	37	37
Projected Load Factor:	46%	42%	44%	46%	48%
Passenger per Departure:	17	16	16	17	18
Destination:		**LAX**	**LAX**	**LAX**	**LAX**
Daily Departures:		3	3	4	4
Seat per Departure:		50	50	50	50
Projected Load Factor:		45%	50%	45%	50%
Passenger per Departure:		23	25	23	25
Destination:		**SLC**	**SLC**	**SLC**	**SLC**
Daily Departures:		3	3	4	4
Seat per Departure:		50	50	50	50
Projected Load Factor:		45%	50%	45%	50%
Passenger per Departure:		23	25	23	25
Destination:			**DEN**	**DEN**	**DEN**
Daily Departures:			3	3	3
Seat per Departure:			50	50	50
Projected Load Factor:			45%	50%	55%
Passenger per Departure:			23	25	28
Total Daily Passengers:	119	244	331	374	407
Total Daily Operations:	7	13	16	18	18
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	2,300	4,271	5,256	5,913	5,913
Projected Annual Operations:	4,599	8,541	10,512	11,826	11,826
Projected Annual Enplanements:	**39,137**	**80,082**	**108,885**	**122,905**	**133,640**
Population/MSA:	125,000	143,044	154,333	165,380	175,755
Per Capita Enplanements:	**0.31**	**0.56**	**0.71**	**0.74**	**0.76**



Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-10: *Yuma Potential Service Levels*

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	
Daily Departures:	6	7	5	5	
Seat per Departure:	19	19	19	19	
Projected Load Factor:	53%	55%	55%	55%	
Passenger per Departure:	10	10	10	10	
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	2	3	4	4	8
Seat per Departure:	37	37	37	37	37
Projected Load Factor:	60%	60%	60%	60%	65%
Passenger per Departure:	22	22	22	22	24
Destination:	**LAX**	**LAX**	**LAX**	**LAX**	**LAX**
Daily Departures:	6	3	3	4	4
Seat per Departure:	30	50	50	50	50
Projected Load Factor:	60%	65%	65%	65%	65%
Passenger per Departure:	18	33	33	33	33
Destination:			**LAS**	**LAS**	**LAS**
Daily Departures:			2	3	3
Seat per Departure:			50	50	50
Projected Load Factor:			65%	65%	70%
Passenger per Departure:			33	33	35
Destination:				**DFW**	**DFW**
Daily Departures:				3	3
Seat per Departure:				50	50
Projected Load Factor:				50%	55%
Passenger per Departure:				25	28
Total Daily Passengers:	213	237	304	444	510
Total Daily Operations:	14	13	14	19	18
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	4,599	4,271	4,599	6,242	5,913
Projected Annual Operations:	9,198	8,541	9,198	12,483	11,826
Projected Annual Enplanements:	**69,911**	**77,937**	**99,716**	**145,706**	**167,502**
Population/MSA:	131,300	148,732	164,285	181,218	199,418
Per Capita Enplanements:	**0.53**	**0.52**	**0.61**	**0.80**	**0.84**



Source: Kiehl-Hendrickson Group - 2001

5.6 SMALL COMMUNITIES: Show Low, Lake Havasu City, Prescott, Sierra Vista, Kingman, Safford, Winslow, Page

Arizona's smaller communities have experienced various rates of growth over the years, reflecting their role in state tourism or development of business and commerce. The following table highlights these communities side by side with one another:

Category	City	Characteristics	Outlook/Forecast Factors
Small and Rural Community	Show Low Lake Havasu Prescott Sierra Vista Kingman Safford Winslow Page	- Regional Service Only - "Tag" Service to Single hub - Some EAS contracts - Seasonal Markets - Tag Dependent - Often Single-Hub Only	- Vulnerable to Carrier Fleet decisions - Excessive Leakage - Carrier Reliability/Completion Factor - Alternative Transportation Modes - Proximity to Alternative Air Service - Small Mass Overshadows Strong - Business travel/high yield traffic (Results could hinge on efforts of Community leadership)

Source: Kiehl-Hendrickson Group - 2001

Population Size and Concentration

The cities in this category will continue to see growth over the long term of the forecast period, but none are expected to reach the critical mass that suggests they will serve as regional commerce centers. As a matter of fact, three of these communities (Prescott, Kingman, and Page) have been identified as Essential Air Service (EAS) cities, given federal funding to help ensure some level of commercial air service. Typically, EAS applies only to the smallest air service markets that could otherwise lose all of their air service.

Leakage

The growth of ground shuttle services has been a nation-wide trend, with operators seizing on opportunities to transport passengers from outlying communities into major airports where service levels, and often air fares, are significantly better. Comfortable 9-15 passenger vans are often used, with multiple daily trips running on a regularly scheduled basis.

Reported Leakage Rates

Page	63%
Lake Havasu	74%
Bull Head City	76%
Sierra Vista	78%
Prescott	79%
Kingman	79%
Show Low	86%

Source: AZ DOT

For trips within 100-200 miles, the convenience, reliability, and cost of ground transport alternatives have proven attractive to consumers in many smaller cities. Even though markets such as Prescott have continued to experience steady growth, improvements such as the widening for Route 69 to Interstate 17 have made the drive alternative more attractive.

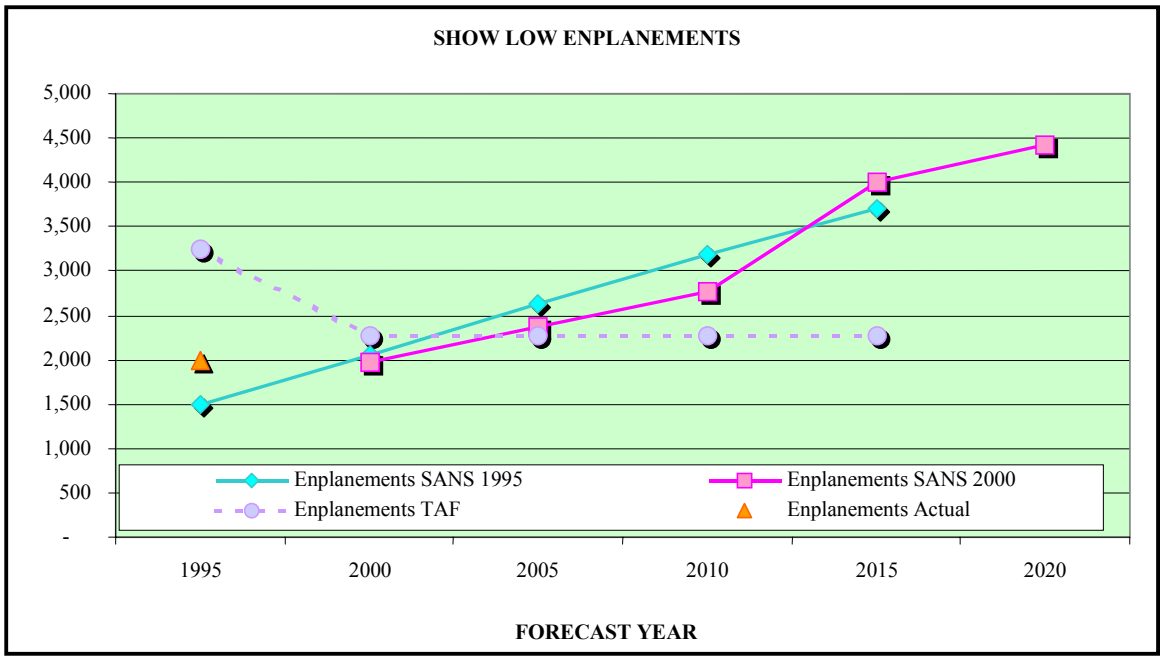
Leakage will continue to be a major factor in these communities. As shown earlier (Table 5-3), even much larger markets such as Champaign, IL, Wilkes-Barre, PA, and Asheville, NC lose 40-50% of their passengers today.

Furthermore, commercial airline service options for these communities are not projected to be nearly as robust as Flagstaff and Yuma will witness. Service upgrades are expected over the time span of the forecast period, but consumer preference for larger jets and lower air fares will continue to generate relatively high leakage rates.

EXHIBIT 5-11: *Show Low Potential Service Levels*

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	3	3	3	4	4
Seat per Departure:	8	8	8	8	8
Projected Load Factor:	25%	30%	35%	38%	42%
Passenger per Departure:	2	2	3	3	3
Total Daily Passengers:	6	7	8	12	13
Total Daily Operations:	3	3	3	4	4
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	986	986	986	1,314	1,314
Projected Annual Operations:	1,971	1,971	1,971	2,628	2,628
Projected Annual Enplanements:	**1,971**	**2,365**	**2,759**	**3,995**	**4,415**
Population:	7,542	8,390	8,823	9,257	9,742
Per Capita Enplanements:	**0.26**	**0.28**	**0.31**	**0.43**	**0.45**

1. A community of this size will very likely be able to support only the smallest of commercial aircraft. Nonstops to hubs other than Phoenix are not within the scope of this forecast.



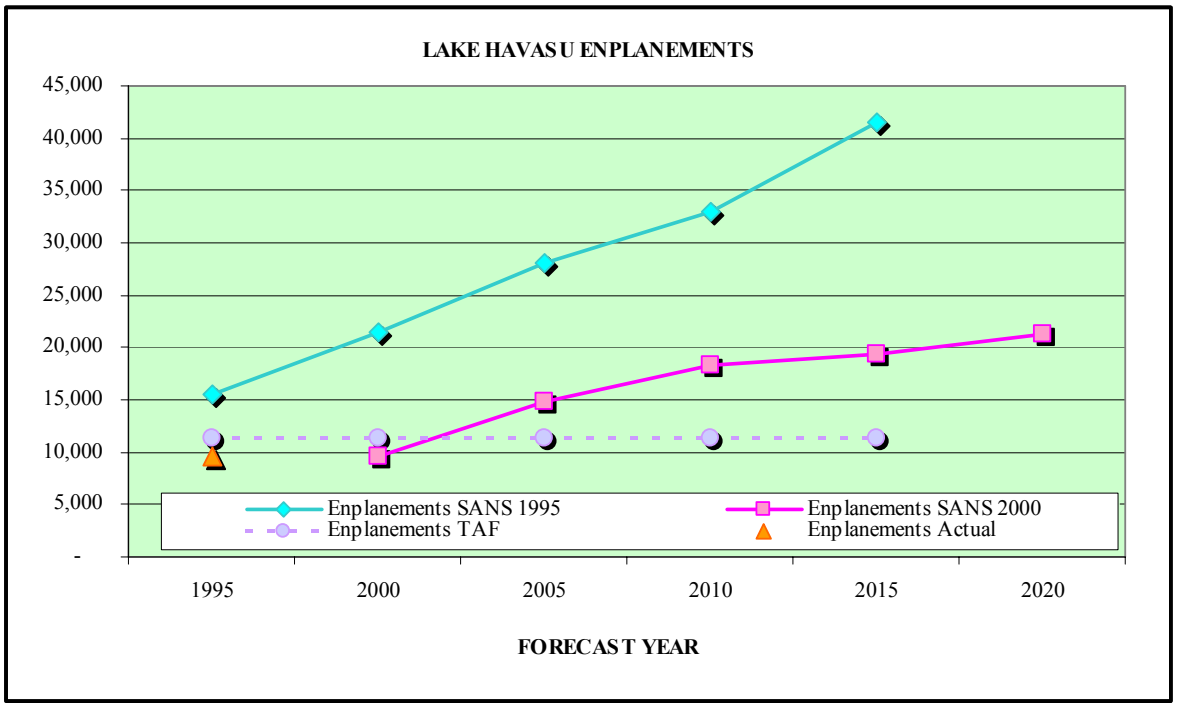
Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-12: ***Lake Havasu Potential Service Levels***

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	4	6	6	7	7
Seat per Departure:	19	19	19	19	19
Projected Load Factor:	49%	50%	55%	50%	55%
Passenger per Departure:	9	10	10	10	10
Total Daily Passengers:	37	57	63	67	73
Total Daily Operations:	4	6	6	7	7
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	71%	71%	80%	80%	80%
Projected Annual Departures:	1,037	1,555	1,752	2,044	2,044
Projected Annual Operations:	2,073	3,110	3,504	4,088	4,088
Projected Annual Enplanements:	**9,651**	**14,772**	**18,308**	**19,418**	**21,360**
Population:	41,362	53,275	58,777	63,783	68,886
Per Capita Enplanements:	**0.23**	**0.28**	**0.31**	**0.30**	**0.31**

1. Low fares and yields associated with leisure and retirement travel will create hurdles for service to Los Angeles or other hubs within the region.

2. Frequency to PHX, however, is expected to increase throughout the forecast period.



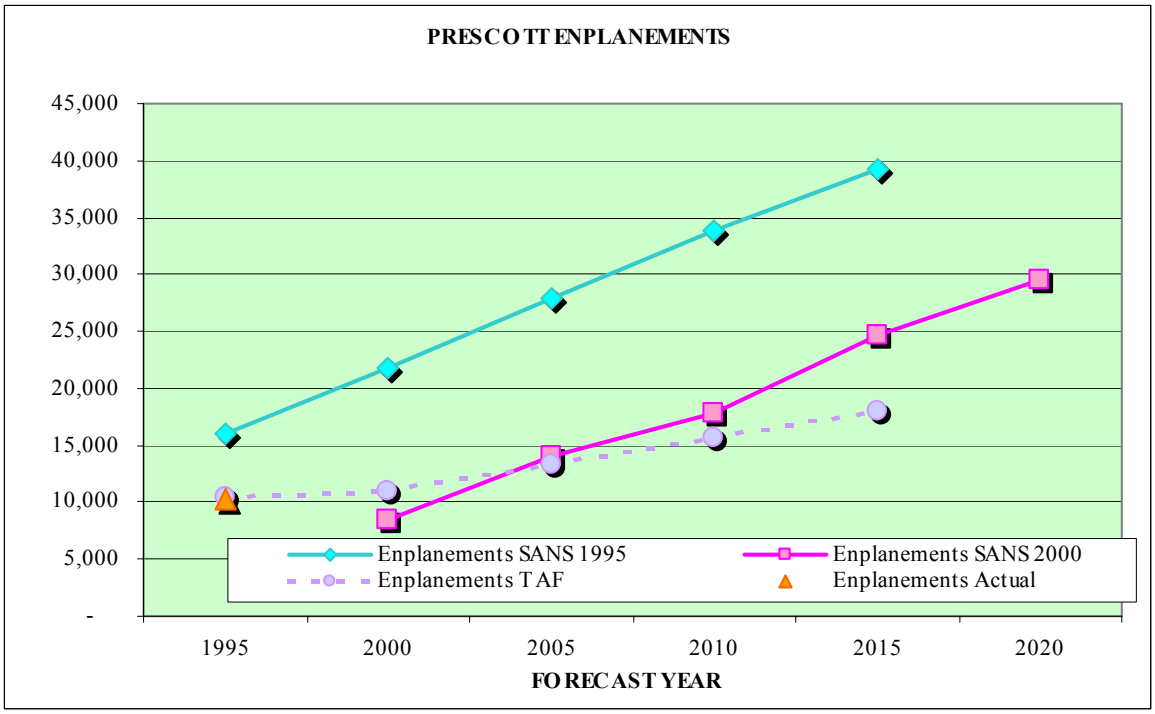
Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-13: ***Prescott Potential Service Levels***

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	3	5	4	5	6
Seat per Departure:	19	19	30	30	30
Projected (ENPL) Load Factor:	45%	45%	45%	50%	50%
Passenger per Departure:	9	9	14	15	15
Total Daily Passengers:	26	43	54	75	90
Total Daily Operations:	3	5	4	5	6
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	986	1,643	1,314	1,643	1,971
Projected Annual Operations:	1,971	3,285	2,628	3,285	3,942
Projected Annual Enplanements:	**8,426**	**14,043**	**17,739**	**24,638**	**29,565**
Population:	53,424	67,293	78,048	87,117	96,228
Per Capita Enplanements:	**0.16**	**0.21**	**0.23**	**0.28**	**0.31**

1. Low fares and yields associated with leisure and retirement travel will create hurdles for service to other hubs within the region.

2. Local population, despite good drive access to PHX, will still warrant aircraft frequency and capacity upgrades.



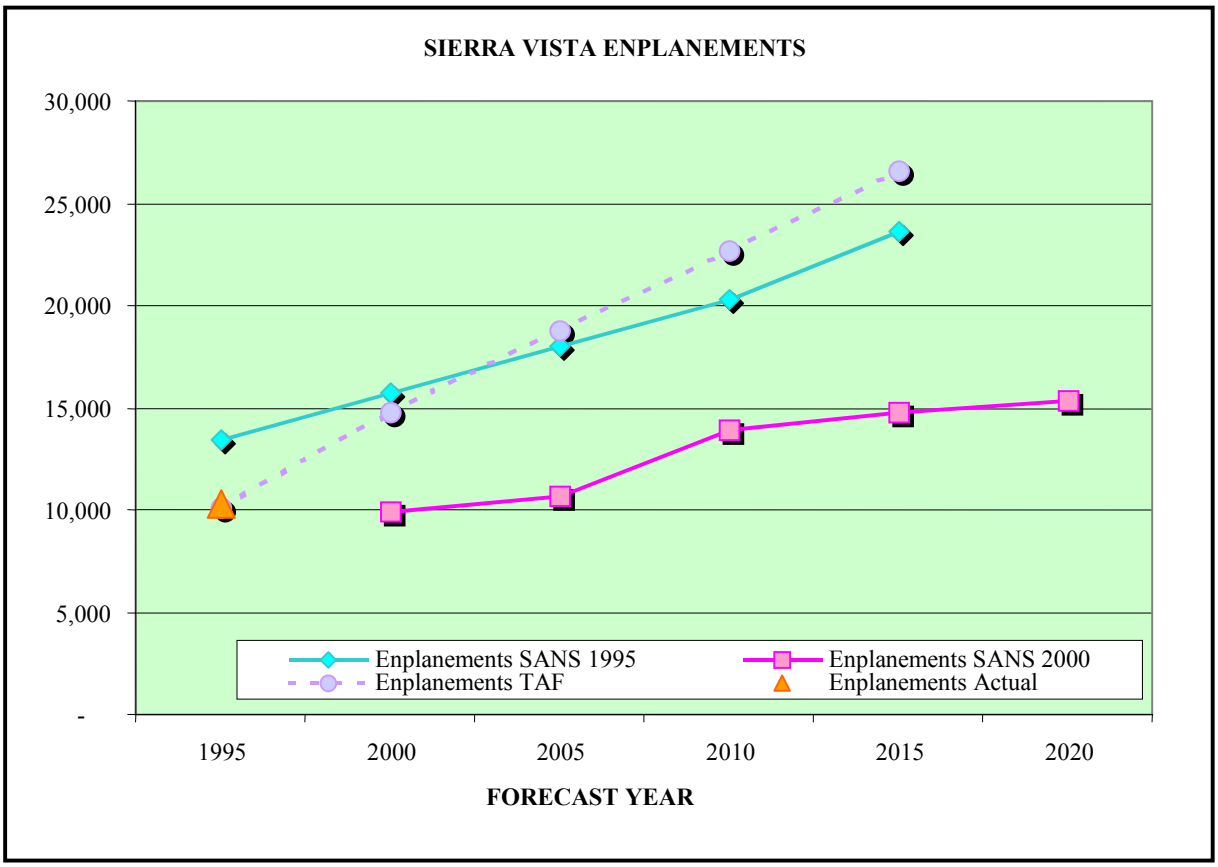
Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-14: ***Sierra Vista Potential Service Levels***

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	3	3	3	3	3
Seat per Departure:	19	19	30	30	30
Projected Load Factor:	53%	57%	47%	50%	52%
Passenger per Departure:	10	11	14	15	16
Total Daily Passengers:	30	32	42	45	47
Total Daily Operations:	3	3	3	3	3
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	986	986	986	986	986
Projected Annual Operations:	1,971	1,971	1,971	1,971	1,971
Projected Annual Enplanements:	**9,924**	**10,673**	**13,896**	**14,783**	**15,374**
Population:	39,428	43,402	46,642	49,795	52,571
Per Capita Enplanements:	**0.25**	**0.25**	**0.30**	**0.30**	**0.29**

1. Passenger leakage to Tucson will continue to be a challenge that prohibits service to additional hubs within the region.

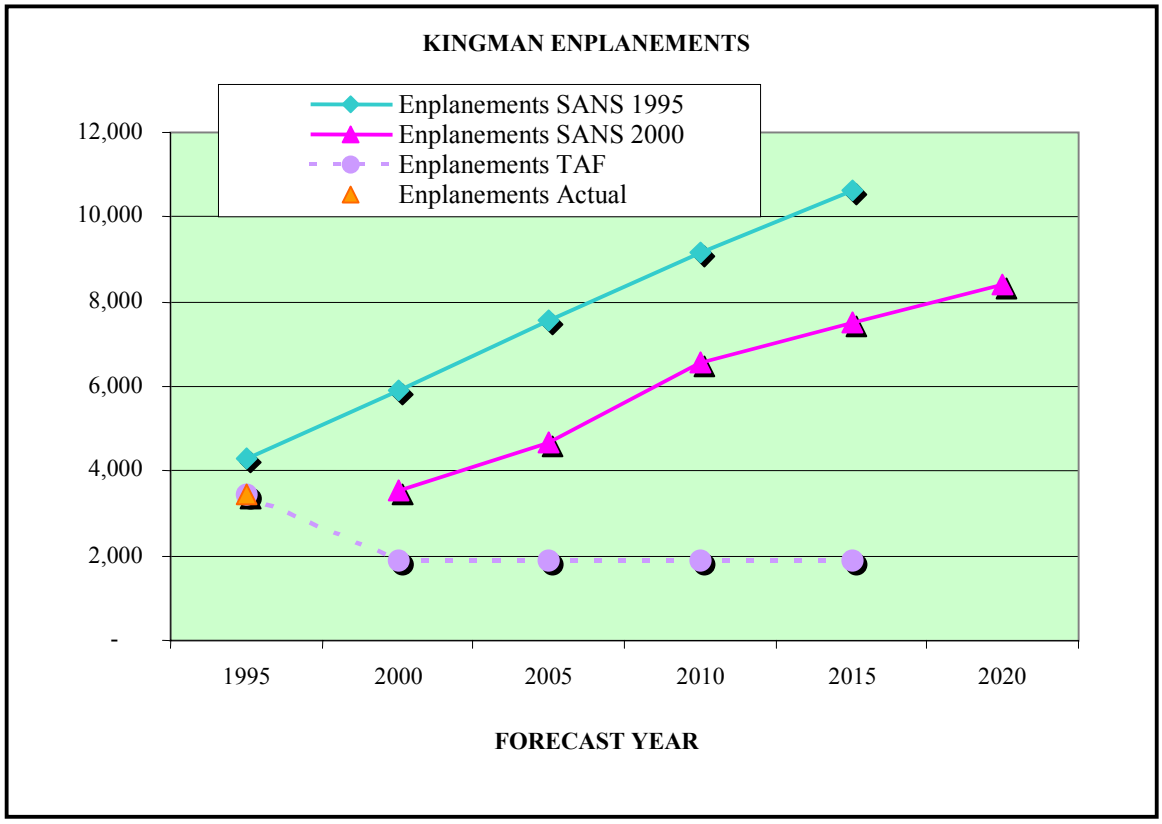
2. While frequency remains modest, increased military traffic could support capacity upgrades within the forecast period.



Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-15: *Kingman Potential Service Levels*

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:	3	3	3	3	3
Seat per Departure:	19	19	19	19	19
Projected Load Factor:	19%	25%	35%	40%	45%
Passenger per Departure:	4	5	7	8	9
Total Daily Passengers:	11	14	20	23	26
Total Daily Operations:	3	3	3	3	3
Days of Operation per Year:	365	365	365	365	365
Projected Completion Rate:	90%	90%	90%	90%	90%
Projected Annual Departures:	986	986	986	986	986
Projected Annual Operations:	1,971	1,971	1,971	1,971	1,971
Projected Annual Enplanements:	**3,558**	**4,681**	**6,554**	**7,490**	**8,426**
Population:	18,724	23,073	25,225	27,256	29,227
Per Capita Enplanements:	**0.19**	**0.20**	**0.26**	**0.27**	**0.29**

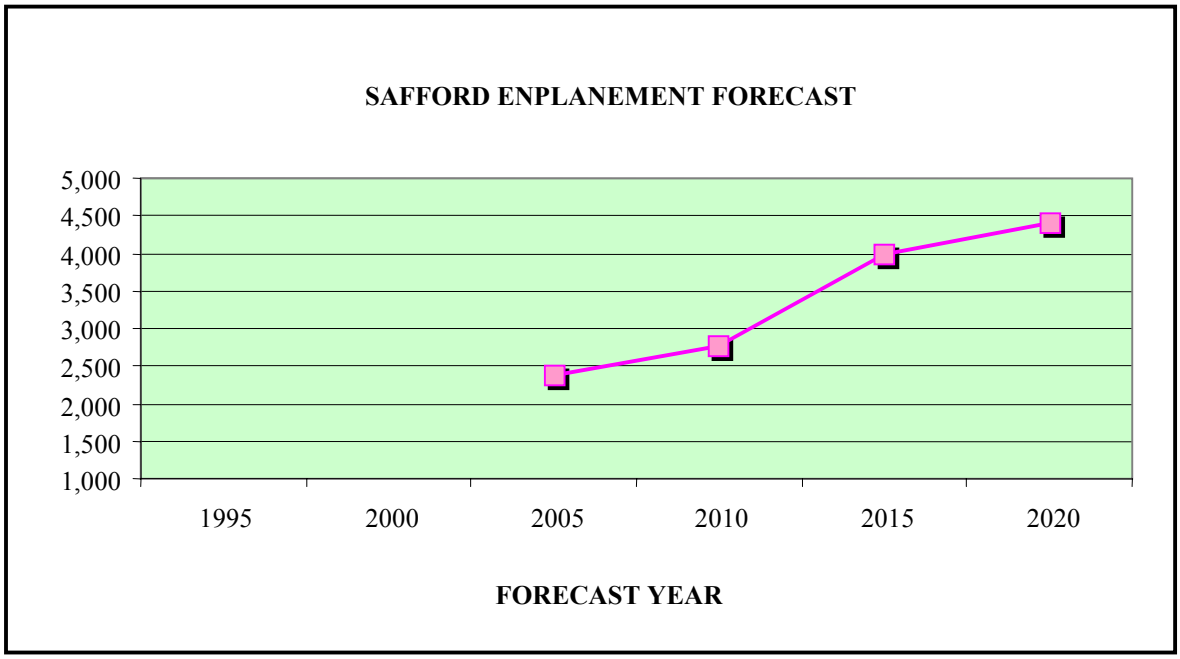


Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-16: ***Safford Potential Service Levels***

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:		3	3	4	4
Seat per Departure:		8	8	8	8
Projected Load Factor:		30%	35%	38%	42%
Passenger per Departure:	0	2	3	3	3
Total Daily Passengers:	0	7	8	12	13
Total Daily Operations:	0	3	3	4	4
Days of Operation per Year:		365	365	365	365
Projected CompLetion Rate:		90%	90%	90%	90%
Projected Annual Departures:	-	986	986	1,314	1,314
Projected Annual Operations:	-	1,971	1,971	2,628	2,628
Projected Annual Enplanements:	**-**	**2,365**	**2,759**	**3,995**	**4,415**
Population:	10,304	11,837	12,969	13,473	10,304
Per Capita Enplanements:	**-**	**0.20**	**0.21**	**0.30**	**0.43**

1. With continued growth of the community, it can be forecast that some entry-level commercial service could be realized. Significant levels of community support would be paramount to the long-term success of any such service.

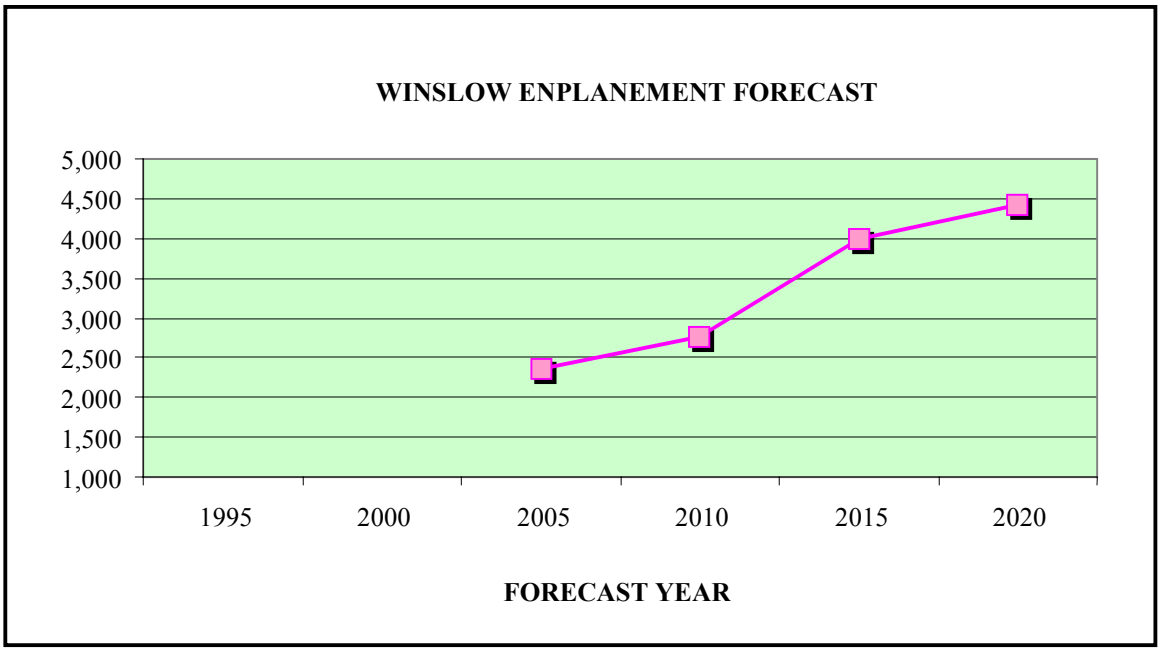


Source: Kiehl-Hendrickson Group - 2001

EXHIBIT 5-17: ***Winslow Potential Service Levels***

	Today	2005	2010	2015	2020
Destination:	**PHX**	**PHX**	**PHX**	**PHX**	**PHX**
Daily Departures:		3	3	4	4
Seat per Departure:		8	8	8	8
Projected Load Factor:		30%	35%	38%	42%
Passenger per Departure:	0	2	3	3	3
Total Daily Passengers:	0	7	8	12	13
Total Daily Operations:	0	3	3	4	4
Days of Operation per Year:		365	365	365	365
Projected Completion Rate:		90%	90%	90%	90%
Projected Annual Departures:	-	986	986	1,314	1,314
Projected Annual Operations:	-	1,971	1,971	2,628	2,628
Projected Annual Enplanements:	**-**	**2,365**	**2,759**	**3,995**	**4,415**
Population:	11,220	11,842	12,249	12,601	13,007
Per Capita Enplanements:	**-**	**0.20**	**0.23**	**0.32**	**0.34**

1. With continued growth of the community, it can be forecast that some entry level commercial service could be realized. Significant levels of community support would be paramount to the long term success of any such service.



Source: Kiehl-Hendrickson Group - 2001

5.7 DESTINATION MARKETS: Grand Canyon, Bullhead City/Laughlin, Page

Category	City	Characteristics	Outlook/Forecast Factors
Destination Markets	Grand Canyon Bullhead City Page (EAS)	- Traffic and/or Service: - Not related to population - Primarily "in-bound" - Group Travel - Short Stays - Low Fares/Yield - Seasonal Influences	- Challenges to attracting scheduled service - Periodic Charters - Tour Packaging - Hotel Accommodations

Source: Kiehl-Hendrickson Group - 2001

Destination markets are unique among all others, with no reliable relation between local city size or population and the commercial service activities that take place. In many respects, the Grand Canyon and Laughlin-Bullhead City are not unlike Las Vegas, Orlando, or Buffalo-Niagara Falls. All experience large volumes of in-bound passenger traffic that is disproportionately higher than out-bound passenger levels, and all have higher mixes of international and group traffic than most other markets.

The Grand Canyon remains one of the world's foremost tourism destinations, and there is no reason to assume that this will change over the next 20 years. Due to environmental and traffic congestion concerns, Canyon officials are making plans for such substantial improvements as light rail systems to accommodate the growing visitor volumes. Commercial air service will continue to be a mix of scheduled flights and low-frequency charter activities, even if overfly rules are changed or other restrictions are placed on sightseeing excursions. The forecast for the Grand Canyon reflects continued growth, supported by ongoing demand for this natural attraction.

Bullhead City grew up around the building of the Davis Dam, but has since been the gateway to Laughlin's casino properties. The airport in Bullhead City once enjoyed low-frequency scheduled service provided by Morris Air from Salt Lake City, Oakland, and San Jose. Per-flight passenger revenues generally exceeded $5,000, over twice that of most PHX-Las Vegas flights, and onboard load factors over 80% were not uncommon.

Although Morris Air was subsequently acquired by Southwest Airlines, it is very conceivable that similar service could emerge again in future years. Laughlin now has a substantial gaming, recreation, and entertainment franchise, and the market offers an experience that remains unique relative to Las Vegas or other regional gaming alternatives. Charter services have done well, and the only inhibiting factor for future traffic and service growth will be the expansion rates of casino and hotel properties.

Finally, Page has been included in this category, primarily due to the traffic associated with Lake Powell and recreational activities. As shown in the accompanying tables, all three experience a wide variety of passenger numbers and projections, due to inconsistent reporting and confusion between scheduled service, charters, air taxi operations, etc. In fact, each of these markets could warrant its own more intensive analysis as necessary.

EXHIBIT 5-18: *Grand Canyon Potential Service Levels*

SOURCES	1993	1995	1998	1999	2000	2005	2010	2015	2020
SANS 1995 Enplanements:	377,819	927,000	na	na	1,152,000	1,322,398	1,518,000	1,742,535	
AZ DOT Enplanements:	na	na	512,365	na	na	na	na	na	
FAA Terminal Area Forecast Air Carrier & Commuter Enpl:	241,338	283,322	386,763*	418,422*	450,081*	608,376*	766,671*	924,966*	
US DOT*	355,726	285,092	273,149	na	na	na	na	na	na
SANS 2000 Projected Enplanements:			273,149	295,508	317,867	429,662	541,457	653,252	757,298
SANS 1995 Projected Operations:		124,379	na	na	235,000	282,800	311,903	344,000	
FAA Terminal Area Forecast Air Carrier & Commuter Ops:			185,064	188,341	191,912	213,930	235,099	252,214	
SANS 2000 Projected Operations:		na	131,395	133,015	135,537	151,087	166,037	179,072	205,933

- The very nature of the Grand Canyon facility will produce challenges to the ongoing need for accurate forecasting. Strong ties to the National and International economies and related tourism trends result in complex forecasting unrelated to linear growth of the local

- Future efforts of the United States Park Service, the FAA and environmental organizations to control traffic levels and preserve the integrity of the Park will play an extensive role in future air service

- The Grand Canyon is accompanied by a small community, itself, limited in growth due to efforts of maintaining park and environmental conditions. This community is strongly tied to the welfare of the park and is unlikely to jeopardize this resource with expansive commercial development.

- Air service campaigns by new entrant carriers such as Far West may provide advertising and public scheduled service alternatives for the Grand Canyon community. Aggressive local awareness of the service will be paramount to the success of any scheduled service without a major code share relationship.

- Air Taxi type operations will continue to support the bulk of the air travel to/from the Grand Canyon. Day trip travelers originating in Las Vegas, California and within the Park will remain as the major source of the Grand Canyon air travel. A comparatively small amount of air travel could be expected to be generated from a local population base.

- SANS 2000 enplanements utilize the FAA Terminal Area Forecast growth rates, applied to the most recent U.S DOT Figures (1998).

- Grand Canyon operations forecast utilizes the existing FAA Terminal Area Forecast, adjusted downward for passenger projections.

EXHIBIT 5-19: *Bullhead Potential Service Levels*

SOURCES	1993	1995	1998	1999	2000	2005	2010	2015	2020
SANS 1995 Enplanements:	146,500	112,000	na	na	235,000	403,000	617,000	874,000	
AZ DOT Enplanements:	na	na	30,387	na	na	na	na	na	na
FAA Terminal Area Forecast Air Carrier & Commuter Enpl		75,795*	56,786*	58,666*	60608*	71,327*	83,948*	98,805*	
US DOT*	91,297	82,896	26,592						
SANS 2000 Enplanement Projections:				32,000	40,000	65,000	80,000	95,000	110,000
FAA Terminal Area Forecast Air Carrier & Commuter Ops:	7,600	11,862	4,941*	5,000*	5,060*	5,379*	5,802*	6,378*	7,042*
SANS 2000 Projected Operations:				2,750	3,339	4,902	5,529	6,151	7,131

- Carriers such as Sun Country and ATA refocus their efforts towards increased scheduled service and less charter based operations.
- Growth of low fare carriers (WN,FL,F9, VG) would imply that services similar to those once offered by Morris Air could eventually return to Bullhead City.
- Bullhead City operations forecasts utilize the existing FAA Terminal Area Forecast, adjusted downward for passenger projections.

*Source: DOT Report T-100

EXHIBIT 5-20: *Page Potential Service Levels*

SOURCES	1993	1995	1998	1999	2000	2005	2010	2015	2020
SANS 1995 Enplanements	3,200	4,504	na	na	6,904	8,040	9,727	11,768	
AZ DOT Enplanements:	na	na	27,000	na	na	na	na	na	na
FAA Terminal Area Forecast Air Carrier & Commuter Enpl	13,112	19,704	12,296	12,955	13,613	16,904	20,196	23,487	na
US DOT*	11,567	19,411	11,164	na	na	na	na	na	na
SANS 2000 Enplanement Projection:				25,587	13,613	16,904	20,196	23,487	27,227
SANS 1995 Projected Ops:		1258	na	na	1636	2272	3154	4380	na
SANS 2000 Projected Ops:			16,451	16,967	17,457	19,566	21,563	23,803	26,280

- Page continues to establish itself as a strong in-bound "destination" market, primarily serving the seasonal travel demand for the Lake Powell area.
- As Flagstaff realizes the increased service levels associated with its expanding role as a Regional Commerce Center, Flagstaff could develop as a more reasonable alternative for travel to and from the Page / Lake Powell area.
- Due to several data descrepancies, the existing FAA Terminal Area Forecast appears to be a reasonable base for the SANS 2000 projections.

*Source: DOT Report T-100

TABLE 5-9: *Forecast Summary Of Commercial Enplanements And Operations 1995-2020*

		1995	2000	2005	2010	2015	2020
PHX Enplanements	*SANS 1995*	12,588,987	16,114,055	18,573,992	21,409,457	24,677,778	
	SANS 2000		17,643,630	20,334,932	23,439,034	27,016,974	31,141,082
	TAF	13,517,238	16,846,937	21,583,700	27,117,641	32,515,592	
	ACTUAL	13,502,744					
Operations	*SANS 1995*	330,450	352,188	413,762	439,191	461,594	
	SANS 2000		473,046	552,070	583,109	615,894	650,521
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
TUS Enplanements	*SANS 1995*	1,622,930	2,075,000	2,400,000	2,797,276	3,260,314	
	SANS 2000		1,970,858	2,214,162	2,580,682	3,007,872	3,505,778
	ACTUAL	1,672,887					
Operations	*SANS 1995*	46,716	51,578	65,828	76,313	88,898	
	SANS 2000		48,583	62,005	71,881	83,735	97,544
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
YUM Enplanements	*SANS 1995*	89,500	109,000	129,500	150,000	173,745	
	SANS 2000		69,911	77,937	99,716	145,706	167,502
	TAF	68,140	88,309	105,706	123,104	140,501	
	ACTUAL	67,822					
Operations	*SANS 1995*	17,482	16,800	19,700	21,200	22,600	
	SANS 2000		9,198	8,542	9,910	12,484	11,826
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
FLG Enplanements	*SANS 1995*	69,500	88,700	113,300	144,500	184,292	
	SANS 2000		39,137	80,082	108,885	122,905	133,640
	ACTUAL	37,370					
	TAF	36,229	47,531	50,802	54,074	57,346	
Operations	*SANS 1995*	9,093	10,666	13,019	15,893	19,400	
	SANS 2000		4,600	8,542	10,512	11,826	11,826
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
SOW Enplanements	*SANS 1995*	1,500	2,055	2,623	3,191	3,699	
	SANS 2000		1,971	2,365	2,759	3,995	4,415
	TAF	3,244	2,279	2,279	2,279	2,279	
	ACTUAL	2,000					
Operations	*SANS 1995*	2,000	2,880	4,000	5,000	6,000	
	SANS 2000		1,972	1,972	1,972	2,628	2,628
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
HII Enplanements	*SANS 1995*	15,500	21,500	28,000	33,000	41,500	
	SANS 2000		9,651	14,772	18,308	19,418	21,360
	ACTUAL	9,633					
Operations	*SANS 1995*	3,017	7,600	8,800	10,200	11,000	
	SANS 2000		2,074	3,110	3,504	4,088	4,088
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
PRC Enplanements	*SANS 1995*	15,935	21,833	27,865	33,902	39,302	
	SANS 2000		8,426	14,043	17,739	24,638	29,565
	ACTUAL	10,339					
Operations	*SANS 1995*	6,938	10,903	13,000	16,000	20,000	
	SANS 2000		1,972	3,286	2,628	3,286	3,942

Source: Kiehl-Hendrickson Group - 2001

TABLE 5-8: *Forecast Summary of Commercial Enplanements and Operations 1995-2020 (continued)*

		1995	2000	2005	2010	2015	2020
FHU Enplanements	*SANS 1995*	13,400	15,700	18,000	20,300	23,600	
	SANS 2000		9,924	10,673	13,896	14,783	15,374
	ACTUAL	10,286					
Operations	*SANS 1995*	5,600	6,200	6,900	7,500	8,200	
	SANS 2000		1,972	1,972	1,972	1,972	1,972
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
IGM Enplanements	*SANS 1995*	4,311	5,907	7,539	9,172	10,633	
	SANS 2000		3,558	4,681	6,554	7,490	8,426
	ACTUAL	3,459					
Operations	*SANS 1995*	1,643	2,594	4,591	8,126	14,381	
	SANS 2000		1,972	1,972	1,972	1,972	1,972
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
GCN Enplanements	*SANS 1995*	927,000	1,152,000	1,322,398	1,518,000	1,742,535	
	SANS 2000		317,867	429,662	541,457	653,252	757,298
	ACTUAL						
Operations	*SANS 1995*	124,379	235,000	282,800	311,903	344,000	
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
IFP Enplanements	*SANS 1995*	112,000	235,000	403,000	617,000	874,000	
	SANS 2000		40,000	65,000	80,000	95,000	110,000
Operations	*SANS 1995*	14,433	11,790	18,800	26,000	32,480	
	SANS 2000		3,339	4,902	5,529	6,151	7,131
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
PGA Enplanements	*SANS 1995*	4,505	6,904	8,040	9,727	11,768	
	SANS 2000		13,613	16,904	20,196	23,487	27,227
Operations	*SANS 1995*	1,258	1,636	2,272	3,154	4,380	
	SANS 2000		17,457	19,566	21,563	23,803	26,280
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
INW Enplanements	*SANS 1995*						
	SANS 2000			2,365	2,759	3,995	4,415
Operations	*SANS 1995*						
	SANS 2000			1,971	1,971	2,628	2,628
		1995	**2000**	**2005**	**2010**	**2015**	**2020**
SAF Enplanements	*SANS 1995*						
	SANS 2000			2,365	2,759	3,995	4,415
Operations	*SANS 1995*						
	SANS 2000			1,971	1,971	2,628	2,628

Source: Kiehl-Hendrickson Group - 2001

TABLE 5-10: ***Population and Enplanements per Capita, 1998-2020***

TABLE 5-10: ***Population and Enplanements per Capita, 1998-2020 (continued)***

TABLE 5-10: ***Population and Enplanements per Capita, 1998-2020 (continued)***

TABLE 5-10: ***Population and Enplanements per Capita, 1998-2020 (continued)***

5.8 CARGO AND MAIL

Commercial Air Freight:
Overview and Implications for Arizona

Commercial air freight is a rapidly growing segment of the aviation industry, and deserves the attention of planners on a nationwide basis. The FAS points out that although domestic and international air tonnage account for a minor portion of the total carried by all modes of transportation, the air shipment value is disproportionately higher. Domestic air represented 0.1% of the domestic tonnage in 1997 but 6% of the value, with international results of 0.9% and 36% respectively.

High technology industries drive much of the growth in air freight, primarily due to the value of goods produced and the immediacy of the manufacturing and assembly process. Just-in-time (JIT) processes have become commonplace on a global basis, further supporting the need for rapid transit of sub-assembly components. An examination of specific high tech commodities shows an overwhelming percentage that uses air freight as the mode of transportation.

Regarding the aircraft used to provide commercial air freight services, a number of all-cargo airlines as well as passenger carriers turn to freighter aircraft such as DC8's, DC10's, 737F's, and the largest 747 Freighters. However, available cargo capacity on passenger aircraft, referred to as belly space, often serves as the primary, if not only, cargo lift into many airports. Small parts, medical supplies, domestic and international mail, and other time-sensitive goods can most always be accommodated by excess space in passenger aircraft being operated to all but the largest markets.

Another key element of the air cargo transportation network is the vast trucking systems associated with freight companies. Unlike passenger travel, air cargo often goes via extremely out-of-the-way routings on its way to the final destination, and many advertised "air cargo" shipments into smaller and mid-sized communities are actually trucked from the nearest large metropolitan area.

The following exhibits highlight some of these factors in more detail. With the FAA forecasting air cargo demand to grow at annual rates that are about 1.0% higher than those projected for passenger demand, planners must be taking such growth into account. In Arizona's particular situation, however, the future is expected to look much like the current blend of air cargo activities, with the Valley of the Sun still being the primary recipient of true air cargo activity.

Phoenix Sky Harbor, servicing the greater Valley region, has clearly defined its role as the center of Arizona's commercial air cargo. The Phoenix Metro area has the attributes required for supporting long-term commercial air cargo expansion:

1. Population mass
2. Strong base of industry and commerce
3. Strength of high-tech companies that depend on air freight
4. Access to most of the State's outlying communities (for service via the roadway/ trucking networks)

As the Metro Area's population continues to move towards the East Valley, both integrators and heavy freight operators may seek to take advantage of Williams Gateway's emerging facilities, relative lack of congestion, and airport operating fees that could remain lower than Sky Harbor's. Whether the growth happens at Sky Harbor, Williams Gateway, or a longer-term combination of the two, the Phoenix Metro area will remain the hub of Arizona's commercial air cargo.

Tucson's emergence as a regional freight center, Yuma's position as another commerce hub, and the acceleration of trans-border trade, could also have positive long-term effects on cargo operations in the southern portion of Arizona, although all trends suggest that Phoenix's position as the hub will dwarf other cities. Looking at the broader picture, the majority of border operations shipments have continued to utilize trucking as the primary mode of transportation, with goods being driven to the larger metroplex operations for transfer to aircraft where necessary.

Finally, the "out-state" regions of Arizona are expected to remain dependent on a combination of belly freight capacity in passenger aircraft and access to and from their markets via the trucking networks of air freight carriers. With much less population mass, little high-tech industrial activity relative to the major markets, and a strong roadway system that facilitates trucking, Arizona's small and mid-sized communities shouldn't require airport infrastructure investments necessary to accommodate dedicated air freight activities.

Main Points – Industry

- "High tech" industries are far and away the biggest users of air freight services, in large part due to their heavy reliance on Just-In-Time inventory management processes.

- The goods in these types of industries are typically relatively expensive and the cost to carry this type of inventory could be prohibitively expensive. This creates demand for relatively inexpensive air freight.

- While the cost of air freight may be inexpensive relative to carrying inventory, companies pay a significant premium for the ability to ship time-definite goods in a very short amount of time (cost of overnight, time-definite services can be 40x the cost of using other modes of transportation).

- Its easy to understand why companies pay this aforementioned premium when one considers the cost of shutting down an assembly line (i.e. auto plant) because certain parts are not available.
  RELIABILITY is key.

- These trends have resulted in increased demand/market share for integrated carriers like Federal Express and UPS, who offer "door-to-door" service and control. Integrated carrier share increases first occurred in the domestic market and more recently is occurring in International markets.

- The aforementioned points speak to the high yield segment of the air freight business and the key industries that drive air freight profitability. Essentially, high tech-driven air freight is analogous to business travelers in the passenger-side of the airline business.

- In the passenger airline business, while business travel is the key segment, no airline could be profitable with this business segment alone. Likewise, the cargo business needs volume from the low yield portion of the market to be profitable. This segment of this industry is commonly referred to as "belly freight."

- Belly freight makes up about 50% of the air freight market for large, hub airports, but only about 20% at smaller airports.

- In other words, the larger the belly space capacity is, the more upside exists for dedicated air cargo service. More belly space = more scheduled passenger service = larger metropolitan areas.

- Implication: Significant cargo growth is only likely to occur in/near large metropolitan areas with a heavy emphasis on high tech industry.

- A recent industry trend has been the growth of secondary airports in/near large metropolitan areas where dedicated cargo facilities are available and less "gridlock" on the ground exists. Also, these airports still offer access to local industry and "belly space" at nearby larger passenger-served airports.

The State of Arizona: Cargo Future Overview

- Major metropolitan markets, like Phoenix, with heavy exposure to high technology companies should prosper with respect to air cargo demand.

- Phoenix air cargo growth could come from PHX or it could occur at Williams Gateway Airport (WGA). Carriers have been adding cargo capacity at secondary airports in/near major metropolitan areas (like WGA) over the past few years because they can not only offer many of the benefits of the passenger-served airports like PHX (access to high tech industry and cheap belly space) but the secondary airport also offers other unique advantages (dedicated cargo facilities, lack of ground "grid-lock").

- While a market like Tucson (TUS) benefits from belly space on scheduled passenger airlines and offers the potential for NAFTA-related growth, at the end of the day, it doesn't appear that TUS is large enough or has the right industry mix to generate significant amounts of air cargo growth.

- Other markets within Arizona do no appear large enough to support any type of significant air cargo growth.

5.8.1 DRIVERS OF COMMERICAL AIR CARGO

What are the Key Factors driving Air Freight Demand?

1. **Economy/Goods Component of GDP**

2. **Industry Location/Type**

3. **Just-In-Time (JIT) Inventory Practices**

4. **Globalization of Business**

5. **International Trade Agreements**

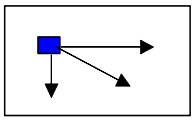
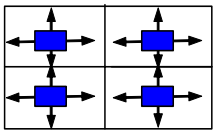
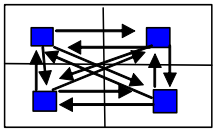
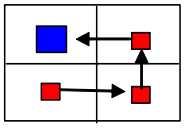
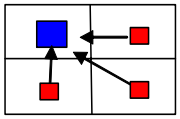
6. **Carrier-Shipper Alliances**

7. **Centralized Warehousing**

8. **Packaging Materials**

<u>Mostly by types of industries that utilize: 1) In-Process (JIT) & 2) Sub-assembly Facilities</u>

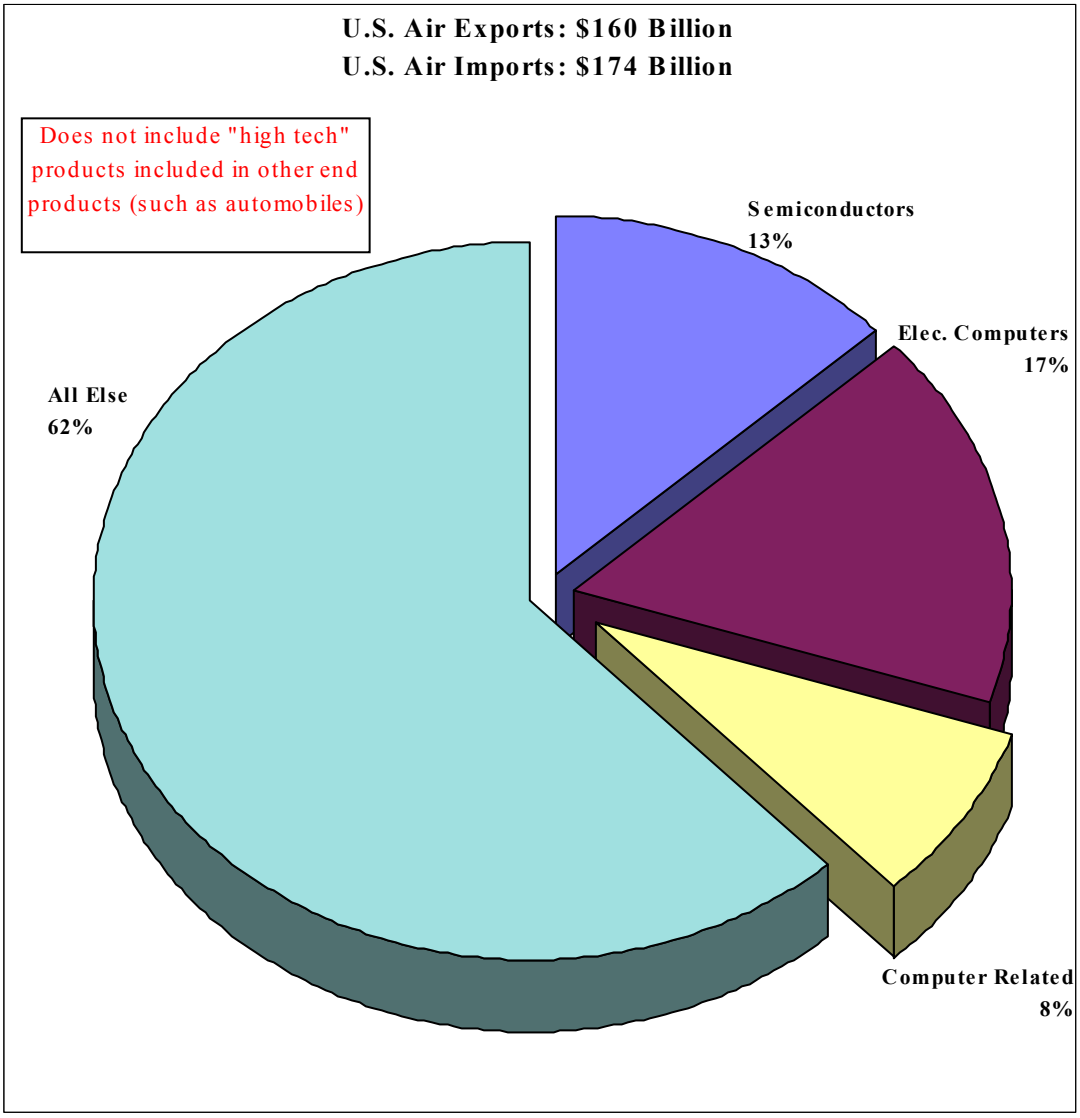
EXHIBIT 5-21: ***Industries that Utilize: 1) In-Process (J-I-T) & 2) Sub-assembly Facilities drive air freight***

	Supply Chain Configuration	Representative Industries	Plant Scale	Air Freight Impact
A		• Construction Equip • Oil Field Machinery • Medical Instruments • Industrial Pumps • Commercial Printing Presses	**Very Large** (One Location For Worldwide Production)	Inbound supply chain is typically limited to a particular geographic region Outbound distribution chains tend to be long distance
B		• Branded Consumer Products • Agricultural Products • Retail Distribution • Direct Mail Distribution	**Medium to Small** (Limited By National Market Size)	Generates large domestic flows. Unless topgraphy requires use of air, most volume goes by surface modes
C		• TV & Stereo Equip. • Office Copiers • Cellular Phones • Musical Equipment • Periodicals • CD/ROM Media	**Very Large** (Due to Regional Market Demand)	Regional market demand is satisfied with surface transportation. Unless topography requires use of air, most volume goes by surface modes
D		• Semiconductors • Printed Circuit Boards • Telecommunications Equip • Apparel	**Medium to Small** (In-Process Facilities) **Large** (Final Assembly)	J-I-T intensive configuration requires time-definite transportation. Industries with this type of chain generally are heavy users of air freight
E		• Computers and Peripherals • Automotive Assembly • Aircraft Engines • Satelite Equipment	**Large to Small** (Subassembly Facilities) **Large** (Final Assembly)	Requires tight control of transport logistics. Air freight is used to ensure that delayed surface shipments do not cause production line stoppages

*Source: MGI - 2001

"High Tech" industries generate most air freight demand …

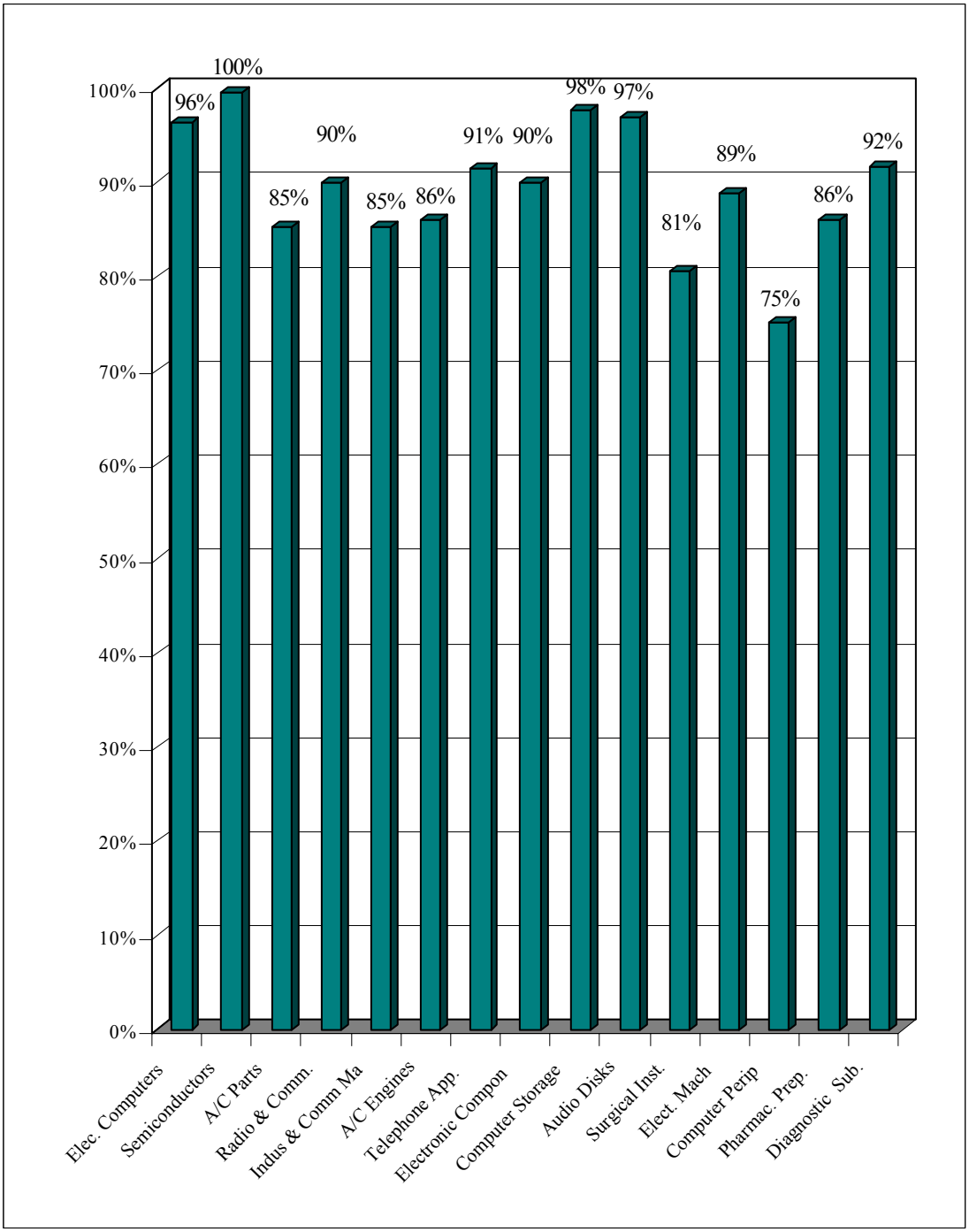
EXHIBIT 5-22: ***U.S. Air Trade by Commodity-Type***



Source: Colography - 2001

…and almost exclusively use air

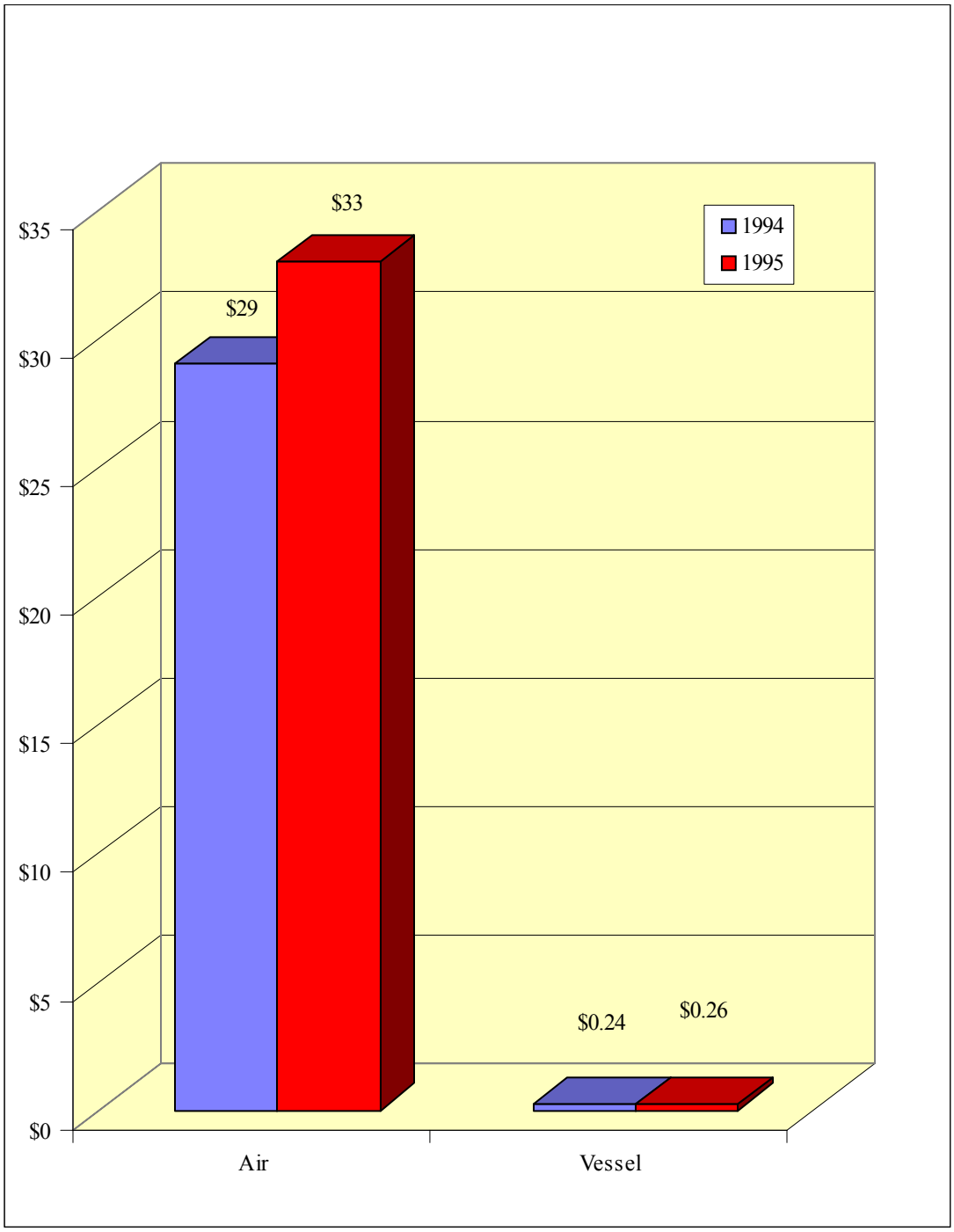
Exhibit 5-23: ***Percentage of Transport by Air***



Source: Colography - 2001

Air Trade is used for relatively more expensive goods…

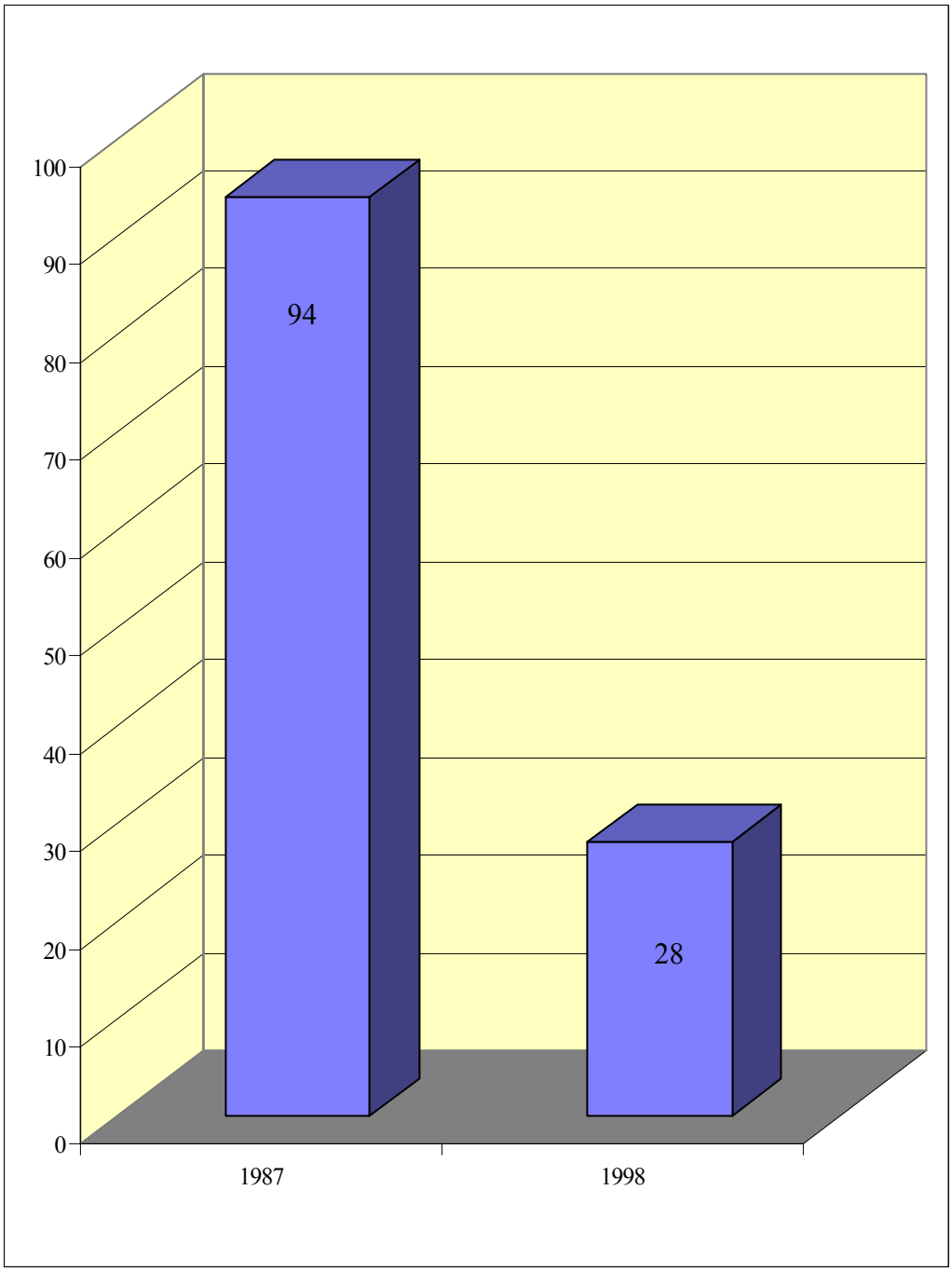
EXHIBIT 5-24: ***Dollar Value Per Pound Shipped, Air Trade vs. Vessel***



Source: Colography - 2001

…that are getting shipped in smaller units

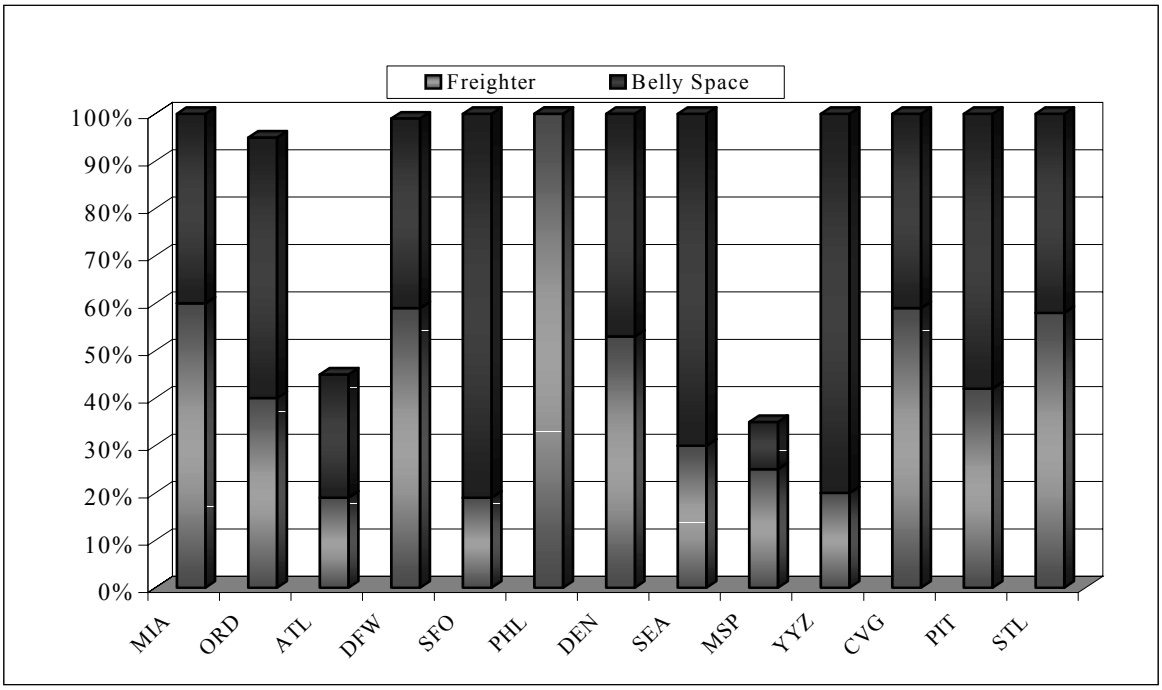
EXHIBIT 5-25: ***Pounds per Shipment – U.S. Air Exports***



Source: Colography – 2001

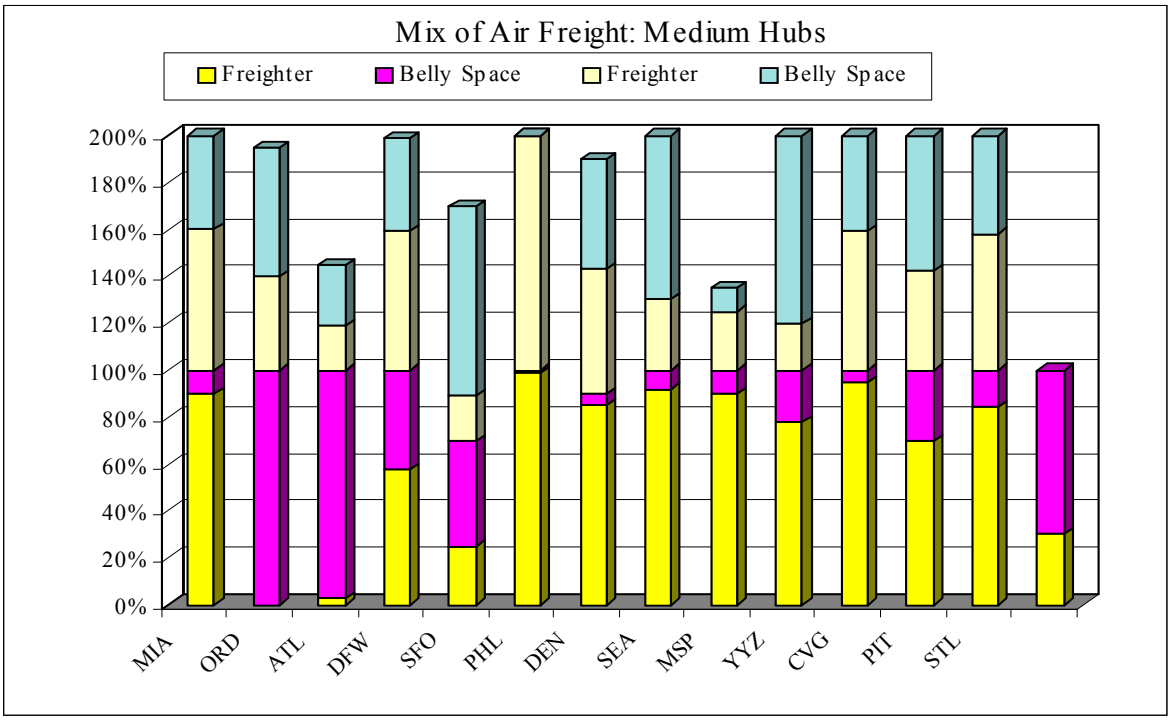
Still, "Belly Space" is a requirement for any significant Cargo Operation

EXHIBIT 5-26: ***Mix of Air Freight – Large Hubs***



Source: Air Cargo Statistics – ACI - 2001

EXHIBIT 5-27: ***Mix of Air Freight – Medium Hubs***



Source: Air Cargo Statistics – ACI - 2001

Conclusions

- "High Tech" industries are far and away the biggest users of air freight.
- In particular, those industries that utilize Just-In-Time and Quick Response Manufacturing processes almost exclusively use air freight.
- These types of goods are typically expensive.
- Dedicated freight, destined for freighter/express service, typically comprises less than 50% of air freight at most major airports. The balance (>50%) typically are shipped via "Belly Space" and is typically less expensive freight.
- Implication: To generate relatively strong freight demand, two factors must be evident: 1) High Tech industry near by, that drives "high yield" freight demand, and 2) Availability of ample passenger service nearby, that avails itself to low yield "belly space" capacity. These two factors equate to being in or near a largely populated metropolitan area.

5.8.2 CARGO INDUSTRY TRENDS

Relative Pricing = Need for Speed and Reliability

TABLE 5-11: ***North Atlantic Cargo Market***

Product	Door - Door Time	Typical Rate/Lb.
Priority Air	2-3 Days	$1.50
Standard Air	4-7 Days	$0.45-$0.85
Direct Ocean	14-28 Days	$0.06 - $0.12
Standard Ocean	21-35 Days	$0.04 - $0.08

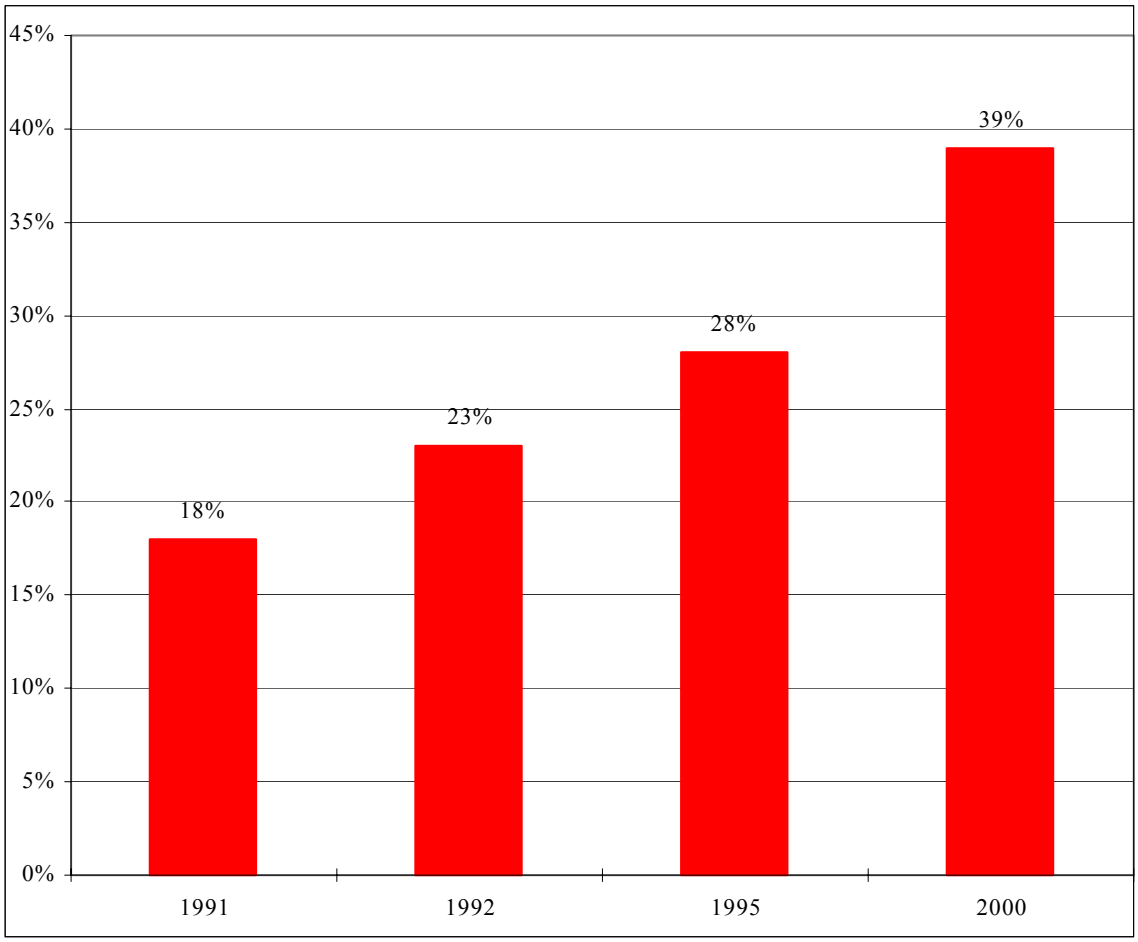
Note price differences

Source: MergeGlobal

Why the "Need for Speed" and Reliability? The increase in JIT/QR Manufacturing

- **Increasing the frequency with which shipments are scheduled**
- **Decreasing the lead time for shipments**
- **Increases in the number of individual shipments**
- **Large increase in the importance of on-time delivery**
- **A shift to faster modes (mostly an international issue)**
- **Within modes, a shift to more reliable carrier (integrated carriers)**
- **Number of supplier & transport companies is reduces by shippers**

EXHIBIT 5-28: ***Percentage of Products Shipped JIT/QR***



Source: Ohio State University via 1995 UPS Annual Report.
JIT = Just-In-Time inventory and Quick Response Manufacturing Technique

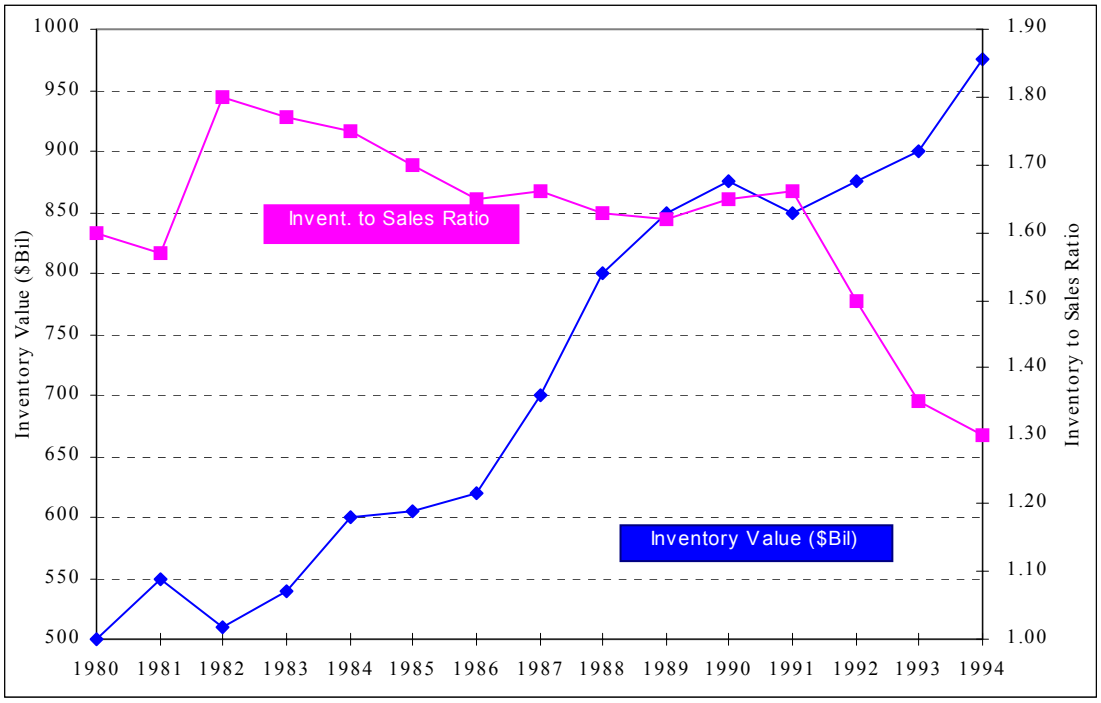
What is J-I-T and QR Manufacturing?

Just-in-time (JIT) or Quick Response (QR) are manufacturing processes that essentially abolish (or at least minimize) inventories of goods or raw materials. Typically, JIT or QR are utilized more aggressively as the cost of inventories (i.e. expensive goods) increases.

Why this manufacturing change?

It is cheaper to use overnight air than to carry expensive inventory.

EXHIBIT 5-29: ***Inventory to Sales Ratio***

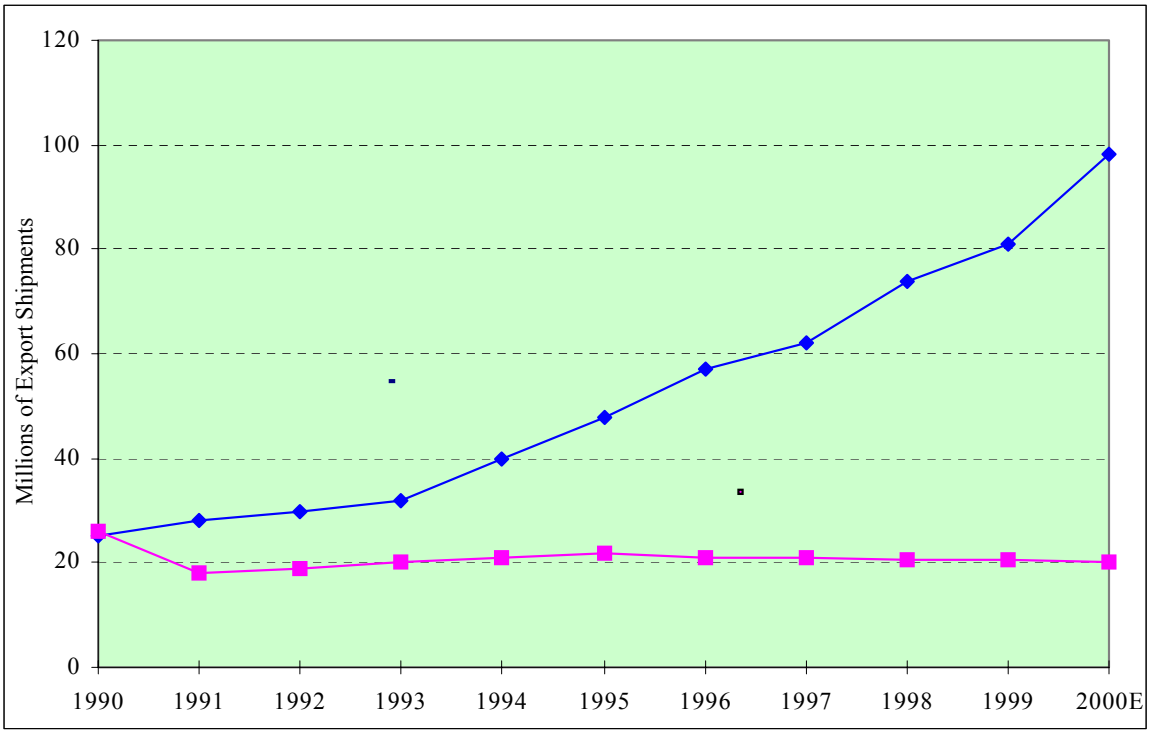


Source: Colography

Much of the problem can be traced to technology; it is more expensive for a company to carry large quantities of lightweight, $2,000 laptop computers in inventory than to carry bulky, outdated type-writers that retail for a fraction of the cost.

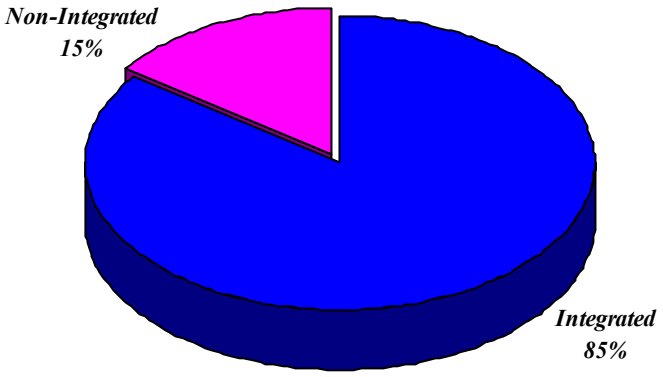
Because of this time-sensitive nature, integrators are taking over.

EXHIBIT 5-30: ***Export Shipments by Carrier***



Integrated Carriers are defined as those that provide seamless, door-door service. They are considered the most reliable, service-oriented. Examples: Federal Express, UPS, Airborne, Emery, DHL & Burlington

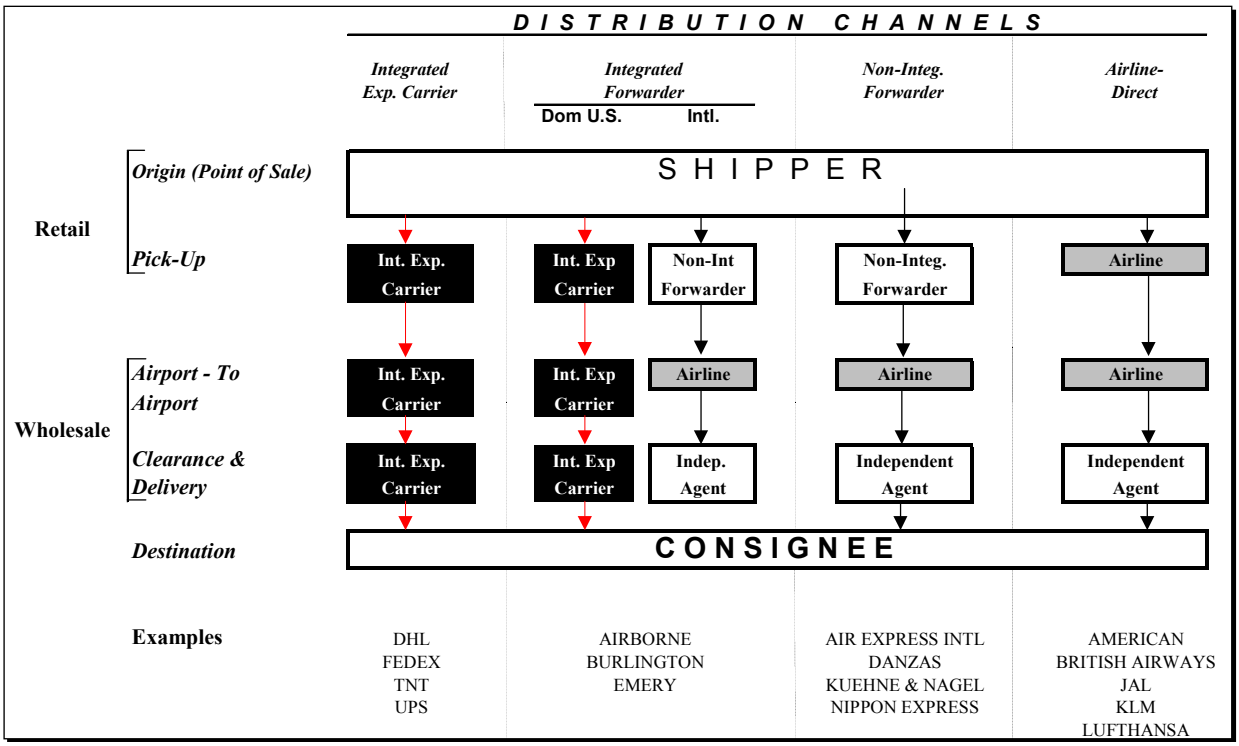
Domestic Market Share



Source: MergeGlobal - 2001

Chart below displays typical Air Freight Distribution Channels

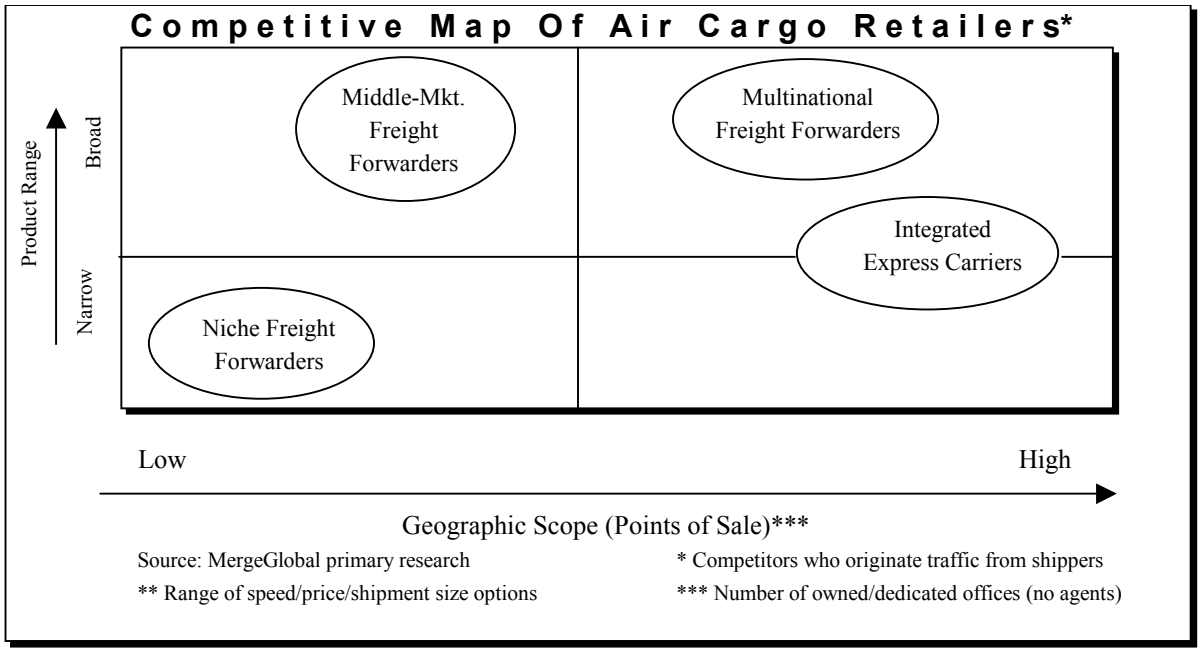
EXHIBIT 5-31: *Air Freight Distribution Channels*



Source: MergeGlobal - 2001

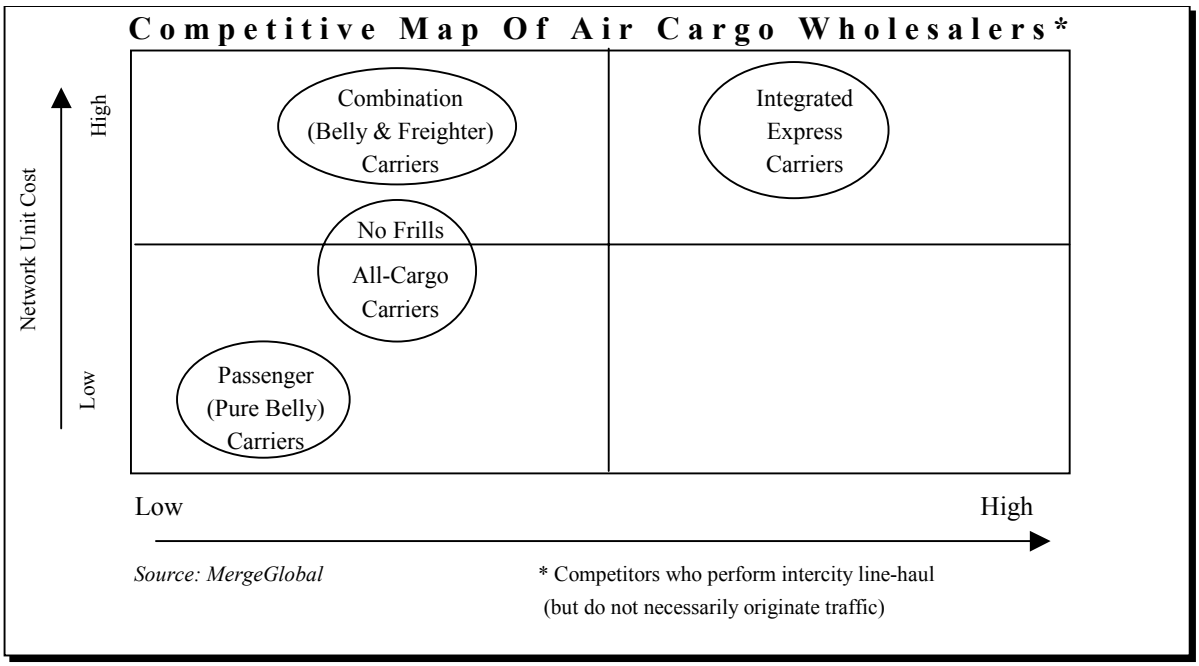
Integrated Carriers operate at the "high-end" of the air cargo market

EXHIBIT 5-32: ***Competitive Map of Air Cargo Retailers***



Source: Merge Global - 2001

EXHIBIT 5-33: ***Competitive Map of Air Cargo Wholesalers***



Source: Merge Global – 2001

Integrated Carrier Specific Commentary

Federal Express

Largest aircraft fleet of Integrators. Primary hubs in Memphis, London-Stansted, Paris (CDG),Subic Bay (Philippines), Tokyo (NRT), Taipei (Taiwan) and Dubai (Middle East). Regional U.S. hubs are located at Indianapolis, Newark, Oakland, Los Angeles, Chicago, and Anchorage. Federal Express is very profitable in the domestic U.S. market, but has struggled in Asia for years.

UPS

Revenue base doubles that of their next biggest competitor, due to UPS' massive ground fleet advantage. UPS operates their primary domestic hub at Louisville (SDF), with regional hubs at Philadelphia, Columbia, South Carolina, Dallas-Fort Worth, Rockford (Illinois), and Ontario (California). UPS operates Anchorage as their Pacific gateway, with direct service to Tokyo, Hong Kong, Korea, Singapore, Malaysia and Taiwan. Pacific hub at Taipei, Taiwan; Atlantic hub in Cologne, Germany. While UPS dominates the domestic U.S. market, they lag in the international arena, and recent facilities investment/strategic moves indicates they are aggressively targeting Asia. announced long-term marketing and operating agreement with Nippon Cargo (who was recently granted 30 additional landing slots from Japan to the U.S.)

DHL

Number 3 integrated carrier in the world. Privately held and difficult to get information on.Relatively large player in intra-Europe, intra-Asia, and Middle East markets. Biggest obstacle is the fact that they are a niche player in the domestic U.S. market, garnering only about 2% of that market; major DHL hubs are Cincinnati, Brussels (Belgium), and Manila (Philippines). Apparently are largest European integrated carrier and are believed to be quite profitable on this continent.

Emery

Subsidiary company of Consolidated Freightways (whose primary business is nationwide U.S.trucking); Emery's primary U.S. hub is located at Dayton, Ohio; Regional hubs at Charlotte, Chicago, Dallas Fort-Worth, Los Angeles, Orlando, Nashville, Sacramento, and Newburgh, New York (Stewart Airport); Emery also serves Europe with a hub located at Brussels, Belgium; Emery has dedicated aircraft and trucks that support service across Europe. $1.8 billion revenue base.
but is dwarfed by Federal Express and UPS. More focused on heavy freight (relative to parcel-dominated Federal Express and UPS) and competes primarily in this market with BAX. Emery continued

Burlington Air Express (BAX)

Fully integrated domestic carrier (not internationally, as BAX does not fly their own aircraftoverseas and must rely on outside contractors). Burlington Air Express is a subsidiary of Pittston Burlington Group (whose principal business evolves around coal and mineral operations). BAX has a $1.2 billion revenue base, with international operations generating about 57% of revenues (and growing). BAX hub is located at Toledo, Ohio. Focuses on relatively heavy freight, with 5% geared towards auto industry (down from 20% a few years ago).

Airborne Express

Fully integrated domestic carrier (not internationally). "Variable Cost Approach" to international business. Wilmington, Ohio is major hub. $2.2 billion revenue base. DC8 operator. Focuses on 5 lb. or less shipment (similar to Federal Express and UPS, less like Emery and BAX).

Conclusions

- Integrated carriers, who already dominate the domestic air freight industry, are beginning to do the same in the international air freight market.

- Why? The requirement by industry for "time definite" services. Time definite example: an automobile part needed for an auto plant manufacturing line. If that part doesn't arrive on schedule, the whole line shuts down – costing A LOT of money.

- Why are companies doing this? It is cheaper than carrying the cost of the inventory. Again, primarily applies to "high-tech" industries.

- Companies are willing to pay a huge premium for the ability to ship goods on short notice and with a high degree of confidence. Note relative price differences (charged by air freight/ other transportation delivery modes).

- As noted earlier, this is a trend toward dedicated cargo operations in secondary airports near major metropolitan areas.

5.8.3 WHAT INDUSTRY TRENDS MEAN FOR ARIZONA

Comment

- As noted earlier, cargo operations typically gravitate toward large metropolitan areas (for previously discussed reasons).

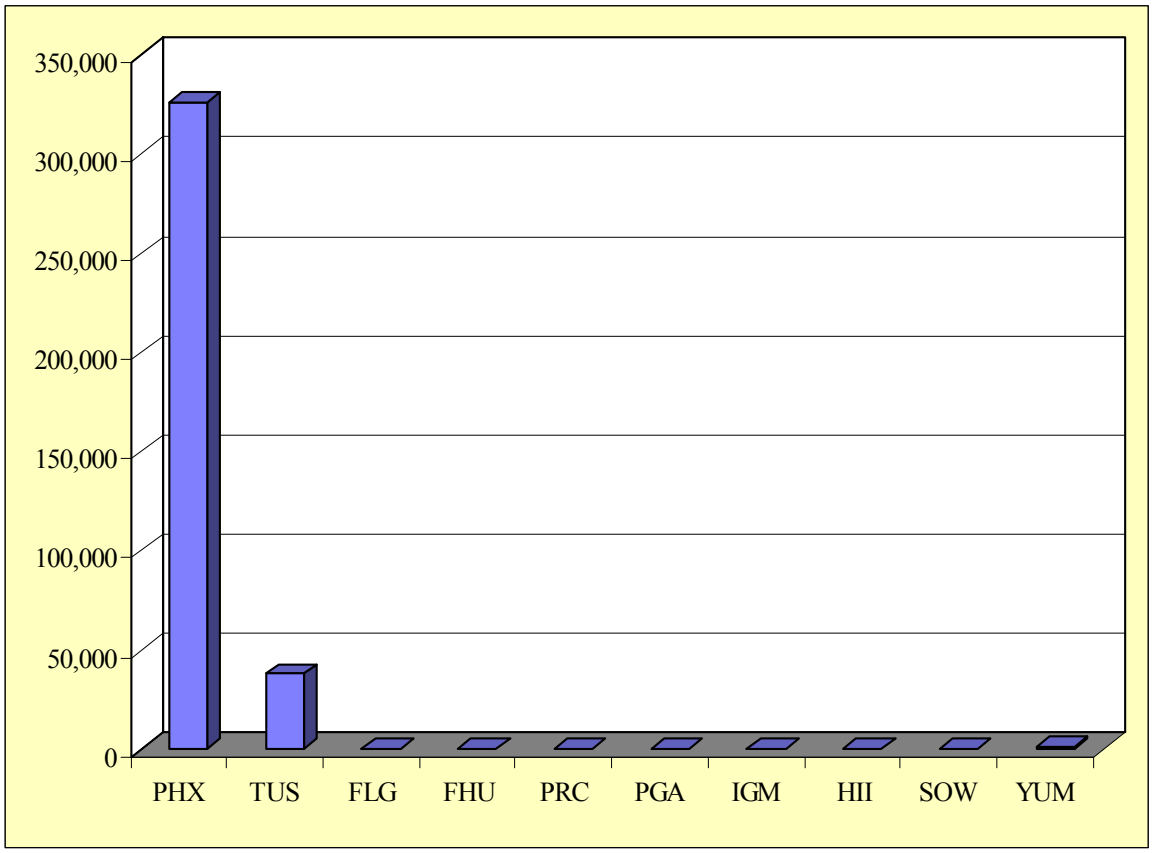
- Given that, Phoenix (PHX) stands out as the only real viable cargo growth market in the State of Arizona.

- Tucson (TUS) has limited opportunities (in part, due to its decent size and potential NAFTA-related growth), but given the industry in/around Tucson, TUS won't experience anything like what Phoenix could.

- All other Arizona markets are probably going to have to rely primarily on truck feeder growth, as they are not big enough to support much in the way of air freight growth.

Phoenix (PHX) dominates the current Arizona air cargo market

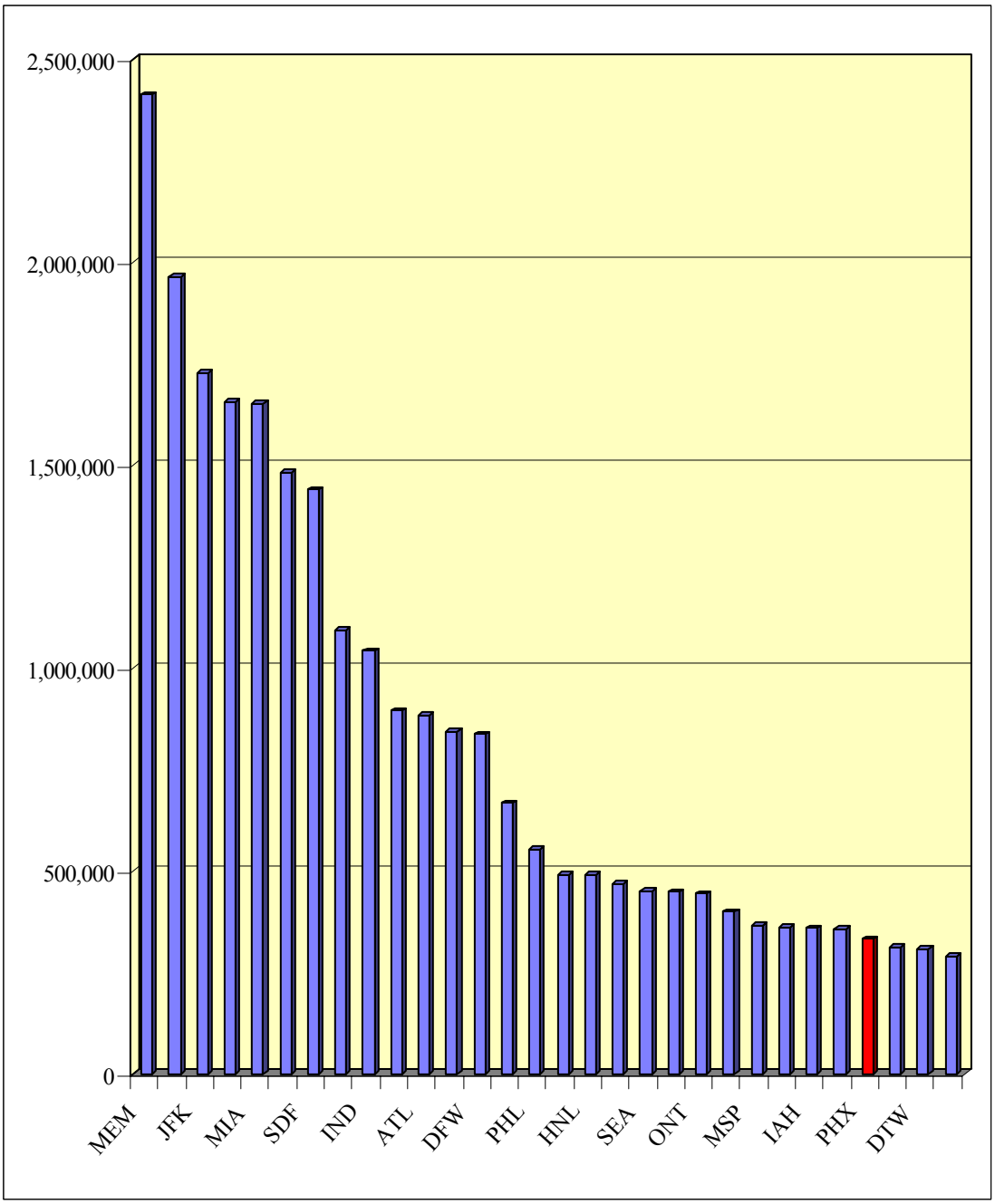
EXHIBIT 5-34: ***Phoenix (PHX) tons Shipped – YE1999***



Source: ACI Cargo Activity Statistics - 2001

PHX is the largest cargo (volume) airport in the U.S. . . .

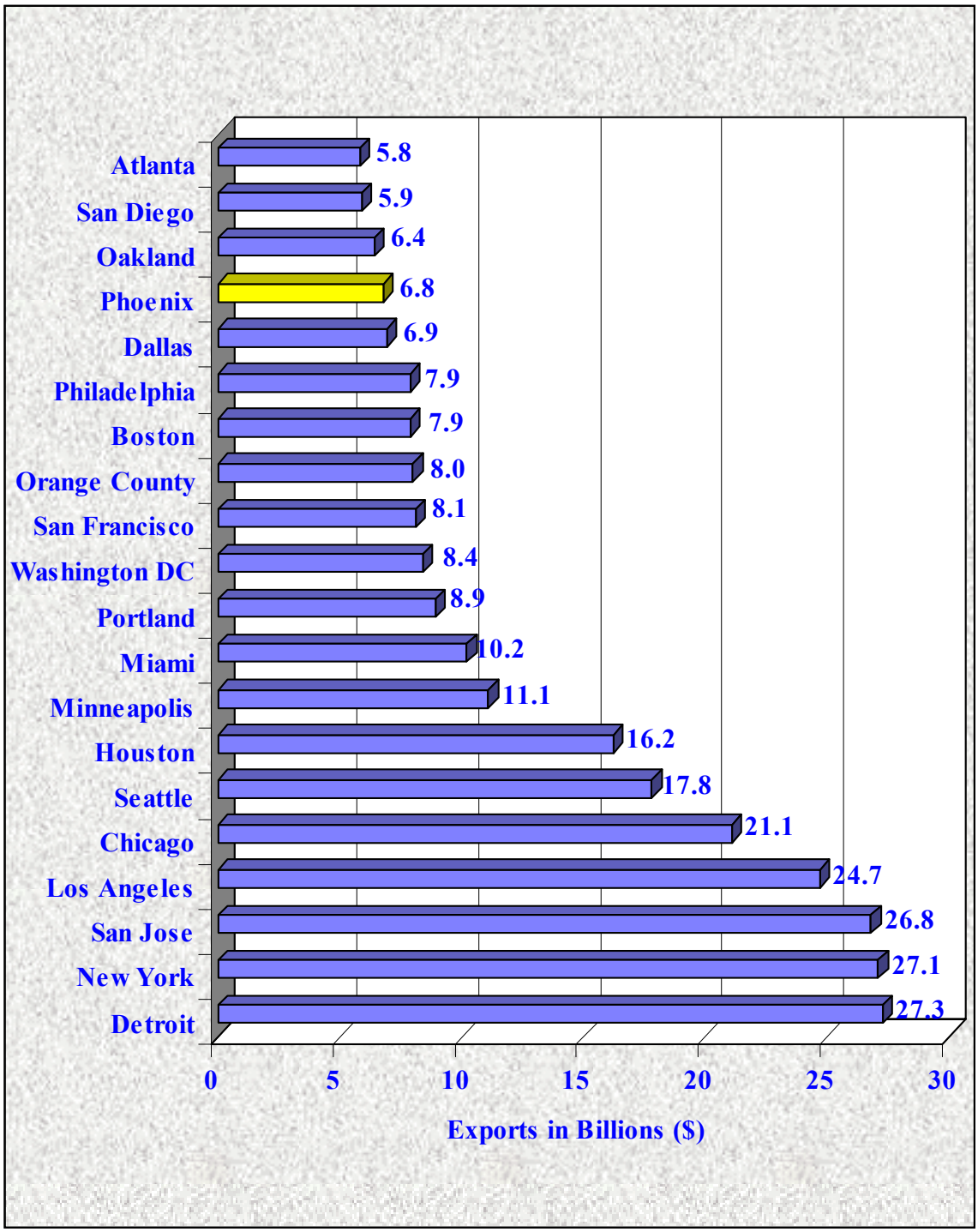
EXHIBIT 5-35: ***Top 30 Cargo Markets in the U.S. – 1999 (Metric Tons)***



Source: ACI Cargo Activity Statistics - 2001

… and Phoenix is the 19th largest export market in the U.S. …

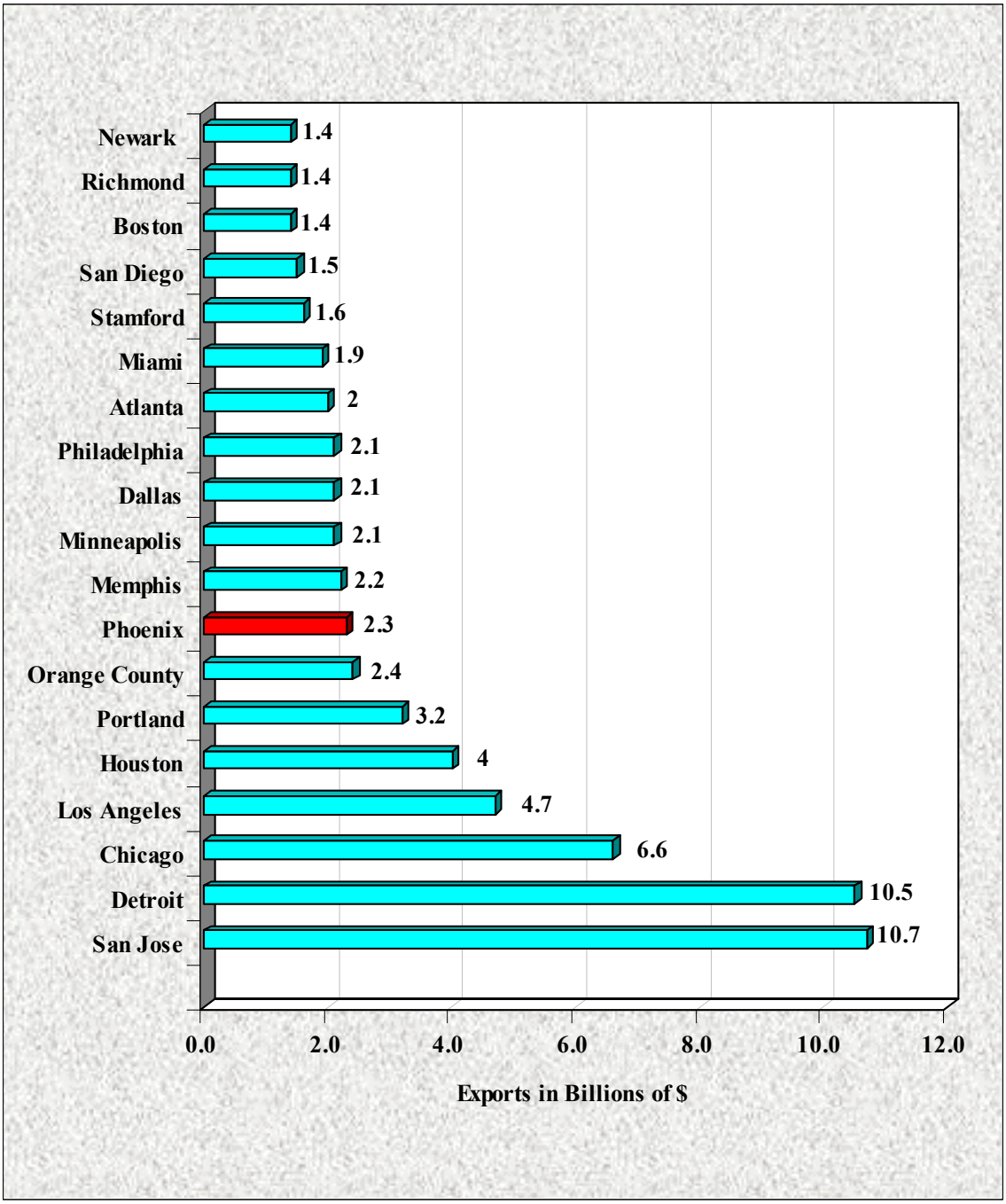
EXHIBIT 5-36: ***Top 25 U.S. Export Markets***



Source: U.S. Dept. of Commerce - 2001

… and is also one of the fastest growing export markets in the U.S.

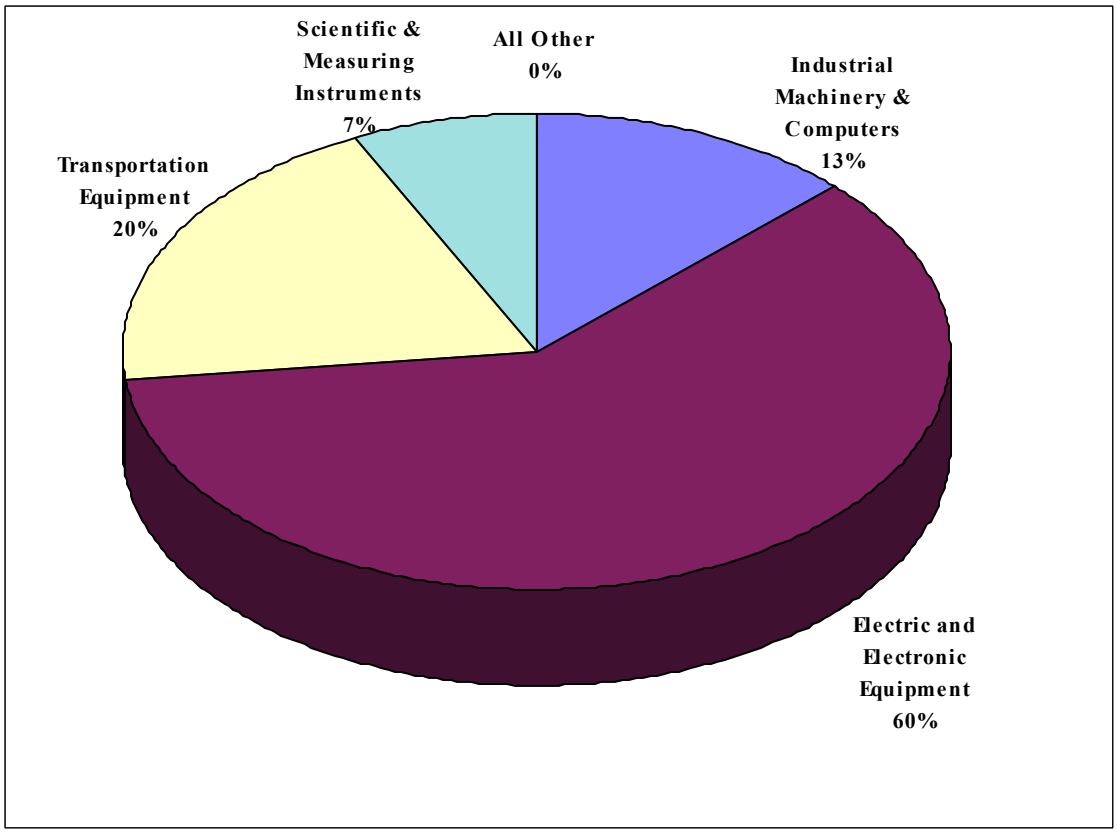
EXHIBIT 5-37: ***Greatest Gains (in dollars) for Metro Areas – 1999 vs. 1993***



Source: U.S. Dept. Of Commence - 2001

Why does PHX generate so much air cargo: High Tech Industry in PHX

EXHIBIT 5-38: ***Phoenix Air Cargo (1999) by Commodity-Type***



Source: U.S. Dept. of Commerce - 2001

Other reasons Phoenix should be the cargo "hub" for Arizona

- Large metropolitan area.
- Significant base of technology-related industry (Intel, Honeywell).
- Significant passenger service at PHX, creating significant low-yield belly space alternatives.
- Good weather – ties to strong operational reliability.
- Good highway access to both PHX and potentially WGA.

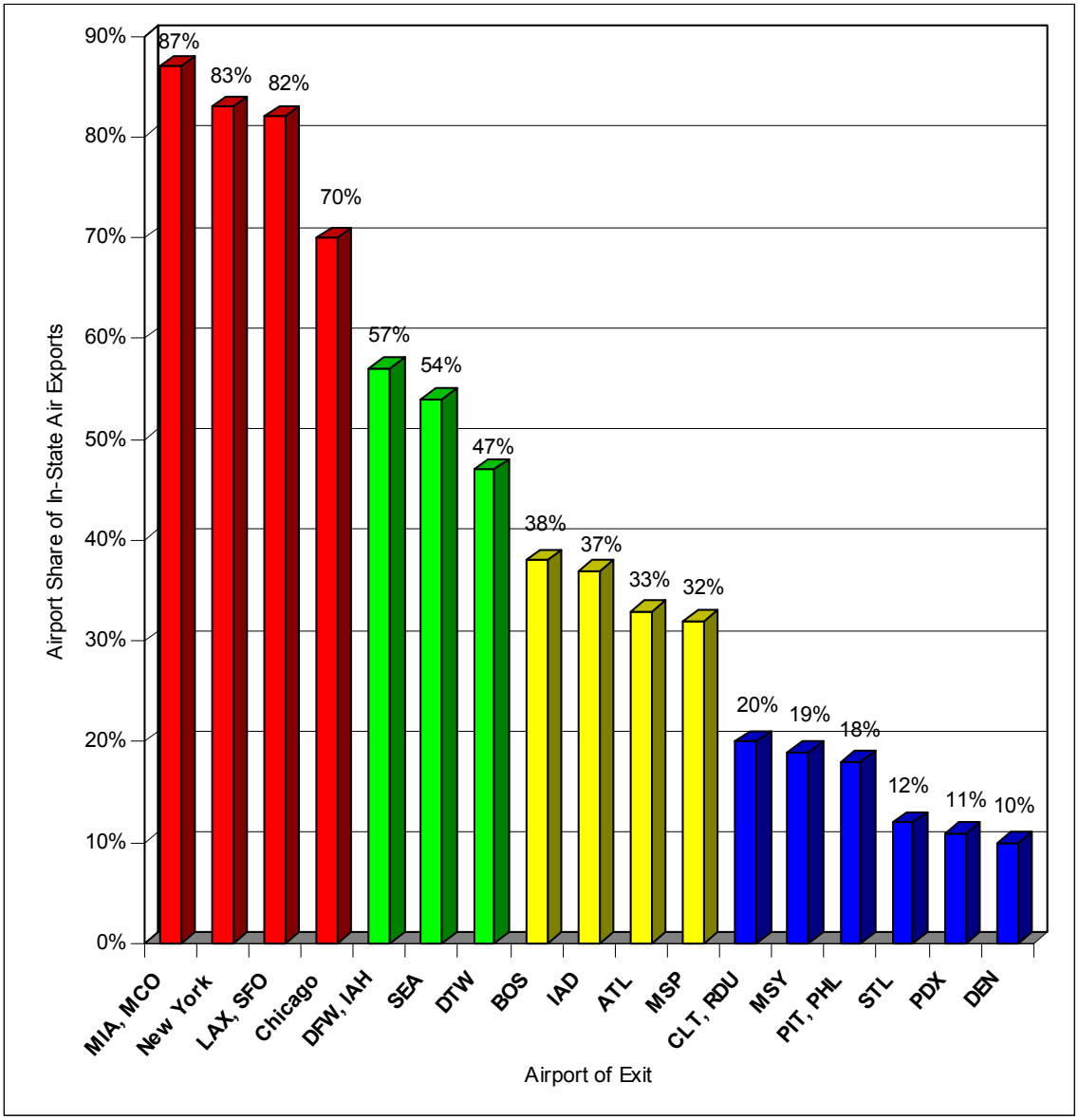
Conclusions

- **Industry trends are pretty clear: Cargo growth from the State of Arizona will have to come from Phoenix**.
- **One question is whether PHX is a viable growth option for cargo or whether another airport – like WGA – presents better long-term cargo growth potential.**

5.8.4 PHOENIX ALTERNATIVE: WILLIAMS GATEWAY AIRPORT (WGA)

Many major cities witness cargo leakage to the big centers such as LAX & ORD. Why?

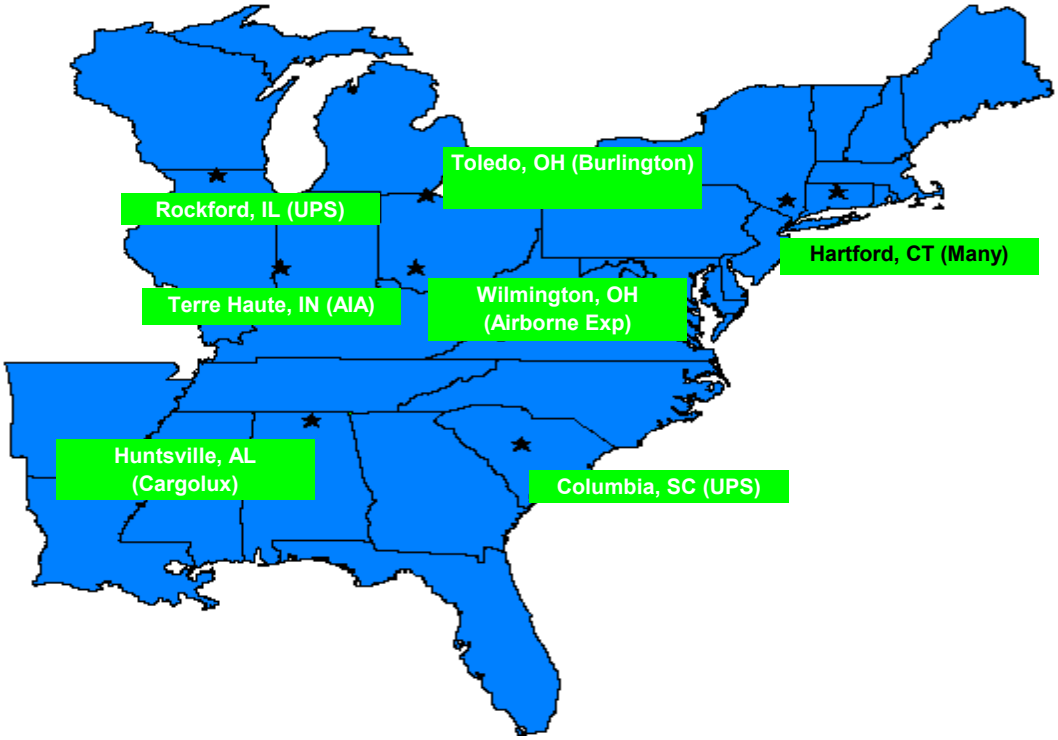
EXHIBIT 5-39: ***Share of State Air Exports (lbs.) at In-State Airports***



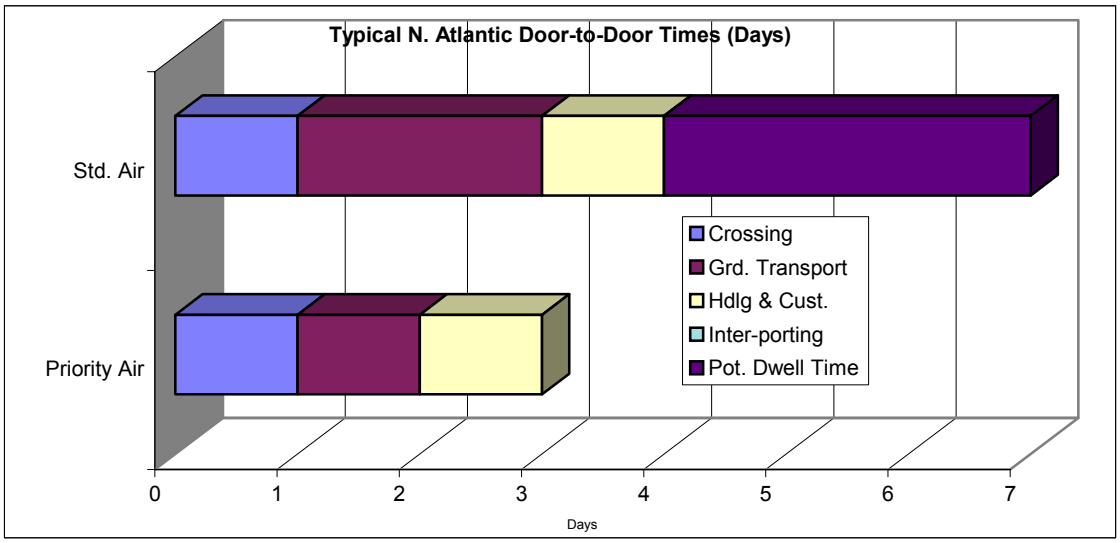
Source: U.S. Bureau of the Census Foreign Trade Statistics - 2001

1) **Lack of dedicated cargo facilities**
2) **Potential for ground "gridlock"**
3) **Lack of space**
4) **Relative costs?**

Recent air cargo trend: Hubbing of "lesse" airports in major metro areas



Why? Major delays at major U.S. gateways …



Source: *Merge Global - 2001*

… and relatively high operating costs at "major airports"

Cost Element	IAD	JFK
Landing Costs	$1,027	$2,360
Airport Fee	$0	$601
Intro-Plane Fuel Fee	$632	$772
Freight A/C Handling	$2,000	$3,200
Cargo Handling	$5,250	$8,250
Apron Fee	$280	$550
On Airport Facilities (Annual)	$330,000	$370,000
Utilities (Annual)	$33,600	$40,000
Weekly Cost of an Air Cargo Operation with 4 scheduled trips/week	**$52,937**	**$86,550**

Finally, WGA facilities appear to make it a strong candidate for air cargo

- **Runway Capacity**
  - Current: 3 parallels
  - Planned: Increased length and separation
- **Expansion Space Available**
  - 4,000+ acres with on-site cargo facilities planned
- **Operational Support Infrastructure**
  - On-site aerospace center to support maintenance, manufacturing and modification
- **Intermodal Access**
  - On-site rail (Union Pacific)
  - Potential for light rail, high-speed transit, etc.
  - Planned road access and highway improvements

5.9 REGISTERED GENERAL AVIATION AIRCRAFT

Methodology

Registered general aviation aircraft were forecast by county and were primarily based on the forecasts of licensed pilots that were prepared in the SANS 1995. Through discussions with members of the project Planning Advisory Committee, it was determined that the SANS 2000 general aviation forecasts would be based on the rate of growth established previously for the 1995-2015 planning period. However, the point of beginning for the forecasts would be based on current registration and basing information which has been obtained in the inventory/data collection phase of this study.

Overall, and based on this forecasting methodology, growth in registration of single-engine aircraft is proportional to the growth in general aviation licensed pilots. Growth in multi-engine aircraft, including multi-engine piston, turboprop and jet aircraft, is proportional to growth in the number of commercial and air transport pilots; and growth in other aircraft, which includes mainly helicopters and gliders, is proportional to general aviation pilots.

These forecasts are forecasts of change. Arizona DOT registered aircraft by county were obtained from the Division of Aeronautics and used to determine the change in registered aircraft. In the two metropolitan counties, new Regional Aviation System Plans will become available, and their forecasts of aircraft will be used as provided.

Base Data

The FAA maintains an airport data base developed through the completion of FAA Form 5010. Completion of these forms is a responsibility of the Arizona DOT, Aeronautics Division. Copies of these forms were obtained for all of the airports concerned. These forms inventoried based aircraft, as of 1998, in categories which were compatible with the three categories forecast.

<u>Arizona Registrations</u>
All aircraft based in Arizona must register with the Arizona DOT. That registration form includes specification of the airport at which the aircraft is based.

5.10 BASED AIRCRAFT BY AIRPORT

In order to determine needs at airports, forecasts of aviation activity are necessary by individual airport. The county totals described above have been allocated to airports for use in the NEEDS determination.

Methodology

There were several factors that were used to allocate aircraft to individual airports. For the two metropolitan areas, the Regional Aviation System Plan forecasts were used, as provided. For other counties, master plan forecasts were used as guidance, but in nearly every case, these forecasts indicated far more growth in the general aviation fleet than current industry forecasts suggest, or than current aircraft manufacturing could support. For multi-engine aircraft, airport capabilities were also considered.

Based aircraft by type for the non-metropolitan are shown on Exhibits 5-40 to 5-43. The base data were the FAA Form 5010 and Arizona DOT registration data described above, as well as from information gathered through the airport sponsor surveys sent out in June, 1999. In addition, many of the airports in the system currently have no based aircraft, but serve important access functions, including Medivac, with Arizona's long distances and sparsely populated areas. For many of these airports, lacking indication to the contrary, no based aircraft were forecast. Total based aircraft by airport are shown on Tables 5-12 to 5-15.

Operations

General aviation operations per based aircraft were calculated from the FAA Form 5010 data for 1998 and from recent survey information, and maintained as constant over the forecast years. Where no historic operations data were available, a constant 200 operations/based aircraft was assumed. Where there were no based aircraft, a minimum 200 operations was assumed at the airport. The results are shown in Table 5-16.

Military Operations

Military operations have been recorded at 21 non-metropolitan airports according to the FAA Form 5010. These include Sierra Vista, Coolidge and Yuma, joint use facilities. In addition, the MAG Regional Aviation System Plan forecasts operations at Luke AFB, Papago AFB and Sky Harbor International, and the PAG Regional Aviation System Plan forecasts operations at Davis-Monthan AFB. Most civil forecasts of military activity assume constancy. This assumption has been used for this study.

Fleet Mix by County

Exhibit 5-40 tabulates the forecast total aircraft by county for the forecast years 2000, 2005, 2010, 2015, and 2020.

These forecasts were further detailed by the three categories of single-engine piston, multi-engine and other, as illustrated on Exhibits 5-41 to 5-43.

EXHIBIT 5-40: ***Forecast Total Based Aircraft by County 1998-2020***

	1998	2000	2005	2010	2015	2020	% of Total (2020)
Apache	35	36	38	41	44	50	0.56%
Cochise	143	147	156	166	178	188	2.12%
Coconino	219	222	239	260	283	311	3.50%
Gila	167	170	172	176	181	186	2.10%
Graham	34	28	36	38	41	43	0.48%
Greenlee	4	4	4	4	4	4	0.05%
LaPaz	21	21	23	26	30	32	0.36%
Maricopa	3,857	3,900	4,065	4,303	4,568	4,877	54.95%
Mohave	449	460	492	537	589	649	7.31%
Navajo	105	108	111	121	128	139	1.57%
Pima	893	900	968	1,050	1,140	1,236	13.86%
Pinal	216	225	231	248	267	284	3.20%
Santa Cruz	23	23	26	29	32	36	0.40%
Yavapai	439	440	491	556	627	708	8.00%
Yuma	95	98	104	114	125	137	1.54%
Totals	**6,694**	**6,782**	**7,150**	**7,663**	**8,231**	**8,874**	**100%**

Source BWR Corporation Forecast Analysis - 2001

Percent of Forecast Total Based Aircraft by County 2020

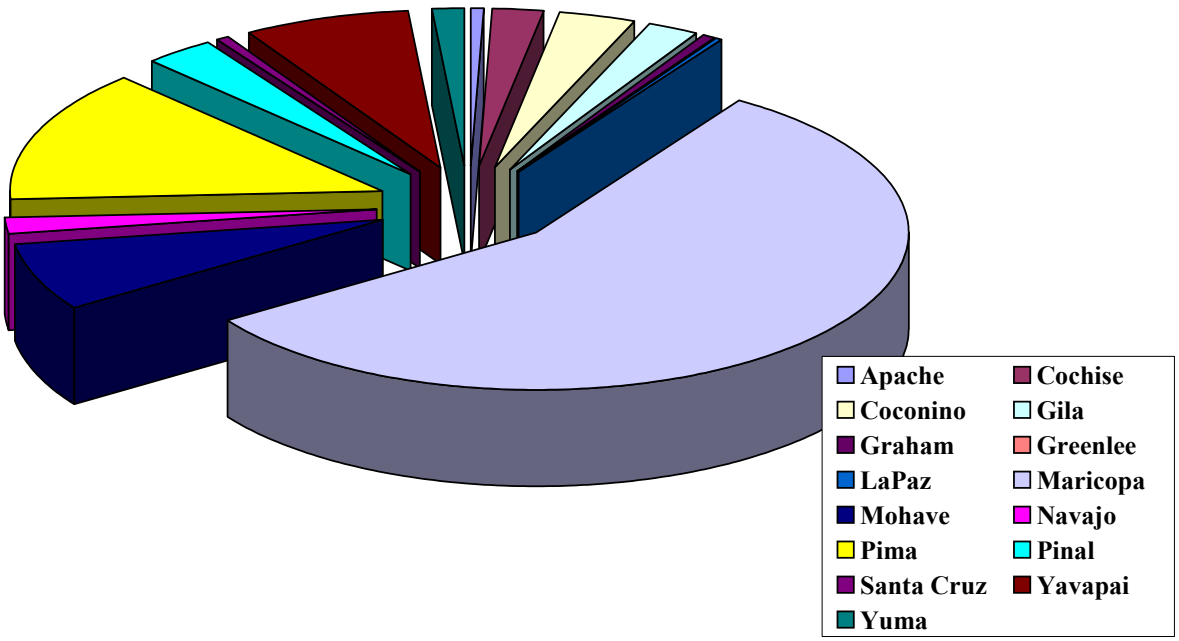


EXHIBIT 5-41*: Forecast Single-Engine Piston Based Aircraft by County 1998-2020*

	1998	2000	2005	2010	2015	2020	% of Total (2020)
Apache	30	31	33	36	39	43	0.65%
Cochise	113	115	124	132	139	148	2.25%
Coconino	154	158	166	180	198	215	3.27%
Gila	104	105	108	112	117	132	2.01%
Graham	21	21	23	24	26	28	0.43%
Greenlee	4	4	4	4	4	4	0.06%
LaPaz	18	18	19	19	19	20	0.30%
Maricopa	2,819	2,908	3,064	3,227	3,400	3,520	53.50%
Mohave	309	310	339	374	412	456	6.93%
Navajo	80	80	86	91	97	104	1.58%
Pima	698	800	857	912	971	1,020	15.50%
Pinal	93	95	96	101	109	111	1.69%
Santa Cruz	15	15	17	20	22	26	0.40%
Yavapai	397	400	446	503	566	640	9.73%
Yuma	78	80	86	94	103	113	1.72%
Totals	**4,933**	**5,140**	**5,468**	**5,829**	**6,222**	**6,580**	**100%**

Source: BWR Corporation Forecast Analysis - 2001

Percent of Total Forecast Single-Engine Piston Based Aircraft by County 2020

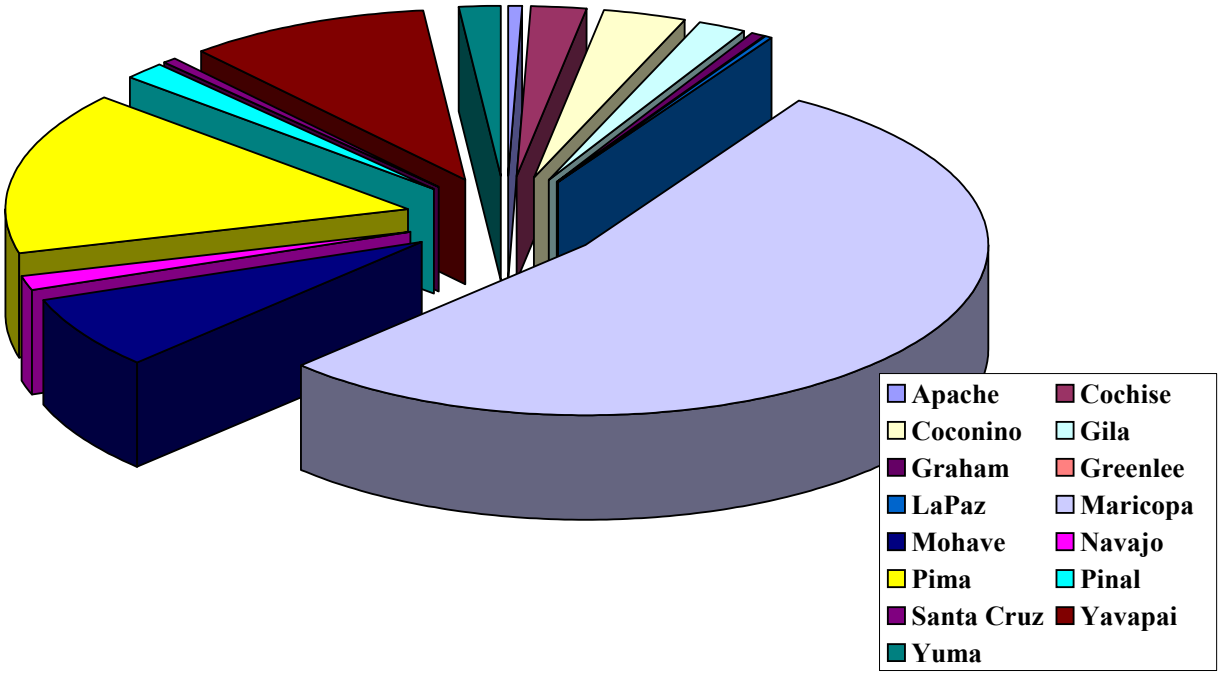


EXHIBIT 5-42: ***Forecast Multi-Engine Based Aircraft by County 1998-2020***

	1998	2000	2005	2010	2015	2020	% of Total (2020)
Apache	4	4	4	4	4	4	0.31%
Cochise	18	18	19	19	20	21	1.64%
Coconino	28	28	30	32	35	38	2.96%
Gila	7	7	7	8	8	8	0.62%
Graham	7	7	7	8	8	8	0.62%
Greenlee	0	0	0	0	0	0	0.00%
LaPaz	0	0	0	0	0	1	0.08%
Maricopa	434	477	529	587	651	712	55.45%
Mohave	128	130	134	142	150	160	12.46%
Navajo	21	21	22	23	27	29	2.26%
Pima	129	147	158	169	180	195	15.19%
Pinal	15	15	15	16	16	17	1.32%
Santa Cruz	8	8	9	10	11	12	0.93%
Yavapai	38	39	42	47	52	57	4.44%
Yuma	16	16	17	19	21	22	1.71%
Totals	**853**	**917**	**993**	**1,084**	**1,183**	**1,284**	**100%**

Source: BWR Corporation Forecast Analysis - 2001

Percent of Forecast Multi-Engine Based Aircraft by County 2020

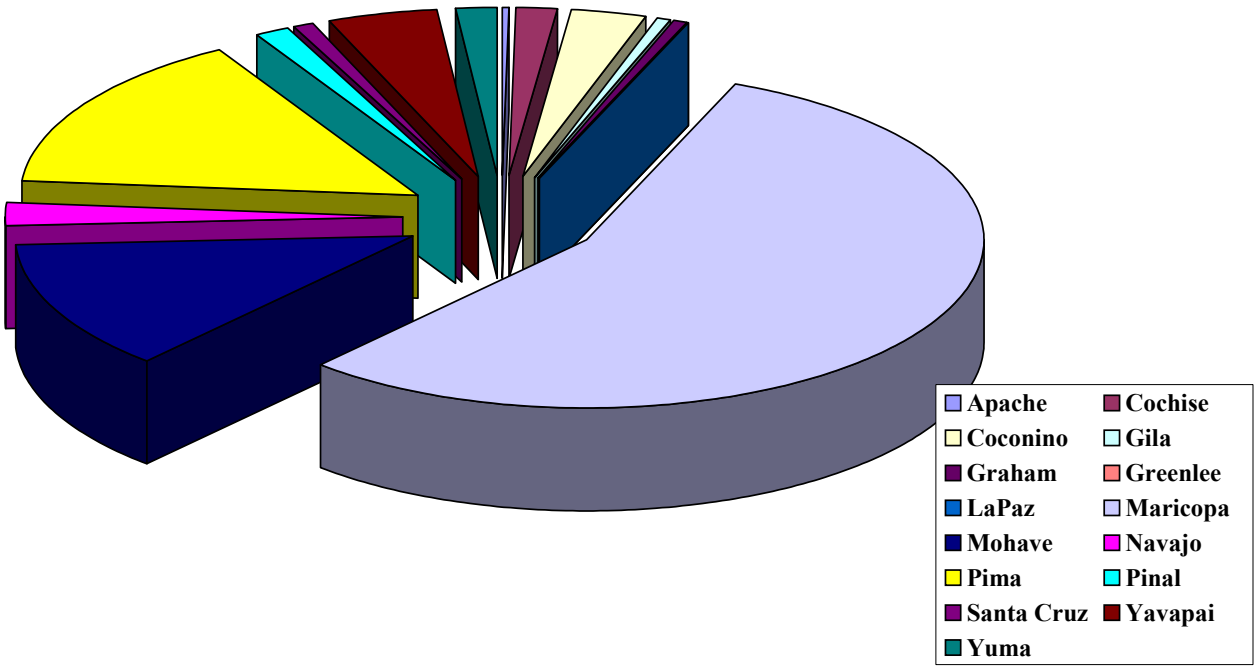


EXHIBIT 5-43: ***Forecast Other Based Aircraft by County 1998-2020***

	1998	2000	2005	2010	2015	2020	% of Total (2020)
Apache	1	1	1	1	1	2	0.18%
Cochise	12	12	13	14	16	18	1.59%
Coconino	37	38	42	47	54	61	5.37%
Gila	56	56	56	56	56	56	4.93%
Graham	0	0	0	0	0	0	0.00%
Greenlee	0	0	0	0	0	0	0.00%
LaPaz	1	1	1	1	2	2	0.18%
Maricopa	347	415	482	561	649	724	63.79%
Mohave	12	12	13	14	16	18	1.59%
Navajo	1	1	1	1	1	1	0.09%
Pima	71	81	88	93	99	107	9.43%
Pinal	111	112	116	124	129	137	12.07%
Santa Cruz	0	0	0	0	0	0	0.00%
Yavapai	4	4	5	5	6	8	0.70%
Yuma	1	1	1	1	1	1	0.09%
Totals	**654**	**734**	**819**	**918**	**1,030**	**1,135**	**100%**

Source: BWR Corporation, Forecast Analysis - 2001

Percent of Forecast Other Based Aircraft by County 2020

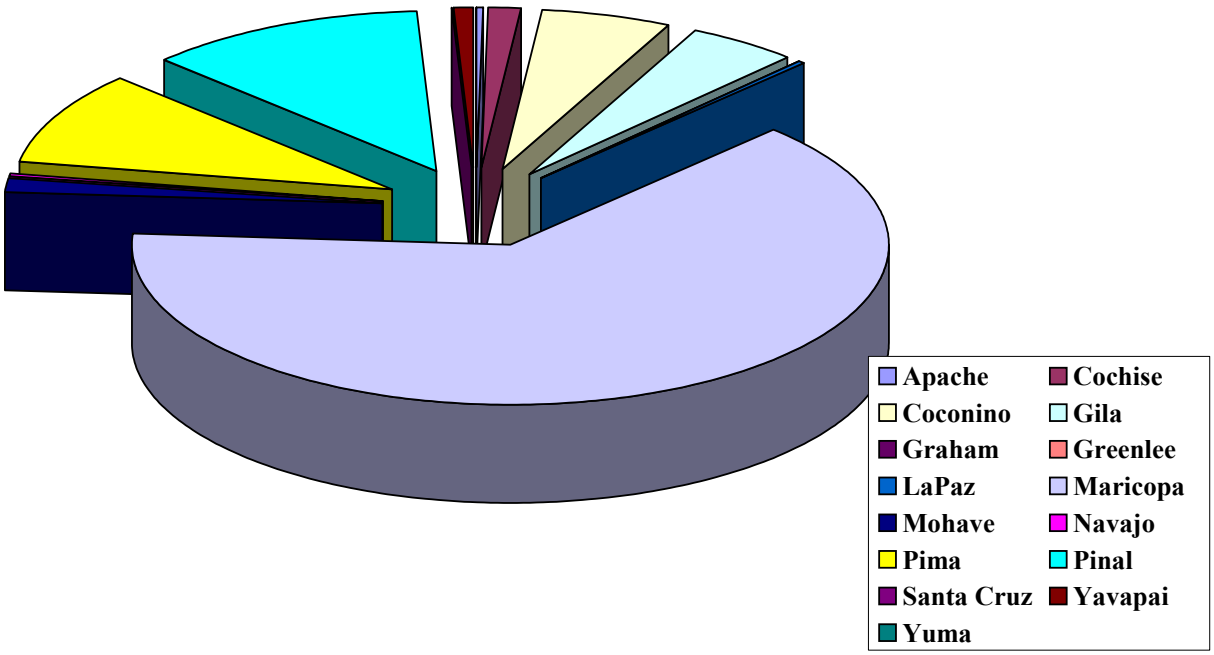


TABLE 5-12: ***Forecast Total Based Aircraft by Airport 1998-2020***

County	Airport	City	1998	2005	2010	2015	2020
Apache			**35**	**38**	**41**	**44**	**50**
	Chinle Municipal	Chinle	2	2	2	2	2
	Ganado	Ganado	0	0	0	0	1
	St. Johns Industrial Airpark	St. Johns	9	9	10	10	11
	Town of Springerville Municipal	Springerville	16	17	18	19	20
	Window Rock	Window Rock	8	10	11	13	16
Cochise			**143**	**156**	**166**	**178**	**188**
	Benson Municipal	Benson	0	4	6	8	9
	Bisbee Douglas Int'l	Douglas Bisbee	31	33	35	38	40
	Bisbee Municipal	Bisbee	10	11	12	12	13
	Bowie	Bowie	4	5	5	6	7
	Cochise College	Douglas	14	14	14	14	14
	Cochise County	Willcox	15	16	17	18	18
	Douglas Municipal	Douglas	29	30	30	31	32
	Sierra Vista Muni/Libby AAF	Ft. Huachuca	40	43	47	51	55
	Tombstone Municipal	Tombstone	0	0	0	0	0
Coconino			**219**	**239**	**260**	**283**	**311**
	Flagstaff-Pulliam	Flagstaff	120	132	144	158	174
	Grand Canyon Nat'l Park	Grand Canyon	53	58	63	68	74
	H.A. Clark Memorial Field	Williams	12	12	12	12	12
	Marble Canyon	Marble Canyon	1	1	1	1	2
	Page Municipal	Page	33	36	40	44	48
	Tuba City	Tuba City	0	0	0	0	0
	Valle Airport	Grand Canyon	0	0	0	0	0
Gila			**167**	**172**	**176**	**181**	**186**
	Payson	Payson	54	57	60	63	66
	Pleasant Valley International (Pvt)	Young	65	65	65	65	65
	San Carlos Apache	Globe	48	50	51	53	55
Graham			**34**	**36**	**38**	**41**	**43**
	Flying J Ranch	Pima	6	6	6	6	6
	Safford Regional	Safford	28	30	32	35	37
Greenlee			**4**	**4**	**4**	**4**	**4**
	Greenlee County	Clifton	4	4	4	4	4

Table 5-12: ***Forecast Total Based Aircraft by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
LaPaz			**21**	**23**	**26**	**30**	**32**
	Avi Suquilla	Parker	18	18	19	20	20
	Quartzsite (New)	Quartzsite	3	5	7	10	12
Maricopa[1]			**3,857**	**4,065**	**4,303**	**4,568**	**4,877**
	Buckeye Municipal	Buckeye	74	95	122	156	200
	Chandler Municipal	Chandler	295	311	329	347	366
	Falcon Field	Mesa	923	958	996	1,034	1,074
	Forepaugh	Wickenburg	0	0	0	0	0
	Gila Bend Municipal	Gila Bend	2	2	3	3	3
	Glendale Municipal	Glendale	250	280	314	352	395
	Memorial Airfield	Chandler	61	66	70	76	81
	Phoenix Deer Valley Municipal	Phoenix	918	961	1,007	1,055	1,106
	Phoenix Goodyear Municipal	Goodyear	196	215	235	257	282
	Phoenix Sky Harbor Int'l	Phoenix	296	271	247	226	206
	Pleasant Valley	New River	65	75	87	100	116
	Scottsdale	Scottsdale	400	414	428	443	459
	Sky Ranch Carefree (Pvt.)	Carefree	139	150	162	174	188
	Stellar Airpark	Chandler	139	144	149	154	159
	Wickenburg Municipal	Wickenburg	39	44	50	56	63
	Williams Gateway	Phoenix	60	79	104	136	179
Mohave			**449**	**492**	**537**	**589**	**649**
	Colorado City Municipal	Colorado City	11	13	15	17	19
	Grand Canyon Bar-Ten	Whitmore	1	1	1	1	1
	Grand Canyon Caverns	Peach Springs	0	0	0	0	0
	Grand Canyon West	Meadview	0	0	0	0	0
	Kingman	Kingman	180	190	200	210	221
	Lake Havasu City Municipal	Lake Havasu City	184	204	226	250	277
	Laughlin/Bullhead International	Bullhead City	59	70	82	96	114
	Pearce Ferry	Meadview	0	0	0	1	2
	Sun Valley	Bullhead City	14	14	14	14	14
	Temple Bar	Temple Bar	0	0	0	0	1
	Tuweep	Tuweep	0	0	0	0	0
Navajo			**105**	**111**	**121**	**128**	**139**
	Holbrook Municipal	Holbrook	10	10	11	11	12
	Kayenta	Kayenta	3	3	3	3	3
	Mogollon Airpark	Overgaard	0	0	0	0	0
	Polacca	Polacca	4	4	4	4	5
	Shonto	Shonto	0	0	0	0	0
	Show Low Municipal	Show Low	47	52	58	64	71
	Taylor	Taylor	18	19	21	22	24
	Whiteriver	Whiteriver	8	8	8	8	8
	Winslow-Lindberg Regional	Winslow	15	15	16	16	16

[1] Based on *1993 MAG Regional Aviation System Plan*.

TABLE 5-12: ***Forecast Total Based Aircraft by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Pima[2]			**887**	**962**	**1,044**	**1,134**	**1,230**
	Ajo Municipal	Ajo	5	6	6	7	8
	Marana NW Regional	Tucson	216	234	254	276	299
	Ryan Field	Tucson	253	274	298	323	350
	Sells	Sells	1	1	1	2	2
	Tucson International	Tucson	412	447	485	526	571
Pinal			**216**	**231**	**248**	**267**	**284**
	Casa Grande Municipal	Casa Grande	59	62	66	70	74
	Coolidge Municipal	Coolidge	1	1	1	1	1
	Eloy Municipal	Eloy	39	41	44	47	49
	Estrella Sailport	Maricopa	23	24	26	28	293
	Grande Valley	Maricopa	0	0	0	0	0
	Kearny	Kearny	3	4	4	5	6
	Pinal Airpark	Marana	83	90	97	105	113
	San Manuel	San Manuel	8	9	10	11	12
	Superior Municipal	Superior	0	0	0	0	0
Santa Cruz			**23**	**26**	**29**	**32**	**36**
	Nogales International	Nogales	23	26	29	32	36
Yavapai			**439**	**494**	**556**	**627**	**708**
	Bagdad	Bagdad	14	17	22	27	33
	Cottonwood Municipal	Cottonwood	35	40	45	51	58
	Ernest A. Love Field	Prescott	290	323	360	401	446
	Sedona	Sedona	96	108	120	135	151
	Seligman	Seligman	4	6	9	13	20
Yuma			**95**	**104**	**114**	**125**	**137**
	Rolle Field	Somerton	0	0	0	0	0
	Yuma International	Yuma	95	104	114	125	137
State Total			**6,694**	**7,153**	**7,663**	**8,231**	**8,874**

Source: *BWR Corporation Forecast Analysis - 2001*

[2] From *PAG Regional Aviation System Plan*, using averages

TABLE 5-13: ***Forecast Based Single-Engine Aircraft by Airport 1998-2020***

County	Airport	City	1998	2005	2010	2015	2020
Apache			**30**	**33**	**36**	**39**	**43**
	Chinle Municipal	Chinle	2	2	3	3	4
	Ganado	Ganado	0	0	0	0	1
	St. Johns Industrial Airpark	St. Johns	9	10	10	11	11
	Town of Springerville Municipal	Springerville	15	16	17	18	19
	Window Rock	Window Rock	4	5	6	7	8
Cochise			**113**	**124**	**132**	**139**	**148**
	Benson Municipal	Benson	0	4	6	8	9
	Bisbee Douglas Int'l	Douglas Bisbee	25	27	29	30	33
	Bisbee Municipal	Bisbee	10	11	12	12	13
	Bowie	Bowie	4	5	5	6	6
	Cochise College	Douglas	13	13	13	13	13
	Cochise County	Willcox	13	14	15	15	16
	Douglas Municipal	Douglas	23	24	24	25	26
	Sierra Vista Muni/Libby AAF	Ft. Huachuca	25	27	28	30	32
	Tombstone Municipal	Tombstone	0	0	0	0	0
Coconino			**154**	**166**	**180**	**198**	**215**
	Flagstaff - Pulliam	Flagstaff	100	111	123	137	152
	Grand Canyon Nat'l Park	Grand Canyon	15	13	12	11	9
	H.A. Clark Memorial Field	Williams	12	12	12	12	12
	Marble Canyon	Marble Canyon	1	1	1	2	2
	Page Municipal	Page	26	29	32	36	40
	Tuba City	Tuba City	0	0	0	0	0
	Valle Airport	Grand Canyon	0	0	0	0	0
Gila			**104**	**108**	**112**	**117**	**132**
	Payson	Payson	54	57	60	63	67
	Pleasant Valley International (Pvt)	Young	10	10	10	10	10
	San Carlos Apache	Globe	40	41	42	44	45
Graham			**21**	**23**	**24**	**26**	**28**
	Safford Regional	Safford	21	23	24	26	28
Greenlee			**4**	**4**	**4**	**4**	**4**
	Greenlee County	Clifton	4	4	4	4	4
LaPaz			**18**	**18**	**19**	**19**	**20**
	Avi Suquilla	Parker	18	18	19	19	20
	Quartzsite (New)	Quartzsite	3	3	5	7	9

Note: Maricopa and Pima Counties not included.

TABLE 5-13: ***Forecast Based Single-Engine Aircraft by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Mohave			**309**	**339**	**374**	**412**	**456**
	Colorado City Municipal	Colorado City	10	11	13	15	17
	Grand Canyon Bar-Ten	Whitmore	0	0	0	0	0
	Grand Canyon Caverns	Peach Springs	0	0	0	0	0
	Grand Canyon West	Meadview	0	0	0	0	0
	Kingman	Kingman	80	85	91	97	103
	Lake Havasu City Municipal	Lake Havasu City	155	171	189	208	230
	Laughlin/Bullhead Int'l	Bullhead City	50	58	67	77	89
	Pearce Ferry	Meadview	0	0	0	1	2
	Sun Valley	Bullhead City	14	14	14	14	14
	Temple Bar	Temple Bar	0	0	0	0	1
	Tuweep	Tuweep	0	0	0	0	0
Navajo			**80**	**86**	**91**	**97**	**104**
	Holbrook Municipal	Holbrook	10	10	11	11	12
	Kayenta	Kayenta	3	3	3	3	3
	Mogollon Airpark	Overgaard	0	0	0	0	0
	Polacca	Polacca	3	4	4	4	4
	Show Low Municipal	Show Low	38	42	45	50	54
	Taylor	Taylor	10	11	12	13	14
	Whiteriver	Whiteriver	4	4	4	4	4
	Winslow-Lindberg Regional	Winslow	12	12	12	13	13
Pinal			**93**	**96**	**101**	**109**	**111**
	Casa Grande Municipal	Casa Grande	46	48	50	53	55
	Coolidge Municipal	Coolidge	1	1	1	1	2
	Eloy Municipal	Eloy	30	32	34	36	38
	Estrella Sailport	Maricopa	3	3	3	4	4
	Kearny	Kearny	2	2	3	3	4
	Pinal Airpark	Marana	0	0	0	1	1
	San Manuel	San Manuel	8	9	9	10	10
	Superior Municipal	Superior	0	0	0	0	1
	Three Point	Casa Grande	3	3	4	4	4
Santa Cruz			**15**	**17**	**20**	**22**	**26**
	Nogales International	Nogales	15	17	20	22	26
Yavapai			**397**	**446**	**503**	**566**	**640**
	Bagdad	Bagdad	14	17	21	25	31
	Cottonwood Municipal	Cottonwood	35	40	45	51	57
	Ernest A. Love Field	Prescott	257	286	320	357	398
	Sedona	Sedona	87	97	108	120	134
	Seligman	Seligman	4	6	9	13	20
Yuma			**78**	**86**	**94**	**103**	**113**
	Rolle Field	Somerton	0	0	0	0	0
	Yuma International	Yuma	78	86	94	103	113
State Total			**1,416**	**1,546**	**1,690**	**1,851**	**2,040**

Note: Maricopa and Pima Counties not included.

Source: *BWR Corporation Forecast Analysis - 2001*

TABLE 5-14: ***Forecast Based Multi-Engine Aircraft by Airport 1998-2020***

County	Airport	City	1998	2005	2010	2015	2020
Apache			**4**	**4**	**4**	**4**	**4**
	Chinle Municipal	Chinle	0	0	0	0	0
	Ganado	Ganado	0	0	0	0	0
	St. Johns Industrial Airpark	St. Johns	0	0	0	0	0
	Town of Springerville Municipal	Springerville	0	0	0	0	0
	Window Rock	Window Rock	4	4	4	4	4
Cochise			**18**	**19**	**19**	**20**	**21**
	Benson Municipal	Benson	0	0	0	0	0
	Bisbee Douglas Int'l	Douglas Bisbee	4	4	4	4	4
	Bisbee Municipal	Bisbee	0	0	0	0	0
	Bowie	Bowie	0	0	0	0	0
	Cochise College	Douglas	1	1	1	1	1
	Cochise County	Willcox	0	0	0	0	0
	Douglas Municipal	Douglas	4	4	4	4	4
	Sierra Vista Muni/Libby AAF	Ft. Huachuca	9	10	10	11	12
	Tombstone Municipal	Tombstone	0	0	0	0	0
Coconino			**28**	**30**	**32**	**35**	**38**
	Flagstaff-Pulliam	Flagstaff	18	19	20	21	22
	Grand Canyon Nat'l Park	Grand Canyon	6	7	8	10	12
	H.A. Clark Memorial Field	Williams	0	0	0	0	0
	Marble Canyon	Marble Canyon	0	0	0	0	0
	Page Municipal	Page	4	4	4	4	4
	Tuba City	Tuba City	0	0	0	0	0
	Valle Airport	Grand Canyon	0	0	0	0	0
Gila			**7**	**7**	**7**	**7**	**8**
	Payson	Payson	0	0	0	0	0
	Pleasant Valley International (Pvt)	Young	0	0	0	0	0
	San Carlos Apache	Globe	7	7	7	7	8
Graham			**7**	**7**	**8**	**8**	**8**
	Safford Regional	Safford	7	7	8	8	8
Greenlee			**0**	**0**	**0**	**0**	**0**
	Greenlee County	Glifton	0	0	0	0	0
LaPaz			**0**	**1**	**1**	**1**	**1**
	Avi Suquilla	Parker	0	0	0	0	0
	Quartzsite (New)	Quartzsite	0	1	1	1	1

Note: Maricopa and Pima Counties not included.

TABLE 5-14: ***Forecast Based Multi-Engine Aircraft by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Mohave			**128**	**134**	**142**	**150**	**160**
	Colorado City Municipal	Colorado City	1	1	2	2	2
	Grand Canyon Bar-Ten	Whitmore	0	0	0	0	0
	Grand Canyon Caverns	Peach Springs	0	0	0	0	0
	Grand Canyon West	Meadview	0	0	0	0	0
	Kingman	Kingman	92	92	92	92	92
	Lake Havasu City Municipal	Lake Havasu City	26	29	32	35	39
	Laughlin/Bullhead Int'l	Bullhead City	9	12	16	21	27
	Pearce Ferry	Meadview	0	0	0	0	0
	Sun Valley	Bullhead City	0	0	0	0	0
	Temple Bar	Temple Bar	0	0	0	0	0
	Tuweep	Tuweep	0	0	0	0	0
Navajo			**21**	**22**	**23**	**27**	**29**
	Holbrook Municipal	Holbrook	0	0	0	0	0
	Kayenta	Kayenta	0	0	0	0	0
	Mogollon Airpark	Overgaard	0	0	0	0	0
	Polacca	Polacca	1	1	1	1	1
	Show Low Municipal	Show Low	9	10	12	14	16
	Taylor	Taylor	8	8	9	9	9
	Whiteriver	Whiteriver	0	0	0	0	0
	Winslow-Lindberg Regional	Winslow	3	3	3	3	3
Pinal			**15**	**15**	**16**	**16**	**17**
	Casa Grande Municipal	Casa Grande	7	7	8	8	9
	Coolidge Municipal	Coolidge	0	0	0	0	0
	Eloy Municipal	Eloy	7	7	7	7	7
	Estrella Sailport	Maricopa	0	0	0	0	0
	Kearny	Kearny	1	1	1	1	1
	Pinal Airpark	Marana	0	0	0	0	0
	San Manuel	San Manuel	0	0	0	0	0
	Superior Municipal	Superior	0	0	0	0	0
Santa Cruz			**8**	**9**	**10**	**11**	**12**
	Nogales International	Nogales	8	9	10	11	12
Yavapai			**38**	**42**	**47**	**52**	**57**
	Bagdad	Bagdad	0	0	0	0	0
	Cottonwood Municipal	Cottonwood	0	0	0	0	0
	Ernest A. Love Field	Prescott	32	35	39	43	47
	Sedona	Sedona	6	7	8	9	10
	Seligman	Seligman	0	0	0	0	0
Yuma			**16**	**17**	**19**	**21**	**22**
	Rolle Field	Somerton	0	0	0	0	0
	Yuma International	Yuma	16	17	19	21	22
State Total			**290**	**307**	**328**	**352**	**377**

Note: Maricopa and Pima Counties not included.

Source: *BWR Corporation Forecast Analysis - 2001*

TABLE 5-15: ***Forecast Based Other Aircraft by Airport 1998-2020***

County	Airport	City	1998	2005	2010	2015	2020
Apache			**1**	**1**	**1**	**1**	**2**
	Chinle Municipal	Chinle	0	0	0	0	0
	Ganado	Ganado	0	0	0	0	0
	St. Johns Industrial Airpark	St. Johns	0	0	0	0	0
	Town of Springerville Municipal	Springerville	1	1	1	1	1
	Window Rock	Window Rock	0	0	0	0	1
Cochise			**12**	**13**	**14**	**16**	**18**
	Benson Municipal	Benson	0	0	0	0	0
	Bisbee Douglas Int'l	Douglas Bisbee	2	2	2	2	2
	Bisbee Municipal	Bisbee	0	0	0	0	0
	Bowie	Bowie	0	0	0	0	0
	Cochise College	Douglas	0	0	0	0	0
	Cochise County	Willcox	2	2	2	2	2
	Douglas Municipal	Douglas	2	2	2	2	2
	Sierra Vista Muni/Libby AAF	Ft. Huachuca	6	7	8	10	12
	Tombstone Municipal	Tombstone	0	0	0	0	0
Coconino			**37**	**42**	**47**	**54**	**61**
	Grand Canyon Nat'l Park	Grand Canyon	32	37	42	49	56
	H.A. Clark Memorial Field	Williams	0	0	0	0	0
	Marble Canyon	Marble Canyon	0	0	0	0	0
	Page Municipal	Page	3	3	3	3	3
	Flagstaff-Pulliam	Flagstaff	2	2	2	2	2
	Tuba City	Tuba City	0	0	0	0	0
	Valle Airport	Grand Canyon	0	0	0	0	0
Gila			**56**	**56**	**56**	**56**	**56**
	Payson	Payson	0	0	0	0	0
	Pleasant Valley International (Pvt)	Young	55	55	55	55	55
	San Carlos Apache	Globe	1	1	1	1	1
Graham			**0**	**0**	**0**	**0**	**0**
	Safford Regional	Safford	0	0	0	0	0
Greenlee			**0**	**0**	**0**	**0**	**0**
	Greenlee County	Clifton	0	0	0	0	0
LaPaz			**0**	**1**	**1**	**2**	**2**
	Avi Suquilla	Parker	0	0	0	0	0
	Quartzsite (New)	Quartzsite.	0	1	1	2	2

Note: Maricopa and Pima Counties not included.

TABLE 5-15: ***Forecast Based Other Aircraft by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Mohave			**12**	**13**	**14**	**16**	**18**
	Colorado City Municipal	Colorado City	0	0	0	0	0
	Grand Canyon Bar-Ten	Whitmore	1	1	1	1	1
	Grand Canyon Caverns	Peach Springs	0	0	0	0	0
	Grand Canyon West	Meadview	0	0	0	0	0
	Kingman	Kingman	8	8	8	8	8
	Lake Havasu City Municipal	Lake Havasu City	3	4	5	7	9
	Laughlin/Bullhead Int'l	Bullhead City	0	0	0	0	0
	Pearce Ferry	Meadview	0	0	0	0	0
	Sun Valley	Bullhead City	0	0	0	0	0
	Temple Bar	Temple Bar	0	0	0	0	0
	Tuweep	Tuweep	0	0	0	0	0
Navajo			**1**	**1**	**1**	**1**	**1**
	Holbrook Municipal	Holbrook	0	0	0	0	0
	Kayenta	Kayenta	0	0	0	0	0
	Mogollon Airpark	Overgaard	0	0	0	0	0
	Polacca	Polacca	0	0	0	0	0
	Show Low Municipal	Show Low	0	0	0	0	0
	Taylor	Taylor	0	0	0	0	0
	Whiteriver	Whiteriver	1	1	1	1	1
	Winslow-Lindberg Regional	Winslow	0	0	0	0	0
Pinal			**111**	**116**	**124**	**129**	**137**
	Casa Grande Municipal	Casa Grande	6	6	7	7	7
	Coolidge Municipal	Coolidge	0	0	0	0	0
	Eloy Municipal	Eloy	2	2	2	2	2
	Estrella Sailport	Maricopa	20	21	23	24	26
	Kearny	Kearny	0	0	0	0	0
	Pinal Airpark	Marana	83	87	92	96	101
	San Manuel	San Manuel	0	0	0	0	0
	Superior Municipal	Superior	0	0	0	0	0
Santa Cruz			**0**	**0**	**0**	**0**	**0**
	Nogales International	Nogales	0	0	0	0	0
Yavapai			**4**	**5**	**5**	**6**	**8**
	Bagdad	Bagdad	0	0	0	0	0
	Cottonwood Municipal	Cottonwood	0	0	0	0	0
	Ernest A. Love Field	Prescott	1	1	1	1	2
	Sedona	Sedona	3	4	4	5	6
	Seligman	Seligman	0	0	0	0	0
Yuma			**1**	**1**	**1**	**1**	**1**
	Rolle Field	Somerton	0	0	0	0	0
	Yuma International	Yuma	1	1	1	1	1
State Total			**235**	**249**	**264**	**282**	**304**

Note: Maricopa and Pima Counties not included.

Source: *BWR Corporation Forecast Analysis - 2001*

TABLE 5-16: ***General Aviation Operations Forecast by Airport 1998-2020***

County	Airport	City	1998	2005	2010	2015	2020
Apache			**27,330**	**29,094**	**31,183**	**33,541**	**36,227**
	Chinle Municipal	Chinle	900	1,184	1,559	2,051	2,700
	Ganado	Ganado	700	700	700	700	700
	St. Johns Industrial Airpark	St. Johns	15,100	15,700	16,432	17,199	18,001
	Town of Springerville Municipal	Springerville	8,580	9,072	9,593	10,144	10,726
	Window Rock	Window Rock	2,050	2,438	2,899	3,447	4,100
Cochise			**115,280**	**117,298**	**125,418**	**130,870**	**136,473**
	Benson Municipal	Benson	200	800	1,200	1,600	1,800
	Bisbee Douglas Int'l	Douglas Bisbee	32,000	34,170	36,487	38,961	41,603
	Bisbee Municipal	Bisbee	1,806	1,941	2,085	2,241	2,408
	Bowie	Bowie	100	114	129	147	167
	Cochise College	Douglas	45,250	45,250	45,250	45,250	45,250
	Cochise County	Willcox	7,096	7,474	7,872	8,291	8,733
	Douglas Municipal	Douglas	11,100	11,368	11,641	11,923	12,210
	Sierra Vista Muni/Libby AAF	Ft. Huachuca	17,528	18,981	20,554	22,257	24,102
	Tombstone Municipal	Tombstone	200	200	200	200	200
Coconino			**272,293**	**296,293**	**322,496**	**351,105**	**382,342**
	Flagstaff-Pulliam	Flagstaff	63,400	69,556	76,310	83,720	91,849
	Grand Canyon Nat'l Park	Grand Canyon	164,479	178,916	194,621	211,703	230,286
	H.A. Clark Memorial Field	Williams	3,600	3,600	3,600	3,600	3,600
	Marble Canyon	Marble Canyon	2,340	2,590	2,866	3,172	3,510
	Page Municipal	Page	31,988	35,145	38,613	42,424	46,611
	Tuba City	Tuba City	6,486	6,486	6,486	6,486	6,486
	Valle Airport	Grand Canyon	NA	NA	NA	NA	NA
Gila			**89,200**	**91,036**	**92,957**	**94,965**	**97,066**
	Payson	Payson	25,000	26,260	27,584	28,974	30,435
	Pleasant Valley International (Pvt)	Young	48,000	48,000	48,000	48,000	48,000
	San Carlos Apache	Globe	16,200	16,776	17,373	17,991	18,631
Graham			**15,550**	**16,618**	**17,763**	**18,991**	**20,308**
	Flying J Ranch	Pima	800	800	800	800	800
	Safford Regional	Safford	14,750	15,818	16,963	18,191	19,508
Greenlee			**7,800**	**7,800**	**7,800**	**7,800**	**7,800**
	Greenlee County	Clifton	7,800	7,800	7,800	7,800	7,800
LaPaz			**14,600**	**15,387**	**16,186**	**17,195**	**18,015**
	Avi Suquilla	Parker	14,000	14,387	14,786	15,195	15,615
	Quartzsite (New)	Quartzsite	600	1,000	1,400	2,000	2,400

Note: Includes only general aviation operations.

TABLE 5-16: ***General Aviation Operations Forecast by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Maricopa[3]			**1,981,663**	**2,072,791**	**2,196,123**	**2,370,860**	**2,604,341**
	Buckeye Municipal	Buckeye	16,020	21,069	27,708	36,440	47,924
	Chandler Municipal	Chandler	153,800	163,604	174,034	185,128	196,929
	Falcon Field	Mesa	220,969	233,156	246,016	259,584	273,902
	Forepaugh	Wickenburg					
	Gila Bend Municipal	Gila Bend	1,580	1,678	1,783	1,894	2,012
	Glendale Municipal	Glendale	150,000	166,340	184,460	204,553	226,836
	Memorial Airfield	Chandler	25,500	46,348	84,239	153,109	278,283
	Phoenix Deer Valley	Phoenix	281,124	300,333	320,855	342,779	366,201
	Phoenix Goodyear Muni	Goodyear	140,000	152,640	166,421	181,447	197,829
	Phoenix Sky Harbor Int'l	Phoenix	537,822	498,587	462,214	428,495	397,236
	Pleasant Valley	New River	48,000	55,587	64,373	74,547	86,330
	Rio Vista Hills	Wickenburg	200	200	200	200	200
	Scottsdale	Scottsdale	182,153	186,790	195,000	210,000	240,000
	Sky Ranch Carefree (Pvt)	Carefree	5,400	5,800	6,200	6,700	7,200
	Stellar Airpark	Chandler	41,020	42,133	43,276	44,450	45,656
	Wickenburg Municipal	Wickenburg	8,475	9,226	10,044	10,934	11,903
	Williams Gateway	Phoenix	169,600	189,300	209,300	230,600	225,900
Mohave			**145,790**	**163,156**	**183,004**	**205,727**	**231,783**
	Colorado City Municipal	Colorado City	3,680	4,233	4,869	5,600	6,441
	Grand Canyon Bar-Ten	Whitmore	2,000	2,000	2,000	2,000	2,000
	Grand Canyon Caverns	Peach Springs	700	700	700	700	700
	Grand Canyon West	Meadview	NA	NA	NA	NA	NA
	Kingman	Kingman	33,000	34,747	36,586	38,523	40,563
	Lake Havasu City Municipal	Lake Havasu City	55,344	61,304	67,906	75,220	83,320
	Laughlin/Bullhead Int'l	Bullhead City	47,316	55,746	65,679	77,382	91,170
	Pearce Ferry	Meadview	1,100	1,308	1,556	1,850	2,200
	Sun Valley	Bullhead City	750	750	750	750	750
	Temple Bar	Temple Bar	1,800	2,268	2,858	3,602	4,539
	Tuweep	Tuweep	100	100	100	100	100

Note: Includes only general aviation operations.

[3] Based on *MAG Regional Aviation System Plan.*

TABLE 5-16: ***General Aviation Operations Forecast by Airport 1998-2020 (continued)***

County	Airport	City	1998	2005	2010	2015	2020
Navajo			**81,470**	**85,622**	**90,149**	**95,098**	**100,481**
	Holbrook Municipal	Holbrook	4,650	4,815	4,987	5,164	5,348
	Kayenta	Kayenta	4,700	4,700	4,700	4,700	4,700
	Mogollon Airpark	Overgaard	200	200	200	200	200
	Polacca	Polacca	5,300	5,300	5,300	5,300	5,300
	Show Low Municipal	Show Low	29,170	32,282	35,726	39,538	43,756
	Taylor	Taylor	4,800	5,158	5,542	5,956	6,400
	Whiteriver	Whiteriver	5,000	5,000	5,000	5,000	5,000
	Winslow-Lindberg Regional	Winslow	27,650	28,167	28,694	29,230	29,777
Pima[4]			**508,565**	**551,880**	**598,899**	**649,941**	**705,357**
	Ajo Municipal	Ajo	1,500	1,660	1,837	2,033	2,250
	Marana NW Regional	Tucson	71,300	77,336	83,883	90,984	98,687
	Pinal Airpark	Marana	10,368	11,204	12,107	13,083	14,138
	Ryan Field	Tucson	157,659	171,045	185,567	201,322	218,415
	Sells	Sells	1,310	1,558	1,853	2,203	2,620
	Tucson International	Tucson	266,428	289,077	313,652	340,316	369,247
Pinal			**129,468**	**138,212**	**147,699**	**158,038**	**169,370**
	Casa Grande Municipal	Casa Grande	65,400	69,152	73,120	77,315	81,750
	Coolidge Municipal	Coolidge	8,500	9,318	10,215	11,199	12,277
	Eloy Municipal	Eloy	23,100	24,514	26,015	27,607	29,297
	Estrella Sailport	Maricopa	16,500	17,522	18,606	19,758	20,981
	Grande Valley	Maricopa					
	Kearny	Kearny	4,200	4,995	5,940	7,064	8,401
	Pinal Airpark	Marana	10,368	11,017	11,707	12,440	13,219
	San Manuel	San Manuel	1,000	1,096	1,202	1,318	1,445
	Superior Municipal	Superior	400	598	894	1,337	2,000
Santa Cruz			**22,890**	**27,602**	**33,283**	**40,133**	**48,394**
	Nogales International	Nogales	22,890	27,602	33,283	40,133	48,394
Yavapai			**428,809**	**480,450**	**538,689**	**604,493**	**679,020**
	Bagdad	Bagdad	14,000	17,380	21,576	26,785	33,251
	Cottonwood Municipal	Cottonwood	19,410	22,003	24,942	28,273	32,050
	Ernest A. Love Field	Prescott	353,299	393,494	438,261	488,121	543,655
	Sedona	Sedona	41,000	45,928	51,450	57,636	64,564
	Seligman	Seligman	1,100	1,645	2,460	3,678	5,500
Yuma			**39,964**	**43,300**	**46,954**	**50,956**	**55,338**
	Rolle Field	Somerton	4,900	4,900	4,900	4,900	4,900
	Yuma International	Yuma	35,064	38,400	42,054	46,056	50,438
State Total			**3,880,672**	**4,136,539**	**4,448,603**	**4,829,703**	**5,342,315**

Note: Includes only general aviation operations.

Source: *BWR Corporation Forecast Analysis - 2001*

[4] From *PAG Regional Aviation System Plan*.

ELEMENT SIX: PERFORMANCE OF THE EXISTING SYSTEM

6.1 INTRODUCTION

The purpose of this element is to assess the performance of the existing Arizona state public-use aviation network. This assessment serves three purposes: (1) to assist in determining the relative strengths and weaknesses of the existing system within the context of generally accepted state and federal standards and guidelines; (2) to provide guidance in determining future systemwide aviation facility needs; and (3) to establish a baseline from which trade-offs among different investment strategies can be quantified over time.

As described in Element Two, SANS Methodology, the concept for assessing the aviation system and evaluating future investment scenarios, is one based on the use of performance measures. The performance measures represent the quantification of the goals and objectives identified at the beginning of the study. Three general categories of performance measures were developed: Facility, Service Level, and Economic Measures. The differences between each category are not distinct, but are useful for discussion purposes.

The Facility performance measures are general measures designed to assess the condition, or fitness, of the state's existing airport infrastructure in relation to some generally accepted industry standards. Service level performance measures, in relation to facility performance measures, were designed to measure the adequacy of the system in fulfilling its fundamental mission of the movement of people and goods. Economic performance measures provide some indication of the efficiency of the system and return on investment.

The performance measures listed below were identified and selected based on measures used in previous SANS studies, on comments from the Planning Advisory Committee (PAC), and through public input. For the purpose of this study, the individual performance measures have not been weighted; therefore, they are not listed in any particular order of importance.

Facility Performance Measures

1. The extent to which system airports meet ADOT Transportation Board aviation development and planning standards.

2. The number of airports with an annual demand less than 60 percent of runway annual service volume (ASV).

3. The number of airports experiencing delay to aircraft operations: the maximum and average delay in minutes an aircraft experiences due to airside congestion.

4. The number of airports that generate INM noise contours greater than 65 DNL that extend off airport property.

5. The number of primary airports without adequate utilities (electricity, telephone, water, sewer, and gas).

6. The number of airports with no close-in obstructions (within the 200 feet primary surface) and where all FAR Part 77 approach obstructions are marked (not including trees and roads).

7. The number of total airports in the state with no or minimal shared airspace and/or restrictions under visual/instrument flight rules. (VFR – Class A, B aircraft – IFR, Class C, D aircraft)

Service Level Performance Measures

8. Percent of communities in the State with a population greater than 5,000 within 60 minutes driving time of a commercial service airport.

9. Percent of communities in the State with a population greater than 1,000 within 30 minutes driving time of a general aviation airport.

10. Percent of communities in the State with a population greater than 15,000 within 30 minutes driving time of a general aviation airport that can accommodate large general aviation aircraft (ARC B-II) and has Instrument Meteorological Conditions (IMC) capability.

11. Percent of hospitals in the State within 30 minutes driving time of a general aviation airport with Instrument Meteorological Conditions (IMC) capability, on-site weather reporting, and jet fuel availability.

12. The number of major recreational areas in the state within 30 minutes driving time of a general aviation airport.

Economic Performance Measures

13. The dollar cost of average aircraft annual delay to Arizona airport system users.

14. Dollars of direct and indirect economic impact on the state from aviation.

15. The cost ratio of annual aviation infrastructure to total number of statewide annual enplaned passengers and annual aircraft operations.

16. The total dollar cost from aircraft delays associated with airspace congestion.

6.2 PERFORMANCE OF THE EXISTING SYSTEM

This section details the steps utilized in assessing the relative performance of the existing public use aviation system. Each of the performance measures are again described with a discussion of each individual analysis.

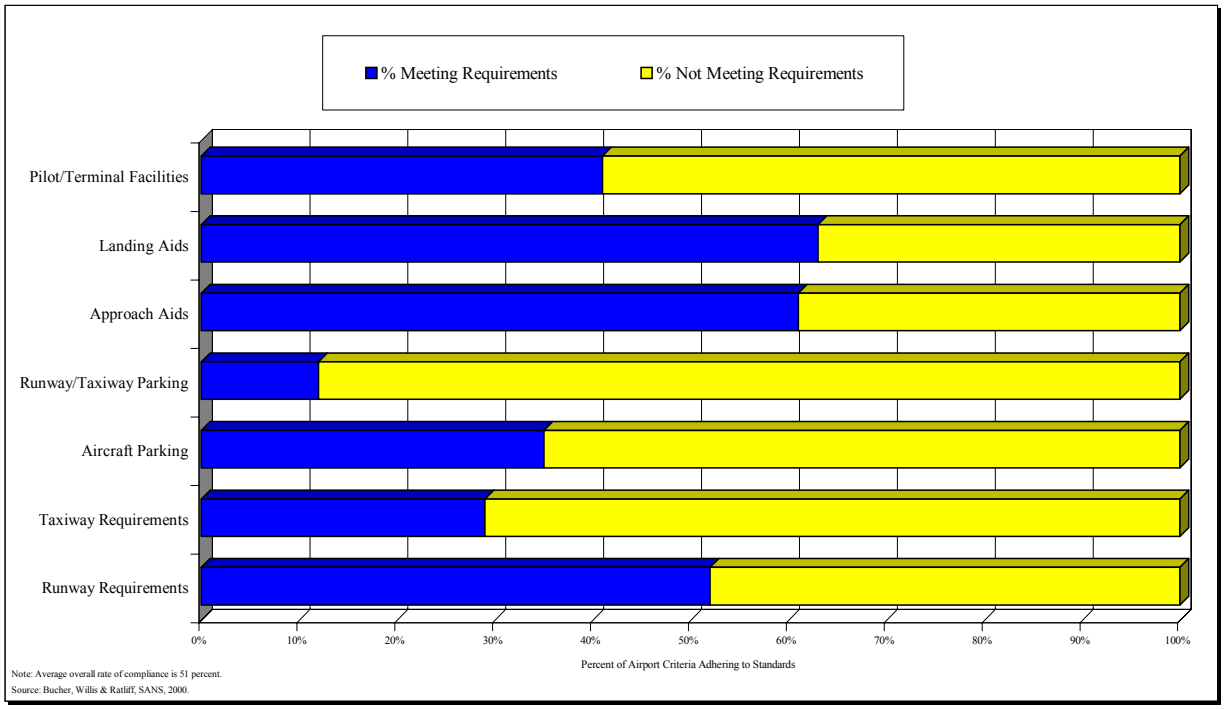
Facility Performance Measure 1

The extent to which system airports meet ADOT Transportation Board aviation development and planning standards.

Calculation
As described and presented in Element Four, Status and Condition, the condition of each facility being addressed in the SANS was determined by comparing the existing facility to basic design guidelines and standards appropriate to an airport's status. The standards used in determining the condition of the system were those developed by the ADOT. These development standards and planning guidelines are based on FAA airport planning and design advisory circulars with modifications and additions relevant to conditions particular to the State of Arizona.

The condition of the existing system of airports relevant to an individual facility's status and recommended state aviation development standards and planning guidelines pertinent to that facility are shown repeated from Element Four and are presented in Exhibit 6-1. On average, 51 percent of all airports are in adherence with key state and federal development and planning standards.

EXHIBIT 6-1: Airports Adhering to Key State and Federal Standards



Facility Performance Measure 2

The number of airports with an annual demand less than 60 percent of runway annual service volume.

Calculation
Capacity is an important indicator of system performance, and was also addressed in Element Four. Runway capacity was determined for every airport in the system and is shown in Table 6-1. Where possible, runway capacity as defined by the Annual Service Volume (ASV) was used, as reported by individual master plans and regional aviation system plans. Where no ASV was reported, it was calculated using the procedures described in FAA Advisory Circular 150/5060-5, Airport Capacity and Delay.

The ASV for each airport was compared to 1998 annual operations to determine the annual volume to capacity ratio. The number of airports with annual airside delay greater than 60 percent was noted. The 60 percent capacity trigger was taken from FAA recommendations that suggest that planning for additional runway capacity should occur when activity approaches this level. This allows sufficient lead time so that facilities can be developed before a problem actually occurs.

The number of airports exceeding the 60 percent threshold was six (6). The state average ASV was 213,256.

Facility Performance Measure 3

The number of airports experiencing delays to aircraft operations: the maximum and average delay in minutes an aircraft experiences due to airside congestion.

Calculation
Average aircraft delay was calculated using FAA Advisory Circular 150/5060-5, Airport Capacity and Delay. Total annual aircraft delays for each airport were calculated as the average delay multiplied by the annual demand. These figures are also shown in Table 6-1.

The number of system airports experiencing delays was 23. The state average for aircraft delay was 0.50 minutes per aircraft, and the state average annual delay was 2,253 hours. Based on the demand/capacity calculations and on the existing operational conditions, three (3) airports in the state are above 100 percent capacity: Phoenix-Sky Harbor, Grand Canyon National Park, and Ernest A. Love Field in Prescott, while three (3) airports fall between the 60-100 percent demand to capacity ratio: Scottsdale Municipal, Tucson International, and Phoenix-Deer Valley Airports. These levels of activity would suggest that short-term capacity related improvements are warranted at these airports to enhance individual and overall system-wide capacity levels.

TABLE 6-1: *Existing Airport Capacity and Delay - 2000*

Facility Name	1998 Operations	Annual Service Volume	Volume to Capacity	Average Aircraft Delay Per Operation (min.)	Average Annual Airport Delay (hours)	Hourly Capacity	
						VFR	IFR
Ajo Municipal	1,900	175,000	1%	0.00	0	71	54
Avi Suquilla (NA)	N/A	175,000	0%	0.00	0	71	54
Bagdad	14,000	143,300	10%	0.00	0	55	39
Benson Municipal	N/A	123,284			0	50	30
Bisbee Douglas International	32,000	325,360	10%	0.00	0	140	56
Bisbee Municipal	3,020	147,600	2%	0.00	0	55	39
Bowie	850	120,000	1%	0.00	0	51	31
Buckeye Municipal Airport	16,020	245,000	7%	0.00	0	100	61
Casa Grande Municipal	65,400	285,000	23%	0.08	112	121	71
Chandler Municipal	153,800	269,000	57%	0.14	660	119	70
Chinle Municipal	900	120,000	1%	0.00	0	51	31
Cibecue	N/A						
Cochise College	45,250	267,000	17%	0.33	540	119	70
Cochise County	7,096	230,000	3%	0.00	0	98	59
Colorado City Municipal	3,680	110,700	3%	0.00	0	47	28
Coolidge Municipal	91,500	347,600	26%	0.08	234	147	57
Cottonwood Municipal	19,410	295,100	7%	0.00	0	126	74
Douglas Municipal	11,100	155,200	7%	0.00	0	66	40
Eagle Airpark	5,053	225,400	4%	0.00	0	98	59
Eloy Municipal	23,100	285,400	8%	0.00	0	121	71
Ernest A. Love Field	353,299	326,400	108%	0.60	2,358	101	61
Estrella Sailport	16,500	381,800	14%	0.01	10	117	53
Falcon Field	220,969	381,800	58%	0.31	1,195	117	53
Flagstaff – Pulliam	63,400	274,000	23%	0.10	107	116	70
Flying J Ranch	800	120,000	1%	0.00	0	51	31
Forepaugh	N/A						
Ganado (NA)	700	120,000	0%	0.00	0	51	31
Gila Bend Municipal	4,550	174,900	3%	0.00	0	71	54
Glendale Municipal	150,000	275,000	55%	0.29	740	117	53
Grand Canyon Bar-Ten	2,000	120,000	2%	0.00	0	51	31
Grand Canyon Caverns	700	120,000	0%	0.00	0	51	31
Grand Canyon National Park	164,179	156,000	105%	3.96	12,305	64	40
Grand Canyon West	0	120,000	0%	0.00	0	51	31
Grande Valley	N/A						
Greenlee County	6,650	126,300	5%	0.00	0	53	39
H. A. Clark Memorial Field	3,600	137,400	3%	0.00	0	54	38
Holbrook Municipal	4,650	267,400	2%	0.00	0	119	70
Kayenta (NA)	4,700	120,000	4%	0.00	0	51	31
Kearny	4,200	120,000	9%	0.00	0	51	31
Kingman	33,000	347,600	9%	0.00	0	148	89
Lake Havasu City Municipal	55,344	307,900	18%	0.16	102	131	79
Laughlin/Bullhead International	47,316	267,000	18%	0.12	108	118	59
Marana NW Regional	71,300	267,000	31%	0.20	254	119	70
Marble Canyon	2,340	100,000	2%	0.00	0	162	98
Memorial Airfield (NA)	25,500	100,000	26%	0.08	80	162	98

TABLE 6-2: ***Existing Airport Capacity and Delay – 2000 (continued)***

Facility Name	1998 Operations	Annual Service Volume	Volume to Capacity	Average Aircraft Delay Per Operation (min.)	Average Annual Airport Delay (hours)	Hourly Capacity	
						VFR	IFR
Nogales International	22,890	276,100	8%	0.00	0	125	73
Page Municipal	31,988	294,600	11%	0.00	0	126	74
Payson	25,000	267,000	9%	0.00	0	124	72
Pearce Ferry	1,100	120,000	0%	0.00	0	51	31
Phoenix Deer Valley	281,124	336,400	84%	0.42	1,902	143	54
Phoenix Goodyear	157,250	276,100	57%	0.31	810	117	53
Phoenix Sky Harbor International	537,822	475,000	113%	2.49	19,710	149	63
Pinal Airpark	10,368	195,000	5%	0.00	0	83	50
Pleasant Valley	48,000	120,000	40%	0.20	152	51	31
Polacca (NA)	5,300	120,000	4%	0.00	0	51	31
Rolle Airfield	4,900	120,000	4%	0.00	0	51	31
Ryan Field	157,659	355,000	44%	0.21	527	151	89
Safford Regional	14,750	286,700	5%	0.00	0	122	74
St. Johns Industrial Airpark	15,000	286,700	5%	0.00	0	122	74
San Carlos Apache	16,200	285,400	6%	0.00	0	121	71
San Manuel	1,000	120,700	1%	0.00	0	51	31
Scottsdale	182,153	294,600	62%	0.69	4,868	128	74
Sedona	41,000	276,100	15%	0.08	114	118	71
Seligman	1,100	120,000	1%	0.00	0	51	31
Sells (NA)	1,310	130,000	1%	0.00	0	54	33
Show Low Municipal	29,170	378,400	8%	0.00	0	161	97
Sierra Vista Muni/Libby AAF	49,651	367,400	14%	0.09	112	156	94
Stellar Airpark	41,020	120,000	34%	0.20	120	51	31
Sun Valley	750	120,000	0%	0.00	0	51	31
Superior Municipal	400	120,000	0%	0.00	0	51	31
Taylor	4,800	137,400	4%	0.00	0	54	33
Temple Bar	1,800	120,000	2%	0.00	0	51	31
Tombstone Municipal	350	105,900	1%	0.00	0	49	29
Town of Springerville Municipal	8,580	286,700	3%	0.00	0	122	74
Tuba City (NA)	7,000	120,000	6%	0.00	0	51	31
Tucson International	266,428	380,000	70%	0.54	2,224	162	98
Tuweep	100	120,000	1%	0.00	0	51	31
Valle Airport	N/A						
Whiteriver (NA)	1,730	230,000	1%	0.00	0	98	59
Wickenburg Municipal	18,377	267,000	7%	0.00	0	119	70
Williams Gateway	228,313	410,000	57%	0.65	6,098	174	105
Window Rock (NA)	2,050	120,000	2%	0.00	0	51	31
Winslow-Lindberg Regional	27,650	286,700	10%	0.00	0	122	74
Yuma International/MCAS Yuma	172,975	347,600	50%	0.71	3,150	148	89

Legend:
NA – Native American

Facility Performance Measure 4

The number of airports that generate INM noise contours greater than 65 DNL that extend off airport property.

Calculation
Examination of airport noise impact data overall showed a lack of consistent up-to-date information. This made it difficult to evaluate which airports generate noise contours greater than 65 DNL that extend outside airport property boundaries. To overcome this problem, it was decided to use accepted parameters that could identify airports that have the potential to fall within this category. The parameters chosen are based on FAA Order 5050.4A, "Airport Environmental Handbook." In this Order, it is assumed that forecast operations that do not exceed 90,000 annual propeller operations or 700 adjusted jet operations resulting in cumulative noise levels not exceeding 60 Day/Night Level (DNL) more than 5,500 feet from the start of takeoff roll or 65 DNL on the runway itself. The parameters were then applied against current activity and fleet mix at existing airports to determine the number of airports with the potential for off-airport noise compatibility impacts. This number was calculated to be 16 and illustrated in Exhibit 6-2.

It should be noted that this measure of system noise impacts does not indicate the existence or nonexistence of a noise problem at a particular airport, and is the reason why individual airports were not identified. The Cessna Citation 500, the Gates Learjet 35A, and other similar jet aircraft producing equivalent or less levels of noise are quieter than many propeller aircraft under 12,500 pounds. Noise problems at airports are dependent on surrounding land uses and community attitudes. A noise compatibility analysis requires a detailed study beyond the scope of this report. This performance measure was designed only to reflect the growing potential for airport/community noise conflicts over time.

Facility Performance Measure 5

The number of system airports without adequate utilities (electricity, telephone, and water).

Calculation
All system airports should have basic services including water, electricity, and a telephone for closing out flight plans, contacting weather information services, and emergencies. Information from airport sponsor surveys indicate that for the primary system airports (those which have been received) all airports currently have adequate utilities. The number of secondary system airports without telephone, electricity, or water totaled 29. Table 6-2 summarizes this information for the statewide secondary system of airports.

EXHIBIT 6-2: ***Airports with 65 DNL - Noise Levels Off Airport Property***

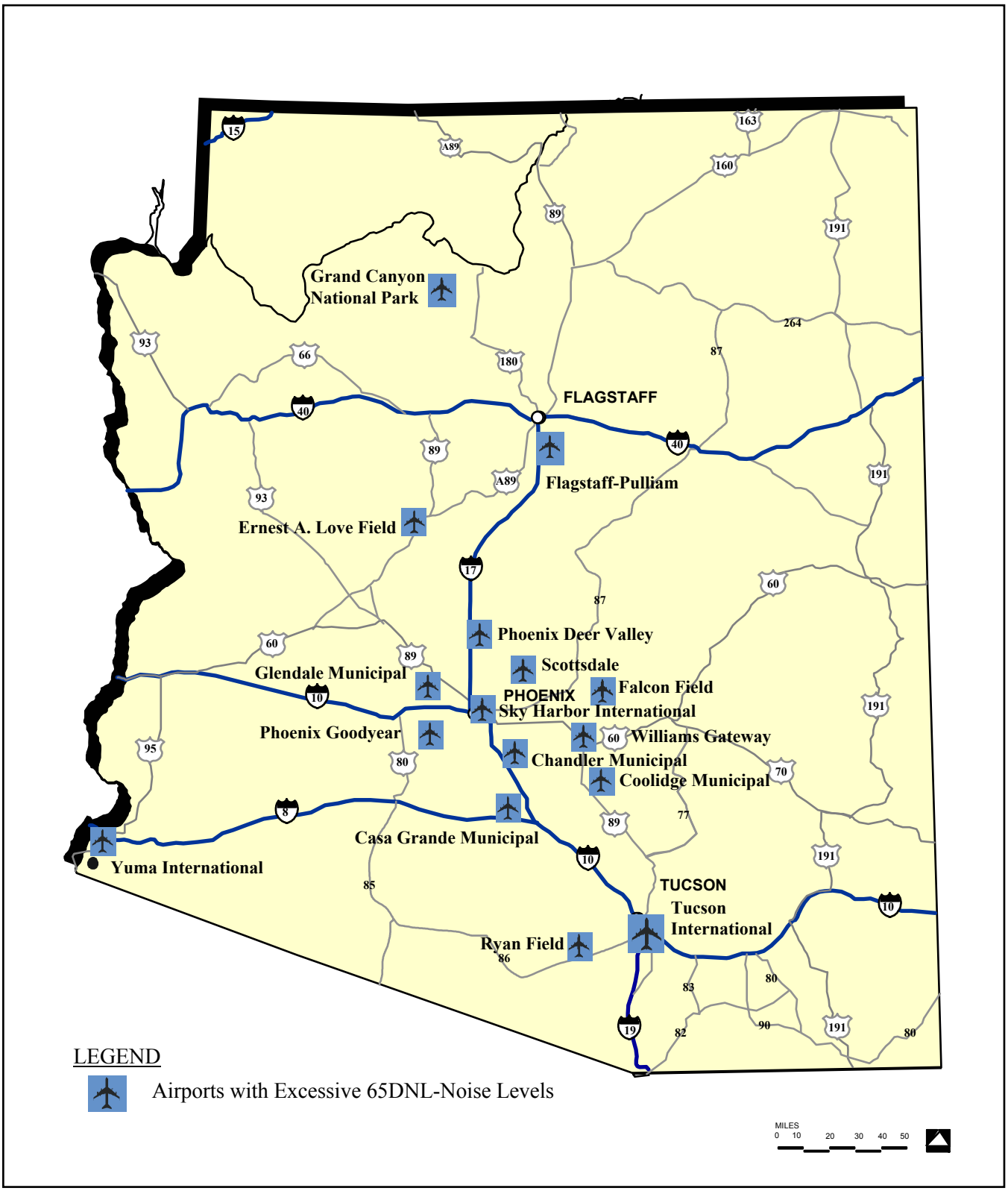


TABLE 6-2: ***Basic Utility Needs***

Facility Name	Water	Telephone	Electricity
Ajo Municipal	■	□	■
Bagdad	□	■	■
Bowie	□	□	□
Cascabel	□	■	■
Chinle Municipal	□	□	□
Flying J Ranch	□	□	□
Ganado (NA)	□	□	□
Grand Canyon Bar-Ten	□	□	□
Grand Canyon West	□	□	□
H.A. Clark Memorial Field	□	■	■
Kayenta (NA)	□	□	□
Kearny	□	□	□
Memorial Airfield (NA)	□	□	□
Mogollon Airpark (ERA)	□	□	□
Pearce Ferry	□	□	□
Pleasant Valley	□	□	□
Polacca (NA)	□	□	□
Rolle Airfield	□	□	□
San Manuel	□	□	□
Sedona	□	□	□
Seligman	□	□	□
Sells (NA)	□	□	□
Somerton	□	□	□
Sun Valley	□	□	□
Superior Municipal	□	□	□
Temple Bar	□	□	□
Tombstone Municipal	□	□	□
Tuba City (NA)	■	■	□
Tuweep	□	□	□

■ Has utility in place
□ Does not have utility in place
N/A Not Applicable
NA Native American

Facility Performance Measure 6

The number of airports with no close-in obstructions (within the 200 feet primary surface) and where all FAR Part 77 approach obstructions are marked (not including trees and roads).

Calculation

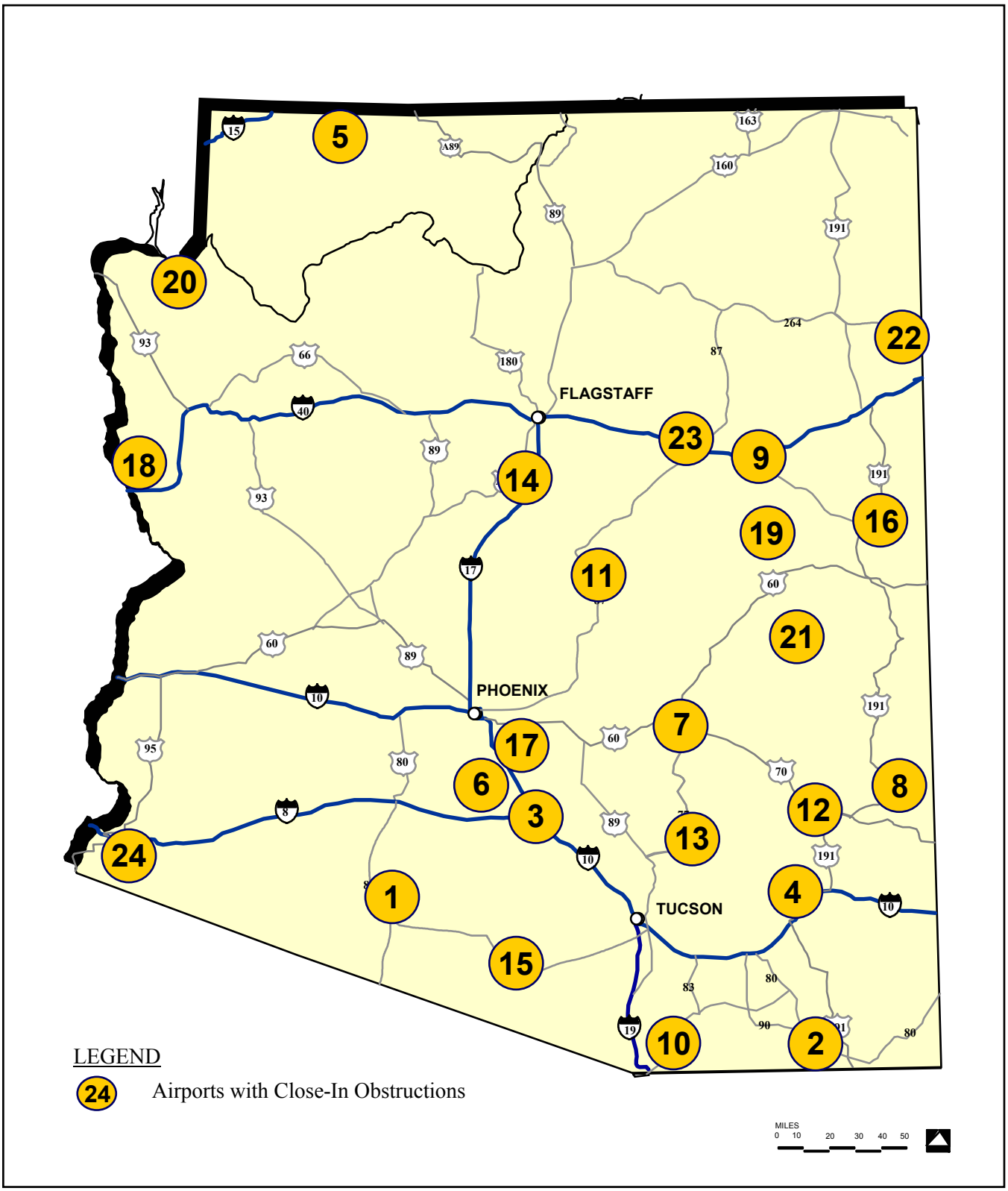
Federal Aviation Regulations Part 77, Objects Affecting Navigable Airspace, define the airspace around an airport that should be kept clear of obstructions to conduct safe operations. Part 77 surfaces are related to the type of approach and departure procedures in effect at a particular airport. Obstructions within the defined Part 77 approach surfaces will generally result in the FAA raising approach minimums or restricting the type of approaches or departures that can be conducted on a runway where the obstruction(s) have been identified. This could result in the displacement or relocation of a runway threshold, thus reducing the usable length of the runway for takeoffs and/or landings, or could result in an airport not able to accommodate an instrument approach procedure.

At a minimum, to maintain the efficiency of the state's system of airports, close-in obstructions should be eliminated where possible. Airports with close-in obstructions have been identified through examination of FAA 5010 Airport Master Record forms, and through airport sponsor surveys. Airports without 5010 forms, or did not respond to the sponsor survey, were not included.

The number of airports identified as having no close-in obstructions that would affect airport operation is 63, compared with only 39 in the 1995 SANS. This is a significant improvement in this performance measure since the last SANS study. The following is a list of affected airports with close-in obstructions preceeding the illustration of these airport in Exhibit 6-3.

1. Ajo Municipal
2. Bisbee Municipal
3. Casa Grande Municipal
4. Cochise County Airport
5. Colorado City Municipal
6. Estrella Sailport
7. Globe-San Carlos Regional
8. Greenlee County
9. Holbrook Municipal
10. Nogales International
11. Payson
12. Safford Regional
13. San Manuel
14. Sedona
15. Sells (Nat. Amer.)
16. St. Johns Industrial Airpark
17. Stellar Airpark
18. Sun Valley
19. Taylor Municipal
20. Temple Bar
21. Whiteriver (Nat. Amer.)
22. Window Rock (Nat. Amer.)
23. Winslow-Lindberg Regional
24. Yuma International

EXHIBIT 6-3: ***Airports with Close-In Obstructions***



Facility Performance Measure 7

The number of total airports in the state with no or minimal shared airspace and/or restrictions under Visaul/Instrument flight rules (VFR-Class A, B aircraft - - IFR – Class C, D aircraft). This facility performance factor was not evaluated in the 1995-SANS.

Calculation
In this analysis, we look at all the airports in the system and delineate the radar airspace requirements for each airport and identify how many airports have problems and significant overlaps. This allows an identification of congested airspace and how many problem airports are in the system. The analysis identified 40 airports in the system as having significant shared or restricted airspace that affect airport operations or delay.

Service Level Performance Measure 8

Percent of communities in the State with a population greater than 5,000 within 60 minutes driving time of a commercial service airport, or 90 minutes of a major metropolitan airport (ie., Phoenix Sky Harbor International and Tucson International Airports).

Calculation
Convenient access to the national scheduled commercial airline network is an important economic asset to the state and to individual communities. It benefits executives and salespersons in their inter-city travels, business managers interested in carrying lower inventories, suppliers in meeting the demand for perishable goods, communities in attracting new industry, and vacationing travelers.

Convenient access to an airport providing scheduled commercial service is generally considered to be within the range of 60 minutes driving time of the airport, or 90 minutes of a major metropolitan airport. To determine the adequacy of the existing system in providing convenient scheduled air service to Arizona communities, lines representing driving times (isochrones) were drawn around airports providing scheduled airline service.

Fifty-one cities with a population of 5,000 or greater were identified in the state (Exhibit 6-4) compared with 50 cities in the 1995-SANS. Based on the analysis described above, all but three (3) of these communities were within 60 minutes of an airport providing regularly scheduled service compared with only one in the 1995-SANS. Exhibit 6-5 graphically portrays commercial service airport service areas within the state.

EXHIBIT 6-4: ***Populations Greater than 5,000 People***

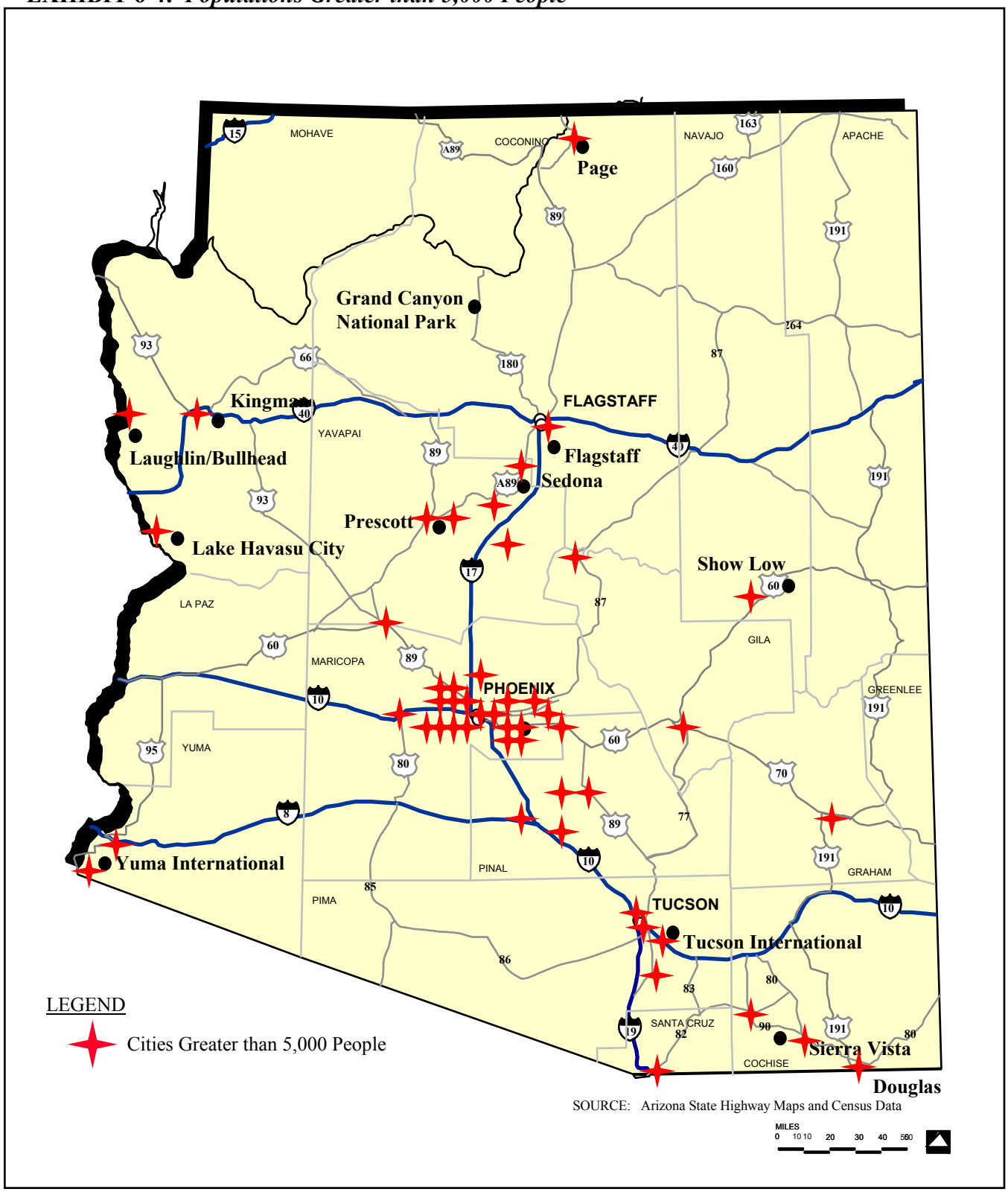
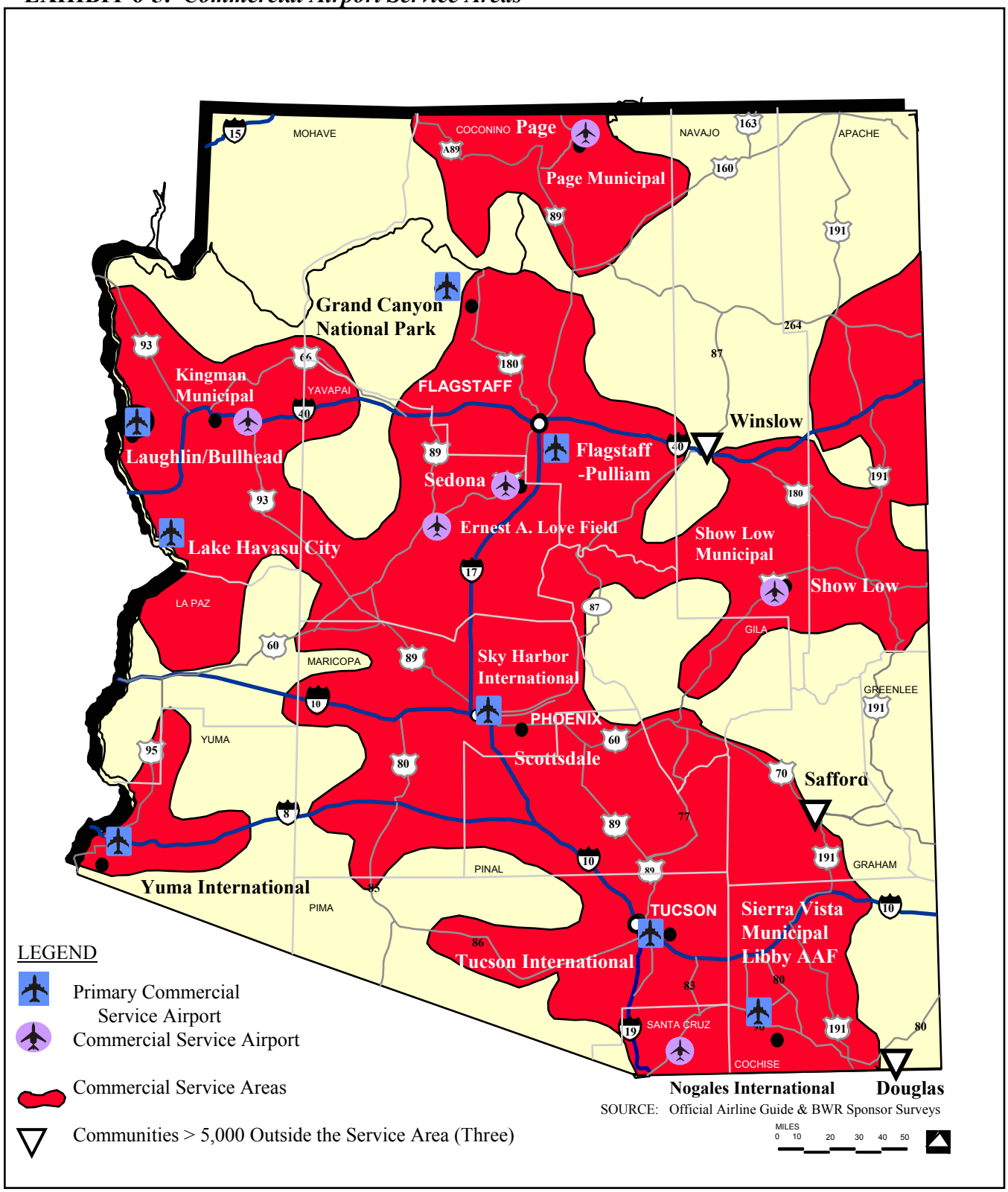


EXHIBIT 6-5: ***Commercial Airport Service Areas***



Service Level Performance Measure 9

Percent of communities in the State with a population greater than 1,000 within 30 minutes driving time of a general aviation airport.

Calculation

The advantages of general aviation have received less publicity than those of commercial and military aviation. General aviation activity includes all civil aviation activity except that of certified air carriers. A large number of general aviation activities provide benefits to the public, for example: law enforcement, rescue, medical aid, air cargo, aerial application, air taxi and air ambulance service, flight training, and business and corporate transportation. Each of these activities contributes significantly toward linking the region with other markets.

The types of aircraft used in general aviation activities cover a wide spectrum. They range from corporate, multi-engine jet aircraft piloted by professional crews to home-built single-engine piston planes, balloons, and dirigibles. Convenient access to an airport providing general aviation service is generally considered to be within the range of 30 minutes driving time of the airport. To determine the adequacy of the existing system in providing convenient access to general aviation facilities, 30 minute isochrones were drawn around public use airports serving the study area.

No communities with populations greater than 1,000 (Exhibit 6-6) fell outside a 30-minute service area. As can be seen in Exhibit 6-7, significant overlap exists in most parts of the region in terms of 30-minute service areas for general aviation airports. Therefore, it can be concluded that in terms of general aviation airport locations, the state is well-served. Many existing airports, however, are in need of improvements to their facilities based on state and federal development standards. There is no change in this performance measure since the 1995-SANS evaluation.

EXHIBIT 6-6: ***Populations Greater than 1,000 People***

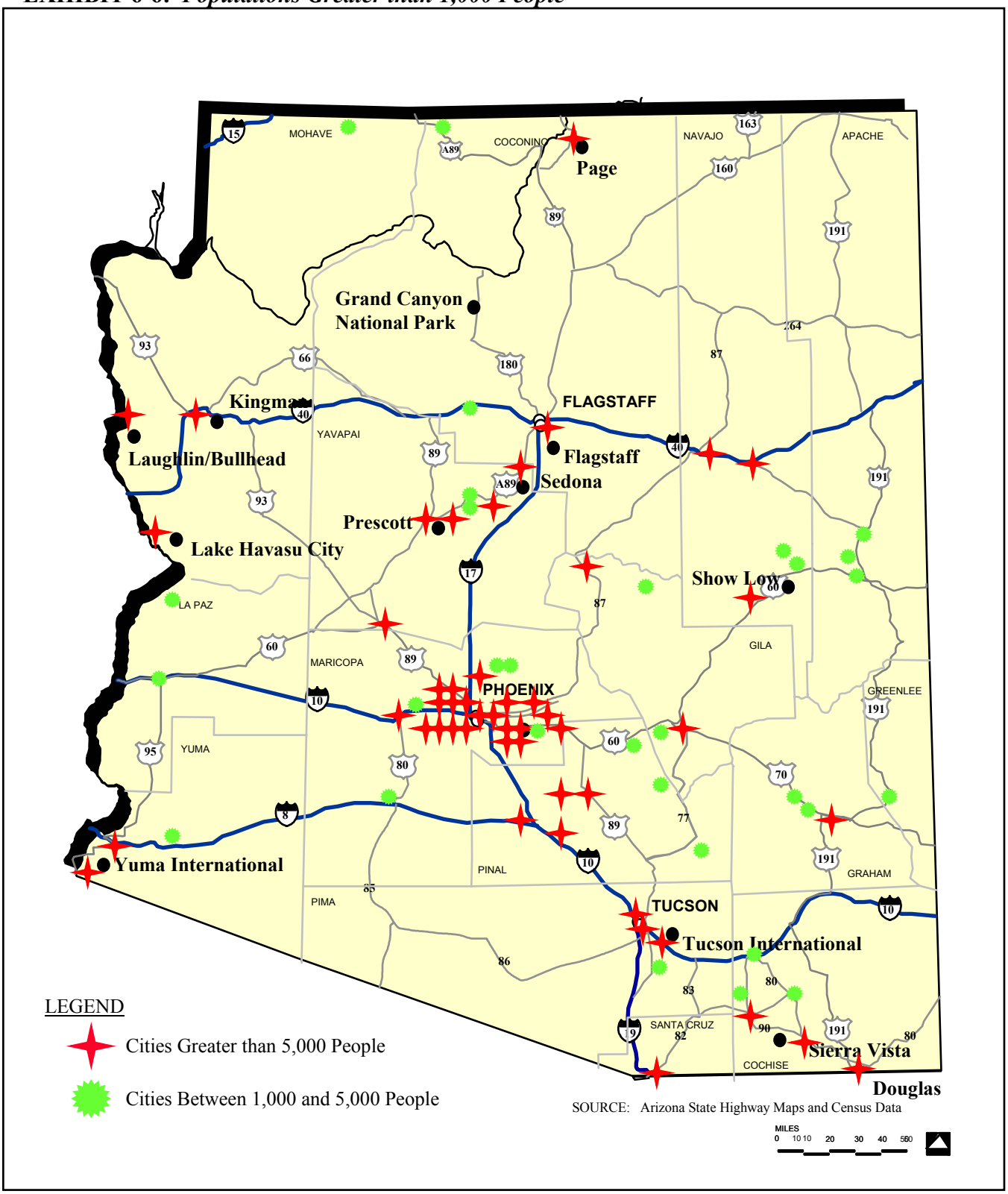
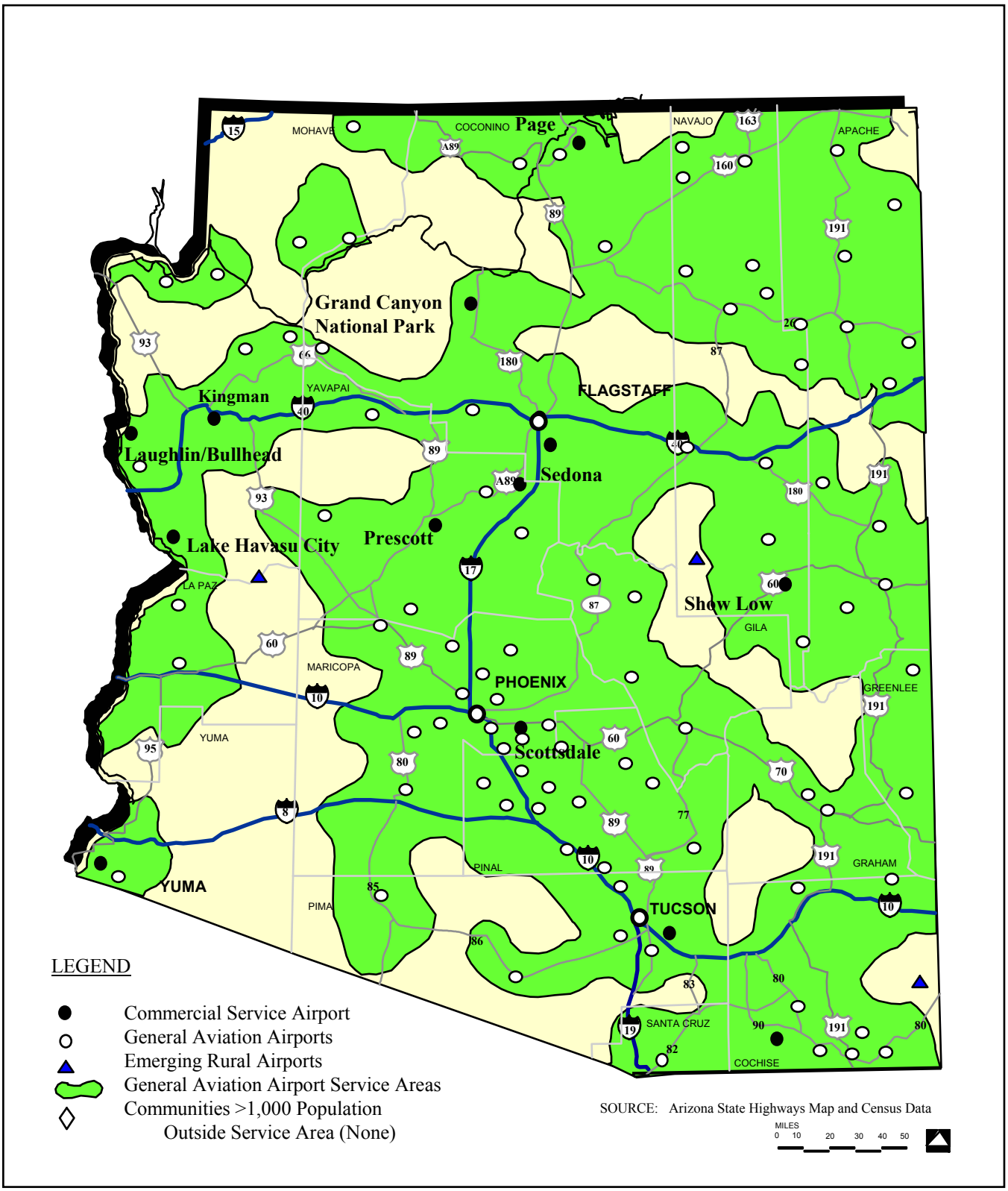


EXHIBIT 6-7: ***General Aviation Service Areas***



Service Level Performance Measure 10

Percent of communities in the State with a population greater than 15,000 within 30 minutes driving time of a general aviation airport that can accommodate large general aviation aircraft (ARC B-II) and has Instrument Meteorological Conditions (IMC) capability.

Calculation

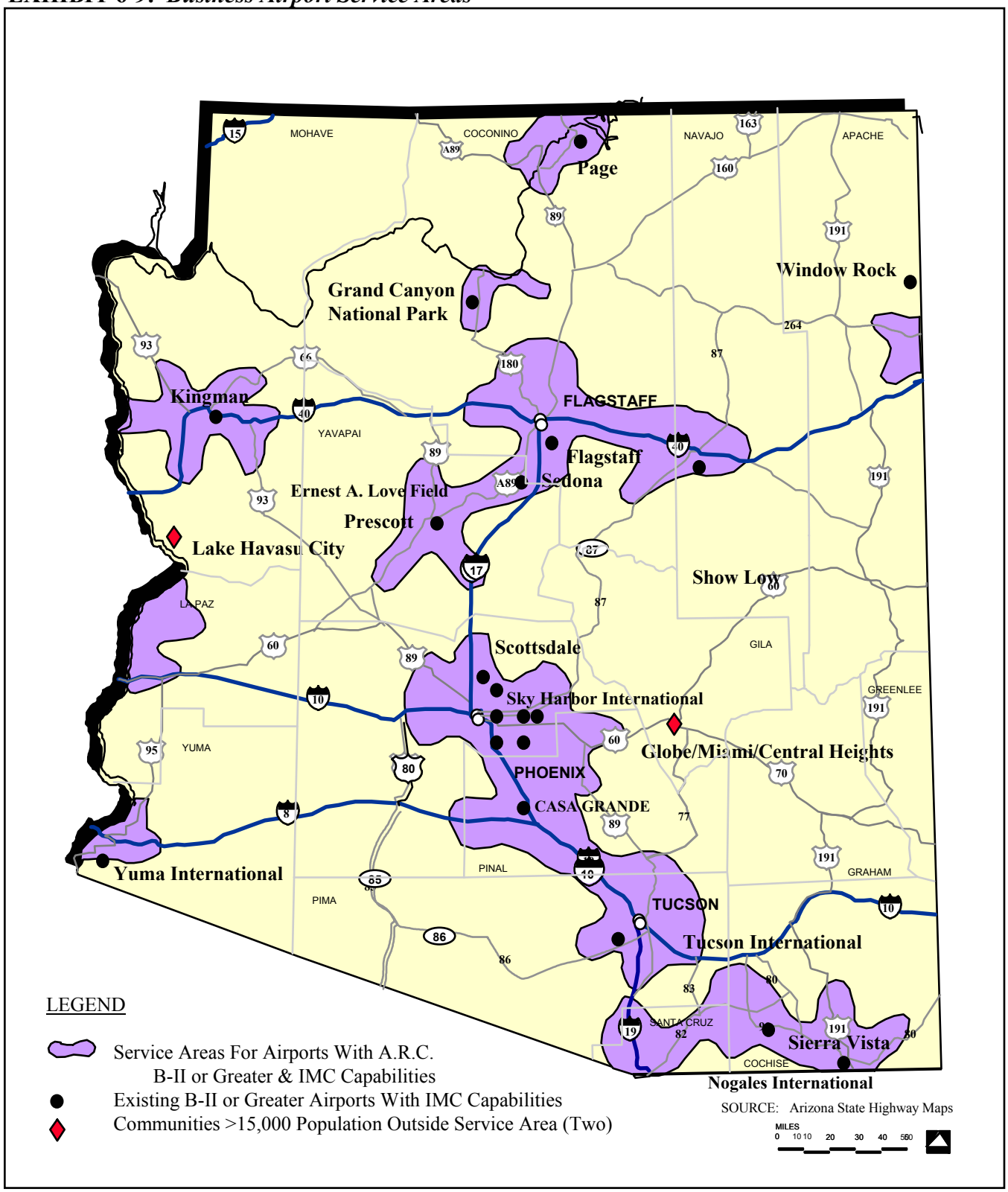
The airport's role in providing access to the national air transportation system is important for attracting economic development to a community. Few major corporations will select a location where their aircraft cannot operate. Thus, any community without convenient and adequate airport facilities nearby will be at a disadvantage in competing for business investment and employment.

This analysis identifies those places with a population greater than 15,000 that are more than 30 minutes from an airport that can accommodate business-type general aviation aircraft. Business aircraft, for the purposes of this analysis, have been defined as aircraft with landing speeds of up to 120 knots, and wingspans of up to 78 feet. Representative aircraft include Beech King Air, Cessna Citation, Piper Cheyenne, and Jetstream 31 (Airport Reference Code B-II).

Exhibit 6-8 identifies 20 communities in the state with a population greater than 15,000. Exhibit 6-9 indicates that only two (2) areas do not fully meet the criteria for this performance measure -- Lake Havasu City and the Globe/Miami/Central Heights region. The only deficiency is that neither of the airports servicing these communities has IMC capability. This performance measure is unchanged since the evaluation performed in the 1995-SANS.

EXHIBIT 6-8: ***Populations Greater than 15,000 People***

EXHIBIT 6-9: ***Business Airport Service Areas***



Service Level Performance Measure 11

Percent of hospitals in the State within 30 minutes driving time of a general aviation airport with Instrument Meteorological Conditions (IMC) capability, on-site weather reporting, and jet fuel availability.

Calculation

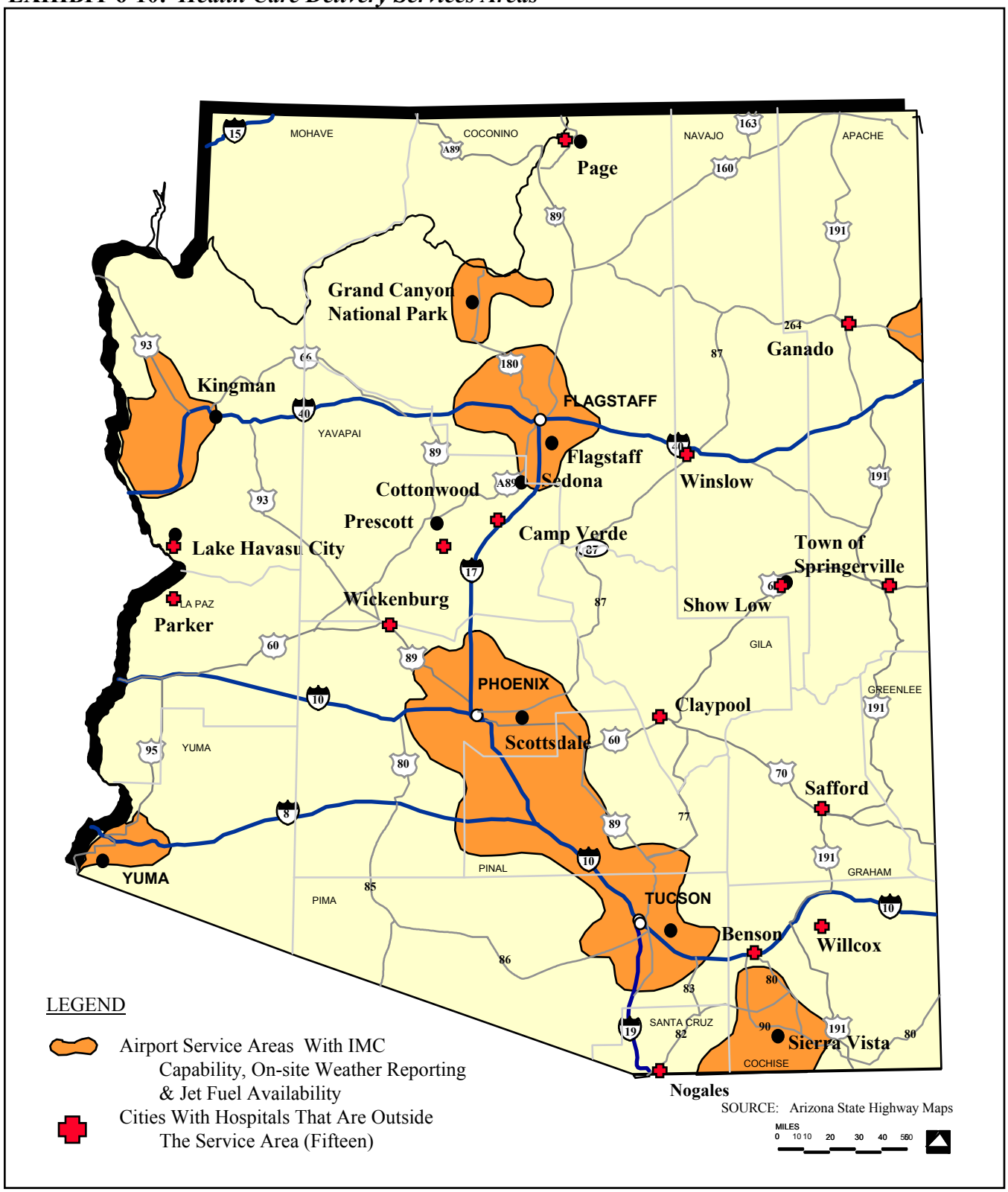
Most community hospitals and health clinics in rural Arizona have only limited facilities and staff for routine health care. These facilities rely on access to larger medical facilities primarily in Phoenix and Tucson for specialized care or emergency trauma cases. A safe and reliable air ambulance service is, therefore, an important part of this rural health care system.

To measure the performance of the existing airport system to support this type of activity, airports serving the medical facilities in rural Arizona were evaluated as to whether they provided three basic services: (1) instrument meteorological conditions (IMC) takeoff and landing capability; (2) on-site weather reporting capability; and (3) aviation fuel availability. These features were identified as important to the basic reliability of the system.

IMC capability, as represented by a nonprecision instrument approach, is important to the ability of air ambulances to land and take off in marginal or poor weather. On-site weather reporting capability allows flight crews to anticipate possible delays and avoid problems due to thunderstorms or other local weather conditions. Lastly, the availability of aviation fuel is an important factor that relates directly to range and payload of an aircraft utilizing an airport. Aircraft serving medical centers located near airports without adequate fueling facilities must limit flight time and number of passengers in order to carry enough fuel for the return flight to base.

Of the 82 community clinics and general hospitals identified in the study area, as shown in Exhibit 6-10, 18 percent, or 15 hospitals/clinics, were located over 30 minutes from an airport providing all three of the basic services discussed above. This is a decrease of one percent since the 1995-SANS analysis recorded 17% of hospitals in Arizona were located in excess of 30 minutes from an airport.

EXHIBIT 6-10: ***Health Care Delivery Services Areas***



Service Level Performance Measure 12

The number of major recreational areas in the state within 30 minutes driving time of a general aviation airport.

Calculation
The extent to which recreational areas are served by an airport within 30 minutes driving time is high. This performance measure also required the use of isochrones around all applicable airports. All recreational areas attracting over 50,000 annual visitors were identified and evaluated to determine if the main usage area was within 30 minutes driving time. Of the 29 areas identified, al, except Alamo Lake in La Paz County were considered well-served, for a performance rating of 97 percent. This is shown in Exhibits 6-11 and 6-12. According to the *Arizona Recreational Airports System Plan*, a site and recommended facilities have been planned for this area. This performance measure is unchanged since the evaluation performed in the 1995-SANS.

Economic Performance Measure 13

The dollar cost of average aircraft annual delay to Arizona airport system users.

Calculation
The annual dollar cost of delay for airport users was estimated at $39.1 million for the existing system. This was calculated by applying block hour costs of operating an aircraft to the amount of average aircraft annual delay experienced in the system. Block hour cost is a common industry cost measurement that is calculated using the total costs of aircraft maintenance, insurance, crew expense, and other items to determine the hourly cost of aircraft operation. This cost does not consider lost passenger time, disruption to airline schedules, or any other intangible factors. The block hour costs used in the calculation was $1,375 for Phoenix Sky Harbor and Tucson International Airports; $260 per hour for Commercial Service and larger (ARC C-III) general aviation airports, and $130 an hour for aircraft used at other airports in the state. The annual cost of delay increased by $9.0 million when compared with the cost calculated in the 1995-SANS.

The block hour costs for Tucson and Phoenix Sky Harbor are based on those block hour costs reported in the Phoenix Sky Harbor Airport Capacity Enhancement Plan, adjusted to 2000 dollars. Block hour costs for all other airports were estimated based on block hour costs for single engine piston, multi-engine piston, and corporate jet aircraft block hour costs. Block hour costs for commercial service and larger general aviation airports were set higher to reflect the type of fleet mix in use at these airports. It should be noted that the cost of delay identified in this performance measure is for comparison purposes only and may not reflect the true cost of system delay.

EXHIBIT 6-11: ***Recreation Areas***

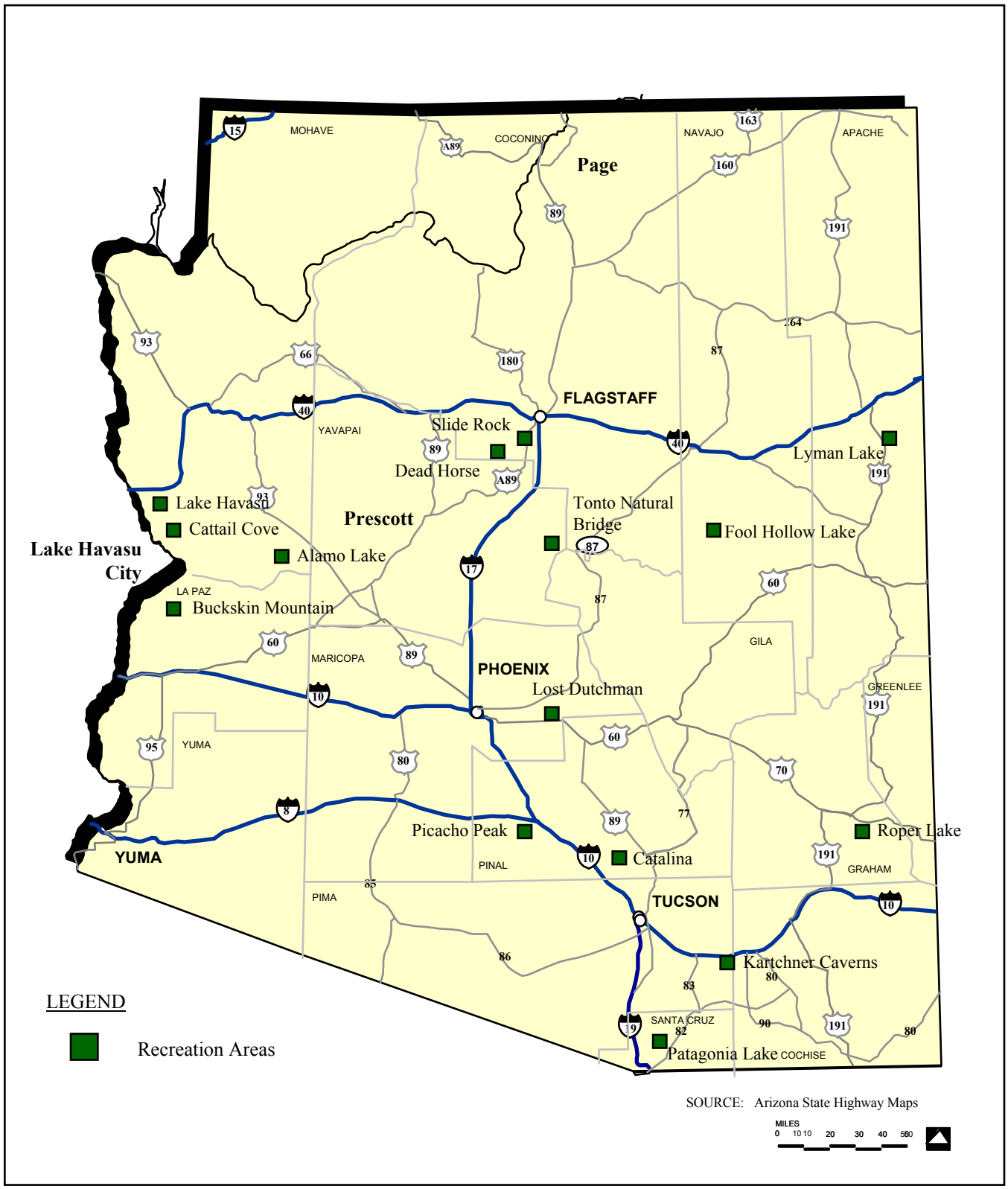
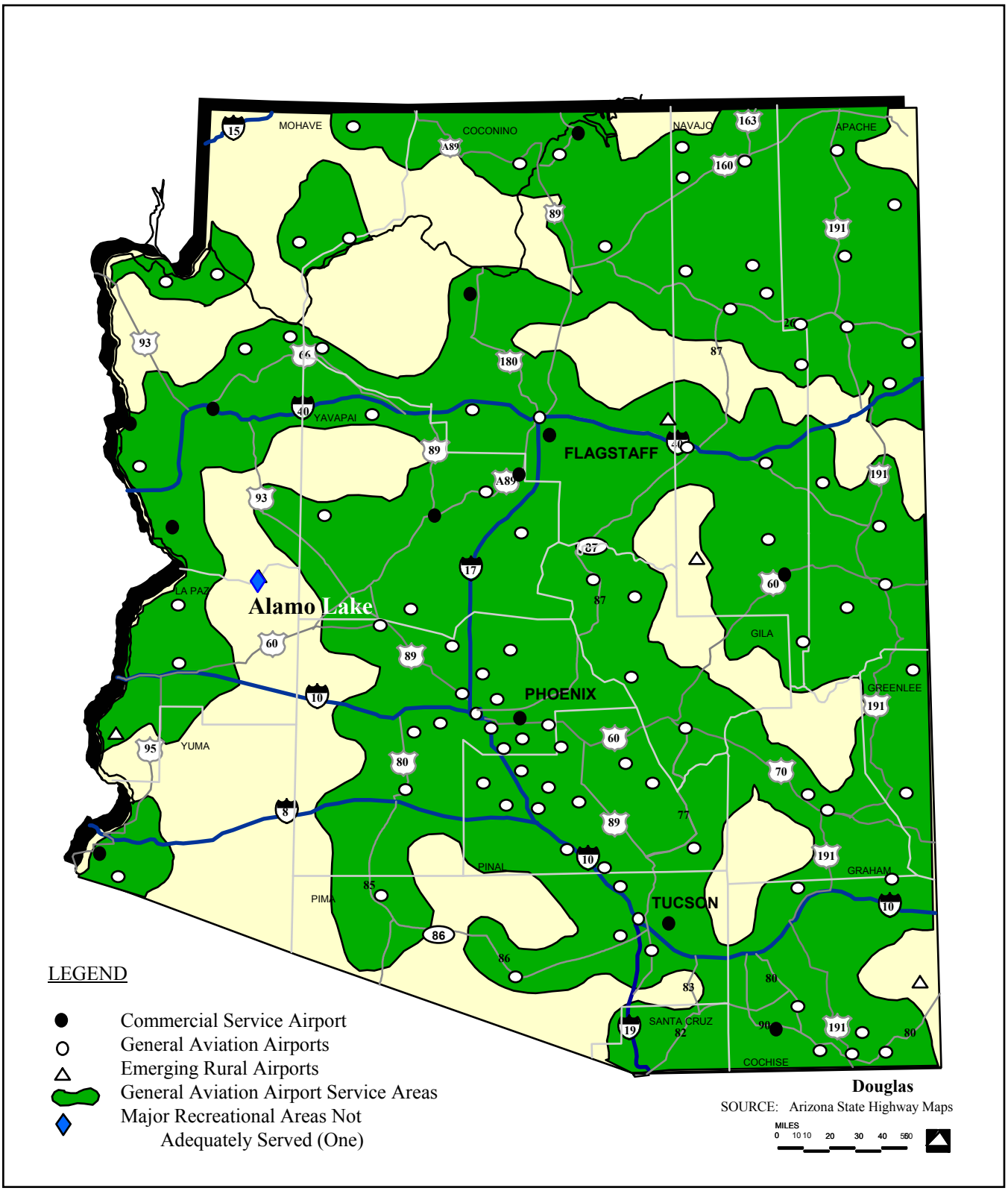


EXHIBIT 6-12: ***Recreational Service Areas***



Economic Performance Measure 14

Dollars of economic impact on the state from aviation.

Calculation

A primary indicator that may be measured and cited as evidence of an airport system's importance is its economic impact. Economic impacts are the statewide economic activities, employment, and payrolls that can be attributed directly and indirectly to the operation of system airports. They describe the importance of aviation as an industry.

Profit, or the difference between expenses and revenues, is a valid measure of the viability of a private business. However, public airports are generally operated as public utilities, with the provision of service rather than profit as the primary motive. Thus, profit is not always relevant to the economic significance of an airport system. The calculation of direct and indirect contributions of the system to the economy is a more relevant measure.

Direct impacts are the consequence of economic activities carried out at system airports by airlines, airport management, fixed base operators, and other activities with direct involvement in aviation. Strictly speaking, direct impacts should represent economic activities that would not have occurred in the absence of an airport system. If it were determined that without the system some on-site airport employees would be doing comparable work elsewhere in the state without displacing other workers, their employment should not be part of the system's contribution to state economic activity.

Indirect impacts derive from off-site economic activities that are attributed to the airport system. These activities include services provided by travel agencies, hotels, restaurants, and retail establishments. These enterprises, like airport businesses, employ labor, purchase locally produced goods and services, and invest in capital expansion and improvements. Indirect impacts differ from direct impacts in that they originate entirely off-site.

To determine the impact of Arizona's system of public use airports we used the formulas developed in the publication *Estimating the Regional Economic Significance of Airports* prepared by the United States Department of Commerce. Economic impact studies for Phoenix Sky Harbor and Tucson International were also considered. For the air carrier contribution to direct and indirect impacts, $296 per enplanement was calculated, for air cargo, $834 per enplaned ton, and for general aviation activity, $140 per operation. These figures are state averages in constant 2000 dollars. For 1999, this represented $6.3 billion in economic impact by aviation to the state economy, an increase of $2.2 billion since the economic impact evaluation performed in the 1995-SANS.

Economic Performance Measure 15

The cost ratio of aviation infrastructure to total number of statewide annual enplaned passengers and annual aircraft operations.

Calculation
The cost ratio of 1999 aviation infrastructure improvements to total number of statewide 1999 annual enplaned passengers was approximately 4:1; the ratio to annual aircraft operations was approximately 15:1. These numbers were calculated to establish a baseline condition for the existing system compared with a baseline of 5:1 and 17:1 for the 1995-SANS.

Economic Performance Measure 16

The total dollar cost from aircraft delays associated with airport airspace congestion.

Calculation
Starting with an assessment of the PHOCAP (practical hourly capacity) of the airport, the anaylsis concentrates on quantifying the costs of the different types of aircraft which are delayed. From the inventory and forecasts of airport usage, the total delays have been estimated by types of aircraft, using hourly operating costs, and quantifying it at the system level by a cumulative evaluation of the individual airports. In 1999, these costs totalled about $8.2 million, related strictly to what could be described as airspace congestion. This is over and above those costs of delay due to airfield capacity issues. These costs are identified in Table 6-3. This performance factor was not evaluated in the 1995-SANS.

6.3 PERFORMANCE EVALUATION MATRIX

Presented in Table 6-11 is a performance evaluation matrix that summarizes the performance measures and relative performance scores of the existing aviation system. With the addition of performance scores calculated for each future investment scenario (at the completion of Element 7 - Needs Scenarios), it can be used to compare future system performance with the existing baseline case. The task of choosing a preferred strategy will be one of prioritizing the performance measures and evaluating the performance of each scenario against funds allotted for future system development.

In looking at Table 6-3 and Exhibit 6-13, which graphically present the data, it is easy to see the less effective areas of performance within the existing aviation system by looking at the 1999 baseline condition data and percentages. For example, only 51 percent of existing system airports currently meet state and federal development and planning standards and only 72 percent of the airports currently have been identified as having no close-in obstructions that adversely affect airport operation. At the same time, 100 percent of all primary system airports currently have adequate utilities, but with the secondary system included, only 64 percent of the total system is considered adequately served.

On the service side, only 82 percent of all hospitals in the state are served within 30 minutes driving time of a general aviation airport with IMC capabilities, on-site weather reporting, and

fuel availability and 90 percent of communities are served by business-use type airports. With respect to scheduled air service, approximately 94 percent of all communities with a population of over 5,000 are within 60 minutes driving time of an adequate commercial service airport.

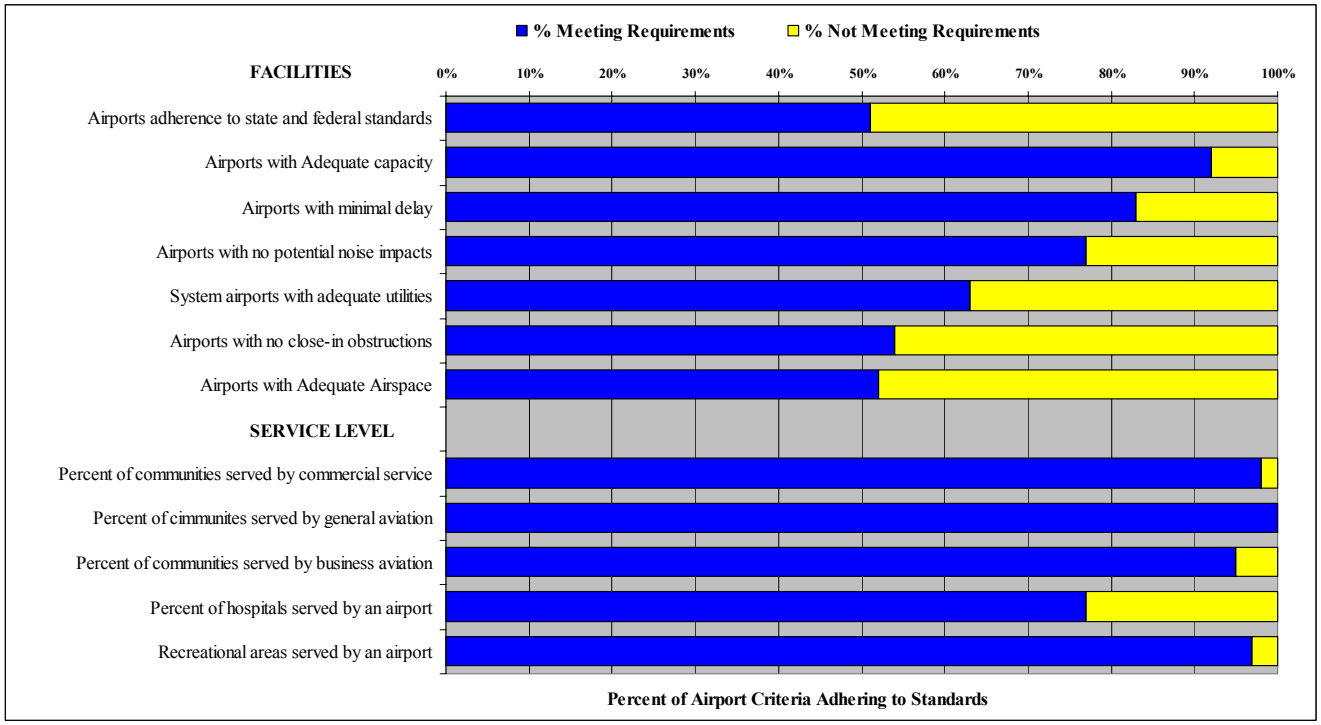
With this information, those areas of performance which are most in need of improvements can be readily identified and related directly to the issues, goals, and objectives outlined at the outset of the study. Policy decisions can then be made as to where to focus monetary resources, and the results can be measured in relation to the increased system performance they provide. This summary is the basis for the selection of system-wide improvements and individual projects at system airports.

TABLE 6-3: ***Performance Measure Comparison of the State Aviation System – 1995 to 2000***

PEFORMANCE MEASURE		1995 SANS	2000 SANS	% - CHANGE
Facilities				
1	Airports meeting Planning Standards	57%	51%	-6%
2	Airports with adequate capacity	92%	92%	No Change
3	Airports with minimal aircraft delay	2639 hrs	2253 hrs	7%
4	Airports with no/minimal Noise Impacts	84%	77%	-8%
5	Airports with adequate Utilities	65%	64%	-1%
6	Airports with no close-in Obstructions	38%	73%	35%
7	Airports with no significant/restricted shared airspace	N/A	54%	N/A
Service Level				
8	Percent of communities with commercial air service	98%	94%	-4%
9	Percent of communities served by general aviation	100%	100%	No Change
10	Percent of communities served by business aircraft	95%	90%	-5%
11	Percent of hospitals served by an airport	80%	82%	2%
12	Recreational areas served by an airport	97%	97%	No Change
Economic				
13	Cost of Average Aircraft Annual Delay	$28.5 Million	$39.1 Million	25%
14	Aviation Economic Impact	$4.1 Billion	$6.3 Million	35%
15A	Cost ratio of enplaned passengers	5:1	4:1	Decreased
15B	Cost of ratio of annual aircraft operations	17:1	15:1	Decreased
16	Cost of Aircraft delays	N/A	$8.2 Million	N/A
Total System Cost		$45.0 Million	$60.0 Million *	25%

Legend:
* = Represents a one-year average for comparison
N/A – Not Applicable – new performance measure
NC – No Change

EXHIBIT 6-13: *Comparison of Performance Levels 1995 to 2000*



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ELEMENT SEVEN: NEEDS ASSESSMENT

The performance based needs scenarios are the focus of the study. They have been designed to evaluate various alternative aviation system development strategies. By comparing the resulting system performance for each investment strategy, performance trade-offs can be determined.

This Element applies the three investment scenarios, described in Element Two, and measures the performance of the state aviation system over the next five- and ten-year periods for each scenario. It is organized in the following manner:

- Application of Scenarios;
- Alternative Scenario Performance;
- Comparison of Scenarios;
- Additional Financial Requirements; and
- Summary and Conclusions.

7.1 SCENARIO A: EXISTING INVESTMENT

This scenario is designed to explore a possible condition in which the existing funding level will be assumed to remain unchanged over the next 5-, 10-, and 20-year periods. The goal is to examine the types of improvements that can be done under circumstances in which the funding for maintenance and construction of aviation facilities does not keep up with the increasing demand. In this scenario, status, condition, and performance of the system at the fixed level of funding will be evaluated.

This scenario includes many of the projects that have already been programmed by the Arizona Department of Transportation Aeronautics Division for fiscal years 2002-2006. The state and federal revenue to be invested continues the current trend for the State Aviation Fund forecasts and averages the last nine years to determine potential for Federal revenues since the continuation of the current AIR-21 cannot be assumed. Local revenues are primarily utilized as a match for state or federally-funded projects or for non-eligible items. While pavement maintenance for some of the airports is planned in this scenario, pavement management is not possible for the remaining airports due to inadequate funding. It should be noted that the airports with no pavement maintenance will eventually experience pavement failures that may force closure, adding congestion to neighboring facilities. In addition, only a few airports will be improved to keep pace with the increasing demand. Therefore, the overall performance of the system in this scenario would be expected to decline over the 20-year planning period.

Some individual projects under this scenario were selected with an emphasis on safety projects including obstruction removal to accommodate possible GPS approaches. Many of these projects were found to have relatively low costs when compared to the operational benefits that would result.

The cost of planned improvements in this scenario is summarized in Table 7-1, and a list of proposed projects for each individual airport is presented in Appendix A. For Scenario A, investment is approximately $289.5 million over the first five years, approximately $596.9 million over the 10-year period, and $1.095 billion for the total 20-year planning period.

TABLE 7-1: ***Existing Investment Costs***

	Phase I 2001-2005	Phase II 2006-2010	Phase III 2011-2020	20 Year Total
Commercial Service Airports	$101,586,962	$140,490,334	$195,945,136	$438,022,432
Other Primary Airports	167,213,826	155,889,854	280,104,065	603,207,745
Secondary Airports	14,597,172	3,663,260	8,101,210	26,361,642
Other Airports	6,146,908	7,312,503	13,449,920	26,909,331
Total for State System	**$289,544,868**	**$307,355,951**	**$497,600,331**	**$1,094,501,150**

The resulting performance of the system under investment Scenario A is shown in Table 7-2. This scenario demonstrates the consequences of an existing funding level that does not keep up with demand. The demand/capacity ratio of some airports will increase but at other airports it declines. Overall, system congestion and delay will increase, and while capacity and services at some airports will improve, service and facilities at secondary airports will be stressed.

TABLE 7-2: ***Scenario "A" Performance (Existing Investment)***

PERFORMANCE MEASURE	SCORE			
Facilities	1999 Baseline Condition	Year 2005	Year 2010	Year 2020
1. Airports conformity to state and federal development and planning standards.	51%	50%	50%	49%
2. Airports with adequate capacity	92%	91%	90%	90%
3. Average annual aircraft delay.	2,253 hrs.	2,590 hrs[1]	2,924 hrs	3,795 hrs
4. Airports with limited potential noise impacts.	77%	77%	77%	77%
5. Airports with adequate utilities.	64%	64%	64%	64%
6. Airports with no close-in obstructions.	72%	72%	72%	72%
7. Airports with no or minimal shared airspace	54%	54%	54%	54%
Service Level				
8. Percent of communities served by commercial air service.	94%	94%	94%	94%
9. Percent of communities served by general aviation.	100%	100%	100%	100%
10. Percent of communities served by business aircraft.	90%	86%	86%	86%
11. Percent of hospitals served by an airport.	82%	82%	82%	82%
12. Recreational areas served by an airport.	97%	97%	97%	97%

TABLE 7-2: ***Scenario "A" Performance (Existing Investment) (continued)***

Economic	1999 Baseline Condition	Year 2005	Year 2010	Year 2020
13. Cost of average aircraft annual delay (capacity).	$39.1 mil	$44.1 mil	$51.2 mil	$58.4 mil
14. Dollars of economic impact.	$6.3 bil	$6.4 bil	$6.8 bil	$7.2 bil
15a. The cost ratio of enplaned passengers.	4:1	2.3:1	1.9:1	1.8:1
15b. The cost ratio of annual aircraft operations.	15:1	12:1	12:1	12:1
16. Cost of average aircraft annual delay (airspace congestion)	$8.2 mil	$9.0 mil	$9.9 mil	$10.9 mil
Total System Cost	**$57.9 mil ***	**$57.9 mil ***	**$61.4 mil ***	**$49.8 mil ***
				($57.6 mil average for 20 yrs.

* Represents a one year average for comparison purposes.

7.2 SCENARIO B: EXISTING PERFORMANCE

This scenario explores a possible condition in which the existing system performance level will remain relatively unchanged. The goal is to estimate a level of funding which can help the state aviation system keep up with the increasing demand in the future. A funding level for each of the 5-, 10-, and 20-year periods needed to maintain the existing system status, condition, and performance was estimated.

In Scenario B, the system is improved to keep up with growing demand. In addition, to maintain a safe operational condition, other improvements such as routine maintenance, replacement of worn-out lighting systems, and removal of approach obstructions are included. The costs of planned improvements in this scenario are summarized in Table 7-3 with a list of designated projects and costs for individual airports included in Appendix B.

TABLE 7-3: ***Existing Performance Costs***

	Phase I 2001-2005	Phase II 2006-2010	Phase III	20-Year Total
Commercial Service Airports	$165,875,557	$230,860,470	$195,175,386	$591,911,413
Other Primary Airports	347,211,326	258,525,127	280,389,427	886,125,880
Secondary Airports	18,093,282	8,433,814	8,675,102	35,162,198
Other Airports	7,995,613	75,785	806,000	8,877,398
Total for State System	**$539,135,778**	**$497,895,196**	**$485,045,915**	**$1,522,076,889**

For Scenario B, the total needs will be approximately $539.1 million over the first five years, $1.04 billion over the 10-year period, and $1.52 billion over the 20-year planning period. The resulting performance of the system under this scenario is presented in Table 7-4.

TABLE 7-4: ***Scenario "B" Performacne (Existing Performance)***

PERFORMANCE MEASURE	SCORE			
Facilities	**1999 Baseline Condition**	**Year 2005**	**Year 2010**	**Year 2020**
1. Airports conformity to state and federal development and planning standards.	51%	51%	51%	51%
2. Airports with adequate capacity	92%	92%	92%	92%
3. Average annual aircraft delay.	2,253 hrs	2,044 hrs	2,001 hrs	2,095 hrs
4. Airports with limited potential noise impacts.	77%	77%	77%	77%
5. Airports with adequate utilities.	64%	64%	64%	64%
6. Airports with no close-in obstructions.	72%	78%	100%	100%
7. Airports with no or minimal shared airspace	54%	54%	54%	54%
Service Level				
8. Percent of communities served by commercial air service.	94%	94%	94%	94%
9. Percent of communities served by general aviation.	100%	100%	100%	100%
10. Percent of communities served by business aircraft.	90%	90%	90%	90%
11. Percent of hospitals served by an airport.	82%	82%	82%	82%
12. Recreational areas served by an airport.	97%	97%	97%	97%
Economic				
13. Cost of average aircraft annual delay (capacity).	$39.1 mil	$24.4 mil	$20.3 mil	$15.6 mil
14. Dollars of economic impact.	$6.3 bil	$8.4 bil	$9.56 bil	$10.7 bil
15a. The cost ratio of enplaned passengers.	5:1	4.8:1	1.9:1	
15b. The cost ratio of annual aircraft operations.	15:1	19:1	18:1	12.4:1
16. Cost of average aircraft delay (airspace congestion)	$8.2 mil	$7.2 mil	$6.4 mil	$5.2 mil
Total System Cost	**$57.9 mil ***	**$107.8 mil ***	**$99.6 mil ***	**$48.6 mil ***
				($76.1 mil average for 20-years)

* Represents a one year average for comparison purposes for 5-year, 10-year, and 20-year periods.

In Scenario B, delay is expected to decrease over 1999 levels during the interim period due to the capacity enhancement projects programmed in Phase II, but will begin increasing again toward the end of the planning period as demand increases.

7.3 SCENARIO C: INCREASED PERFORMANCE

The third scenario examines a possible condition in which all existing public-use airports would be brought up to meet minimum State airport development standards, existing airports would be expanded to meet forecast demand, and new airports would be constructed to meet access or capacity deficiencies. This would be essentially an unconstrained growth scenario and will determine the costs of expanding the existing system to meet the expected growth in future State aviation activity.

The costs associated with Scenario C are summarized in Table 7-5. Under this scenario, total investment will be about $1.12 billion over the first five years, $1.90 billion over the 10-year planning period, and $2.7 billion over the 20-year planning period. Detailed projects and costs for individual airports are presented in Appendix C.

TABLE 7-5: ***Increased Performance Costs***

	Phase I 2001-2005	Phase II 2006-2010	Phase III 2011-2020	20 Year Total
Commercial Service Airports	$459,664,598	$296,533,865	$359,588,086	$1,115,786,549
Other Primary Airports	618,849,443	445,045,547	393,032,529	1,456,927,519
Secondary Airports	25,509,389	20,793,602	20,390,745	66,693,736
Other Airports	19,239,990	18,827,307	27,461,415	65,528,712
Total for State System	**$1,123,263,420**	**$781,200,321**	**$800,472,775**	**$2,704,936,516**

The resulting performance of the system under this scenario is presented in Table 7-6. In this scenario average annual delay is reduced significantly from a system-wide cost of $39.1 million to a level of $12.2 million over the 20-year planning period. In addition to a significant number of capacity enhancement projects, Scenario C also includes projects necessary to bring all system airports into conformity with state airport planning and engineering guidelines.

TABLE 7-6: ***Scenario "C" Performance (Increased Performance)***

PERFORMANCE MEASURE	SCORE			
Facilities	**1999 Baseline Condition**	**Year 2005**	**Year 2010**	**Year 2020**
1. Airports conformity to state and federal development and planning standards.	51%	76%	90%	95%
2. Airports with adequate capacity	92%	97%	97%	98%
3. Average annual aircraft delay.	2,253 hrs	1,985 hrs	1,226 hrs	910 hrs
4. Airports with limited potential noise impacts.	77%	84%	87%	95%
5. Airports with adequate utilities.	64%	100%	100%	100%
6. Airports with no close-in obstructions.	72%	100%	100%	100%
7. Airports with no or minimal shared airspace	54%	60%	78%	84%
Service Level				
8. Percent of communities served by commercial air service.	94%	97%	100%	100%
9. Percent of communities served by general aviation.	100%	100%	100%	100%
10. Percent of communities served by business aircraft.	90%	100%	100%	100%
11. Percent of hospitals served by an airport.	82%	94%	95%	100%
12. Recreational areas served by an airport.	97%	97%	100%	100%
Economic				
13. Cost of average aircraft annual delay (capacity).	$39.1 mil	$22.2 mil	$19.4 mil	$12.2 mil
14. Dollars of economic impact.	$6.3 bil	$8.22 bil	$9.74 bil	$12.9 bil
15a. The cost ratio of enplaned passengers.	4:1	6.3:1	2.7:1	1.5:1
15b. The cost ratio of annual aircraft operations.	15:1	24.6:1	20.9:1	14.9:1
16. Cost of average aircraft delay (airspace congestion)	$8.2 mil	$4.6 mil	$4.1 mil	$2.6 mil
Total System Cost	**$57.9 mil ***	**$224.6 mil ***	**$156.2 mil ***	**$80.0 mil ***
				($135.2 mil average for 20-yrs)

* Represents a one year average for comparison purposes for 5-year, 10-year, and 20-year periods.

7.4 ANALYSIS OF SYSTEM PERFORMANCE

The purpose of this section is to compare the resulting system performance from the application of each of the three alternative investment scenarios. This allows a recognition of the trade-offs involved from one scenario to another. A 10-year cost comparison for each scenario is shown in Table 7-7. As illustrated in this exhibit, costs range from a low of $597 million for Scenario A, to $1.9 billion for Scenario C. This represents a difference of approximately $1.3 billion.

TABLE 7-7: ***Scenarios "A", "B", and "C" Ten-Year Investment Costs***

	"A" Existing Investment	"B" Existing Performance	"C" Increased Performance
Commercial Service Airports	$242,077,296	$396,736,027	$756,198,463
Other Primary Airports	323,103,680	605,736,453	1,063,894,990
Secondary Airports	18,260,432	26,487,096	46,302,991
Other Airports	13,459,411	8,071,398	38,067,297
Total for State System	**$596,900,819**	**$1,037,030,974**	**$1,904,463,741**

To link system capital costs to system performance and to differentiate between scenarios, a comparison performance evaluation matrix of year 2020 system performance for each scenario is presented in Table 7-8.

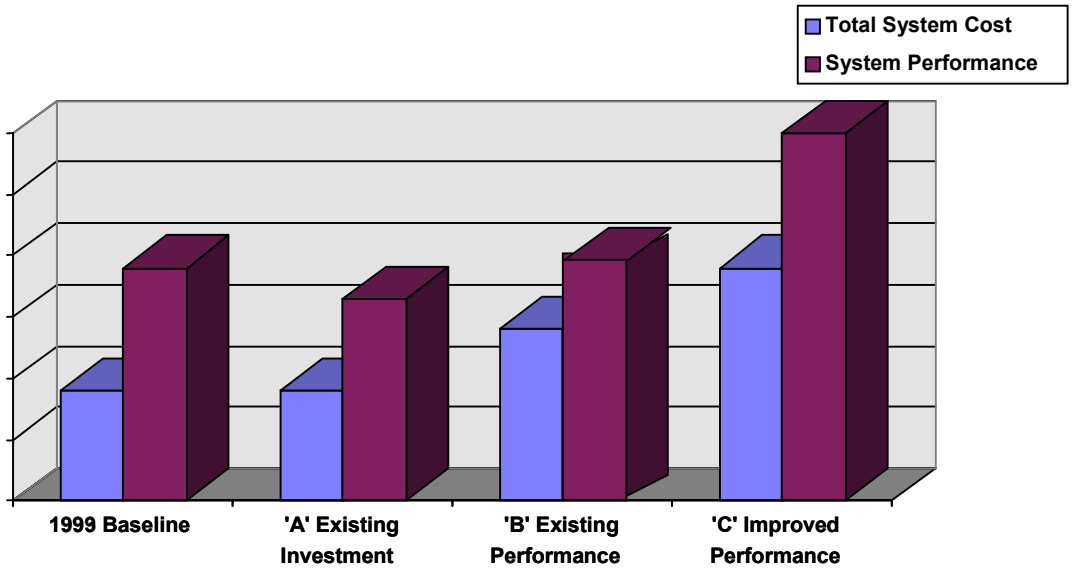
As can be seen in this exhibit, most performance measures improve, as expected, with each subsequent increase in investment levels. Scenario C shows a significant decrease in aircraft delay, with a corresponding increase in dollars of economic impact over Scenarios A and B. The differences between Scenarios B and C are reflected mostly in improvements to conformity to airport planning standards, and utility and infrastructure improvements to Secondary and Other Airports.

TABLE 7-8: ***Year 2020 Scenario Performance Comparisons***

PERFORMANCE MEASURE	SCORE			
Facilities	**1999 Baseline Condition**	**Scenario A Existing Investment**	**Scenario B Existing Performance**	**Scenario C Increased Performance**
1. Airports conformity to state and federal development and planning standards.	51%	49%	51%	95%
2. Airports with adequate capacity	92%	90%	97%	98%
3. Average annual aircraft delay.	2,263 hrs	3,795 hrs	2,095 hrs	910 hrs
4. Airports with limited potential noise impacts.	77%	77%	77%	95%
5. Airports with adequate utilities.	64%	64%	64%	100%
6. Airports with no close-in obstructions.	72%	72%	100%	100%
7. Airports with no or minimal shared airspace	54%	54%	54%	84%
Service Level				
8. Percent of communities served by commercial air service.	94%	94%	94%	100%
9. Percent of communities served by general aviation.	100%	100%	100%	100%
10. Percent of communities served by business aircraft.	90%	86%	90%	100%
11. Percent of hospitals served by an airport.	82%	82%	82%	95%
12. Recreational areas served by an airport.	97%	97%	97%	100%
Economic				
13. Cost of average aircraft annual delay (capacity).	$39.1 mil	$58.4 mil	$15.6 mil	$12.2 mil
14. Dollars of economic impact.	$6.3 bil	$7.26 bil	$10.7 bil	$12.9 bil
15a. The cost ratio of enplaned passengers.	4:1	1.8:1	1.6:1	1.5:1
15b. The cost ratio of annual aircraft operations.	15:1	1.2:1	12.4:1	14.9:1
16. Cost of average aircraft delay (airspace congestion)	$8.2 mil	$10.9 mil	$5.2 mil	$2.6 mil
Total System Cost	**$289.5 mil** $57.9 mil *	**$1.094 bil** $54.7 mil *	**$1.522 bil** $76.1 mil *	**$2.705 bil** $135.25 mil *

* Represents a one year average for comparison purposes pro rated over the 20-year period.

YEAR 2020 INVESTMENT AND PERFORMANCE



As demonstrated in the above graphic for the 20-year performance window, an increase in investment results in increased system performance. Under the "existing investment" Scenario A, performance of the systems will deteriorate over the planning period. Under the existing performance scenario, Scenario B, existing baseline performance will remain at its current levels at a 20-year cost of about $1.03 billion for the system. Under the improved performance, Scenario C, approximately $2.7 billion would be required over the 20-year planning period to bring the system up to nearly 100% performance. Under this scenario, nearly all airports would be brought up to minimum DOT/FAA design standards and the "service level" performance categories would all reach 100% compliance with the established performance measures used in this study.

7.5 ADDITIONAL INVESTMENT NEEDS

The proceeding section addressed the resulting system performance from the application of the three investment scenarios. In this section, the needs are expressed as additional financial requirements over and above the projected level of funding from the current revenue sources. Additional financial needs have been desegregated by federal, state, local, and private sector based on their respective role in development and maintenance of public use airports. The distribution of financial responsibilities in ADOT's 2002-2006 Airport Improvement Program has been used as a guide. However, depending on the continuation of the Federal AIR-21 program, and assuming local revenue sources become more limited, the state may need to assume a greater role in the financing of needed improvements.

It has been assumed that the investment needs of American Indian airports will continue to be met by the Federal government. The privately-owned public use facilities will be funded by the private sector. In other words, the revenues from the private sector sponsors will equal the cost of improvements at privately-owned airports under each scenario. Thus, additional financial requirements of privately-owned public use facilities will be zero for all scenarios.

Based on these assumptions, additional financial needs under each scenario have been estimated. These needs are presented in Tables 7-9 through 7-11.

Scenario A was designed to explore a possible condition in which the existing funding level was assumed to remain unchanged over the 5-, 10-, and 20-year periods. The goal was to examine the types of improvements that could be done in the circumstances in which the funding for maintenance and construction of aviation facilities does not keep up with the increasing demand. As can be seen in Table 7-9, it is assumed that federal and local funding levels will keep pace with past levels of funding, and in the short term, maybe exceed those levels with the passage of AIR-21 legislation. For the long term, however, these higher levels of funding are assumed to revert back to lower levels for FY 2006 and beyond.

As shown in the exhibit, the remaining federal and state costs related to improvements programmed as a part of this Scenario are close, but are expected to exceed revenue expectations by approximately $3.2 million through 2005. Based on projected costs, the need for additional local revenues is estimated to be $1.98 million in the second phase. Federal funds will be needed to support the state and local funding deficits. The appearance of combined revenue surpluses in Phase III is due to the difficulty of projecting the need and extent of future projects with as much detail in the 0-5 and 5-10-year time frames. Many additional projects and needs will be identified as these funding periods become closer.

TABLE 7-9: ***Additional Financial Requirements for Scenario "A"(Existing Investment)***
(Thousands of Constant 2000 Dollars)

	Phase I 2001-2005			Phase II 2006-2010			Phase III 2011-2020		
	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)
Federal	$229,253	$227,010	($2,243)	$221,833	$225,000	$3,167	$330,650	$536,000	$205,350
State	46,284	45,290	(994)	65,100	64,200	(900)	138,450	134,000	(4,450)
Local	13,841	16,049	2,208	13,237	10,210	(3,027)	18,400	21,300	2,900
Private	167	167	0	7,186	5,967	(1,219)	10,100	10,100	0
Total	**$289,545**	**$288,516**	**($1,029)**	**$307,356**	**$305,377**	**($1,979)**	**$497,600**	**$701,400**	**$203,800**

* Numbers in parentheses show that estimated costs exceed revenues.
Phase 1 revenues represent the estimated remaining levels of funding available for fiscal years 2002-2005.

For Scenario B, total additional financial needs will amount to approximately $120.6 million in the first phase, $149.5 million in the second phase, with a surplus at least shown in the 10-20 year period. The additional investment in the first phase is necessary to maintain the existing system performance in the wake of rapidly growing travel demand. Again, the reason for the decrease in costs and the projected surplus in Phase III is only due to the difficulty of projecting the need and extent of future projects with as much detail in the 20-year time frame as in the short- and middle-term 10-year periods. Historically, the state's five-year Airport Development Program recommended list of projects has exceeded revenues available.

TABLE 7-10: ***Additional Financial Requirements for Scenario "B"(Existing Performance)***
(Thousands of Constant 2000 Dollars)

	Phase I 2001-2005			Phase II 2006-2010			Phase III 2011-2020		
	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)
Federal	$468,166	$324,300	($143,866)	$408,391	$268,000	($140,391)	$387,852	$536,000	$148,148
State	36,348	64,700	28,352	37,900	64,200	26,300	83,092	134,000	50,908
Local	28,282	23,166	(5,116)	37,900	2,473	(35,427)	14,102	21,300	1,198
Private	6,340	6,340	0	13,704	13,704	0	0	0	0
Total	**$539,136**	**$412,166**	**($120,630)**	**$497,895**	**$348,377**	**($149,518)**	**$485,046**	**$701,400**	**$216,354**

* Numbers in parentheses show that estimated costs exceed revenues.

In Scenario C, total additional financial needs will amount to $699.5 million dollars in the first phase, $432.8 million dollars in Phase II, and $99.1 million dollars in Phase III. Again, as in Scenario B, the reason for the lower costs in the later stage of the planning program is due to the difficulty of projecting the need and extend of future projects with as much detail in the 10- and 20-year time frames as in the intermediate term 10-year phase.

TABLE 7-11: ***Additional Financial Requirements for Scenario "C" (Increased Performance)***
(Thousands of Constant 2000 Dollars)

	Phase I 2001-2005			Phase II 2006-2010			Phase III 2011-2020		
	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)	Costs	Revenues	Surplus/ (Deficit)
Federal	$993,485	$324,700	($668,785)	$615,213	$268,000	($347,213)	$630,391	$536,000	($94,391)
State	83,431	64,700	(18,731)	124,013	64,200	(59,813)	139,277	134,000	(5,277)
Local	34,823	22,850	(11,973)	36,000	10,210	(25,790)	20,705	21,300	595
Private	11,524	11,524	0	5,974	5,974	0	10,100	10,100	0
Total	**$1,123,263**	**$423,774**	**($699,489)**	**$781,200**	**$348,384**	**($432,816)**	**$800,473**	**$701,400**	**($99,073)**

* Numbers in parentheses show that estimated costs exceed revenues.

7.6 SUMMARY AND CONCLUSIONS

The performance based needs model has been used to develop various funding scenarios. The model provides information that directly relates capital investment in the system with resulting performance. Three scenarios were addressed. The focus of the funding scenarios was on the first 5-10-year planning phase, with a more broad range look at the long-term 20-year phase.

Scenario A describes how the system will perform if the existing level of funding is maintained. This reflects projects included in ADOT's 2002-2006 Airport Development Program. Pavement at some of the airports is preserved and a few improvements are made in the system. However, the system cannot keep pace with growing demand at this level of investment. Performance at most of the system airports will deteriorate due to inadequate funding. Overall, system congestion and delay will increase and the economic impact of aviation to the state will decline.

Scenario B explores the minimum cost strategies and investment level to maintain the current level of system performance over the 20-year planning period. The system is improved only to maintain existing performance levels as demand on the system increases. The majority of investment is directed to Commercial Service and other Primary system airports.

In Scenario C, all airports in the system are improved to meet the FAA/ADOT's minimum planning and design guidelines. Where the necessary improvements are physically, environmentally, or economically infeasible, the airports will be improved to the best possible condition. Also, the system will be improved to keep pace with growing demand, and service levels will be improved to raise performance scores. The cost of average aircraft delay decreases to $12.2 million. The total 20-year cost of all the improvements under this scenario is about $2.7 billion.

Projected levels of funding from current revenue sources are assumed to be maintained over the 5-year planning period and decline and stabilize after that. Communities that support primary air carrier airports may pursue the option of implementing passenger facility charges (PFCs) to supplement declining federal and local revenues. Local communities that do not have the option of implementing PFCs will most likely turn to the state for additional assistance.

An estimated $1.04 billion 10-year investment is needed to maintain the existing system performance, and an estimated $1.9 billion is necessary for an improved system that will bring all airports up to state standards, again over 10 years. As federal funding may decrease, state and local governments will be challenged to financially support continued system development.

The issue of the possible decline of federal support for general aviation and small commercial service airports continues to be one of the single most important challenges facing aviation in the state today. All indications based on past history and recent trends are that federal assistance may not remain at its AIR-21 levels for the long term. As a result of this potential decline in federal assistance, these funds, along with the total funding available from state, local and private sources, will not adequately maintain the aviation system. The probable result of any decline in available funds is that aid to smaller airports will not be provided in the future. This will result in a significant deterioration in overall system performance, particularly in regard to

facility infrastructure, service levels, safety, accessibility to and from rural areas of the state, economic opportunities and benefits, and delivery of social and medical services.

To respond to the expected shortfalls in federal and state support, local airport sponsors need to be more creative in leveraging existing AIP funding with other federal, state and local development programs. Local funding requirements can also be supplemented by imposing more user fees for services provided. Because the benefits of an airport often spread beyond city/sponsor boundaries, multi-jurisdictional authorities could be created to share the cost of operating and maintaining a facility. Where practical, aviation facilities can be combined to avoid duplication of services.

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