Aurora State Airport Master Plan Update

October 2000

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October, 2000

Acknowledgements

This plan was prepared under the direction of Ann Crook, Director for the Oregon Department of Aviation. Preparation of this document was financed in part through a Grant from the Department of Transportation, Federal Aviation Administration (FAA), under provisions of the Airport and Airways Improvement Act of 1982 as amended.

Effective July 1, 2000, the Oregon Department of Transportation - Aeronautics Division officially became the Oregon Department of Aviation. However, the work in preparing this document was accomplished by Oregon Department of Transportation – Aeronautics Division. Nevertheless within this document, this agency is referred to as the Oregon Department of Aviation.

"The preparation of this document may have been supported, in part, through the Airport Improvement Program financial assistance from the Federal Aviation Administration Project Number 3-41-0004-05 as provided under Title 49, United States Code, section 47104. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the Untied States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws."

Project team members wish to acknowledge the contributions and support of the following individuals in the preparation of this document:

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	Pete Lance, Columbia Helicopter Inc.
	Mayor Loretta Scott, City of Aurora
	Paul Silver, City of Wilsonville
	Larry Stevens, Mulino Chapter OPA
	W.O. Traphagen
	Allen Warner, Columbia Aviation Association
	Tom Whitney

Acknowledgements

The entire Master Plan Advisory Committee and all other participants in numerous public meetings for their hard work in helping to guide the airport into the future, despite the many difficult issues they faced.

Federal Aviation Administration:	Don Larson, Community Planner
W&H Pacific Project Team:	Rainse Anderson, P.E., Project Manager Brian Rapalee, P.E., Project Planner Chris Corich, Airport Planner
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CHAPTER 1

Executive Summary

INTRODUCTION

In August 1997, the Aeronautics Section of the Oregon Department of Transportation retained W&H Pacific, Inc., to prepare a Master Plan Update for the Aurora State Airport. The Master Plan Update is intended to forecast airport aviation facility requirements, prepare a 20-year development program, and identify methods to implement airport-related programs for the planning period 1998-2017. As with any planning effort, the ultimate objective is to recommend adoption and implementation of the plan.

Findings and Conclusions

FAA Compliance

Land lease rates, fuel flowage fees and ingress/egress permits were evaluated to address FAA compliance requirements. Analysis of these issues and recommendations for future policies are included in a separate report, but a brief summary of that report's scope is described below.

Aurora State Airport is one of only a few in the state that allows access onto airport property from adjacent private property. The Oregon Aeronautics Division allows access from private property upon approval of an Ingress/Egress Agreement. The Aeronautics Division has experienced problems in the past implementing an agreement with some of the off-airport businesses, as well as with the different rate structures used within the program. The FAA became concerned that the airport was non-compliant with Grant Assurances that require the imposition of fair and equitable fees to all operators accessing the airport. An analysis of the existing Ingress/Egress agreements and a review of options for the existing agreements was completed in order to address the non-compliance issue.

The State of Oregon owns approximately 22 acres of developable land on the Aurora State Airport. The balance of the land owned by the State is used for runways and taxiways and is not available for development. This developable land is leased by the State to private parties wanting to establish aviation-related businesses at the airport. Land lease rates are set by Oregon Administrative Rules (OAR) Chapter 738, Division 10 – Aeronautics Division. However, these rates were last adjusted on April 20, 1981. Recommendations were developed for updated land lease rates, as well as fuel flowage fees, that will insure fair and equitable rates and charges.

Inventory

Aurora State Airport is located approximately mid-way between the Portland metropolitan area and the state capitol at Salem, on the border between Marion County and Clackamas County. The airport is an important general aviation airport serving the Portland metropolitan area and the northern Willamette Valley. It is the busiest State-owned airport and the overall fifth busiest airport in Oregon. The facility serves a wide-range of charter, corporate and recreational users. There are a number of businesses at the airport providing services such as fuel sales, maintenance, storage, charter, aircraft sales, and flight training.

The airport is made up of a combination of public and private parcels. Oregon Aeronautics owns the runway and taxiway area and some of the adjacent land in the mid-field area. The State owns approximately 144 acres of airport land. Additionally, the State has avigation easements over another 350 acres along the sides and off the ends of the runways. An avigation easement is a legal agreement between the State and a landowner that allows the State to protect airport airspace from natural and man-made obstructions in areas that the State does not own by fee title. Access to the airport is permitted from approximately 120 acres of privately-owned land through access agreements with the State known as "ingress/egress agreements".

Aurora State Airport has a single asphalt concrete runway with a full-length parallel taxiway. The runway is 5,000 feet long by 100 feet wide, and is equipped with Medium Intensity Runway Lights (MIRLs) with Visual Approach Slope Indicators (VASIs) at both ends. Runway pavement strength is rated at 30,000 pounds for aircraft with single wheel landing gear and 45,000 for aircraft with two (dual) wheels per landing gear.

Aurora State Airport is one of seven airports in the Portland area with published instrument approach procedures. Radar service is provided by the Portland International Airport Terminal Radar Approach Control (TRACON). Voice communication for aircraft using the airport is provided on the airport radio UNICOM on a radio frequency of 122.7. There is also an Automatic Weather Observation Station (AWOS) which reports altimeter setting, wind data and temperature, dew point and density altitude on frequency 118.52.

There are approximately 180 tie-down aircraft parking spaces. In addition, there are approximately 157 hangar spaces, of which 107 are T-Hangar type and the remainder open or corporate style. About 30 percent of both the tie-downs and the hangar spaces are on State-owned land. There is also a commercial helicopter operation (Columbia Helicopters) at the northeast end of the airport. Fuel service (Jet A, 100LL and 80) is provided primarily by 3 Fixed Based Operators.

Forecasts

Forecasts provide the basis for evaluating the type of facilities needed to meet future needs and are presented for the next 20 years, from 1998 through the year 2017, in five-year increments. However, a forecast is an estimate of future activity and can therefore serve only as a guideline.

As the forecast horizon gets further away, the assumptions which form the basis for the forecast become more subject to change and influence from outside events. Unforeseen changes will occur within the community and service area, and will result in deviations between the forecast and actual events.

Development of forecasts for the Aurora State Airport involved multiple processes. These included: defining the airport's service area; analyzing the relationship between the population within this service area and the number of based aircraft; and evaluating the relationship between the number of based aircraft and the level of operations at the airport. Other factors included in the forecast process were: estimated population and other demographic changes; business trends within the area; and changes in general aviation and aviation technology.

Demand forecasts for the Aurora State Airport have been developed in three categories: based aircraft; operations; and critical aircraft. "Based aircraft" refers to the number of aircraft that are located (either hangared or tied down) at the airport. "Operations" refer to the number of take offs and landings; i.e., one operation is either a take off or a landing. The "critical aircraft" is the type of aircraft or family of aircraft that is the most demanding of the facilities from a size, weight or speed standpoint. In addition, the designated critical aircraft must commonly and frequently use the airport. A small, but gradually increasing percentage of the growth in annual operations will come from business class aircraft. These aircraft will, however, remain a small percentage of the airport's overall operations compared to the number of single engine aircraft operations. Forecasts are summarized in **Table 1-1.**

Table 1-1
SUMMARY OF CONSTRAINED FORECAST

1998	**2002**	**2007**	**2012**	**2017**	
Based Aircraft	259	272	288	304	318
Annual Operations	87,914	92,270	97,714	103,159	108,204
Critical Aircraft	ARC B-II	Same	Same	Same	Same
	Beech King Air - Cessna Citation II or Similar Aircraft				

Source: W&H Pacific

Facility Requirements

The Airport Layout Plan (ALP) depicts the existing and proposed airport facilities. Preliminary airport development alternatives were presented and discussed at a series of public and airport advisory committee meetings. Further discussions with FAA and State Aeronautics staff helped refine the ALP into a long-range development plan.

Significant facility requirements include the following:

- Removal of obstructions to airspace
- Reconstruction and expansion of the Central Ramp
- Continued development of T-hangars, corporate hangars and FBOs in response to market demand
- Acquisition of aviation easements
- Construction of a relocated parallel taxiway at a 300 foot separation from the runway
- Comprehensive rehabilitation/maintenance of the runway, taxiways and other airport pavements
- Replacement of aged/outdated navigation and lighting systems

Land Use Compatibility

Land use compatibility was evaluated by comparing the effect of existing and forecast airport operations, both on-airport and off-airport, for the planning period. Three areas of compatibility were evaluated: ownership of Runway Protection Zones (RPZs); protection of airport airspace from obstructions; and zoning classification for the airport.

The airport already controls through existing avigation easements nearly enough surrounding property to adequately control airspace in the RPZs for both approaches, as well as for the transitional surfaces. The State should continue with its program of purchasing avigation easements by gaining control of two remaining areas southeast of Runway 35 and northwest of Runway 17. Upon acquisition of easements for those two areas, the airport will gain sufficient control of both RPZs to meet aviation needs.

Several areas of obstructions to airspace have been identified, particularly along the Wilsonville-Hubbard Highway. A program for removal/trimming of obstructing trees and vegetation has been included as a high priority item in the Capital Improvement Program.

Existing Marion County zoning classification of Public Use was evaluated, as well as compliance requirements to meet Senate Bill 1113. Recommendations were submitted to the Aeronautics Division for review.

A fourth issue of compatibility, aircraft noise, was originally part of the master plan scope and is a sensitive issue for the airport's neighboring communities. It became apparent during the course of the master plan study that effective evaluation of noise impacts was well beyond the scope of this study. To adequately address issues and impacts related to noise, the Aeronautics Division has set aside additional funds for a separate noise study that is outside of the master plan scope.

Financial Plan

Three elements have been merged to create the financial plan for implementation of the Master Plan:

- The facilities and improvements required to accommodate forecasted demand.
- The estimated cost to provide the required improvements.
- A development schedule identifying when improvements are expected to be needed.

The proposed improvement projects fall within one of three phases. Phase I covers the first five years from 2000 to 2004 and is the most detailed. Phase II covers the next five years from 2005 to 2009. Phase III covers the next ten years from 2010 through the year 2019. Projects for Phase I are prioritized and scheduled for specific years, while Phase II and III projects are listed only in approximate anticipated order within each respective phase.

Capital improvements have been scheduled to accommodate forecast demand. A Twenty-Year Capital Improvement Program presents specific facility improvements required during the study period. This table lists the proposed schedule, estimated total cost in 1999 dollars and the level of anticipated federal and local funding. Actual implementation schedules may be altered in response to changing needs and the availability of funds. **Table 1-2** summarizes the total estimated cost for all three phases during the twenty-year planning period.

Table 1-2
PHASED DEVELOPMENT PLAN - FINANCIAL PARTICIPATION

	Cost (1999)	Portion of Total
Federal Share of Public Development	$5,058,900	49 %
State Share of Public Development	$ 872,100	9 %
Private Property Development	$4,276,000	42 %
TOTAL CIP PROJECT COSTS	**$10,207,000**	**100 %**

Recommendations

In order to provide for and foster aviation in the best interest of the residents of the Aurora region, the Master Plan Update recommends the following:

- Provide for future development at the airport in accordance with this plan.
- Place a high priority on removal of identified airspace obstructions.
- Acquire remaining identified avigation easement areas to gain sufficient control of airport airspace.
- Maintain compatibility of this plan with the comprehensive plans, other necessary planning documents, and land use regulations for the City of Aurora, Marion County and Clackamas County.
- Request and utilize funding assistance as provided by the Federal Aviation Administration.

Chapter 2

Inventory

INTRODUCTION

The inventory chapter is presented to provide background data on the existing airport facilities, airspace, on and off airport land use and local demographics. The master planning team visited the Aurora State Airport and the local community, and reviewed existing State and local documents to gather the information presented here. This information includes airport history, its role within the community, existing facilities, aviation activity, airspace data, and land use and socio-economic data. In addition to providing background information, this data will be used in the development of subsequent chapters.

AIRPORT HISTORY

The Aurora State Airport was established in 1943. Between 1943 and 1953, the Airport was administered by the U.S. Bureau of Public Roads. Since 1953, the State Department of Transportation, Aeronautics Section (and its predecessors) has operated the Airport, although ownership of the land was not actually transferred from Highways to Aeronautics until 1973. The airport has been in continuous operation since its opening in 1943.

In 1976, the first Airport Master Plan was prepared. Following this, in 1977 and 1978, major improvements were constructed, including construction of a parallel taxiway, installation of a rotating beacon, reconstruction and narrowing (to 100 feet) of the runway, addition of drainage improvements, installation of medium-intensity runway lighting, and construction of a tie-down apron for 16 aircraft. In 1979, a 22-acre parcel near midfield was purchased with FAA funds. This parcel has since been leased to private parties who have constructed aircraft hangars and other facilities on the property. In 1985, a non-precision Non-Directional Beacon (NDB) instrument approach was established. In 1986, another 10 acres with a small tiedown apron was purchased near midfield. A second Airport Master Plan for the Airport was completed in 1988. In 1995, the runway was lengthened from 4,104 feet to 5,000 feet and a non-precision Localizer Landing System instrument approach was added to Runway 17.

AIRPORT'S ROLE WITHIN THE COMMUNITY

The Aurora State Airport is approximately mid-way between the Portland metropolitan area and the state capitol at Salem. The Airport lies in Marion County, and is adjacent to Clackamas County to the North. The City of Aurora, which had a 1996 population of 675, is approximately 0.5 miles to the southeast. Other nearby cities include Woodburn (pop. 15,780), Hubbard (pop. 2,185), Donald (pop. 580), Wilsonville (pop. 10,600), Canby (pop. 11,430) and Barlow (pop. 125).

Dr. William Keil founded the City of Aurora in 1856 as the Aurora Colony. Aurora continues today as a national historic district that boasts 200 antique dealers. The noise generated by the airport, and particularly by the jet traffic, is the airport issue for the communities of Aurora to the south and Charbonneau to the north.

The Aurora State Airport is an important general aviation airport serving the Portland metropolitan area and the northern Willamette Valley. It is the busiest State-owned airport and the overall fifth busiest airport in Oregon. The facility serves a wide-range of charter, corporate and recreational users. There are a number of businesses at the Airport providing services such as fuel sales, maintenance, storage, charter, aircraft sales, and flight training.

Climate

The Willamette Valley has a temperate maritime climate. Summers are moderately warm and dry; winters are mild and wet. Temperature extremes (highs greater than 100 degrees or lows below 20 degrees) are rare. The percentage of IFR weather varies from 6.1 percent at Portland International to 7.9 percent at Troutdale to 9.1 percent at Salem. Although data regarding these conditions is not maintained for the Aurora State Airport, IFR conditions probably occur on the order of 8 to 9 percent of the time.

AIRPORT DATA

EXISTING FACILITIES

Aurora State Airport is located to the northwest of the City of Aurora and one mile from Interstate-5. There is direct access to the airport from I-5 via the Wilsonville-Hubbard Highway and the Ehlen Road exit off I-5.

The airport is comprised of a combination of public and private parcels. Oregon Aeronautics owns the runway and taxiway area and some of the adjacent land in the mid-field area. The State owns approximately 144 acres of airport land. Additionally, the State has avigation easements over another 350 acres along the sides and off the ends of the runways. An avigation easement is a legal agreement between the State and a landowner that allows the State to protect airport airspace from natural and man-made obstructions in areas that the State does not own by fee title. Access to the airport is permitted from approximately 120 acres of privately owned land through access agreements with the State known as "ingress/egress agreements".

The airport elevation is 196 feet above mean sea level using North American Datum of 1983 (NAD83) as the horizontal reference. The Airport Reference Point (ARP) is located at North

Latitude 45°14.83', West Longitude 122°46.20' as noted in the NOAA Airport/Facility Directory dated September 1995.

The Aurora State Airport has a single runway with a full-length parallel taxiway. The runway is 5,000 feet long and 100 feet wide, and is equipped with medium-intensity runway lights (MIRLs). It is constructed of asphalt and is equipped with visual approach slope indicators (VASI) at both ends. The strength of the Runway is rated at 30,000 pounds for aircraft with single wheel landing gear, and 45,000 pounds for aircraft with two (dual) wheels per landing gear. Pavement conditions at the airport were evaluated during a pavement condition index survey in May 1995 under the Oregon State Aviation System Plan.

The taxiway is located between 200 and 300 feet east of the runway and is 40 feet wide. Reflectors mark each edge. Airfield drainage was greatly improved during the 1977-78 construction projects, although some flooding continues to occur on private property near the FBO area at the south end of the Airport.

The Aurora State Airport is one of seven airports in the Portland area with published instrument approach procedures. As of February 1998, the airport is served with the following non-precision instrument approaches[1]:

- VOR/DME or GPS-A
- NDB Runway 17
- GPS Runway 17
- GPS Runway 35
- LOC/DME Runway 17

Radar service is provided by the Portland International Airport Terminal Radar Approach Control (TRACON). Voice communication for aircraft using the airport is provided on the airport radio UNICOM[2] on a radio frequency of 122.7 MHz. There is also an Automatic Weather Observation Station (AWOS) which reports altimeter setting, wind data and temperature, dew point and density altitude.

There are approximately 180 tie-down aircraft parking spaces. In addition, there are approximately 157 hangar spaces of which 107 are T-Hangar type and the remainder open or corporate style. About 30 percent of both the tie-down and the hangar spaces are on State-owned land. There is also a commercial helicopter operation (Columbia Helicopters) at the northeast end of the Airport.

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[1] A non-precision instrument approach provides horizontal guidance to the runway or airport. A precision instrument approach provides horizontal and vertical descent guidance to the runway. Descent minimums (how low an aircraft can fly on the approach) are generally lower for a precision instrument approach than for a non-precision instrument approach.

[2] The UNICOM is a non-federal radio frequency assigned to the airport. One of the FBO's on the field staffs the UNICOM providing wind, runway, and limited air traffic data to aircraft coming in to land.

Fuel service is provided primarily by Aurora Aviation from a 12,000-gallon tank of Jet A, and a 12,000-gallon tank of 100LL. AAA Aviation provides 100 LL from a 10,000-gallon tank and 80/87 from a 5,000-gallon tank. Skywest Aviation provides 100LL from a 10,000-gallon tank. According to Oregon Aeronautics Division data, total 1998 annual fuel flow for the airport is approximately 383,000 gallons or 31,900 gallons per month. Fuel flowage revenue to the State is based on fee of $0.03 per gallon of fuel sold.

Based Aircraft

In 1997, the airport had an estimated 256 based aircraft. Historic based aircraft data is provided in **Table 2-1**.

Table 2-1
Historical Based Aircraft Data

Year	Number of Based
1971	100
1976	144
1979	247
1983	231
1984	234
1985	223
1997	256*

Source: * = W&H Pacific Survey; all others, 1986 Master Plan Update.

Airport Operations

Oregon Aeronautics conducts an acoustical aircraft counting program that is used to estimate the number of aircraft operations at airports without control towers. The Aurora Airport is included in that counting program. The system uses a microphone and tape recorder system to monitor take-offs and landings at the airport. The Rens counter is the system most commonly used throughout the country for documenting traffic counts at airports with no control tower.

For 1997, the number of operations estimated by this method was 69,964. In discussions between the airport manager and the planning team, the consensus was that the 69,964 figure was too low. After contacting the staff who run the acoustical counting program, it was revealed that the tape recorder which records aircraft sound sometimes runs out of tape at airports that are as busy as Aurora. As a result, the system sometimes does not record a full day of aircraft operations. This problem was noted in the series of counts in 1996 when the total count was calculated at 56,369.

In 1997, procedures were improved for collecting the count data, and the number of operations increased to 69,964 – an increase of 24.1 percent. Despite improved data collection procedures, there were still errors with the 1997 counts. After review of the 1997 data and discussions with ODOT's aircraft monitoring analyst, it was determined that further adjustments to the 1997 counts were warranted. It was felt that an adjustment similar to the improvement seen between the 1996 and 1997 counts was appropriate. As a result, a 24.1 percent increase was applied to the raw 1997 number of 69,964 increasing it to 86,825. This should better reflect the actual level of activity at the airport. Procedures have been further improved for counts made at busy airports, such as Aurora, using on-site staff to monitor the system and to change the recording tapes more frequently. It is anticipated that the 1998 counts will be more accurate.

Historic operations information presented in **Table 2-2**.

Table 2-2
HISTORICAL AIRPORT ACTIVITY

YEAR	TOTAL OPERATIONS
1979	165,000
1983	58,390
1985	61,503
1986	56,054
1987	75,816
1988	79,317
1989	80,400
1996	*86,825

Source: 1986 Airport Master Plan Update
1989 Oregon Aviation System Plan
*W&H Pacific/OAS Estimate

Airspace Data

The airport traffic pattern is a standard left-hand pattern to both runways. This traffic pattern is illustrated in **Figure 2-1**. Straight-out departures to the north are prohibited by Administrative Rule on Runway 35 and pilots are advised to make left turns.

The traffic pattern altitude is 1,000 feet above ground level (AGL), or 1,196 above mean sea level (MSL). The location of the airport and surrounding airports is depicted in **Figure 2-2** which shows a portion of the Seattle Sectional Chart (a type of map used by pilots flying visual flight rules).

As previously noted, the airport has four non-precision instrument approach procedures. The instrument approach procedures are used by pilots wishing to land at the airport during bad weather, also known as Instrument Flight Rule (IFR) conditions. Pilots use radios on–board their aircraft to determine their position, receive guidance to the airport and follow approach procedures illustrated by "approach plates". Copies of the approach plates are provided on the following pages.

Traffic Pattern - Figure 2-1

Seattle Sectional – Figure 2-2

Approach Plate – Figure 2-3

Approach Plate – Figure 2-4

Approach Plate – Figure 2-5

Approach Plate – Figure 2-6

Approach Plate - Figure 2-7

Airport Utilities and Public Services

The following summarizes utilities and public services provided at the airport.

- Water is provided at the airport from a system of wells.
- Sanitary Sewer is provided by individual drain field/septic tank systems.
- Telephone is provided by Century Tel.
- Police protection is provided by Marion County.
- The Aurora Rural Fire Protection District provides fire protection and they have mutual aid agreements with other agencies for extended level of emergency services.

Demographic Data

Airport Area Land Use

Aurora State Airport is on approximately 244 acres of land, 100 acres of which are privately owned. The Marion County Zoning Map designation for airport proper (runways and taxiways) and adjacent property with access to the airport is zoned "P" – Public Zone. This use classification allows airports a conditional use. The land surrounding the airport but outside the airport boundaries is predominately Exclusive Farm Use (EFU) with some pockets of "AR" – Acreage Residential - on the west and southwest. Recently adopted Oregon Land Conservation and Development Commission rules require that public airports be zoned to outright allow airport uses. A sample zoning ordinance compliant with the new requirements has been developed as a part of this plan for Marion County's consideration.

North of Arndt Road is Clackamas County. The area immediately adjacent to the airport is zoned Exclusive Farm Use (EFU).

Socio-Economic Data

Historical population data for the years 1970 through 1995 is shown in **Table 2-4**. This information was provided by the Office of Economic Analysis – Department of Administrative Services, State of Oregon.

Table 2-3
Historical County Population Data

YEAR	MARION	MULTNOMAH	CLACKAMAS	WASHINGTON
1970	151,309	556,667	166,088	157,920
1975	171,700	547,400	205,100	197,400
1980	204,692	562,640	241,919	245,808
1985	213,019	564,249	250,118	269,244
1990	230,028	587,128	280,935	315,368
1995	258,000	626,500	308,600	370,000

The economy of the area served by the Aurora State Airport has grown steadily over the last 10 years. This growth has been driven by expansion in the high tech segment of the economy. Companies like Tektronix and Intel have experienced steady expansion of products, markets, and local area employment.

Per Capita Personal Income has also grown in the airport service area. **Table 2-4** illustrates the change in the last ten years.

Table 2-4
PER CAPITA INCOME

YEAR	MARION	MULTNOMAH	CLACKAMAS	WASHINGTON	OREGON
1985	$11,902	$15,002	$15,045	$15,157	$13,059
1990	$16,179	$19,904	$20,232	$20,374	$17,424
1995	$19,541	$24,091	$25,237	$24,934	$21,530

Source: Oregon Employment Department 1998 Regional Economic Profile

Forecasts

INTRODUCTION

The purpose of this chapter is to estimate the level of activity the Aurora State Airport will experience over the next 20 years. This forecast activity provides the basis for evaluating the type of facilities needed to meet demand. By comparing the existing facilities at the airport (as described in Chapter 2) with the facilities needed to meet the future demand, timely and cost effective improvements can be planned and implemented.

This forecast is for the next 20 years, from 1998 through the year 2017. The forecast is presented in detail for the first five years and then at five- and ten-year intervals. As the forecast horizon gets further away, the assumptions which form the basis for the forecast become more subject to change and influence from outside events. These changes increase the level of uncertainty in the forecast as it gets further out in time.

The development of the forecast for the Aurora State Airport involved multiple processes. These processes included defining the airport's service area, analyzing the relationship between the population within this service area and the number of based aircraft, and evaluating the relationship between the number of based aircraft and the level of operations (take-offs and landings) at the airport. Other factors included in the forecast process were: estimated population and other demographic changes; business trends within the area; and changes in general aviation and aviation technology.

Because a forecast is an estimate of future activity, it can only serve as a guideline. Unforeseen changes will occur within the community and service area and will result in deviations between the forecast and actual events. A major community-wide change in the area could impact the number of based aircraft and aircraft operations. This change could effect the airport's service level and needed facilities. The users of this plan should be alert to changes within the community and how these changes may affect the planning process.

ECONOMIC FACTORS IN GENERAL AVIATION

Any forecast of aviation activity should include a discussion of the economic and political climate that surrounds the industry and, in particular, the general aviation industry. In addition to the condition and overall strength of the local, regional and national economy, issues such as product liability, purchase price of new and used aircraft and avionics, the cost of maintaining and operating the aircraft, advances in navigation and aircraft technology, and the number of active and student pilots all have an influence on the anticipated activity at the Aurora State Airport.

Product Liability Reform

One factor, which has had a profound affect on the general aviation (GA) industry, has been the issue of product liability. Prior to August 1994, there was no time limitation on product liability for an aircraft manufacturer. This meant that no matter how old the aircraft, the manufacturer of that aircraft could be found liable in the event of an accident. Annual product liability claims paid by manufacturers increased from $24 million to over $210 million during the last 10 years. This increase in awards triggered a significant increase in liability insurance premiums, which in turn drove up the price of new aircraft. One manufacturer estimated that product liability costs are two times the cost of building a new aircraft. Faced with these large increases in the cost of new aircraft, production of factory-built GA aircraft has dwindled from a high of 17,811 aircraft in 1978 to between 928 and 1,130 per year for the last 5 years.

In August 1994, a new product liability law was passed by Congress and signed into law by the President. This law limits to 18 years the time period during which a lawsuit can be brought against the manufacturer of a general aviation aircraft. With the passage of this legislation, aircraft manufacturers have increased or restarted their production of light general aviation aircraft. Cessna Aircraft, which ceased manufacture of single-engine piston aircraft in 1988, has resumed production of the 172, 182 and the 206. They estimate they will ultimately produce approximately 900 Cessna 172's, 600 Cessna 182s and 400 to 500 Cessna 206s per year.

In 1997, the first year of Cessna's renewed production of piston-engined aircraft, the company produced 360 new piston engined aircraft including 287 Cessna 172s, and 73 182s. Production of 206s was delayed until the first quarter of 1998, pending a decision on the type of engine to use in the aircraft. Should these production trends continue, this one manufacturer will produce approximately five times the total 1993 production of factory-built, piston-engine, general aviation aircraft.

Home-built Aircraft

The number of home-built or experimental aircraft has steadily increased over the last 10 years, partly filling demand for new light general aviation aircraft and partly as a result of the use of new materials and technology in these aircraft. The FAA estimates that from 1993 to 1995, the fleet of experimental aircraft increased from 10,938 to 16,382. According to statistics kept by the Experimental Aircraft Association (EAA), there are over 22,000 home built aircraft licensed by the FAA, with about 1,000 new aircraft being registered each year. Two notable examples of these aircraft are produced in Oregon – the Van's RV series and Lancair. These two companies produce very different, yet very popular, aircraft which have gained wide acceptance throughout the country.

Corporate/Business Aviation Use

One of the growth areas of general aviation has been in corporate or business aviation use. This growth is driven by a number of factors. As companies expand throughout the U.S., many find investments in company aircraft to provide real time saving benefits for the transport of company employees. Another factor driving this trend is the airline hub and spoke operations. Requiring all passengers to fly through a hub-and-spoke airline system is often not the most direct or timely way to get from point “A” to point “B”. Increased congestion and delay at many of the larger airports has also driven this trend.

Another trend in business aviation that has taken off in the last five years is that of fractional ownership of business aircraft. With fractional ownership, a company with limited needs or means can buy a fractional part of a business aircraft. This will allow the company to use the aircraft a certain number of hours per year. Many of the aircraft manufacturers are seeing this as a means to stimulate business aircraft sales.

GPS Navigation

The most exciting advance in navigation during recent years has been the development of Global Positioning System or GPS. This navigation system uses a receiver that tracks the signal from a system of satellites in Earth orbit. By triangulating on the signal from three or more of these satellites, the pilot can determine not only his position by latitude and longitude, but also his altitude and speed. This allows for “area” navigation, or direct travel between two points. Under the present system of VOR navigational beacons, the pilot must plot a course using the signal from one VOR to the next. By flying directly from the point of departure to the destination, significant economies are achieved. In addition, GPS technology has allowed for the development of instrument approach procedures without the need of ground based equipment. Because of this technology, it may also be possible to design curved approach and curved missed approach flight paths. This will enable approaches to be designed for terrain where an approach using non-GPS technology was previously considered impossible.

Pilot Population

The decline in the number of FAA-certified pilots has leveled off at about 622,000 from a high of approximately 827,000 in 1980. The classifications making up this number are student, private, commercial and airline transport pilot. While the number of private and commercial pilots has slowly declined, the number of airline transport pilots has increased steadily, signaling an increase in commercial (airline and commuter) and corporate aviation employment. On the opposite end of the spectrum, preliminary data for 1997 indicates that student starts are up over 1996 levels and will likely equal or surpass 60,000. This would represent a one percent increase over the prior year.

While recovery to the levels experienced prior to the 1980s is generally not expected, the enactment of the product liability law, the development of GPS navigation, increased business and corporate aviation use, and the continuing need for airline and corporate pilots may act to stimulate this industry.

AIRPORT MASTER PLAN FORECASTING

The forecasts for future demand at the Aurora State Airport have been developed in three categories:

- Based Aircraft, or the number of airplanes which are "home-based" or located on the airport,
- Number of Operations, or the annual number of take-offs and landings, and
- Critical Aircraft, or the aircraft that frequently uses the airport and places the greatest demand on the facilities from a size, weight or speed standpoint.

The facility impacts for each of these categories is listed in **Table 3-1**.

Table 3-1
FORECAST OF DEMAND AND FACILITY IMPACTS

DEMAND	FACILITY IMPACTS
Based Aircraft ➢ Annual Based Aircraft ➢ Fleet Mix	The number and type of based aircraft determines the aircraft hangar and apron space demands, and the auto parking requirements.
Operations ➢ Annual Operations ➢ Type of Operations ➢ Operations by AC type ➢ Peaking Characteristics	The number of operations by type of aircraft, whether local or itinerant and by time of day, month and year helps determine runway, taxiway and navigation aid requirements
Critical Aircraft	The critical aircraft determines the runway and taxiway design requirements such as runway length, pavement strength, clearance requirements.

Source: W&H Pacific

FORECASTING METHODOLOGY

Preparation of the forecasts for the Aurora State Airport was a multi-step process. First, an unconstrained forecast of based aircraft was prepared. Next, a forecast of operations was prepared using the unconstrained forecast of based aircraft. The last step involved an analysis of the critical aircraft. In the case of this forecast, determination of the critical aircraft places a constraint on the future growth of the airport.

Based Aircraft Forecast

In preparing the based aircraft forecast, three methodologies were used. One utilized the FAA Forecast Growth in the fleet of general aviation aircraft, one utilized a combination of growth in the fleet plus changes in market share, and a third utilized population growth in the airport service area.

The FAA publishes a Terminal Area Forecast (TAF) report. This report looks at specific airports on a regional basis and projects growth in based aircraft and operations. In the most recent TAF, both the based aircraft and operations numbers for the year 2010 have been exceeded. Given that the 2010 forecasts were exceeded in 1997, the TAF forecast figures will not be used in this forecast process.

The three methodologies that have been used to forecast based aircraft are described below:

FAA FORECAST GROWTH OF NEW AIRCRAFT. EACH YEAR, THE FAA PUBLISHES A 12-YEAR AVIATION FORECAST. THE FORECAST FOR GENERAL AVIATION (GA) BREAKS THE FLEET GROWTH INTO SINGLE ENGINE PISTON, TWIN ENGINE PISTON, TURBOPROP, TURBOJET, PISTON HELICOPTERS, TURBINE HELICOPTERS, AND EXPERIMENTAL (HOME BUILT) AIRCRAFT. FORECAST CHANGE IN EACH OF THESE CATEGORIES IS LISTED BELOW:

Single Piston Engine = +. 69%
Turboprop = +1.23%
Piston Helicopters = -1.74%
Experimental/Homebuilt Aircraft = +1.03%
Twin Engine Piston = +. 38%
Turbojet = +1.50%
Turbine Helicopters = 0%

Applying these factors for a 20-year period at Aurora results in a growth rate of **1.6 aircraft per year**, from 256 aircraft in 1997 to 288 aircraft in 2017 (the forecast period is 1998 – 2017). The growth of 1.6 aircraft per year represents net growth of the general aviation aircraft fleet – new aircraft less aircraft which leave the fleet.

FLEET GROWTH + MARKET SHARE SHIFT. **THE SECOND COMPONENT IN THE GROWTH OF BASED AIRCRAFT COMES FROM CHANGES IN AIRCRAFT MARKET SHARE – *EXISTING* AIRCRAFT MOVING TO AURORA FROM OTHER AIRPORTS IN THE AREA (LOCAL MARKET SHIFT) AND FROM OUTSIDE THE REGION COMING FROM PEOPLE MOVING INTO OREGON. GROWTH RESULTING FROM MARKET SHARE COULD BE EQUAL TO OR GREATER THAN GROWTH CAUSED BY NEW AIRCRAFT ENTERING THE FLEET.**

Within the Portland/Metro area, aircraft move from airport to airport for a variety of reasons. There has been long term speculation that Evergreen Airport in Clark County Washington might close some day. This would likely result in a shift of aircraft throughout the Portland/Metro area. Portland International Airport and the Hillsboro Airport are both very busy with annual operations levels exceeding 200,000 operations. High levels of activity at those airports may be unattractive to some operators looking for a less active airport at which to base their aircraft.

Because of the strong economy, the Portland/Metro area has experienced steady population growth from in-migration, people moving in from outside the area. Some of these people will likely bring aircraft with them. The four counties around the Aurora Airport are forecast to grow steadily over the forecast period, with in-migration being one component.

An argument can be made that the Aurora State Airport will attract more than its share of aircraft when compared to other airports in the region and will experience a net positive influx of aircraft exceeding any loss that may occur. The reasons why this may happen are outlined below.

- **Excellent Ground Access**. The airport has easy access to Interstate 5. Interstate 5 provides a ground transportation link throughout the northern Willamette Valley area.

- **Facilities**. The airport has a lighted runway capable of serving most of the general aviation fleet, is located in relatively uncongested airspace, and has multiple instrument approaches for operations in bad weather.

- **Services**. There are a wide variety of aviation and aircraft services available at the airport from the businesses located there.

- **Facility Ownership**. Because the majority of the developed airport is on private property, it is possible to own in fee simple hangars and property with access to the airport. On most other airports within the region, use of property is through a leased interest with reversion or removal clauses at the end of the lease term. Ownership is very attractive to many operators because the interest can be easily sold or transferred without the issue of remaining lease term being a factor.

- **Operating Costs**. For aircraft owners and pilots in the Portland Metro area, the Aurora State Airport is competitively priced. At some airports in the area, there are aircraft landing fees charged to certain of the larger classes of GA aircraft operators. However, general aviation landing fees are often controversial. There is greater market acceptance of other types of fees, such as land leases, fuel flowage fees and ingress/egress fees. The absence of landing fees at Aurora may prove attractive to some operators.

For these reasons, a "New + Market Shift" forecast was prepared. This forecast assumes that Aurora will receive not only 1.6 aircraft per year from growth in the fleet, but an equal number of aircraft from local and national market shift. This would result in the addition of an average of **3.2 aircraft per year or** based aircraft growth from 256 in 1997 to 320 in 2017.

POPULATION BASED FORECAST. A POPULATION-BASED FORECAST WAS ALSO PREPARED. THIS FORECAST INVOLVED CALCULATING A RATIO BETWEEN THE POPULATION IN THE AIRPORT SERVICE AND THE NUMBER OF AIRCRAFT AT THE AIRPORT. A REVIEW OF PILOT AND AIRCRAFT REGISTRATION RECORDS LISTING AURORA AIRPORT AS THE "HOME" AIRPORT REVEALS THAT THE AIRPORT SERVES A WIDE AREA OF THE NORTHERN AND CENTRAL WILLAMETTE VALLEY. THE MAJORITY OF AIRCRAFT OWNER REGISTRATIONS LIST ADDRESSES IN MULTNOMAH (31.6%), MARION (12.5%), WASHINGTON (14.7%), AND CLACKAMAS (36.3%) COUNTIES. THIS ILLUSTRATES THE WIDE SERVICE AREA OF THE AIRPORT WITH AIRCRAFT OWNERS COMING FROM FOUR OF THE MOST POPULATED COUNTIES IN THE STATE.

Table 3-2 illustrates 1995 population figures and growth forecast in the airport service area through 2017. The four counties listed are projected to experience growth of over 576,000 persons in the 23-year period from 1995 – 2017. This represents a 36 percent increase in population within these four counties.

Table 3-2
FORECAST OF AIRPORT SERVICE AREA POPULATION

County	1995 Population	2015 Forecast Forecast Population	Per Cent Population Increase	2017 Forecast Population*
Washington County	370,000	554,945	50%	582,686
Multnomah County	626,500	713,532	14%	726,586
Clackamas County	308,600	441,193	43%	461,081
Marion County	258,000	354,561	37%	369,045
Total:	1,563,100	2,064,231	32%	2,139,398

Source: Oregon Office of Economic Analysis – Department of Administrative Services

W&H Pacific Projection

POPULATION-BASED FORECAST OF BASED AIRCRAFT. THE RATIO OF BASED AIRCRAFT TO POPULATION IN THE AIRPORT SERVICE AREA (MARION, WASHINGTON, MULTNOMAH, AND WASHINGTON COUNTIES) FOR THE AURORA STATE AIRPORT WAS ESTIMATED TO BE ONE AIRCRAFT FOR EVERY 6,105 POPULATION IN THE FOUR-COUNTY SERVICE AREA. APPLYING THIS RATIO TO FORECAST POPULATION GROWTH YIELDS AN ESTIMATED 345 AIRCRAFT IN 2017. THIS REPRESENTS AN AVERAGE GROWTH OF 4.4 AIRCRAFT PER YEAR. GROWTH WOULD BE A COMBINATION OF NEW AIRCRAFT WITH MARKET SHARE CHANGES TO EQUAL 4.4 AIRCRAFT PER YEAR.

Table 3-3 summarizes the three forecast methods used. In addition to the three new forecasts, the Oregon System Plan Forecast for the airport has also been presented in the **Table 3-3**. **Figure 3-1** illustrates these trends graphically.

Table 3-3
COMPARATIVE FORECAST OF BASED AIRCRAFT

Year	Oregon System Plan	New Aircraft Growth	New Aircraft + Market Share	Population Based Forecast
1995	**233**			
1997		**256**	**256**	**256**
2000	**245**			
2017		**288**	**320**	**345**
Change	**12**	**32**	**64**	**89**
Average A/C Per Year	**2.4**	**1.6**	**3.2**	**4.4**

Source: W&H Pacific
Oregon Aviation System Plan

Figure 3-1
COMPARATIVE FORECAST OF BASED AIRCRAFT

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Source: W&H Pacific
Oregon Aviation System Plan

RECOMMENDED BASED AIRCRAFT FORECAST. THE RECOMMENDED BASED AIRCRAFT FORECAST IS THE NEW + MARKET SHIFT FORECAST WHICH RESULTS IN AN INCREASE IN THE NUMBER OF BASED AIRCRAFT FROM THE PRESENT 256 TO AN ESTIMATED 320, AN INCREASE IN 3.2 AIRCRAFT PER YEAR. THIS FORECAST WAS SELECTED BECAUSE IT REFLECTS:

- Slow growth of the general aviation aircraft fleet.
- Steady population growth that will occur in the planning area.
- The relative attractiveness of the airport within the region.

These three factors should result in a net influx of aircraft to the Aurora State Airport.

Market forces will drive growth at the Aurora State Airport. The State Aeronautics Section is generally not in the business of developing property beyond construction of limited amounts of public aircraft parking ramp. With limited land available, the State will likely lease it to others to develop. Development of aircraft storage hangars on State land and on adjacent privately owned land will result in the construction of those facilities that will bring more aircraft to the field. In early 1998, a new development with space for between 15 and 20 aircraft came on line. Some of the aircraft that will fill these hangars are already on the field. Some will come from other airports, both within and outside of the region. Additional in-fill development opportunities exist within currently developed parts of the airport to accommodate growth in based aircraft.

There is another vacant 22-acre parcel of land adjacent to the airport that was recently sold and is capable of being developed for airport uses and with access to the airport. This parcel could accommodate between 100 and 150 aircraft if it were developed at densities similar to existing development. With the present supply of land, the airport can accommodate the forecast growth in the recommended forecast.

BASED AIRCRAFT FLEET MIX. NATIONALLY, THE INCREASED USE BY BUSINESSES OF GENERAL AVIATION AIRCRAFT IS EXHIBITED IN THE

CHANGING CHARACTER OF THE NATIONAL FLEET. FASTER GROWTH IS EXPECTED IN THE TURBINE AND JET POWERED SEGMENT OF THE GENERAL AVIATION FLEET THAN IN THE PISTON-POWERED SEGMENT. WHILE SOME GROWTH IS ANTICIPATED IN THIS SEGMENT AT THE AURORA STATE AIRPORT, BECAUSE OF THE SMALL NUMBER OF BASED AIRCRAFT, THE FLEET MIX IS ANTICIPATED TO REMAIN RELATIVELY UNCHANGED.

The forecasts for the fleet mix at the airport are presented in **Table 3-4**.

TABLE 3-4
UNCONSTRAINED FORECAST OF BASED AIRCRAFT FLEET MIX

Aircraft Type	1997	2017
Single-Engine Piston	220	284
Multi-Engine Piston	25	36
Turboprop	2	10
Business Jets	1	4
Helicopters	6	9
Specialty Aircraft	2	2
Total	**256**	**345**

Source: W&H Pacific

FORECAST OF AIRCRAFT OPERATIONS

The forecast of aircraft operations for the Aurora State Airport was prepared using five methods. These included:

- Aurora Acoustic Count Program Ratio.
- Salem Airport Tower Count Ratio.
- Scappoose Industrial Airpark Acoustic Count Program Ratio.
- Bend Municipal Airport Acoustic Count Program Ratio.
- Oregon Aviation System Plan Ratio.

Each of these methodologies will be described below.

Aurora Acoustic Count Program. The 1997 adjusted operations count for the Aurora State Airport is estimated to be 86,825 annual operations (see discussion of the acoustic count contained in the Inventory Chapter of this Plan). With 256 based aircraft, the ratio of operations per aircraft is 339 operations per aircraft. Applying this ratio to the forecast number of based aircraft results in an estimated 108,604 annual operations in the year 2017.

Salem Airport Tower Count Ratio. The Salem Airport has a control tower, which provides data on the estimated number of operations. In 1997, Salem had 165 based aircraft and 57,406 annual operations. This yields a ratio of 347 operations per based aircraft – a figure very similar to the 339 operations derived using the adjusted acoustic count for Aurora State. Applying this ratio to the existing and forecast based aircraft results in an estimated 88,832 operations in 1997 and 119,942 in 2017.

Scappoose Industrial Airpark Acoustic Count Program Ratio. The Scappoose Industrial Airpark is located west of Portland. Airport operations are counted using the Rens System and, in 1997 there were an estimated 52,977 operations. With a based aircraft count of 135, the ratio of operations per aircraft is 392. Applying this ratio to the existing and forecast based aircraft results in an estimated 100,352 operations in 1997 and 135,497 in 2017.

Bend Municipal Airport Acoustic Count Program Ratio. The Bend Municipal Airport is located east of the Cascade Mountains near the City of Bend Oregon. Airport operations are counted using the Rens System and in 1997, there were an estimated 27,754 operations. The number of based aircraft at Bend Municipal airport is 105. Dividing the number of operations by the number of based aircraft yields a ratio of 264 operations per aircraft. Applying this ratio to the existing and forecast based aircraft results in an estimated 67,584 operations in 1997 and 91,253 in 2017.

1989 System Plan Ratio. In 1989, the Oregon Aviation System Plan calculated a ratio of 386 annual operations per based aircraft for the Aurora State Airport. This was based upon data collected through the acoustic aircraft counting program with some cross correlation to airports with control towers. Applying this ratio results in an estimate of 98,816 operations in 1997 increasing to 133,423 in 2017.

Table 3-5 illustrates these five ratios. The forecasts are also illustrated in **Figure 3-2**.

Table 3-5
UNCONSTRAINED FORECAST OF AIRCRAFT OPERATIONS

Forecast Method	**1998**	**2002**	**2007**	**2012**	**2017**
Aurora Acoustical Count Ratio (339 OPS/Aircraft)	87,914	92,270	97,714	103,159	108,604
Salem Operations Ratio (347 OPS/Aircraft)	89,946	94,403	99,973	105,544	111,114
Scappoose Ratio (392 OPS/Aircraft)	101,611	106,645	112,938	119,231	125,524
Bend Municipal Ratio (264 OPS/Aircraft)	68,432	71,822	76,060	80,298	84,536
Oregon System Plan Ratio **123,602** (386 OPS/Aircraft)		**100,055**	**105,013**	**111,209**	**117,406**

Source: W&H Pacific

Figure 3-2
Unconstrained Forecast of Aircraft Operations

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Source: W&H Pacific

PREFERRED AIRCRAFT OPERATIONS FORECAST. ALL FIVE OF THE FORECASTS OF OPERATIONS ARE DERIVED FROM SOME TYPE OF EMPIRICAL EVIDENCE, AND ARGUMENTS CAN BE MADE FOR AND AGAINST EACH OF THEM. THE PREFERRED OPERATIONS FORECAST, HOWEVER, IS THE AURORA ACOUSTIC COUNT BASED RATIO. WHILE THE BASE ACOUSTIC COUNT FOR 1997 MUST BE ADJUSTED TO BEGIN THE FORECASTING PROCESS, IN THE JUDGEMENT OF BOTH THE AIRPORT MANAGER AND THE PROJECT TEAM, THIS MORE CLOSELY REFLECTS THE ACTUAL LEVEL OF OPERATIONS AT THE AIRPORT. AS SEEN IN THE TABLE AND FIGURE ABOVE, FORECASTS DERIVED FROM RATIOS AT OTHER AIRPORTS FALL BOTH ABOVE AND BELOW PREFERRED FORECAST.

In subsequent years, when additional acoustic data is available for Aurora, this forecast can be verified or adjusted, as needed. In the opinion of the airport manager and planning team, it is unlikely that any over- or understatement made by the preferred operations forecast would result in significant changes in the airport’s operating character.

The Salem Operations Ratio is very similar to the Acoustic Count Based Ratio. Applying the Salem Ratio would result in only a small difference from the preferred forecast. The fact that it closely matches the Acoustic Count Based Ratio provides some validation of the adjustment of the annual operations number.

The Scappoose Operations Ratio and the ratio derived from the 1989 Systems Plan appear to overstate the level of operations, while the Bend Operations Ratio appears to understate the level of operations based upon the experience of the planning team and the Airport Manager.

CRITICAL AIRCRAFT. IN ORDER TO PLAN THE FACILITIES AT AN AIRPORT, THE CRITICAL AIRCRAFT MUST BE IDENTIFIED. THE CRITICAL AIRCRAFT IS DEFINED AS THE FAMILY OF AIRCRAFT THAT CONTROLS ONE OR MORE OF THE DESIGN ITEMS BASED ON WINGSPAN, APPROACH SPEED AND/OR CERTIFICATED TAKE-OFF WEIGHT. THE CRITICAL AIRCRAFT SHOULD USE THE AIRPORT ON A REGULAR BASIS, DEFINED BY THE FAA AS AT LEAST 500 ANNUAL ITINERANT OPERATIONS.

Designating the critical aircraft for the Aurora State Airport based upon *existing* air traffic would result in a designation of Airport Reference Code [1](ARC) B-II. The airport is currently used by a variety of business class aircraft falling into the ARC B-II category, which easily meets the standard for 500 annual itinerant operations by aircraft in that class.

There have been operations conducted by larger business class aircraft such as the Gulfstream II, an aircraft falling into the ARC D-II category. There have also been inquires regarding the opportunity to base Gulfstream aircraft at the airport. Historically, the number of operations of the larger ARC D-II aircraft has been far below the amount needed to designate that class as the critical aircraft. It is possible, however, that if improvements were made to the airport, such as extending the runway, the level of operations by aircraft in the ARC D-II category would grow to exceed the number needed to designate the critical aircraft for Aurora as falling into the ARC D-II category.

The designation of a critical aircraft became a policy decision for the State of Oregon Aeronautics Section – subject to approval by the FAA. In considering which class of aircraft to designate, the Section considered the following factors:

- **Limited Market Segment**. Business class aircraft falling into the ARC D-II category primarily include the Gulfstream family of business jets. These large aircraft make up less than 10 percent of all business jets and 4 percent of all business aircraft when turboprops and large piston twins are included. The costs to design and construct an airport to accommodate this small group are quite high because of the design impacts caused by their large size and high approach speed.

- **Alternative Airports in the Region**. Within the mid and northern Willamette Valley, there are four airports designed to serve the large ARC D-II aircraft, including Portland International Airport, the Hillsboro Airport, the McMinnville Airport, and McNary Field in Salem. These four provide strategically located service for the referenced large aircraft.

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[1] Airport Reference Codes are a method to classify the size and speed of aircraft using an airport. The alphabetic character denotes approach speed, "A" being the slowest and "F" being the fastest. The Roman numeral designates the wing span with "I" being the smallest and "IV" being the largest.

- **Airport Design**. Moving from ARC B-II to ARC D-II has a major impact on airport design. One example is runway/taxiway setbacks. ARC B-II requires a 300-foot runway/taxiway separation for an airport planned to have a precision instrument approach. ARC D-II requires a 400-foot separation. Accommodating a 400-foot separation would require extensive property acquisition and would likely include removal of some existing buildings. This would further increase the cost.

- **Pavement Strength Requirements**. Aircraft in the D-II category, such as the Gulfstream II, can weigh in excess of 62,000 pounds up to as much as 90,900 pounds. This would require strengthening the runway. The present runway is built for aircraft weighing in the range of 30,000 to 45,000 pounds.

- **Environmental Impacts**. Larger aircraft, despite the newer technology engines typically found on the newer models, create more noise on landing and takeoff than do the smaller aircraft.

- **Runway Length**. It is very possible that if the airport were designed for larger aircraft, there would be demand for a runway extension beyond the present 5,000 feet. This would also add to the cost to serve this small segment of the general aviation market.

- **Community Input**. In meetings with citizens of the City of Aurora, there were strong objections to taking any action that would increase aircraft noise at the airport. The concept of designing the airport for larger aircraft was particularly troublesome for most of the community members who spoke or provided input in public meetings and the Aurora Airport Master Plan Advisory Committee (AAMPAC) meeting where the topic was discussed.

Based upon community input and in consideration of the high cost to build to ARC D-II standards, the Aeronautics Section made the decision to designate the airport for ARC B-II rather than attempt to upgrade the airport to accommodate ARC D-II.

Designation of the critical aircraft as the ARC B-II category will impose a very small constraint on the airport. As noted above, aircraft in the ARC D-II group make up only a very small portion of the business aircraft fleet. Within the 20-year time horizon covered by this master plan, this constraint might represent 1-2 additional aircraft based at Aurora generating 150 - 200 annual operations per aircraft. As a result, the 20-year forecast of aircraft has been reduced by 2 based aircraft and 400 annual operations.

WEIGHT LIMITATION. AS OF MARCH 1998, THE AIRPORT WEIGHT LIMIT IS 30,000 POUNDS FOR AIRCRAFT WITH A SINGLE WHEEL ON EACH LANDING GEAR AND 45,000 POUNDS FOR AIRCRAFT WITH DUAL WHEELS ON EACH LANDING GEAR. SERVING AIRCRAFT IN THE ARC B-II CATEGORY WOULD REQUIRE NO CHANGE IN THE RUNWAY AND TAXIWAY STRENGTH, AS THE AIRCRAFT FALLING INTO THAT GROUP GENERALLY WEIGH 45,000 POUNDS OR LESS. AT MOST AIRPORTS, THERE ARE OCCASIONAL OPERATIONS BY AIRCRAFT WEIGHING MORE THAN THE PUBLISHED WEIGHT LIMIT. THIS

GENERALLY DOES NOT CAUSE A PROBLEM AS LONG AS THE OPERATIONS DO NOT BECOME TOO FREQUENT.

RECOMMENDED FORECAST OF BASED AIRCRAFT & AIRCRAFT OPERATIONS

As noted above, the designation of the critical aircraft at ARC B-II will constrain based aircraft and operations growth by an estimated 2 based aircraft in the year 2017 and 400 annual operations. The 2017 forecast of based aircraft and operations has been reduced by those numbers.

Table 3-6
CONSTRAINED FORECAST BASED AIRCRAFT AND OPERATIONS

1998	2002	2007	2012	2017	
Based Aircraft	**259**	**272**	**288**	**304**	**318**
Annual Operations	**87,714**	**92,270**	**97,714**	**103,159**	**108,204**
Critical Aircraft	ARC B-II	Same	Same	Same	Same
	Beech King Air - Cessna Citation II or Similar Aircraft				
Source:	W&H Pacific				

PEAK DEMAND CHARACTERISTICS. FROM THE PREFERRED FORECAST OF OPERATIONS, PEAK DEMAND FIGURES CAN BE CALCULATED FROM AVERAGES DEVELOPED THROUGH OBSERVATIONS MADE AT NUMEROUS OTHER AIRPORTS NATIONWIDE AND ACCEPTED BY THE FAA. PEAK DEMAND FORECASTS ARE DEVELOPED TO EVALUATE PEAK HOUR OPERATIONAL CAPACITY, MUCH LIKE THE PEAK HOUR CAPACITY FOR SURFACE ROADWAYS. **TABLE 3-7** LISTS THE FORECASTED PEAK DEMAND CHARACTERISTICS FOR THE AURORA STATE AIRPORT.

Table 3-7
CONSTRAINED FORECAST OF PEAK DEMAND

Operations	**1998**	**2002**	**2007**	**2012**	**2017**
Annual Operations	87,714	92,270	97,714	103,159	108,204
Peak Month	**8,771**	**9,227**	**9,771**	**10,316**	**10,820**
10% of Annual. Ops.					
Average Day	283	298	315	333	349
Peak Mo./31 days					
Peak Hour	**31**	**33**	**35**	**36**	**38**
11% of Ave. Day					
Source:	W&H Pacific				

TYPE OF OPERATIONS. GENERAL AVIATION ITINERANT FLIGHTS (THOSE FLIGHTS WHICH BEGIN OR END AT AN AIRPORT OTHER THAN THE AURORA STATE AIRPORT) CURRENTLY MAKE UP APPROXIMATELY 40 PERCENT OF THE ANNUAL OPERATIONS. AIR TAXI OPERATIONS COMPRISE ABOUT 10 PERCENT OF THE ANNUAL OPERATIONS AND THE REMAINING 50 PERCENT ARE MADE UP OF LOCAL FLIGHTS, OR FLIGHTS BEGINNING AND ENDING AT THE AURORA STATE AIRPORT WITH NO LANDING IN BETWEEN. THIS DISTRIBUTION OF TYPE OF OPERATION IS LISTED IN **TABLE 3-8** AND IS NOT ANTICIPATED TO CHANGE DURING THE PLANNING PERIOD.

Table 3-8
CONSTRAINED FORECAST OF OPERATIONS BY TYPE

1998	**2002**	**2007**	**2012**	**2017**	
Air Taxi (10%)	8,791	9,227	9,771	10,316	10,820
GA Itinerant (40%)	35,166	36,908	39,086	41,264	43,281
GA Local (50%)	43,957	46,135	48,857	51,579	54,102
Total	**87,914**	**92,270**	**97,714**	**103,159**	**108,204**
Source:	W&H Pacific				

CONCLUSION. BASED ON THE INFORMATION PRESENTED WITHIN THIS CHAPTER, THE BASED AIRCRAFT AND OPERATIONS FORECAST ARE SUMMARIZED IN **TABLE 3-9**.

Table 3-9
SUMMARY OF CONSTRAINED FORECAST

1998	**2002**	**2007**	**2012**	**2017**	
Based Aircraft	259	272	288	304	318
Annual Operations	**87,914**	**92,270**	**97,714**	**103,159**	**108,204**
Critical Aircraft	ARC B-II	Same	Same	Same	Same
	Beech King Air - Cessna Citation II or Similar Aircraft				
Source:	W&H Pacific				

Chapter 4

Facility Requirements

INTRODUCTION

The objective of the facility requirements chapter is to analyze the ability of the airside and landside facilities to accommodate future activity levels. Existing facilities are compared with demand projections to determine what type and when additional facilities will be required.

RUNWAY DEMAND/CAPACITY

Hourly airport capacity is used to describe the throughput capacity of the runway and taxiway system. This is a measure of the maximum number of aircraft operations that can be accommodated at the airport in an hour. The annual service volume (ASV) is a reasonable estimate of an airport's annual capacity. The ASV accounts for differences in runway use, aircraft mix, weather conditions, etc., that would be encountered over a year's time.

The capacity of the Aurora State Airport is 98 VFR operations per hour and 59 IFR operations per hour based upon the method defined in FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay* and the associated *Airport Design* computer model, Version 4.2b. This equates to an annual service volume of 230,000 operations. Standard FAA planning practices indicate that improvements should be considered when 60 percent of the ASV is reached. For Aurora State Airport, this threshold is 138,000 annual operations. The number of operations for the year 2017 is forecast to be 108,204 (see **Table 4-1**). This is significantly less than the ASV or the 60 percent threshold for considering capacity related improvements. As a result, this plan recommends that no action be taken with regard to runway capacity enhancement.

Table 4-1

DEMAND/CAPACITY AIRCRAFT MIX

Classification	Year 2017 Operations	Year 2017 Aircraft Mix
A – Single Engine, 12,500 lbs. or less	73,367	68%
B – Multi Engine, 12,500 lbs. or less	30,469	28%
C – Multi Engine, 12,500 lbs. to 30,000 lbs.	4,368	4%
D – Multi Engine, over 30,000 lbs.	0	0%
Totals	**108,204**	**100%**

AIRPORT DESIGN STANDARDS

The design of facilities at the Aurora State Airport is based upon three factors:

- The Airport Reference Code (ARC) for the critical aircraft types using the airport.
- The weight class of the critical aircraft – large or small. A critical aircraft weighing more than 12,500 pounds is defined as a “large” aircraft.
- Instrument Approach Minimums. Instrument approaches are classified by the landing minimums. One factor used in defining landing minimums is visibility - how far a pilot can see ahead out the front windshield of the aircraft. The lower the visibility minimum, the lower the landing minimum.

A discussion of each of these factors is provided below.

AIRPORT REFERENCE CODE

Within the Forecast Chapter 2, there was a discussion of the critical aircraft. The conclusion of that Chapter was that the critical aircraft be designated in the ARC B-II category. Aircraft in this class have approach (landing) speeds of more than 91 knots but less than 121 knots and wingspans of more than 49 feet but less than 79 feet.

Airport design features such as runway width and length, and separation between the runway and taxiway are some examples of airport design criteria impacted by the ARC designation of the critical aircraft. In general terms, larger and faster landing aircraft require more space. To use an automotive analogy – the design of a local street for small cars is different than the design of an interstate freeway with large semi-tractor trucks. The same concept holds true for airports. An airport serving only small single engine airplanes is very different from one designed to accommodate Boeing 747s flying international routes.

WEIGHT CLASS

The FAA defines any aircraft weighing over 12,500 pounds as a “large” aircraft. The type of aircraft that will be typical of the critical aircraft using the Aurora State Airport will weigh more than 12,500 pounds. As a result, the airport runway will be designated to accommodate “large” aircraft. This does not, however, mean that the runway will have no weight restrictions. As was noted in the Forecast Chapter, the weight limitation of 45,000 pounds will be retained.

INSTRUMENT APPROACH VISIBILITY MINIMUMS

The last of the three factors impacting airport design is the instrument approach visibility minimum. Visibility minimums for an approach are the measure of how far a pilot must be able to see out the front windshield to land. The current instrument approaches into the Aurora State Airport have visibility minimums of one mile. In general terms, lower minimums are desirable because they allow pilots to operate safely in a wider variety of weather conditions. For a precision instrument approach[4], visibility minimums are typically one-half mile. For a non-precision instrument approach, the visibility minimums are higher – typically from three-quarter to a mile or more.

Airport design standards change as visibility minimums are lowered. **Table 4-2** illustrates the differences between visibility minimums.

Table 4-2

Airport Design Standards for Various Visibility Standards

	Existing Condition	**1 Mile**	**Not Lower Than ¾ Mile**	**½ Mile**
Runway Width	100'	75'	75'	100'
Runway/Taxiway Separation	200'–300'	240'	240'	300'
Rwy Centerline to Edge of Arcft Parking	350'	250'	250'	400'
Runway Safety Area Width	500'	150'	150'	300'
Runway Safety Area Off Runway End	*1000' – 2000'**	*300'*	*300'*	*600'*
Runway Object Free Area	500'	500'	500'	800'
Obstacle Clearance Approach Slope	20:1	20:1	20:1	34:1
Federal Aviation Regulations (FAR)				
Part 77 Approach Slope	34:1	34:1	34:1	50:1
Part 77 Primary Surface Width	500'	500'	1000'	1000'

* *The Runway Safety Area extends 1000' off the south end and 2000' off the north end of the runway.*

Source: Airport Design Computer Model 4.2b. & Federal Aviation Regulations (FAR) Part 77

With the exception of the FAR Part 77 primary surface, the airport currently meets the standards for one mile and three-quarter mile. In order to reduce the minimums to three-quarter mile from the present one-mile, it would be necessary to analyze obstructions for the FAR Part 77 Primary Surface. With removal of certain obstructions and lighting and marking others, three-quarter mile

[4] A precision instrument approach provides both vertical and horizontal guidance to the pilot. A non-precision approach provides only horizontal guidance.

visibility

minimums may be possible. An FAA aeronautical obstruction analysis would be necessary to determine if it is feasible. Such a study is conducted separate from a master plan update.

In order to achieve visibility minimums as low as one-half mile, it would be necessary to make significant changes to meet the standards outlined above. The following four standards are particularly problematic:

- **Runway/Taxiway Separation**. The existing separation is 200 feet, except on the south end where there is a 1,000-foot section that is 300 feet. The standard for a one-half mile visibility minimum is 300 feet. To meet a 300-foot separation for the full length would require property acquisition, relocation of aircraft parking and, possibly, aircraft hangars.

- **Runway Centerline to Edge of Aircraft Parking**. The existing distance is 350 feet; the standard for one-half mile calls for 400 feet. Implementing this standard would require relocation of part of the existing midfield aircraft-parking ramp.

- **Runway Object Free Area (ROFA)**. The ROFA is an area centered on the runway, which should be cleared of all objects except those needed for air navigation or ground maneuvering (but not parking) of aircraft. The standard is 800 feet wide for one-half mile visibility approach minimums. Within an 800-foot ROFA, on the east side of the runway there are extensive aircraft parking ramps and a hangar. On the west side, a fence, trees and a state highway obstruct the ROFA. To meet this standard, it would be necessary to move the aircraft parking, the hangar, fence, trees, and state highway.

- **FAR Part 77 Primary Surface Width**. For one-half mile visibility minimums, the primary surface is 1,000 feet wide – centered on the runway. Within the primary surface, objects penetrating an imaginary plane 500 feet wide either side, and at the same elevation as the runway, may be considered obstructions. This width takes in hangar buildings on the east, and a fence, trees, and a state highway on the west. To meet this standard, it would be necessary for the FAA to analyze the objects within the primary surface, and for them to determine which could remain with marking and lighting, and which should be removed.

The estimated cost to move the highway, taxiway, aircraft parking, and hangars is in excess of six million dollars.

In discussions with Oregon Aeronautics Staff and the airport users, it was the consensus that the benefit to improve the airport to allow a one-half mile vs. the current one-mile visibility minimum was not justified, given the high cost.

For purposes of this master plan, the current one-mile visibility minimum will be used for planning. Implementation of visibility minimums of three-quarter mile may be feasible at some point in the future. The significant airfield geometric standards (runway width, runway/taxiway separation, and runway safety area standards) are identical for one-mile vs three-quarter mile.

Utilizing the standards associated with one-mile visibility will not preclude changing to visibility minimums of three-quarter mile in the future.

FUTURE GPS PRECISION APPROACH

Historically, one-half mile visibility minimums have been associated with precision instrument approaches. With the advent of GPS satellite-based navigation and approach systems, FAA plans call for precision approach capability to be added to existing non-precision GPS approaches within the next five to ten years. Although plans are not final, it is likely that the higher minimums and the design standards associated with those non-precision approaches will be allowed to remain. Vertical descent guidance will be added creating a precision instrument approach, albeit with higher minimums than are currently typical for precision approaches.

A precision approach provides a benefit over non-precision in that it provides descent guidance in addition to horizontal guidance provided with a non-precision approach. Descent guidance allows the pilot to fly a more stabilized descent profile at lower power settings to landing, thus reducing noise impacts. This is particularly true of small single engine and twin engine piston aircraft. The advantage at Aurora would be that these aircraft remain higher and quieter over the noise sensitive land uses around the airport.

CONVENTIONAL PRECISION INSTRUMENT APPROACH

Ground-based (as opposed to GPS satellite based) precision instrument approaches are provided with two radios transmitters located at the airport that send out the radio signals making up the precision flight path followed by aircraft. A "glideslope" system provides descent guidance, and the "localizer" provides horizontal guidance to aircraft approaching to land. Aurora Airport has half of that two-part system – the localizer.

Installation of a glideslope at Aurora to make a complete ground based precision instrument landing system is unlikely for two reasons:

- **Availability**. The FAA is no longer purchasing and installing new ground-based precision landing systems. Their plan is to develop precision GPS satellite based systems.
- **Land Constraints at Aurora**. Glideslope systems have a large "critical area" that must be precisely graded and free of metal objects such as airplanes, fences, and automobiles. Metal objects or uneven ground will degrade the glideslope signal and may make it unreliable or unusable. The Aurora Airport is constrained on the west side of the runway where the glideslope antenna system would be placed. The 400-foot separation between the Wilsonville-Hubbard Highway and the runway does not provide enough space to install a glideslope.

For these two reasons, future precision instrument approach capability, if it proves feasible, will likely come from a satellite based GPS system rather than a ground based system.

RUNWAY DESIGN CRITERIA

The runway design criteria for the Aurora State Airport are:

- ARC B-II
- Large Aircraft
- One Mile Visibility Minimums for Non-Precision Instrument Approaches

Based upon these design criteria listed above, Table 4-3 summarizes the FAA design standards to be used for planning the airport.

Table 4-3
DESIGN STANDARDS - ARC B-II

Large Aircraft - One Mile Visibility Minimums

	Existing	ARC B-II
Runway Width	100'	75'
Runway/Taxiway Separation	200-300'	240'
Runway Centerline to Edge of Aircraft Parking	350'	250'
Runway Safety Area (RSA) Width	500'	150'
Runway Safety Area (RSA) Beyond R/W End	1,000 – 2,000'*	300'
Runway Object Free Area (ROFA) Width	500'	500'
Runway Object Free Area (ROFA) Length Beyond R/W End	1,000' – 2,000'	300'
Taxiway Width	40'	35'
Runway Protection Zone (Both Ends)	500'x 700'x 1,000'	500'x700'x 1,000'

Source: FAA Airport Design Computer Model – Version 4.2b. Copies of the FAA Airport Design Computer Model printout for this airport are provided in the Appendix.

Runway Length. A review was made of the business class aircraft falling into the ARC B-II class. The runway length requirements for those aircraft and smaller business aircraft falling into the ARC B-II class are shown in **Table 4-4**. The data in the table are averages that assume the following conditions: sea level elevation; 59 degrees F. ambient air temperature; and maximum gross weight for the specified operation (landing or take off). The actual length for each take-off or landing varies, based upon such factors as the following: weight of the aircraft; runway condition (wet/dry/icy); individual pilot technique; condition of the aircraft; and ambient air temperature. Aircraft may require more or less runway than that shown in **Table 4-4**, depending upon the factors listed above.

The Aurora State Airport is located at an elevation of 196 feet and in a temperate climate (as opposed to a hot climate such as you might find in parts of Arizona). As a result, the runway length requirement for the aircraft listed provides a reasonable representation of the runway length that is needed. Based upon the data in the table, the existing 5,000-foot runway length is adequate for most of the aircraft in the ARC B-II class and no runway extension is needed. Depending upon the specific conditions, some operations may be constrained by the 5,000-foot runway length. This may require that aircraft take off or land with a lighter load than might otherwise be desirable. However, these constrained operations should be the exception rather than the rule.

Table 4-4
ARC B-II, RUNWAY LENGTH REQUIREMENTS

Aircraft	Take-off Length (Feet)	Landing Length (Feet)	Max. Gross Weight (Pounds)
Astra SPX	5,400	2,720	24,650
Beechjet 400A	3,802	2,960	16,300
Cessna Citation Excel	3,460	3,310	19,400
Cessna Citation Jet	3,080	2,750	10,500
Cessna Citation 7	4,690	2,910	22,650
Challenger 600W	5,700	3,050	41,400
Lear 31A	3,490	2,767	17,000
Lear 35A	4,972	3,075	18,500
Saberliner 600	5,100	2,425	20,372

Source: Aviation & Space Technology Aerospace Source Book January 12,1998
Assumptions: Sea level elevation; 59 degrees F. air temperature; and maximum gross weight for the specified operation.

Runway Width. The existing runway width of 100 feet exceeds the 75-foot standard for an ARC B-II runway. At such time as the runway needs a full overlay or reconstruction, or when the runway lights need an upgrade, the runway width should be reviewed and a decision made on the appropriate width. It may be more cost effective to overlay the full width and allow the lights to remain vs. narrowing the runway and having to move the lights. There may be an advantage, if and when the runway is narrowed, to narrow it from east to west, removing the excess width on the east side. Doing this will have the effect of moving the runway and taxiway centerlines an additional 12½ feet further apart. See the discussion of runway/taxiway separation below.

Runway Load Bearing Capacity. **Table 4-4** also illustrates the maximum gross weight of the aircraft falling into the ARC B-II category. Most of these aircraft have dual wheels, meaning that on the main landing gear, there are two wheels to carry the weight of the aircraft. This distributes the weight over a larger area and causes less impact on airport pavements. The current runway weight limits for the Aurora State Airport are 30,000 pounds for single wheel aircraft and 45,000 pounds for dual wheel aircraft. Based upon the critical aircraft, this will not change.

Runway Landing Threshold Siting. Runway landing threshold siting requirements are dictated by analysis of two factors:

- Obstacle Clearance Approach[5] (OCA) Landing Threshold Siting Standards found in FAA Advisory Circular 150/5300-13, Airport Design, Appendix 2, and within the Airport Design Computer Model, and;

- Runway Safety Area (RSA) Standards.

Obstacle Clearance Approach. The OCA is an imaginary surface used for siting the landing threshold. No objects can penetrate the OCA. A runway serving large aircraft is classified as a Type "C" runway. The dimensions of a Type "C" runway OCA are as follows:

- 400 feet wide at the landing threshold.

- Expanding to a width of 1,000 feet at a point 1,500 feet from the threshold.

- Extending an additional 8,500 feet at a width of 1,500 feet.

- The OCA has a slope of 20:1 (for each twenty you move horizontally from the runway, the OCA imaginary surface rises one foot vertically).

The OCA for Runway 17 is penetrated by a tree (approximately one to two feet), but otherwise meets the FAA's OCA requirements. The OCA for Runway 35 is clear of obstructions

Runway Safety Area. As previously noted, the RSA standards for an ARC B-II aircraft call for the extension of a 150-foot-wide RSA 300 feet off the ends of the runway. The airport exceeds these standards by a wide margin. Runway Safety Area issues are discussed in more detail in a following section of this chapter.

Runway/Taxiway Separation. Taxiway A does not meet the current ARC B-II separation standard of 240 feet for its full length of 5,000 feet. For approximately 4,100 feet, Taxiway A's centerline is located 200 feet from the runway centerline, which is less than the FAA standard. The centerline for the remaining 900 feet of Taxiway A on the south end is located 300 feet from the runway centerline, exceeding the FAA standard. Three major alternatives (**Figure 4-1**) were considered regarding the taxiway separation from the runway.

Alternative 1 - Do Nothing. In this alternative, the taxiway would remain at its present location. Any major maintenance or lighting would be built on the existing alignment. No land

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[5] The OCA is one of two criteria used to site the landing threshold. It is an imaginary surface created by a trapezoid of the dimensions outlined above.

acquisition would be required for this alternative since the taxiway would remain on its current alignment. The present modification to standards acknowledging the 200-foot separation vs the 240-foot standard would continue. At such time as the runway is narrowed to 75 feet from the present 100-foot width, it may be possible to increase the separation by 12½ feet by narrowing the runway from east to west. This could also be done with any of the alternatives listed below.

Alternative 2 – Relocate to 240-Foot Separation. With this alternative, the taxiway would be relocated to 240 feet from the runway centerline. This will allow the airport to meet the ARC B-II design standard. Preliminary planning level analysis shows that this can be done on existing airport owned property. Drainage improvements will be needed with this alternative. The drainage ditch located on the east side of the taxiway would need to be enclosed in pipe or moved to the west side of the taxiway.

Alternative 3 – Relocate to 300-Foot Separation. With this alternative, the taxiway would be relocated to 300 feet from the runway centerline to match the setback of the southern most section. Implementation of this alternative will require property acquisition from adjacent landowners as well as drainage improvements similar to Alternative 2. The benefit of this alternative is that it may allow the airport to meet the standards for lower visibility instrument approach minimums. The current minimums are one-mile visibility. With a 300-foot separation, it may be possible to have instrument approach visibility minimums as low as three-quarter mile. This would improve the all weather access to the airport.

Evaluation of Alternatives. Alternatives 1, 2 and 3 as described above, were presented to the AAMPAC for evaluation and discussion. The AAMPAC also discussed some derivatives to the major alternatives for consideration by the State and the consultant. One was to build a new parallel taxiway west of the existing runway at either a 240-foot or 300-foot separation distance. This was not deemed a viable alternative due to the lack of property available, the existing Wilsonville-Hubbard Highway, and the high cost of constructing the alternative compared to other alternatives. Other derivatives involved runway width reduction from 100 feet to 75 feet vs. using the existing full width of 100 feet for Alternatives 2 and 3.

After thorough discussion, the AAMPAC conducted a straw poll to assess committee views on the various alternatives. The results were as follows:

- (4 votes) Alternative 1: Do nothing

- (10 votes) Alternative 2a: 240-foot separation, keeping existing 100-foot runway width at its existing centerline with a 40-foot taxiway centerline shift to the east.

- (0 votes) Alternative 2b: 240-foot separation, using a reduced 75-foot runway width and a 12.5-foot shift of the runway centerline to the west to minimize impacts to flightline properties to the east of the parallel taxiway with a 27.5-foot taxiway centerline shift to the east.

- (7 votes) Alternative 3a: 300-foot separation, keeping existing 100-foot runway width at its existing centerline with a 40-foot taxiway centerline shift to the east.

- (0 votes) Alternative 3b: 300-foot separation, using a reduced 75-foot runway width and a 12.5-foot shift of the runway centerline to the west to minimize impacts to flightline properties to the east of the parallel taxiway with a 27.5-foot taxiway centerline shift to the east.

Recommended Alternative – Alternative 3 (Relocate to 300-Foot Separation). The clear AAMPAC preference was to use the existing runway width and centerline location. The AAMPAC majority also preferred the 240-foot separation vs. the 300-foot separation, mainly to minimize impacts to the area east of the parallel taxiway. On balance, however, Alternative 3 provides the most long term benefit to the airport by preserving the option for lower minimums as instrument approach systems improve with technological advances, particularly in GPS systems. Also, the FAA may reevaluate its design criteria for different categories of approaches. Keeping a 300-foot separation will allow the maximum benefit without significantly greater expense than a 240-foot separation would. A 300-foot separation will also match the recent runway and taxiway extension project's separation distances.

For the reasons stated on the report, we concur with the recommendation to relocate the remaining parallel taxiway not already at a 300-ft separation from the runway centerline at such time as that older portion of the taxiway would require rehabilitation.

Future airport planning should reevaluate the issue of runway centerline-to-taxiway-centerline separation distance based on FAA standards in effect at that time.

INSERT FIGURE 4-1, RUNWAY/TAXIWAY SEPARATION ALTERNATIVES

Runway to Aircraft Parking. All aircraft parking adjacent to Runway 17/35 meets the 250-foot setback standard for an ARC B-II runway.

Runway Safety Area (RSA) Width. The RSA is an area surrounding the runway, capable of supporting the weight of an aircraft accidentally leaving the runway. The FAA standards call for the RSA to be:

- Cleared and graded and have no potentially hazardous ruts, humps, depressions, or other surface variations;

- Drained by grading or storm sewers to prevent water accumulation;

- Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft;

- Free of objects, except objects that need to be located in the RSA because of their function, such as signs or navigation lights (objects higher than 3 inches should be constructed on frangible (breakable) supports).

- The soil should be firmly compacted.

For Runway 17/35, the required RSA width is 150 feet wide. The airport presently exceeds the standard.

Runway Safety Area Beyond the Runway End. The required RSA length beyond the end of the runway for an ARC B-II standard runway is 300 feet. The runway presently exceeds the standard.

Runway Object Fee Area (ROFA) Width. The ROFA is centered on the runway centerline and requires the removal of all objects above ground level, except those objects that are required within the ROFA for air navigation or aircraft ground maneuvering, such as taxiways, airport signs, or navaids. Aircraft parking and agricultural operations are specifically excluded from the ROFA. The airport currently exceeds the ARC B-II standards for a runway object free area width of 500 feet.

Runway Object Free Area Beyond the Runway End. The standard for the ROFA extension beyond the runway ends for an ARC B-II runway is 300 feet. The runway presently exceeds the standard.

Taxiway "A" Width. Taxiway "A" that parallels Runway 17/34, is 40 feet wide. This exceeds the ARC B-II standard of 35 feet. At such time as it becomes necessary to reconstruct the taxiway, consideration should be given to narrowing it to the 35-foot standard. If the reconstruction is done on the present alignment, consideration should also be given to taking the

5 feet from the west side of the taxiway. This will have the effect of moving the runway/taxiway centerline an additional 2½ feet further apart toward meeting the runway/taxiway separation standard. If the taxiway is relocated to meet the runway/taxiway separation standard, it should be constructed 35 feet wide to meet the ARC B-II standard.

Taxiway "A" Safety Area Width. The taxiway has a safety area just as the runway does. The standard for ARC B-II is 79 feet. The taxiway meets this standard.

Taxiway "A" Object Free Area Width. The taxiway has an object free area just as the runway does. The standard for ARC B-II is 115 feet. The existing taxiway meets this standard. If the taxiway is relocated to meet the 240 foot runway/taxiway separation standard, it may be necessary to acquire a strip approximately 25 feet wide to provide a clear taxiway object free area.

Runway Protection Zone. The runway protection zone (RPZ) is a trapezoidal area off the end of the runway. It should be owned by the airport and kept free of people and objects. The purpose of the RPZ is to enhance the safety of people and property on the ground in the area off the ends of the runway where aircraft mishaps are most likely to occur.

The dimensions of the RPZs for the Aurora State Airport are:

- 500 feet wide - 200 feet from the runway end.
- 700 feet wide - 1,200 feet from the runway end.
- 1,000 feet long.

The RPZs are illustrated in **Figure 4-2**. Only a small portion of the RPZ on the north end falls off airport on Columbia Helicopter property. Consideration should be given to limiting any future development that would result in concentrations of people or construction of structures within the RPZ.

On the south end of the airport, a small portion of the RPZ falls off airport on land that is under cultivation and is zoned exclusive farm use (EFU). Exclusive farm use is compatible with the RPZ so long as the crops grown there do not attract birds.

Keil Road passes through the RPZ. In the future, if the opportunity presents itself to relocate the road it would be desirable to move the road out of the RPZ. Moving roads out of RPZs is not routinely done, except as part of another project. In the case of the Aurora Airport, moving Keil Road out of the RPZ would not be a high priority.

INSERT FIGURE 4-2, RPZ

Landside Facility Requirements

The landside facilities generally include Fixed Base Operator (FBO)[6] operations, aircraft tiedowns, T-hangars, and corporate flight departments. Each of those activities has different needs that affect where they can be located at an airport. The text below outlines the various needs of each type of airfield user.

FBO

An FBO needs easily identified and available public access, visibility from public roads, and good airfield access, and should be easily locatable by itinerant traffic landing at the airport.

Tiedowns

Aircraft tiedown locations do not require ready public access because the users will be aircraft owners or renters who are familiar with aircraft operations and can, on a limited basis, drive their cars on aircraft ramps to access aircraft parked on the tiedowns. It is desirable to separate aircraft operations and auto access and parking, although sometimes this is not practical.

T-Hangar Aircraft Storage

As with aircraft tiedowns, hangars do not need to be readily accessible to the public because most users will be pilot/aircraft owners who are familiar with airport operations and can drive on airport aprons with aircraft, if needed. Often, pilots park their cars inside the hangar if they are to be gone for any length of time. As a result, auto parking requirements for this type of use are not great.

Corporate Flight Departments

A corporate flight department needs only minimal public access for company aircraft users. Most users who fly on the company aircraft will know their way to and around the airport. If possible, access should not require driving on aircraft ramps. Access to the airfield can be less direct than for an FBO because pilots operating the aircraft will be professionals familiar with the airport.

[6] An FBO is an airport business. Typical activities include aircraft rentals, flight instruction, aircraft charter, airframe and power plant repair, painting, and radio repair.

EXISTING AIRPORT LAND INVENTORY

A review was made of the amount of available airport lands and for what uses the lands are suited. In this analysis, all airport land was reviewed, regardless of ownership. **Figure 4-3** shows the location of vacant land which is currently zoned "P". The "P" zone is the Marion County zone that includes airports such as the Aurora State Airport.

Area 1: Approximately 23 Acres – H. D. Aviation Parcel. This parcel represents a major land resource for the future development of the airport. It has good road access from Keil Road and excellent access to the airport with nearly 700 feet of frontage along the parallel taxiway. The parcel could be developed for FBO, T-hangar, or corporate hangar development.

Area 2: Approximately 10 Acres – Oregon Aeronautics. Oregon Aeronautics owns over 32 acres in the mid-field area. Parts of this land have been leased for T-hangars, corporate hangars, and a full service FBO. This same type of development could be continued on the 10 acres of vacant land. Much of this land is currently under lease to existing tenants who will develop it as market conditions dictate to meet aviation demand.

Area 3. Approximately 1.4 Acres – Janzen/Wessman Parcel. This parcel has access to the airport and has been subject to steady development in corporate style hangars in the past 10 years. There are now over 21 such hangars, and there is land for approximately three more.

Area 4. Approximately 4 Acres – Treit Parcel. This parcel has access to the airport and is developed in a mixture of aircraft T-hangars and fixed base operators (FBOs) performing a variety of aircraft services. This development could continue on the vacant areas of this parcel.

FBO OPERATIONS

Currently, there are several FBOs at the Aurora State Airport. Some are specialty businesses providing only one product, such as aircraft instrument sales and repair. In the past, there have been two or more full service FBOs which provided fuel, flight training, aircraft rental, and other aviation related services such as charter. Typically, one full service FBO is adequate for up to 100 based aircraft. Using this standard, Aurora State is well served with the current mix of limited service and full service FBOs. This plan recommends providing space for increased FBO activity by the end of the planning period. FBO area requirements range from one-half acre to 4 acres, depending on the extent of the services provided. To provide sufficient land for new FBOs, 8 to 10 acres will be needed.

INSERT FIGURE 4-3, VACANT LAND

Aircraft Parking Facilities

INTRODUCTION. AS STATED IN THE INVENTORY CHAPTER, IN MARCH OF 1998, A TOTAL OF 180 TIEDOWNS AND 157 AIRCRAFT HANGARS ACCOMMODATE 256 AIRCRAFT. OF THE 256 BASED AIRCRAFT, 204 ARE STORED IN HANGARS AND 52 ARE STORED OUTSIDE ON TIEDOWNS. THE EXISTING RATIO OF HANGARED TO TIEDOWN AIRCRAFT IS 76 PERCENT IN HANGARS AND 24 PERCENT ON TIEDOWNS. BECAUSE OF THE ANTICIPATED SHIFT TO HIGHER VALUE BUSINESS AIRCRAFT AND THE INCREASING VALUE OF MANY PRIVATELY OWNED AIRCRAFT, THE TREND IN AIRCRAFT STORAGE IS FOR INCREASING PERCENTAGES OF AIRCRAFT TO BE STORED IN HANGARS. FOR PLANNING PURPOSES, A RATIO OF 80 PERCENT AIRCRAFT HANGARED TO 20 PERCENT TIED DOWN HAS BEEN USED. CURRENT AND PROJECTED AIRCRAFT STORAGE NEEDS ARE SHOWN IN **TABLE 4-5.**

Table 4-5
AIRCRAFT PARKING REQUIREMENTS

	1998	2002	2007	2012	2017
Total Based Aircraft	256	272	288	304	318
Aircraft in Hangars*	204	218	230	243	254
Area Requirements fo Hangers (s.y.)	168,300	180,000	190,000	200,500	210,000
Aircraft on Tiedowns	52	54	58	61	64
Area Requirments for Tiedowns (s.y.)	19,000	19,500	21,000	22,000	23,000

- Hangar spaces indicate aircraft in hangars, not number of hangars. The number of hangars is reduced by the hangar occupancy ratio, i.e., more than one aircraft per hangar.

Source: W&H Pacific

HANGARS. GIVEN THE FORECAST GROWTH OF 62 MORE BASED AIRCRAFT DURING THE PLANNING PERIOD, THERE WILL BE A DEMAND FOR 50 AIRCRAFT STORAGE SPACES IN HANGARS AND 12 MORE STORAGE SPACES ON TIEDOWNS. SOME OF THE HANGARS WILL BE T-HANGARS WHILE SOME WILL LIKELY BE CORPORATE-TYPE HANGARS. **FIGURE 4-4** ILLUSTRATES THE DIFFERENCE BETWEEN A T-HANGAR AND A CORPORATE STYLE HANGAR.

For planning purposes, it is estimated that half of the hangars will be the corporate style, with the balance being T-hangar style buildings. As illustrated in **Figure 4-4**, the corporate type hangars can accommodate more than one aircraft per hangar. The number of aircraft per hangar varies with the size of the hangar and the size of the aircraft. For planning purposes, a ratio of 1¾ aircraft per corporate hangar has been used in this demand analysis.

The Aurora State Airport currently has examples of both types of hangar development. The average density of the T-hangar development is around 11 units per acre. Applying this ratio to the demand for 25 additional T-hangars results in a need for 2.3 acres of land.

Insert Figure 4-4, Hangar Configurations

The average density of corporate type hangar development at the Aurora Airport is around 4 units per acre. With a demand for 25 corporate aircraft hangars and an average density of 1¾ aircraft per hangar, there is a need for 15 hangars. With an average density of 4 hangars per acre, there is a demand for 3.8 acres of land for corporate type hangars.

Should all of the demand for new hangars be accommodated in the corporate type, the demand for 50 aircraft hangar parking positions would result in a need for 29 hangars. Applying the average density for corporate type hangars to the demand for all new hangars results in a demand of 7.3 acres of land.

AIRCRAFT TIEDOWNS BASED AIRCRAFT: THE EXISTING SUPPLY OF 180 AIRCRAFT TIEDOWNS EXCEEDS THE FORECAST DEMAND FOR EXISTING AND FUTURE BASED AIRCRAFT. AS A RESULT, NO NEW BASED TIEDOWN SPACES ARE PLANNED.

Transient Aircraft: One problem that has been identified is the need for additional aircraft parking ramp space for transient aircraft. Transient aircraft are those who are just "visiting" the airport for a short period of time. These aircraft need to be able to find an easy place to park and, in many cases, be fueled. The assumption has been made as part of this master plan that many of the transient aircraft will be served by the FBOs located on private property.

Expansion of the central ramp owned by Oregon Aeronautics is also recommended. This ramp is used by a combination of single engine piston, and multi-engine turboprop and business jet aircraft. The mixing of light general aviation aircraft and larger business class aircraft requires expansion of the ramp to allow greater separation of the two types of aircraft. It is also desirable to make it possible for the business class aircraft to taxi-in and taxi-out of their parking places. In order to maximize the ramp size, this plan recommends expanding the ramp from its present 6,300 square yards to approximately 24,000 square yards. This will provide the space needed for all types of transient aircraft to operate in a safe manner.

Automobile Parking

Auto parking spaces are typically required at a ratio of one space for every two-based aircraft. This allows sufficient parking for visitors, employees, and pilots. Currently, there are over 450 paved parking spaces dispersed throughout the airport. This number combined with parking in T-hangars is adequate for the needs of the airport through out the planning period. As new developments are brought on line, parking requirements imposed by the Marion County zoning code will result in additional parking supply. Unlike commercial airports like Portland International or Eugene, parking demand at general aviation airports is usually minimal and is rarely a problem.

AIRSIDE LAND DEMAND SUMMARY

The following table summarizes future airport land needs by category.

Table 4-6
Future Land Needs

Use	Land Need
FBO	8 - 10 acres
Hangars (both T-hangars and corporate)	6.1 - 7.3 acres
Tiedowns	0 acres
Total Airport Land Area Requirements	14.1 – 17.3 acres

Source: W&H Pacific

TERMINAL AREA PLAN

The goal of the Terminal Area Plan (TAP) is to match demand for airside facilities with existing land resources. The result is a plan that outlines the most logical method to accommodate the future growth of the airport. With a demand for between 14.1 and 17.3 acres and a supply of more than 38 acres on State-owned and private land, it is clear that the airport has a good supply of land for future development. The majority of development on the airport has always been on adjacent private land.

Airport Land Ownership

Consideration was given to acquiring the land that is adjacent to the airport. Some of the land is vacant and for sale. The majority is developed in aviation businesses and aircraft storage hangars.

In reviewing the cost vs the benefit of purchasing all of the land, it was felt that the high costs outweighed the potential benefits. The costs include:

- **10 percent Local Match for Purchase Price**. This would include the 10 percent match against 90 percent FAA funding. No detailed assessment was prepared to evaluate the value of the adjacent land and improvements. However, based on local experience and costs at other similar airports, it would likely range from $10 million to $20 million. The local 10 percent match for that amount would be $1 to $2 million, a significant capital expense.
- **Environmental Liability**. Purchasing existing land and buildings may mean that the state

would assume some environmental liability for existing and future environmental problems from hazardous materials. An environmental due diligence audit is required prior to any land acquisition with Airport Improvement Program (AIP) participation.

- **Building Maintenance**. If the State purchased the buildings, there would be an obligation on the part of the State to bring them up to building code standards. This could prove very expensive and would require a significant pay-back period to recoup those costs.

The benefits of purchasing the adjacent land and buildings would come from having more control over the businesses and activities that go on at the airport. Ownership of the buildings would also create a significant revenue stream, although it is not certain whether or not the revenue would offset the cost to own, manage, and maintain the buildings.

After reviewing the alternative of purchasing the buildings, it was concluded that it was not a feasible alternative for the State. This Plan recommends that the current policy of allowing off-airport land to access the airport through the mechanism of an ingress/egress agreement should continue.

Development of the airport will be market driven. In the last twelve months, there have been 23 aircraft storage hangar projects built or started on private land. The vacant 23-acre parcel on the south end of the airport has been put on the market and is currently for sale. None of this activity was solicited by the State. It has been entirely market driven.

Development on State-owned land will occur through land leases. Private parties lease land from the State for aviation development. This will continue when there is a market for such development.

SURFACE ACCESS

Surface access to all parts of the airport is good. The airport businesses have access from Arndt Road, Airport Road and Keil Road. Access to Interstate 5 is a short drive on the Wilsonville-Hubbard Highway. Interstate 5 can also be accessed via Ehlen Road. Aurora State Airport, like most general aviation airports, does not generate a significant number of auto or truck trips per day. The existing and anticipated level of trips can easily be accommodated by the existing road system.

Marion County's Rural Transportation System Plan (MCRTSP) does not program any significant changes in the vicinity of the airport to meet either existing operational needs or anticipated future growth of the airport.. The MCRTSP classifies the streets that surround the airport as follows: Airport Road is a major collector; Arndt Road without Airport Road is a county arterial; the end of Airport Road is a major collector; Wilsonville-Hubbard Highway (Highway 51) is an arterial; and Keil Road is a local street. Major streets have access management and/or access separation requirements to reduce traffic conflicts.

Two projects are recommended for funding during the five-to-ten year phase of the 20-year MCRTSP planning period. Arndt Road (from Highway 51 to the county line) is programmed for construction of paved shoulders on both sides to improve bicycle/pedestrian safety. Traffic control improvements (either a signal or two-way stop at the intersection or improvements to State Highway 51) are recommended to improve capacity at the intersection of Arndt Road and Airport Road.

UTILITIES

Portland General Electric (PGE) supplies electric power. Power resources are adequate for the current and anticipated future airport development.

CenturyTel provides telephone service. Telephone services are adequate for the current and anticipated future airport development.

Water is provided by individual water wells. The provision of water from individual wells has not been identified as a problem. Requirements for quantities of water for fire protection are provided by individual businesses as mandated by the local fire marshal.

Wastewater treatment for all the users on the airport is through individual septic tank systems.

Chapter 5

Airport Plans

Chapter 5
Airport Plans

Introduction

The airport plans presented in this chapter graphically describe the existing features and the future development of the airport throughout the 20-year planning period. The basis for the proposed development is the inventory, forecasts, demand/capacity analysis and the facility requirement chapters. The following drawings make up the set of airport plans:

- Cover Sheet – Drawing 1/6
- Airport Layout Plan - Drawing 2/6
- FAR Part 77 Airspace Plan - Drawing 3/6
- FAR Part 77 Approach Surfaces Plan and Profile - Drawing 4/6
- Runway Protection Zones Plan and Profile – Drawing 5/6
- Land Use Plan – Drawing 6/6

The drawings presented at the end of this chapter are reductions of the full size 22"x34" drawings. In order to reduce them to fit on 11"x17" sheets, they have been reduced to 50 percent of their original size.

Airport Layout Plan, Drawing 2/6

The Airport Layout Plan (ALP) depicts the existing and proposed airport facilities. Preliminary airport development alternatives were presented and discussed at a series of public Aurora Airport Master Plan Advisory Committee (AAMPAC) meetings. Further discussions with the FAA, State Aeronautics and local government agencies helped refine the ALP into the long-range development plan shown on Drawing 2/6.

Significant features of the ALP include the following:

- Removal of obstructions to airspace.
- Reconstruction and expansion of the Central Ramp.
- Continued development of T-hangars, corporate hangars and FBOs in response to market demand.
- Acquisition of avigation easements.
- Construction of a relocated parallel taxiway at 300 foot separation from the runway.
- Comprehensive rehabilitation of the runway, taxiways and other airport pavements.
- Replacement of aged/outdated navigation and lighting systems.

Modification to Standards

Unique local conditions (such as constrained space, unfavorable terrain, pre-existing structures and other factors) may prevent compliance with airport design standards. Proposed modifications to airport design standards are considered by the FAA on a case-by-case basis. The FAA requires modification to an airport design standard for deviations at any airport that has received FAA funding. Deviations and modifications to standards are discussed in **Chapter 4** and shown on the ALP.

FAR Part 77 Airspace Plan, Drawing 3/6

The FAR Part 77 airspace is established by the definition of a set of imaginary surfaces surrounding the airport. Objects that penetrate those imaginary surfaces represent obstacles to air navigation. The geometry of these surfaces is governed by the regulations that are set forth in the Federal Aviation Regulations (FAR) Part 77, Objects Affecting the Navigable Airspace. Airspace at Aurora State Airport is protected from encroachment by buildings, structures and vegetation through local zoning ordinances of the City of Aurora, Marion County and Clackamas County.

Drawing 3/6 provides an overall plan view of the Federal Aviation Regulation (FAR) Part 77 airspace for Aurora State Airport. Plan and profile views of the approaches, transitional surfaces, primary surfaces and obstructions to those surfaces are depicted in Drawing 4/6. Close-in approaches and obstructions for Runway 17/35 are shown in Drawing 5/6. A brief description of the FAR Part 77 surfaces is provided below.

Primary Surface

The primary surface is longitudinally centered on the runway extending 200 feet beyond the ends and measuring 500 feet wide for Runway 17/35. The primary surface is essentially a ground level, ribbon-like surface that rests on the runway's centerline. At any given point, the elevation of the primary surface is the same as that of the nearest point on the adjacent runway's centerline.

Approach Surfaces

The approach surfaces are inclined planes extending upward and outward from the ends of the primary surfaces. The approach surfaces vary in size and degree of slope based upon the type of approach (visual vs. non-precision instrument or precision instrument approaches) and the size of aircraft using the approach (small - under 12,500 lbs., vs. large - over 12,500 lbs.).

The FAR Part 77 Approaches for the Aurora State Airport are as follows:

- Runway 17 — Non-Precision Instrument Approach - Large Aircraft
  Not lower than 1 statute mile visibility minimums
  500' x 10,000' x 3,500' at a slope of 34:1

- Runway 35 — Non-Precision Instrument Approach - Large Aircraft
  Not lower than 1 statute mile visibility minimums
  500' x 10,000' x 3,500' at a slope of 34:1

Horizontal Surface

The horizontal surface is a flat plane that is positioned 150 feet above the established airport elevation. Dimensions of the horizontal surface are set by arcs extending from the ends of the primary surface on Runway 17/35, connected by tangent lines. These arcs are 10,000 feet long.

Transitional Surface

The transitional surface is an inclined plane with a slope of 7:1 extending upward and outward from the primary and approach surfaces, terminating at the point where they intersect with the horizontal surface or any other surface with more critical restrictions.

Conical Surface

The conical surface is an inclined plane at a slope of 20:1 extending upward and outward from the periphery of the horizontal surface for a horizontal distance of 4,000 feet.

FAR Part 77 Approach Surfaces Plan and Profile, Drawing 4/6

Obstructions of Horizontal and Conical Surfaces

There are no obstructions to the horizontal and conical surfaces at Aurora State Airport.

Obstructions of Runway Approaches, Primary Surface and Transitional Surfaces

Obstructions in the approach and transitional surfaces are summarized below.

Runway 17 Approach. The approach to Runway 17 is penetrated by trees along both its east and west edges. All of the penetrating trees are programmed by the airport to be removed early in the capital improvement plan as a high priority action.

Runway 35 Approach. The approach to Runway 35 is penetrated by a tree in the RPZ area along the south side of Keil Road.

Primary Surface. There are no penetrations of the primary surface by non-frangible objects.

Transitional Surfaces. Airport transitional surfaces are penetrated by trees along the western side of the Wilsonville-Hubbard Highway. Other trees penetrate the transitional surface adjacent to the Runway 17 approach and in the mid-field area of the airport's east side. All of the penetrating trees are programmed by the airport to be removed early in the capital improvement plan as a high priority action.

Runway Protection Zones Plan and Profile, Drawing 5/6

Drawing 5/6 illustrates the inner approach areas off the ends of the runways included with the Runway Protection Zone (RPZ). The RPZ is an area off the end of the runway within which the FAA prefers to see only open space and no development. The goal of the RPZ is to enhance protection of people and property on the ground in the event of an aircraft mishap. It is desirable for the airport to control all of its RPZ areas and to eliminate any obstructions to airspace within the RPZ.

Land Use Plan, Drawing 6/6

The land use plan drawing illustrates existing and planned land use both on and off the airport. No major changes in existing land use are recommended. Local zoning and land use plans are compatible with the Master Plan Update's long-range airport development plan.

DRAWING 1/6
Cover Sheet

DRAWING 2/6
Airport Layout Plan

DRAWING 3/6
FAR Part 77 Airspace Plan

DRAWING 4/6
FAR Part 77 Approach Surfaces Plan and Profile

DRAWING 5/6
Runway Protection Zones Plan and Profile

DRAWING 6/6
Land Use Plan

Chapter 6

Land Use Compatibility

Chapter 5
Airport Plans

Introduction

The purpose of this chapter is to present discussion of land use issues associated with the Aurora State Airport and the land use impacts of anticipated airport development. Land use compatibility was evaluated by comparing the effect of existing and forecast airport operations both on-airport and off-airport for the planning period. The land use discussion focuses on four areas:

- On-airport zoning and land use.
- Surrounding area land use.
- Protection of airport airspace to prevent hazards and land uses that may interfere with the safety of aircraft operations.
- Ownership/control of airport runway protection zones to enhance the safety of people and property on the ground.

> A fifth category of impact, aircraft noise, was originally part of the master plan scope. However, aircraft noise is a sensitive issue for the airport's neighboring communities. It became apparent during the course of the master plan study that effective evaluation of noise impacts was well beyond the scope of this study. To adequately address issues and impacts related to noise, the Aeronautics Division has set aside additional funds for a separate noise study that will be conducted outside the master plan scope. It should be noted that FAA approved an amendment to the workscope to delete the noise contour task, with the funding re-allocated into an expanded public involvement process.

On-Airport Zoning and Land Use

The Aurora State Airport is a public use airport and is designated as a Public Airport Zone. Marion County is the planning and building permit authority for the airport. The airport's existing zoning classification of Public Airport Zone was evaluated, as well as compliance requirements to meet Senate Bill 1113. Recommendations were submitted to the Aeronautics Division for review.
Permitted uses in the zone include:

- Airport operational and navigation facilities.
- Aircraft sales, rental, repair, service, storage and flight instruction.
- Aircraft fueling facility.
- Administrative and operational buildings.
- Air passenger and air freight services.
- Other public and semi-public structures and uses essential to the operation of the airport.

The Public Airport Zone designation can also allow certain conditional uses such as industrial, manufacturing, commercial or other uses that comply with the standards in the zoning designation.

On-airport uses generally fall within the following categories:

- Airside Uses - land required for runways, taxiways, safety areas object free areas and runway protection zone areas.
- Landside Uses- land to be used for airport uses such as fueling, aircraft repair, aircraft parking and hangars, aircraft passenger loading and cargo operations.

Surrounding Area Land Use

Aurora State Airport is surrounded primarily by land zoned for compatible Exclusive Farm Use along with a golf course to the north of Arndt Road. Two residential areas are located west of the airport along Wilsonville-Hubbard Highway and Boones Ferry Road on land that is zoned Acreage Residential. The separate noise study will assist in determining land use compatibility for land surrounding the airport. Land uses in the surrounding area are illustrated in **Drawing 6/6** from the Airport Layout Plan drawings shown previously in **Chapter 5**.

Marion County has a policy agreement with the City of Aurora regarding cooperative planning of land use actions on and adjacent to the airport. Land subject to this agreement is designated as an “Area of Special Mutual Concern.”

Protection of Airport Airspace

The City of Aurora, Marion County and Clackamas County have each established an Airport Overlay Zone/District to protect the airport and its airspace. Airport overlay zones/districts are adopted in order to regulate or control the various types of airspace obstructions and other hazards that may interfere with the safety of aircraft operations near the airport. An overlay zone/district restricts the height of buildings and other structures or trees within the FAR Part 77 Imaginary Surfaces. Airport overlay zones also restrict any use of land that would create electrical interference with radio communications at the airport, use lighting/building materials that would cause glare or impair visibility in the vicinity of the airport or would otherwise endanger aircraft. Additionally, it restricts conditions or activities that would create congregations of birds and consequent hazards for operating aircraft.

Avigation easements are another means to control obstructions to airspace when the airport does not own fee title to land surrounding the airport property. Aurora State Airport controls, through existing avigation easements, nearly enough surrounding property to adequately control airspace in the RPZs for both approaches, as well as for the transitional surfaces. The State should continue with its program of purchasing avigation easements by gaining control of two remaining areas that are not yet controlled by avigation easements southeast of Runway 35 and northwest of Runway 17. Upon acquisition of easements for those two areas, the airport will sufficiently control both RPZs and transitional surfaces to meet anticipated airport needs during the planning period.

Several areas with obstructions to airspace have been identified, particularly along the Wilsonville-Hubbard Highway. A program for removal/trimming of obstructing trees and vegetation has been included as a high priority item in the Capital Improvement Program.

Ownership/Control of Runway Protection Zones

The FAA strongly encourages the airport operator to either own or exercise some control through easements for all land within the Runway Protection Zones (RPZs). A very small portion of the land underlying the Runway 17 RPZ falls outside the airport property boundary onto the adjacent private land to the east. Purchase of avigation easements is recommended along the northeast boundary of the airport to gain control of airspace for both the RPZ and adjacent land not yet controlled by avigation easement. Approximately 15 percent of the Runway 35 RPZ falls outside of the airport property boundary onto land that is under cultivation and zoned Exclusive Farm Use. Airspace in this area is already controlled by avigation easement. Additionally, the agricultural use is considered compatible as long as the crops grown there do not attract birds.

FAA requirements for RPZs are summarized below:

Purpose and Intent

- To enhance the protection of people and property on the ground through airport owner control over the RPZ.
- Where impractical for airport owner to acquire and plan the land uses within the entire RPZ, the RPZ land use standards have recommendation status for that portion of the RPZ not controlled by the airport owner.
- Desirable to clear all objects from the RPZ.

Compatible Uses

- Some uses permitted, provided they do not attract wildlife, are outside the runway Object Free Area (OFA), and do not interfere with navigational aids.
- Golf courses (but not club houses).
- Agricultural operations (other than forestry or livestock farms).
- Automobile parking (discouraged, but may be permitted provided the parking facilities and any associated appurtenances are located outside the OFA).

Incompatible Uses

- Obstructions to air navigation.
- Objects penetrating approach surfaces.
- Fuel handling and storage facilities.
- Smoke and dust generating activities.
- Misleading lights and lights that may create glare or attract wildlife.
- Residences and places of public assembly.
- Schools, churches and hospitals.
- Office buildings and shopping centers.
- Other uses with similar concentrations of persons.

Chapter 7

Financial Plan

Chapter 5
Airport Plans

Introduction

The purpose of the financial plan chapter is to assess the financial feasibility of the improvements recommended by this plan, and to integrate the development priorities and timing with the financial resources and budget of the airport.

Development projects fall within one of three phases. Phase I includes the projects of highest priority that are recommended to be completed within the five year period from 2000 through 2004. This portion of the plan is the most detailed and lists specific projects for each year. Phase II covers the next 5 years from 2005 through 2009, but does not prioritize specific projects by year because of increasing uncertainty about airport development needs. Phase III covers the final ten years of the planning period from 2009 through 2018. Projects in Phase III are also not assigned to specific years, but only scheduled to take place some time within that ten-year period. As indicated in the Forecast Chapter, the farther out the forecast goes, the greater will be the uncertainty about actual events. Projects assigned to Phase III are considered important for the development of the airport. However, the order in which they are accomplished may be changed after ten years due to unforeseen events.

A key assumption in creating the CIP is that the recommended ingress/egress program will be implemented at the rates recommended in the FAA Compliance Report. Changing economic conditions within the community or the aviation industry, though, may require modifications to the proposed development schedule.

As part of the proposed development program, the suggested projects are evaluated for eligibility for FAA funding under the Airport Improvement Program. Under this program, the FAA provides 90 percent funding for the project, and the local community/sponsor is required to provide the matching 10 percent. While a project may be eligible for FAA funding, it is not guaranteed. In the event that FAA funding is not be available, other methods for financing capital improvements were explored.

Schedule of Improvements and Costs

The phased development plan outlines proposed capital expenditures for the Aurora State Airport. The development projects planned as part of the Master Plan Update are described in the following pages and listed in **Table 7-1**. **Table 7-1** lists the projects by phase and their estimated costs in 1999 dollars. This table also shows the level of eligibility for federal funding for each project and the amount of the local contribution. It has been assumed that every project that is "eligible" for FAA funding will be funded. However, it is unlikely that all eligible projects will be funded. Other sources of funds may be needed for some otherwise "eligible" projects; or, some projects may need to be deferred.

Figures 7-1 and 7-2 graphically depict the location of the projects included in the CIP.

Phase I Projects for 2000 - 2004

Construct Fuel Facility

A new fuel facility with above ground storage tanks, pumps and spill containment systems is required to meet state and federal requirements for aviation fuel facilities. This project will be privately funded and located in the central ramp area.

Conduct Noise Study

Evaluation of aircraft noise to determine land use compatibility was originally part of the master plan scope of work. However, aircraft noise is a sensitive issue for the airport's neighboring communities. It became apparent during the course of the master plan study that effective evaluation of noise impacts was well beyond the scope of this study. To adequately address issues and impacts related to noise, the Aeronautics Division has set aside additional funds for a separate noise study that will be conducted outside the scope of the master plan scope.

Obstruction Removal

This item includes removal of isolated trees and groups of trees that obstruct the transitional surfaces in several locations, mainly west of Wilsonville-Hubbard Highway along the west side of the airport.

Reconstruct and Expand Central Ramp

As indicated in the 1995 pavement condition index survey, most of the existing central ramp is in poor condition and requires reconstruction. Additional ramp is required in 2001 to meet forecast growth at the airport.

Table 7-1 Twenty-Year Capital Improvement Program

Table 7-1 (Continued – 2-page table)

Figure 7-1 Capital Improvement Program-Phase I

Figure 7-2 Capital Improvement Program-Phase II and Phase III

Reconstruct Hangar Taxilanes

As indicated in the 1995 pavement condition index survey, two hangar taxilanes are in poor to fair condition and require reconstruction.

Construct Runway 17 Hold Apron

A hold apron is required to improve operational efficiency and safety for aircraft using Runway 17 and the adjacent parallel taxiway.

Construct Potential Five Corporate Hangars/Construct Potential Corporate Hangar Taxilane

A construction potential of five corporate hangars and the associated taxilane is programmed to meet anticipated market demand during Phase I. Actual facility location and construction schedule will depend on market conditions.

Construct Potential 10-Unit T-Hangar/Construct Potential Hangar Taxilane

Construction of a potential 10-unit T-hangar and the associated taxilane is programmed to meet anticipated market demand during Phase I. Actual facility location and construction schedule will depend on market conditions.

Construct Perimeter Fencing and Gates

Perimeter fencing and gates are required at the airport for State property, as well as adjacent private property. Costs will be shared by the FAA, State and affected private property owners.

Revise Airport Layout Plan

An ALP update is typically projected at five-year increments to maintain compliance with current standards, assess improvements since the previous planning period, and update capital projections for the next five-year period.

Acquire Property for Relocate Parallel Taxiway

Additional property is required along the airport's east side to construct the relocate parallel taxiway at a 300-foot searation from the runway.

Acquire Avigation Easements

To adequately control property interests within the ultimate Runway 17 Runway Protection Zone, it is recommended that the State continue the acquisition program in this area to secure the remaining parcels within the RPZ.

Annual Crack Filling Program (Total for Five Years)
Annual Pavement Patching Program (Total for Five Years)

Annual crack cleaning and filling, accompanied by selective pavement patching, is essential to maximize the lifespan of airport pavements

Property Acquisition

To provide future development options for OAD, it is recommended that the state acquire this 16 acre parcel should it be available for purchase.

Phase II Projects For 2005 - 2009

Replace MIRL

Replace Runway 17 and 35 VASIs with PAPIs

Replace Lighted Wind Cone

Lighting and visual navaid components are typically projected to be serviceable for a 20-year period. Replacement of the MIRL fixtures, cable, conduit and regulator equipment is projected, as well as replacement of the existing ODALs with new REILs. The VASI replacement would involve installation of PAPIs to replace the current aged equipment. The lighted wind cone will be reaching the limit of its useful life.

Overlay Runway and Connector Taxiways

To maintain the structural integrity of the pavements, an overlay is programmed in this phase. The work would include repair of thermal cracking, isolated patching and replacement, asphalt overlay, and shoulder grading to match the new pavement grades.

Construct Potential Five Corporate Hangars

Construct Potential Corporate Hangar Taxilane

Potential construction of five corporate hangars and the associated taxilane is programmed to meet anticipated market demand during Phase I. Actual facility location and construction schedule will depend on market conditions.

Construct Potential 10-Unit T-Hangar

Construct Potential Hangar Taxilane

Construction of a 10-unit T-hangar and the associated taxilane is programmed to meet anticipated market demand during Phase I. Actual facility location and construction schedule will depend on market conditions.

Update Master Plan

A full master plan update is projected in this phase to update forecasts and associated facility requirements based on the current and projected needs of the airport.

Annual Crack Filling Program (Total for Five Years)
Annual Pavement Patching Program (Total for Five Years)

Annual crack cleaning and filling, accompanied by selective pavement patching, is essential to maximize the lifespan of airport pavements

Phase III Projects for 2010 - 2019

Construct Potential Seven Corporate Hangars

Construct Potential Corporate Hangar Taxilane

Potential construction of seven corporate hangars and the associated taxilane is programmed to meet anticipated market demand during Phase III. Actual facility location and construction schedule will depend on market conditions.

Acquire Property for Relocated Parallel Taxiway

Additional property is required along the airport's east side to construct the relocated parallel taxiway at a 300-foot separation from the runway.

Construct Relocated Parallel Taxiway

A parallel taxiway that provides 300 feet of separation from the runway is required to allow for lower approach minimums using future instrument approach systems. The relocated taxiway will then provide separation that is consistent with the recently constructed parallel taxiway during the Runway 35 extension project. Detailed justification for the taxiway relocation, including AAMPAC discussions, is presented in **Chapter 4, Facility Requirements**.

Install Medium Intensity Taxiway Lighting

Currently the parallel taxiway has reflectors to identify the alignment. The relocated parallel taxiway will function as an apron taxiway for about half its length. Medium intensity taxiway lighting will better suit the new parallel taxiway.

Rehabilitate Hangar Taxilanes

As indicated in the 1995 pavement condition index survey, several hangar taxilanes are currently in good to very good condition. These taxilanes will require rehabilitation to counteract normal pavement aging, wear and tear.

Construct Potential 10-Unit T-Hangar

Construct Potential Hangar Taxilane

Construction of a 10-unit T-hangar and the associated taxilane is programmed to meet anticipated market demand during Phase III. Actual facility location and construction schedule will depend on market conditions.

Revise Airport Layout Plan

An ALP update is typically projected at five-year increments to maintain compliance with current standards, assess improvements since the previous planning period and update capital projections for the next five-year period.

Update Master Plan

A full master plan update is projected in this phase to update forecasts and associated facility requirements based on the current and projected needs of the airport.

Annual Crack Filling Program (Total for Ten Years)
Annual Pavement Patching Program (Total for Ten Years)

Annual crack cleaning and filling, accompanied by selective pavement patching, is essential to maximize the lifespan of airport pavements.

Total Estimated Cost

The total estimated cost for all three phases is $8,937,000. Financial participation in the Phased Development Plan is summarized in **Table 7-2.**

Table 7-2
PHASED DEVELOPMENT PLAN - FINANCIAL PARTICIPATION

	Cost (1999)	Portion of Total
Federal Share of Public Development	$5,058,900	49 %
State Share of Public Development	$ 872,100	9 %
Private Property Development	$4,276,000	42 %
TOTAL CIP PROJECT COSTS	**$10,207,000**	**100 %**

Combined Five-Year Capital and Operating Budget Forecast

Table 7-3 shows the combined five-year capital and operating budget forecast for Aurora State Airport. Actual revenue and expenses are likely to vary from these projections. It has been assumed that every project that is eligible for FAA funding will be funded. However, it is unlikely that all eligible projects will be funded. Other sources of funds for FAA-eligible projects may be required, or some FAA-eligible projects may need to be deferred until funding is available.

Sources of Funding

As illustrated in **Table 7-3**, the largest source of capital funding for the proposed projects is the Federal Aviation Administration's Airport Improvement Program (AIP). Projects eligible for AIP funding can receive up to 90 percent federal participation with a 10 percent local/sponsor match. This 10 percent local/sponsor funding can, under certain circumstances, be matched with alternatives other than direct financial contribution. Some of these alternatives include in-kind labor, volunteer services and donated land, buildings and other property. Projects not eligible for FAA participation must be funded at the State/local level through public or private investment.

TABLE 7-3, COMBINED FIVE-YEAR CAPITAL AND OPERATING BUDGET FORECAST

Appendix B

Glossary of Aviation Terms

Table of Contents

Active Aircraft - Aircraft registered with the FAA and reported to have flown during the preceding calendar year.

ADO - Airports District Office. The "local" office of the FAA that coordinates planning and construction projects. Staff in the ADO is typically assigned to a particular state; i.e., Oregon, Idaho, or Washington. The ADO for Oregon, Washington and Idaho is located in Renton Washington.

AIP Funds - AIP stands for Airport Improvement Program and is an FAA program that pays 90 percent of eligible airport improvement projects. The local sponsor of the project (i.e.; airport owner) has to come up with the remaining 10 percent known as the "match".

Air Taxi - Operations of aircraft "for hire" for specific trips, commonly referred to an aircraft available for charter.

Aircraft Approach Category - A grouping of aircraft based how fast they come in for landing. As a rule of thumb, slower approach speeds mean smaller airport dimensions, while faster speeds mean larger dimensions from runway widths to the separation between runways and taxiways.

The aircraft approach categories are:

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; and,
Category E - Speed 166 knots or more.

Airplane Design Group - A grouping of airplanes based on wingspan. As with Approach Category, the wider the wingspan, the bigger the aircraft is, the more room it takes up for operating on an airport. The Airplane Design Groups are:

Group I:	Up to, but not including 49 feet
Group II:	49 feet up to, but not including 79 feet
Group III:	79 feet up to, but not including 118 feet
Group IV:	118 feet up to, but not including 171 feet
Group V:	171 feet up to, but not including 214 feet
Group VI:	214 feet up to, but not including 262 feet

Airport Reference Code (ARC) - An FAA airport coding system. The system looks at the types of aircraft which use an airport most often and then based upon the characteristics of those airplanes (approach speed and wing span), assigns a code. The code is then used to determine how the airport is designed and what design standards are used. An airport designed for a Piper Cub (an aircraft in the A-I approach/design group) would take less room than a Boeing 747 (an aircraft in the D-V approach/design group).

Aircraft Operation - A landing or takeoff is one operation. An aircraft that takes off and then lands creates two aircraft operations.

ALP - Airport Layout Plan - The FAA approved drawing which shows the existing and anticipated layout of an airport for the next 20 years or so. An ALP is prepared using FAA design standards.

Annual Service Volume (ASV) - An estimate of how many airplanes and airport can handle based upon the number and types of runways, the aircraft mix (big vs. small, etc.), and the weather conditions. Annual service volume is one of the bench marks used to determine when an airport is getting so busy that a new runway or taxiway are needed.

AOPA - Aircraft Owners and Pilots Association -

Approach End of Runway - The end of the runway a pilot tries to land - could be thought of as the "landing end" of the runway. Which end a pilot uses depends upon the winds. Pilots almost always try and land into the wind and will line up on the runway that best aligns with the wind.

Approach Surface - Also FAR Part 77 Approach or Obstacle Clearance Approach - An imaginary (invisible) surface which rises off the ends of a runway which must be kept clear to provide airspace for an airplane to land or take off in. The size of the approach surface will vary depending upon how big and how fast the airplanes are, and whether or not the runway has an instrument approach for landing in bad weather.

ARFF - Aircraft Rescue and Fire Fighting; i.e., an on airport fire station.

AvGas - Gasoline used in airplanes with piston engines.

Based Aircraft - Aircraft stationed at an airport on an annual basis. Used as a measure of activity at an airport.

Capacity - A measure of the maximum number of aircraft operations that can be accommodated on the runways of an airport in an hour.

CAVU - Ceiling and Visibility Unlimited. Refers to weather which is clear blue sky - no clouds and very clear so that you can see "forever". The conditions that pilots always want to fly in.

Conical Surface - One of the "FAR Part 77 "Imaginary" Surfaces. The conical surface extends outward and upward from the edge of the horizontal surface at a slope of 20:1 for a horizontal distance of 4,000 feet.

Critical Aircraft - Aircraft which controls one or more design items based on wingspan, approach speed and/or maximum certificated take off weight. The same aircraft may not be critical to all design items.

Crosswind - When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft. Sometimes used in reference to a runway as in "runway 7/25 is the crosswind runway" meaning that it is not the runway normally used for the prevailing wind condition.

FAA - Federal Aviation Administration. The FAA is the branch of the U.S. Department of Transportation that is responsible for the development of airports and air navigation systems.

FAR Part 77 - Federal Aviation Regulations which establish standards for determining obstructions in navigable airspace. FAR stands for Federal Aviation Regulations, Part 77 refers to the section in the regulations; i.e., #77. FAR Part 77 is commonly used to refer to imaginary surfaces, the primary, transitional, horizontal, conical, and approach surfaces. These surfaces vary with the size and type of airport.

FBO - Fixed Base Operator - An individual or company located at an airport providing aviation services. Sometimes further defined as a "Full Service" FBO or a limited service. Full service FBOs typically provide a broad range of services (flight instruction, aircraft rental, charter, fueling, repair, etc) where a limited service FBO provides only one or two services (such as engine repair, or radio repair).

Fixed Wing - A plane with one or more "fixed wings" as opposed to a helicopter that is sometimes called a rotary wing aircraft.

FSS - Flight Service Station - An office where a pilot can call (both on the ground and in the air) to get weather and airport information. Flight plans are also filed with the FSS.

General Aviation - Also Called "GA" - All civil (non-military) aviation operations other than scheduled air services and non-scheduled air transport operations for hire.

GPS or Global Positioning System - GPS is a system of navigating which uses satellites to establish the location of an aircraft. The FAA has recently embraced GPS as a system with potential for application in traveling from point A to point B as well as for use in making landing approaches.

Hangar Queen - An airplane that is seldom flown spending most of its time in an aircraft hangar - may be highly polished and well maintained.

Hangar Flying - A situation in which pilots or aviation enthusiasts gather to talk about flying. May or may not be in a hangar. Exploits discussed may or may not be grounded in truth (can be somewhat akin to telling fish stories).

HIRL - High Intensity Runway Lights. High intensity (i.e., very bright) lights are used on instrument runways where landings are made in foggy weather. The bright runway lights help pilots to see the runway when visibility is poor.

Home Built Aircraft - An aircraft built by an amateur as opposed to an FAA Certified factory built aircraft.

Horizontal Surface - One of the FAR Part 77 Imaginary (invisible) Surfaces. The horizontal surface is an imaginary flat surface 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs (circles) with a radius of 5,000 feet for all runways designated as utility or general; and 10,000 feet for all other runways from the center of each end of the primary surface and connecting the adjacent arc by straight lines. The resulting shape looks like a football stadium - and could also be described as a rectangle with half circles on each end with the runway in the middle.

IFR (Instrument Flight Rules) - IFR refers to the set of rules pilots must follow when they are flying in bad weather. Pilots are required to follow these rules when operating in controlled airspace with visibility (ability to see in front of themselves) of less than three miles and/or ceiling (a layer of clouds) lower than 1,000 feet.

ILS (Instrument Landing System) - An ILS is a system used to guide a plane in for a landing in bad weather. Sometimes referred to as a precision instrument approach, it is m designed to provide an exact approach path for alignment and descent of aircraft. Generally consists of a localizer, glide slope, outer marker, middle marker, and approach lights. This type of precision instrument system is being replaced by Microwave Landing Systems (MLS).

Instrument Runway - A runway equipped with systems to help a pilot land in bad weather.

Itinerant Operation - All aircraft operations at an airport other than local; i.e., flights that originate at another airport.

Landing Area - That part of the movement area intended for the landing and takeoff of aircraft.

Large Aircraft - An aircraft that weighs more than 12,500 lbs.

Ldn - Day-night sound levels, a method of measuring noise exposure.

Local Operation - Aircraft operation in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.

LORAN C - A navigation system using land based radio signals that allows a person to tell where they are and how fast they are moving, but not how high you are off the ground. (See GPS)

MALSR - Medium-intensity Approach Lighting System with Runway alignment indicator lights. An airport lighting facility which provides visual guidance to landing aircraft.

Minimums - Weather condition requirements established for a particular operation or type of operation.

MIRL - Medium Intensity Runway Lights. Runway lights which are not as intense as HIRLs (high intensity runway lights). Typical at medium and smaller airports that do not have sophisticated instrument landing systems required for operations in fog.

MLS - Microwave Landing System. An instrument landing system operating in the microwave spectrum which provides lateral and vertical guidance to aircraft with compatible equipment, and also sometimes referred to at the Mythical Landing System.

Movement Area - The runways, taxiways and other areas of the airport used for taxiing, takeoff and landing of aircraft; i.e.: aircraft movement.

MSL - Elevation above Mean Sea Level.

Navigational Aid (Navaid) - Any visual or electronic device that helps a pilot navigate. Can be for use to land at an airport or for traveling from point A to point B.

NDB - Non-Directional Beacon which transmits a signal on which a pilot may "home" using equipment installed in the aircraft.

Non-Precision Instrument Approach - A non-precision instrument approach provides guidance to pilots trying to land in bad weather. It does not provide the "precision" guidance of a precision instrument approach.

OAS - Oregon Aeronautics Section.

Obstruction - An object (tree, house, road, phone pole, etc) which penetrates an imaginary surface described in FAR Part 77.

PAPI - **Precision Approach Path Indicator**. A system of lights located by the approach end of a runway, which provides visual approach slope guidance to aircraft during approach to landing. The lights typically show green if a pilot is on the correct flight path, and turn red of a pilot is too low.

PIR - Precision Instrument Runway. A runway served by a "precision" instrument approach landing system. The precision landing systems allows property equipped airplanes and trained pilots to land in bad weather.

Precision Instrument Approach - A precision instrument approach is a system that helps guide pilots in for a landing in a very low ceiling (approximately 200 feet) and provides "precise" guidance as opposed to a non-precision approach which is less precise.

Primary Surface - One of the FAR Part 77 Imaginary Surfaces, the primary surface is centered on top of the runway and extends 200 feet beyond each end. The width is from 250' to 1,000' wide depending upon the type of airplanes using the runway.

REILs - Runway End Identifier Lights. These are distinctive flashing lights that help a pilot identify the runway.
Rotorcraft - A helicopter.

RPZ - Runway Protection Zone - An area off the end of the runway which is intended to be clear in case an aircraft lands short of the runway. The size is small for airports serving only small airplanes and gets bigger for airports serving large airplanes. The RPZ used to be known as a clear zone - which was a good descriptive term because you wanted to keep it clear.

Segmented Circle - A system of visual indicators designed to show a pilot in the air which direction the airplanes fly in the landing pattern at that airport.

Small Aircraft - An aircraft that weighs less than 12,500 lbs.

Tie down - A place where an aircraft is parked and "tied down". Can be grass or pavement.

T-Hangar - An aircraft storage hangar in which the individual aircraft space resembles the shape of a "T".

Transitional Surfaces - One of the FAR Part 77 Imaginary Surfaces, the transitional surface extend outward and upward at right angles to the runway centerline and the extended runway centerline at a slope of 7:1 from the sides of the primary surface and from the sides of the approach surfaces.

Transport Airport - An airport designed and constructed to serve large commercial airliners. Portland International and SEATAC are good examples of transport airports.

Utility Airport - An airport designed and constructed to serve small planes. Aurora State Airport in Oregon, Nampa Airport in Idaho and Arlington Airport in Washington are examples of utility airports.

VASI- Visual Approach Slope Indicator. A system of lights located by the approach end of a runway that provides visual approach slope guidance to aircraft during approach to landing. The lights typically show some combination of red and white if a pilot is on the correct flight path, and turn red if a pilot is too low.

War Bird - A military aircraft owned by a civilian. Most typically of World War II vintage, more recently a Cold War era fighter jet aircraft from communist block countries.