CORVALLIS
ENHANCING COMMUNITY LIVABILITY

Chapter Two

FORECASTS

Corvallis Municipal Airport

AIRPORT MASTER PLAN

Corvallis, Oregon

Forecasts

An important factor when planning the future needs of an airport involves a definition of aviation demand that may reasonably be expected to occur in both the near term (five years) and long term (20 years). For a general aviation airport such as Corvallis Municipal Airport (CVO), forecasts of based aircraft and operations (takeoffs and landings) serve as the basis for facility planning.

The Federal Aviation Administration (FAA) has oversight responsibility to review and approve aviation forecasts developed in conjunction with airport planning studies. The FAA reviews such forecasts with the objective of comparing them to the FAA *Terminal Area Forecasts* (TAF) and the *National Plan of Integrated Airport Systems* (NPIAS). In addition, aviation activity forecasts are an important input to the benefit-cost analyses associated with some airport development projects.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, dated December 4, 2004, states that forecasts should be:

- Realistic
- Based on the latest available data
- Reflective of current conditions at the airport
- Supported by information in the study
- Able to provide adequate justification for airport planning and development

The forecast process for an Airport Master Plan consists of a series of basic steps that vary in complexity depending upon the issues to be addressed and the level of effort required to develop the forecast. The steps include a review of previous forecasts, determination of data needs, identification of data sources, collection of data, selection of forecast methods, preparation of the forecasts, and evaluation and documentation of the results.

FAA Advisory Circular (AC) 150/5070-6B, *Airport Master Plans*, outlines seven standard steps involved in the forecast process, including:

1) **Identify Aviation Activity Measures**: The level and type of aviation activities likely to impact facility needs. For general aviation, this typically includes based aircraft and operations.

2) **Review Previous Airport Forecasts**: May include the FAA *Terminal Area Forecast*, state or regional system plans, and previous master plans.

3) **Gather Data**: Determine what data are required to prepare the forecasts, identify data sources, and collect historical and forecast data.

4) **Select Forecast Methods**: There are several appropriate methodologies and techniques available, including regression analysis, trend analysis, market share or ratio analysis, exponential smoothing, econometric modeling, comparison with other airports, survey techniques, cohort analysis, choice and distribution models, range projections, and professional judgment.

5) **Apply Forecast Methods and Evaluate Results**: Prepare the actual forecasts and evaluate for reasonableness.

6) **Summarize and Document Results**: Provide supporting text and tables as necessary.

7) **Compare Forecast Results with FAA's TAF**: Follow guidance in FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*. In part, the Order indicates that forecasts should not vary significantly (more than 10 percent) from the TAF. When there is a greater than 10 percent variance, supporting documentation should be supplied to the FAA.

The aviation demand forecasts are then submitted to the FAA for their approval. Master Plan forecasts for operations and based aircraft for general aviation airports are considered to be consistent with the TAF if they meet the following criteria:

Where the 5- or 10-year forecasts exceed 100,000 total annual operations or 100 based aircraft:

a) Forecasts differ by less than 10 percent in the 5-year forecast and 15 percent in the 10-year period, or
b) Forecasts do not affect the timing or scale of an airport project, or
c) Forecasts do not affect the role of the airport as defined in the current version of FAA Order 5090.3C

Aviation activity can be affected by many influences on the local, regional, and national levels, making it virtually impossible to predict year-to-year fluctuations of activity over 20 years with any certainty. Therefore, it is important to remember that forecasts are to serve only as guidelines, and planning must remain flexible enough to respond to a range of unforeseen developments.

The following forecast analysis for Corvallis Municipal Airport was produced following these basic guidelines. Existing forecasts are examined and compared against current and historic activity. The historical aviation activity is then exam-

ined along with other factors and trends that can affect demand. The intent is to provide an updated set of aviation-demand projections for Corvallis Municipal Airport that will permit airport management to make planning adjustments as necessary to maintain a viable, efficient, and cost-effective facility.

SOCIOECONOMIC CHARACTERISTICS

A variety of historical and forecast socioeconomic data has been collected for use in various elements of this master plan. This data provides essential background information for use in determining aviation service level requirements. Aviation forecasts are related to socioeconomic indicators such as population, employment, and income, as well as the economic strength of the region; therefore, it is necessary to have an understanding of the socioeconomic outlook for the airport service area.

As discussed in the previous chapter, the primary service area for the airport is Benton County and the western portions of Linn County. Of the aircraft based at the airport, 83 are registered to addresses in Benton County and 11 are in Linn County. Therefore, Benton County contributes approximately 88 percent of the two county total, and Linn County contributes the remaining 12 percent.

Several sources were examined for demographic data, including the U.S. Census Bureau, the *Regional Transportation Plan* as developed by the Corvallis Area Metropolitan Planning Organization, Portland State University – Population Research Center, the Oregon Office of Economic Analysis (OEA), and Woods & Poole Economics.

The socioeconomic data from the several local sources listed is somewhat dated. The Regional Transportation Plan is from 2006 (although it is currently being updated) and the OEA data is from 2003. Demographic data available from Woods & Poole Economics, an independent firm specializing in long term demographic projections for U.S. counties, is consistent with the positive population growth trends presented from other local sources.

When preparing aviation forecasts, it is helpful to utilize consistent and comprehensive socioeconomic data. Woods & Poole publishes socioeconomic data annually, and they update the previous several years as necessary. They also provide both historical and forecast data, including yearly data through 2040.

Use of Woods & Poole data for airport forecasting is acceptable as the FAA has approved forecasts at other airports that utilize this data source. Therefore, the primary socioeconomic data sources for use in generating the aviation forecasts will be the Woods & Poole data sets for Benton and Linn Counties and the State of Oregon. **Table 2A** presents historical and forecast data for population, employment, and income for the four counties considered the primary and secondary service area for the Corvallis Municipal Airport. This data will be utilized in forecasting analysis later in the chapter.

TABLE 2A
Demographic Trends and Forecast
Airport Service Area

	HISTORIC		FORECAST			
	2000	2010	2017	2022	2032	AAGR 2010-2032
Benton County						
Population	78,197	83,070	86,548	89,238	94,818	0.60%
Employment	51,494	54,755	59,782	62,873	69,179	1.07%
Income (PCPI)	$32,829	$32,828	$36,299	$38,832	$44,489	1.39%
Linn County						
Population	103,015	117,462	123,899	128,760	138,757	0.76%
Employment	52,698	53,058	57,463	60,074	65,285	0.95%
Income (PCPI)	$25,651	$26,230	$28,359	$30,115	$34,069	1.20%
Combined Statistical Area (CSA)						
Population	181,212	200,532	210,447	217,998	233,575	0.70%
Employment	104,192	107,813	117,245	122,947	134,464	1.01%
Income (PCPI)	$28,748	$28,963	$31,624	$33,683	$38,299	1.28%
Oregon						
Population	3,430,891	3,868,158	4,173,806	4,399,008	4,858,356	1.04%
Employment	2,094,850	2,235,473	2,458,761	2,603,461	2,911,811	1.21%
Income (PCPI)	$31,989	$32,050	$34,689	$36,830	$41,803	1.21%

CSA: Combined Statistical Area includes Corvallis, Lebanon, Albany (from CEDDS)
AAGR: Average annual growth rate
PCPI - Per Capita Personal Income ($2005)

Source: Woods & Poole Economics - Complete Economic Demographic Data Source (CEDDS-2011)

AVIATION TRENDS

The forecasts developed for the airport must also consider national, regional, and local aviation trends. The following section describes the trends in aviation. This information is utilized both in statistical analysis and to aid the forecast preparer in making any manual adjustments to the forecasts as necessary.

NATIONAL TRENDS

Each year, the FAA publishes its national aviation forecast. Included in this publication are forecasts for large air carriers, regional air carriers, general aviation, and FAA workload measures. The forecasts are prepared to meet budgeting and planning needs of the constituent units of the FAA and to provide information that can be used by state and local authorities, the aviation industry, and the general public. The current edition, FAA *Aerospace Forecasts - Fiscal Years 2011-2031*, has been utilized in the generation of the aviation demand forecasts to follow. Aviation trends tend to closely follow the state of the economy.

Over the past decade, the aviation industry has experienced a series of setbacks. Following the devastating impact of the terrorist attacks of September 11, 2001, the industry rebounded for a time only to then experience a spike in oil and fuel prices in 2004-2005. In late 2007, the country entered the most significant economic recession since the Great Depression of the 1930s. The recovery from the recession has been slow to date. None-

theless, the FAA has "cautious optimism that the industry has transformed from one of a boom-to-bust cycle to one of sustainable profits."

The current and forecast state of the U.S. and World economies contribute to the FAA forecasts. Officially, the recession ended in the third quarter of 2009 and each quarter since has shown growth in Gross Domestic Product. In 2010, GDP grew by 4.2 percent after declining by 2.5 percent in 2009. From 2012 through 2016, GDP is forecast at 3.0 percent annually. In the subsequent years, annual GDP is forecast at 2.7 percent annually.

GENERAL AVIATION TRENDS

The passage of the *General Aviation Revitalization Act of 1994* (Act) (federal legislation which limits the liability on general aviation aircraft to 18 years from the date of manufacture) successfully infused new life into the general aviation industry after many years of decline. This legislation sparked an interest to renew the manufacturing of general aviation aircraft due to the reduction in product liability, as well as renewed optimism for the industry. After the passage of this legislation, annual shipments of new aircraft rose every year between 1994 and 2000. The industry then stagnated in the aftermath of 9/11, but recovered to new production highs from 2005 through 2007.

The economic recession beginning in late 2007 has had a negative impact on general aviation aircraft production and the industry has been slow to recover. Aircraft manufacturing declined for three straight years from 2008 through 2010. Since 2008, manufacturing is down more than 61 percent. General aviation billings were down 21 percent from 2008 to 2009 but showed a slight growth in 2010. **Table 2B** presents historical data related to aircraft shipments.

TABLE 2B
Annual General Aviation Airplane Shipments
Manufactured Worldwide and Factory Net Billings

Year	Total	SEP	MEP	TP	J	Net Billings ($millions)
1994	1,132	544	77	233	278	3,749
1995	1,251	605	61	285	300	4,294
1996	1,437	731	70	320	316	4,936
1997	1,840	1043	80	279	438	7,170
1998	2,457	1508	98	336	515	8,604
1999	2,808	1689	112	340	667	11,560
2000	3,147	1,877	103	415	752	13,496
2001	2,998	1,645	147	422	784	13,868
2002	2,677	1,591	130	280	676	11,778
2003	2,686	1,825	71	272	518	9,998
2004	2,961	1,999	52	319	591	11,918
2005	3,590	2,326	139	375	750	15,156
2006	4,053	2,513	242	412	886	18,815
2007	4,270	2,417	258	459	1,136	21,826
2008	3,967	1,943	176	535	1,313	24,766
2009	2,274	893	70	441	870	19,465
2010	2,015	781	108	363	763	19,705

SEP - Single Engine Piston; MEP - Multi-Engine Piston; TP - Turboprop; J - Turbofan/Turbojet
Source: General Aviation Manufacturers Association 2011 Statbook

Worldwide shipments of general aviation airplanes fell for the third year in row in 2010. A total of 2,015 units were delivered around the globe, as compared to 2,274 units in 2009, an 11.4 percent decline. Worldwide general aviation billings, nevertheless, rose by 1.2 percent in 2010 to $19.7 billion. This increase in billings, as compared to the reduction in shipments, is in large part due to deliveries of large-cabin, long-range aircraft remaining relatively stable during the recession and their delivery rates increasing in 2010.

Business Jets: The business jet sector declined for the second year in a row. Manufacturers shipped 763 units, as compared to 870 jets in 2009. This is a 12.3 percent decline. Light business jets were impacted most, due in part to higher dependence on third-party financing, which became more difficult to secure in the economic downturn. This segment of business jets typically has more exposure to the fractional market.

Turboprops: There were 363 turboprop airplane deliveries in 2010, a 17.7 percent decline from 441 units shipped in 2009. The total value of turboprop deliveries in 2010 was $1.3 billion.

Pistons: In years past, the piston market has reacted positively to an improving economy ahead of the other two sectors. It is too early to determine if this will hold true for the current economic downturn, but the piston segment continued to suffer in 2010. Shipments totaled 889 units, a 7.7 percent decrease from 963 units in 2009.

Throughout the first decade of the 2000s, many capable general aviation airports have seen an upward trend in activity by business jets. There are numerous factors that have led to this trend, including the growth of fractional aircraft ownership and a desire by frequent travelers to save time by avoiding commercial service airports. **Table 2C** presents growth trends in fractional aircraft ownership.

TABLE 2C
Fractional Shares and Number of Aircraft In Use

Year	Number of Shares	Number of Aircraft
1986	3	NA
1987	5	NA
1988	26	NA
1989	51	NA
1990	57	NA
1991	71	NA
1992	84	NA
1993	110	NA
1994	158	NA
1995	285	NA
1996	548	NA
1997	957	NA
1998	1,551	NA
1999	2,607	NA
2000	2,810	574
2001	3,601	689
2002	4,244	780
2003	4,516	826
2004	4,765	870
2005	4,828	945
2006	4,863	984
2007	5,168	1,030
2008	5,179	1,094
2009	4,881	1,037
2010	4,862	1,027

Source: GAMA/JETNET LLC

As with most sectors of general aviation, there was a decline in the number of fractional shares and fractional aircraft in operation in 2010. At the same time, the table gives evidence that the concept of fractional ownership is popular and is likely to continue to grow as the economy improves.

Most industry observers believe that the general aviation market, particularly the business aviation market, is in a position

for sustained growth. Industry net orders are back to positive and most leading indicators continue to improve. According to *Bombardiers Market Forecast 2010-2011*, "All long-term market fundamentals remain positive: business jet utilization, backlogs, the pre-owned aircraft market, new aircraft programs, fractional and branded charter demand, business jet penetration in Growth Markets, and aircraft retirements." The business jet market should experience strong growth over the 2011-2030 period, with 24,000 deliveries worth $626 billion of revenues. The worldwide business jet fleet is expected to grow from 14,700 in 2010 to 30,900 by 2030, net of retirements. The large jet category of the market is expected to expand faster than the other categories.

FAA GENERAL AVIATION FORECASTS

The FAA forecasts the active fleet mix and hours flown for single-engine piston aircraft, multi-engine piston, turboprops, business jets, piston and turbine helicopters, light sport, experimental, and others (gliders and balloons). The FAA forecasts "active aircraft," not total aircraft. An active aircraft is one that is flown at least one hour during the year. **Exhibit 2A** presents the historical and forecast figures of U.S. active general aviation aircraft.

After growing rapidly for most of the decade, the demand for business jet aircraft has slowed over the past two years as the industry has been hard hit by the economic recession. Nonetheless, the FAA forecast calls for robust growth in the long-term, driven by higher corporate profits and continued concern about safety, security, and flight delays. Overall, business aviation is projected to outpace personal/recreational use.

The total active general aviation fleet is projected to increase at an average annual rate of 0.9 percent over the 20-year FAA forecast period, growing from 224,172 in 2009 to 270,920 in 2031.

ACTIVE AIRCRAFT FLEET MIX

The FAA forecasts the general aviation active fleet for piston powered aircraft, turboprops, business jets, helicopters, light sport aircraft, and others (experimental, gliders, and lighter than air). An active aircraft is one that is flown at least one hour during the year. The FAA primarily uses estimates from the General Aviation and Part 135 Activity Survey (GA Survey) as baseline figures upon which assumed growth rates are applied. The results of the annual survey are not published until the following year; therefore, 2009 is the most recent statistical year, with 2010 showing only estimates.

Piston-Powered Fixed-Wing Aircraft

Single engine piston powered aircraft are forecast to show a modest growth of 0.3 percent annually from 2010-2031. The total single-engine piston fleet in 2010 was 139,818 and is forecast to grow to 147,960 by 2031.

Multi-engine piston powered aircraft has been experiencing a continuous decline in total numbers for more than a decade. In 2000, there were 21,091 multi-engine piston powered aircraft. By 2010, it is estimated there were 16,322. This trend is forecast to continue to 13,590 aircraft in 2031. This equates to an annual decline of 0.9 percent.

The combined total of single and multi-engine piston fixed-wing aircraft is forecast to grow from 156,140 in 2010 to 161,550 in 2031, an annual growth rate of 0.2 percent.

Turboprops

Turboprop aircraft have been showing steady historical growth. From 2000 to 2010, the turboprop fleet increased from 5,762 to 9,225, an average annual growth rate of 4.8 percent. By 2031, 12,280 turboprops are forecast for an average annual growth rate from 2010 through 2031 of 1.4 percent.

Business Jets

The use of business jets has led the growth in the general aviation industry. In 2000, there were just over 7,000 business jets in the fleet. In 2010, it is estimated that there were 11,568 business jets for an annual growth rate of 5.2 percent. As shown previously, fractional ownership programs became very popular during this period. Corporate safety/security concerns combined with increasing flight delays at some U.S. airports have made these programs practical alternatives to commercial travel. In addition, new product offerings, the addition of very light jets, and increasing foreign demand, have also contributed to this growth. By 2031, the FAA forecasts there will be 27,395 business jets in the fleet. This represents an annual growth rate of 4.2 percent from 2010 through 2031.

With the advent of relatively inexpensive very light jets (VLJs), many questions have arisen as to the future impact they may have. Several years ago, it was thought that the lower acquisition and operating cost could revolutionize the business jet market, particularly by being able to sustain a true on-demand air-taxi service. While initial FAA forecasts called for over 400 VLJs to be delivered annually, events such as the recession and the eventual bankruptcy of Eclipse and DayJet have led to lower expectations. New entries such as the Embraer Phenom 100 have stabilized the VLJ market, but the continuing recession has led the FAA to forecast 216 new VLJs annually for the balance of the forecast; these are included within the total business jet fleet.

Light Sport Aircraft

Starting in 2005, a new category of aircraft was created: "light sport" aircraft. At the end of 2010, a total of 6,996 light sport aircraft were estimated to be in this category. By 2030, a total of 13,870 light sport aircraft are projected to be in the fleet. The average annual growth from 2010 through 2031 is forecast at 3.3 percent for this category.

Helicopters

Helicopter usage has seen growth over the last 10 years. This category includes both piston powered and turbine helicopters, with the turbine representing more than 62 percent of the fleet. In 2000, the fleet consisted of 7,150 helicopters. By 2010, it is estimated there were 10,165 helicopters, representing an average annual growth rate of 3.6 percent. This growth trend is forecast to continue with an average annual growth rate from 2010-2031 of 2.6 percent, bringing the total helicopter fleet to 17,410.

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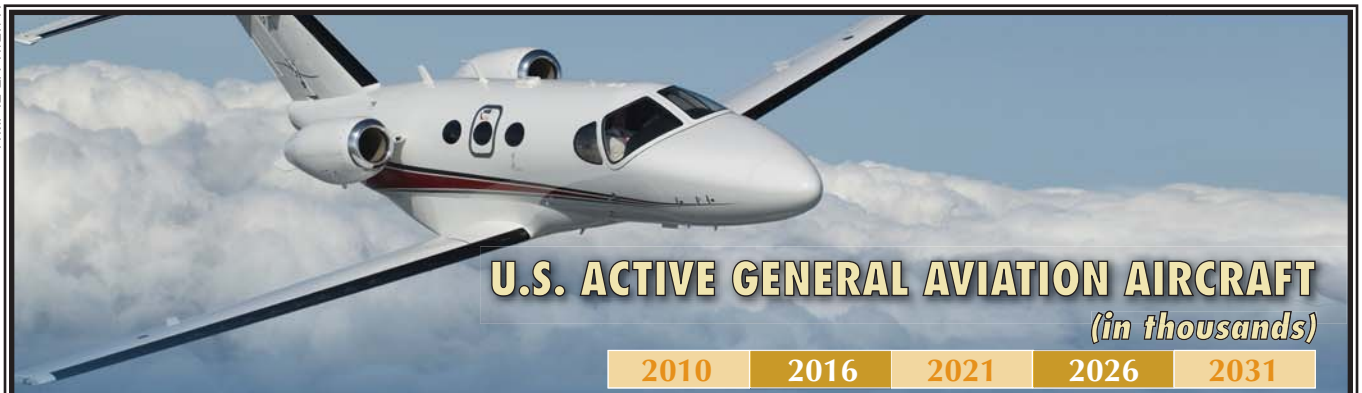
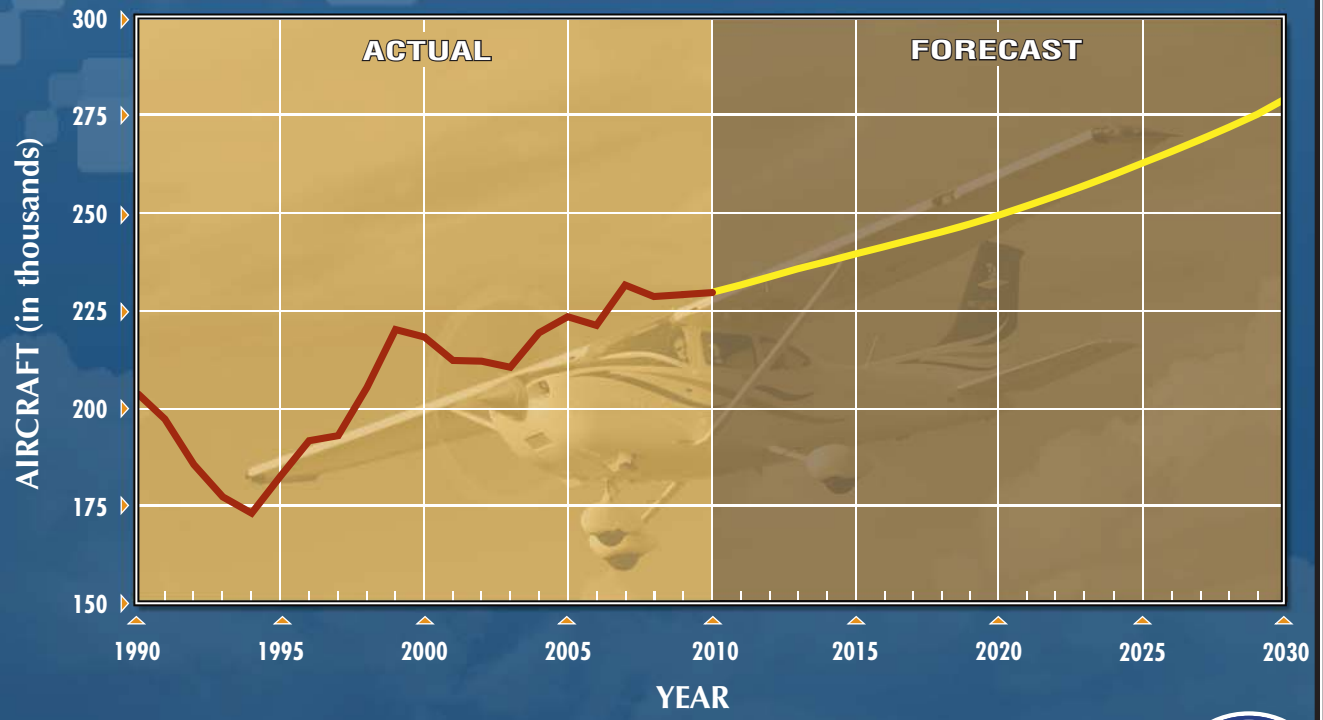


U.S. ACTIVE GENERAL AVIATION AIRCRAFT

(in thousands)

	2010	2016	2021	2026	2031
FIXED WING					
PISTON					
Single Engine	139.8	136.5	137.3	141.2	147.7
Multi-Engine	16.3	15.5	14.8	14.2	13.6
TURBINE					
Turboprop	9.2	10.0	10.7	11.4	12.3
Turbojet	11.7	14.7	18.2	22.4	27.4
ROTORCRAFT					
Piston	3.6	4.3	5.0	5.8	6.6
Turbine	6.6	7.6	8.6	9.7	10.8
EXPERIMENTAL	24.6	27.2	29.1	31.1	33.0
SPORT AIRCRAFT	7.0	9.4	10.9	12.4	13.9
OTHER	5.5	5.5	5.4	5.4	5.4
TOTAL	224.2	230.7	240.4	253.5	270.9



Source: FAA Aerospace Forecasts, Fiscal Years 2011-2031.

Notes: An active aircraft is one that has a current registration and was flown at least one hour during the calendar year.

CORVALLIS MUNICIPAL AIRPORT

Exhibit 2A
U.S. ACTIVE GENERAL AVIATION
AIRCRAFT FORECASTS

General Aviation Fleet Summary

In 2010, the general aviation fleet consisted of 159,720 piston powered aircraft, including piston helicopters. In the short term, piston aircraft are forecast to decline in numbers until 2019, when a modest growth trend is forecast to begin. Overall, through the 21-year FAA forecast, piston powered aircraft are forecast to grow 0.2 percent annually, bringing the total number to 168,140 by 2031.

Turbine aircraft, including turbine helicopters, have been the stalwart category and are forecast to continue to grow from 27,378 in 2010 to 50,495 in 2031. This represents an average annual growth rate of 3.0 percent. While this growth rate is substantial, it does lag slightly behind the growth rate of 4.7 percent experienced from 2000-2010.

Overall, the FAA is forecasting the next few years will be ones of slow or stagnant growth, while the economy struggles to recover from the recession. Ultimately, the FAA is forecasting a return to a consistent growth pattern for general aviation aircraft.

OPERATIONS

The FAA forecasts operations for air carriers, air taxi/commuter, general aviation, and military. FAA forecasts of general aviation operations (takeoffs and landings) are categorized as local and itinerant, with local operations being those within the traffic pattern airspace of an airport, and itinerant being those by aircraft with a destination away from the airport. General aviation activity at FAA air traffic facilities (including FAA contract towers) has been consistently on the decline across all categories since 2000.

In 2010, there were 14.86 million itinerant general aviation operations. This represented an average annual decline of 4.2 percent since 2000, when there were 22.84 million itinerant operations. Growth is forecast to return in 2011, and by 2031, 18.39 million itinerant operations are forecast. This is an average annual growth rate of 1.0 percent from 2010 through 2031.

Local operations have followed a similar trend, declining by 4.2 percent annually from 2000-2010. Growth is forecast to return in 2011, and through 2031 the annual growth rate is forecast at 1.0 percent. In 2010, there were 14.86 million local operations and by 2031, it is forecast there will be 18.39 million operations.

Air taxi operations have also seen a decline from 2000, when there were 10.76 million operations. In 2010, this figure was estimated at 9.41 million. The number of air taxi operations is forecast to reverse trend in 2011, exceeding year 2000 levels in 2018 and ultimately reaching 13.25 million in 2031 for an overall annual growth rate of 1.6 percent.

AVIATION FORECAST METHODOLOGY

The development of aviation forecasts proceeds through both analytical and judgmental processes. A series of mathematical relationships is tested to establish statistical logic and rationale for projected growth. However, the judgment of the forecast analyst, based upon professional experience, knowledge of the aviation industry, and assessment of the local situation, is important in the final determination of the preferred forecast.

Beyond five years, the predictive reliability of the forecasts can diminish. Therefore, it is prudent for the airport to update the forecasts, reassess the assumptions originally made, and revise the forecasts based on the current airport and industry conditions. Facility and financial planning usually require at least a 10-year preview, since it often takes several years to complete a major facility development program. However, it is important to use forecasts which do not overestimate revenue-generating capabilities or understate demand for facilities needed to meet public (user) needs.

A wide range of factors are known to influence the aviation industry and can have significant impacts on the extent and nature of activity occurring in both the local and national markets. Technological advances in aviation have historically altered and will continue to change the growth rates in aviation demand over time. A recent example is the substantial growth in the production and delivery of business jet aircraft, which resulted in a growth rate that far exceeded expectations. Such changes are difficult to predict, but over time, reasonable growth trends can be identified. Using a broad spectrum of demographic, economic, and industry data, forecasts for Corvallis Municipal Airport have been developed. Several standard statistical methods have been employed to generate various projections of aviation demand.

Trend series projections are probably the simplest and most familiar of the forecasting techniques. By fitting growth curves to historical demand data and then extending them into the future, a basic trend line projection is produced. A basic assumption of this technique is that outside factors will continue to affect aviation demand in much the same manner as in the past. As broad as this assumption may be, the trend line projection does serve as a reliable benchmark for comparing other projections.

Correlation analysis provides a measure of a direct relationship between two separate sets of historic data. Should there be a reasonable correlation between the data, further evaluation using regression analysis may be employed.

Regression analysis measures the statistical relationship between dependent and independent variables, yielding a "correlation coefficient." The correlation coefficient (Pearson's "r") measures the association between changes in a dependent variable and independent variable(s). If the r-squared (r^2) value (coefficient determination) is greater than 0.90, it indicates good predictive reliability. A value below 0.90 may be used with the understanding that the predictive reliability is lower.

Historical growth analysis is a simple forecasting method in which the historical average annual growth rate is identified then extended out to forecast years. This analysis method assumes that factors that impacted growth in the past will continue into the future.

Market share analysis involves a historical review of airport activity as a percentage, or share, of a larger regional, state, or national aviation market. A historical market share trend is determined providing an expected market share for the future. These shares are then multiplied by the forecasts of the larger geographical area to produce a market share projection. This method has the same limitations as trend line projections, but can provide a useful check on the validity of other forecasting techniques.

Utilizing these statistical methods, available existing forecasts, and analyst expertise, forecasts of aviation demand for Corvallis Municipal Airport have been developed. The remainder of this chapter presents the aviation demand forecasts and includes activity in two broad categories: based aircraft and annual operations.

GENERAL AVIATION FORECASTS

Several aviation demand indicators must be forecast to determine the future needs of the airport. As a general aviation airport, the most important demand indicators are based aircraft and operations. The following sections will present forecasts of these and other demand indicators following guidelines from the FAA and accepted statistical methods. It should be noted that for many of the demand indicators, several forecasting methods are utilized in order to create a planning envelope. From there, a single forecast is selected based on the reliability of the statistical method employed and upon the judgment of the forecast analyst.

HISTORICAL AIRCRAFT OWNERSHIP

The number of based aircraft is the most basic indicator of general aviation demand. Historically, airports have not been required to track based aircraft. Only recently has the FAA begun to request based aircraft counts, and this system is still being modified. Since a reliable and accurate historical based aircraft count is not available for Corvallis Municipal Airport, an examination of local aircraft ownership has been undertaken.

Any serviceable aircraft is required to be registered with the FAA, and an N-number is assigned. The FAA maintains a database of registered aircraft which includes the resident location by county for each certificated aircraft in the United States. An initial analysis of the history of registered aircraft in Benton and Linn Counties was conducted to obtain an understanding of local aviation ownership trends. **Table 2D** presents the history of registered aircraft in these two counties.

TABLE 2D
Registered Aircraft in Benton and Linn Counties

Year	Benton	Linn	Total
1994	149	265	414
1995	159	288	447
1996	155	301	456
1997	161	327	488
1998	161	324	485
1999	156	322	478
2000	165	328	493
2001	173	273	446
2002	173	275	448
2003	178	277	455
2004	183	281	464
2005	183	291	474
2006	188	283	471
2007	191	295	486
2008	194	294	488
2009	194	313	507
2010	194	313	507
2011	192	310	502
AAGR	1.50%	0.93%	1.14%

AAGR: Average Annual Growth Rate
Source: FAA Aircraft Registry Database; FAA Census of U.S. Civil Aircraft

Since 1994, both Benton and Linn Counties have seen an increase in the number of registered aircraft. Benton County has added 43 aircraft, while Linn County has added 45. Of the two counties, Benton County has an annual growth rate of 1.5 percent, while Linn County has had a growth rate of 0.93 percent. Combined, 88 new aircraft have been registered in the two counties between 1994 and 2011.

REGISTERED AIRCRAFT FORECASTS

Now that the history of aircraft ownership in both counties, representing the approximate airport service area, has been established, projections of future ownership, as defined by registered aircraft, can be made. A multitude of statistical methods has been employed to forecast registered aircraft growth.

Regression Analysis

Two regression techniques were utilized to develop forecasts of registered aircraft. These include a simple time-series analysis as well as regression analyses comparing service area registered aircraft with associated socioeconomic factors. The results of these methods are presented in **Table 2E**.

TABLE 2E
Two-County Service Area Analytical Analysis
Time-Series and Regression

		FORECAST		
	r^2	2017	2022	2032
TIME SERIES				
Year - Time Series	0.384	516	531	561
REGRESSION VARIABLES				
Year, Active Aircraft, Pop., Emp., PCPI	0.684	487	487	505
Year, Active Aircraft, Pop., PCPI	0.681	491	493	513
Active Aircraft, Pop., Emp., PCPI	0.672	495	496	514
Active Aircraft, Pop., PCPI	0.670	498	501	520
Year, Active Aircraft, Emp., PCPI	0.663	497	499	516
Year, Active Aircraft, PCPI	0.662	498	501	519
Year, Active Aircraft, Pop., Emp.	0.662	479	479	501
Year, Active Aircraft, Pop.	0.655	484	487	512
Active Aircraft, Emp., PCPI	0.644	491	494	513
Active Aircraft, PCPI	0.637	483	483	500
Year, Pop., Emp., PCPI	0.535	517	531	561
Year, Pop., Emp.	0.531	513	527	557
Pop., Emp., PCPI	0.525	524	540	568
Year, Emp., PCPI	0.518	525	541	570
Emp., PCPI	0.508	520	536	566
Active Aircraft, Pop., Emp.	0.503	501	510	539
Active Aircraft Pop.	0.490	507	521	554
Year, Pop., PCPI	0.472	512	524	550
Year, Pop.	0.469	516	528	553
Year, Active Aircraft, Emp.	0.459	498	509	542
Year, Active Aircraft	0.459	497	509	541
Active Aircraft, Emp.	0.457	496	508	540
Pop., PCPI	0.456	521	534	559
Active Aircraft	0.456	492	502	534
Pop., Emp.	0.454	518	534	568
Pop.	0.440	519	533	562
Year. PCPI	0.429	525	538	562
Year, Emp.	0.424	513	531	566
Emp.	0.422	511	529	565
PCPI	0.156	486	496	518
Average	**0.522**	**504**	**514**	**540**

PCPI: Per Capita Personal Income ($2005)
Source: Coffman Associates Analysis

The first statistical measure presented is the time-series analysis. A time-series is a sequence of data points measured at successive times spaced at uniform time intervals. Time-series forecasting is the use of a statistical model to forecast future events based on known past events: to predict data points before they are measured. The time-series presented in the table considers the yearly aircraft registrations for the two-county area from 1994 to 2010. The plotted line is then continued into the future; in this case, to the year 2031. This analysis results in registered aircraft increasing from 507 in 2010 to 516 in 2017, 531 in 2022, and 561 in 2032.

A measure of the statistical reliability of the forecast is Pearson's "r." When r^2 = 0.90 percent or higher, the statistical reliability is high. The time series projection results in an r^2 value of 0.38 percent. The statistical reliability of the time-series forecast is limited.

Next, a series of single and multiple variable correlation analyses were run to examine the relationship between the historic two-county registered aircraft and up to four independent variables. The independent variables considered were U.S. active general aviation aircraft, population, employment, and income (as measured by per capita personal income). All of the regression analyses resulted in an r^2 value below 0.90. Therefore, the statistical reliability of the analytical techniques employed is low. As a result, additional forecasting techniques are employed.

Historical Growth Projection

From 1994 to 2011, registered aircraft in the two-county region grew from 414 to 502, for an average annual growth rate of 1.14 percent. By extrapolating this growth through 2031, a forecast can be made. The result is 537 registered aircraft in 2017, 569 in 2022, and 637 in 2032.

Market Share Projections

Two market share projections have been developed, one that compares historical population to registered aircraft and one that compares the U.S. active general aviation aircraft fleet to historical registered aircraft, both utilizing the two-county airport service area. Utilizing population, two forecasts were developed. The first considers the ratio of registered aircraft to every 1,000 people in the two counties. As of 2011, there were 2.4867 aircraft per 1,000 people. By maintaining this ratio as a constant, by 2032, 581 registered aircraft are forecast, as shown in **Exhibit 2B**. (The exhibit also shows the other forecasting methods utilized.)

Typically, the ratio of population to U.S. active aircraft declines as population increases, meaning there is not typically a one-to-one correlation between population growth and registered aircraft. The two counties combined have actually gone against this trend, maintaining and even increasing the number of registered aircraft as a share of the population.

The next market share forecast utilizing population and registered aircraft considers an increasing market share scenario, one that is more reflective of the historical trend. From 2001 to 2010, the ratio increased from 2.4537 to 2.4867 registered aircraft per 1,000 people. By extrapolating the difference through 2032, a forecast is developed. This results in a

2032 forecast of 596 registered aircraft in the two counties.

The second set of market share forecasts considers the relationship between historic registered aircraft and the U.S. active general aviation fleet. The first considers the two-county region maintaining a constant market share (0.2236 percent) of U.S. active aircraft. This forecast results in 611 registered aircraft by 2032.

The next market share forecast utilizing U.S. active aircraft considers an increasing share. In 2001, the two counties represented 0.2109 percent of the national general aviation fleet. By 2011, this ratio had increased to 0.2236 percent. Once again, the increase in market share from 2001 to 2010 was extrapolated out to the long term planning year of 2032. This results in a 2032 forecast of 678 registered aircraft.

Selected Registered Aircraft Forecast

The forecasts of registered aircraft presented consider the major factors that can influence aircraft ownership in the two-county region. Local socioeconomic measures such as population, employment, and income have also been considered. Additional population measures are analyzed in the market share forecasts. Historical growth trends have also been considered, and national aircraft ownership is also considered based on the FAA forecasts.

The five different forecasts of registered aircraft present a reasonable planning envelope. There does not appear to be any obvious outliers in the results. The selected forecast represents an average of the five different forecasts generated for this analysis. By 2017, it is forecast there will be 528 registered aircraft in the two-county region. In 2022, there are 555 registered aircraft forecast and by 2032, it is forecast that there will be 620 registered aircraft. With an established registered aircraft forecast, a forecast of future based aircraft at Corvallis Municipal Airport can be made. **Table 2F** presents the registered aircraft forecasts in tabular format, and **Exhibit 2B** is a graphic presentation of registered aircraft.

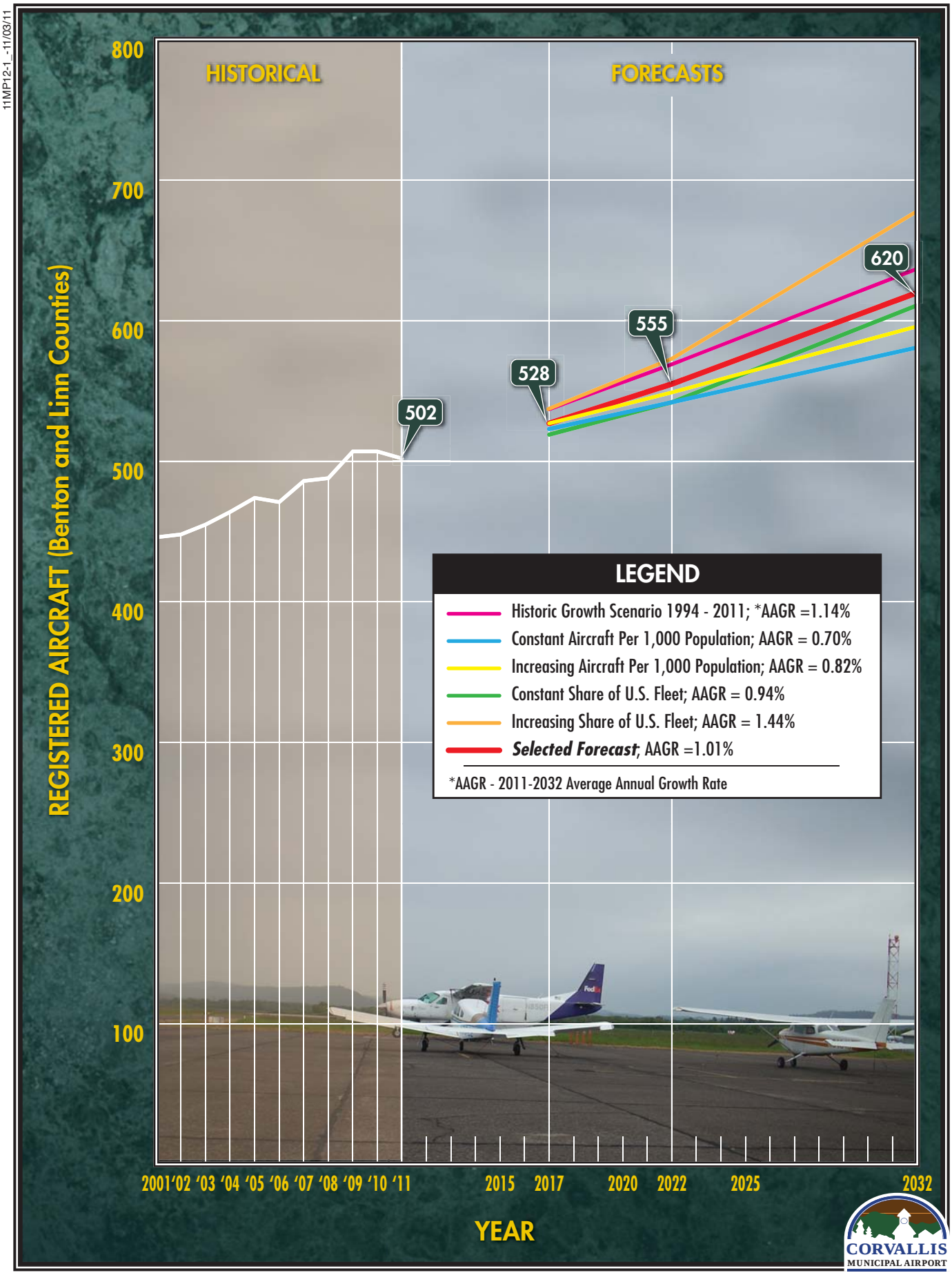


Exhibit 2B
TWO-COUNTY REGISTERED
AIRCRAFT FORECAST

TABLE 2F
Two-County County Registered Aircraft Forecast

Year	Two-County Registrations[1]	U.S. Active Aircraft[2]	Percent of U.S. Active Aircraft	Two-County Population[3]	Aircraft Per 1,000 Population
2001	446	211,446	0.2109%	181,769	2.4537
2002	448	211,244	0.2121%	184,267	2.4313
2003	455	209,606	0.2171%	185,509	2.4527
2004	464	219,319	0.2116%	185,843	2.4967
2005	474	224,350	0.2113%	187,671	2.5257
2006	471	221,939	0.2122%	191,068	2.4651
2007	486	231,606	0.2098%	194,677	2.4964
2008	488	228,668	0.2134%	197,144	2.4753
2009	507	223,920	0.2264%	199,189	2.5453
2010	507	224,172	0.2262%	200,532	2.5283
2011	502	224,475	0.2236%	201,877	2.4867
Historic Growth Scenario 1994-2010 (AAGR = 1.14%)					
2017	537	232,205	0.2314%	210,447	2.5533
2022	569	242,425	0.2346%	217,998	2.6086
2032	637	273,375	0.2330%	233,575	2.7269
Constant Aircraft Per 1,000 Population (AAGR= 0.70%)					
2017	523	232,205	0.2254%	210,447	2.4867
2022	542	242,425	0.2236%	217,998	2.4867
2032	581	273,375	0.2125%	233,575	2.4867
Increasing Aircraft Per 1,000 Population (AAGR = 0.82%)					
2017	527	232,205	0.2270%	210,447	2.5047
2022	549	242,425	0.2266%	217,998	2.5197
2032	596	273,375	0.2178%	233,575	2.5497
Constant Share of U.S. Fleet (AAGR = 0.94%)					
2017	519	232,205	0.2236%	210,447	2.4675
2022	542	242,425	0.2236%	217,998	2.4869
2032	611	273,375	0.2236%	233,575	2.6174
Increasing Share of U.S. Fleet (AAGR = 1.44%)					
2017	535	232,205	0.2306%	210,447	2.5440
2022	573	242,425	0.2363%	217,998	2.6282
2032	678	273,375	0.2479%	233,575	2.9013
Selected Forecast - Average (AAGR = 1.01%)					
2017	528	232,205	0.2276%	210,447	2.5112
2022	555	242,425	0.2289%	217,998	2.5460
2032	620	273,375	0.2270%	233,575	2.6564

[1]FAA Aircraft Registration Database
[2]FAA Aerospace Forecasts Fiscal Years 2011-2031
[3]Woods & Poole Economics 2011

Source: Coffman Associates analysis.

Registered Aircraft Distribution

As can be seen in **Table 2G**, in 1994 there were 149 registered aircraft in Benton County and 265 in Linn County. By 2011, there were 192 registered aircraft in Benton County and 310 in Linn County. As a percent of the two-county total, Benton County has increased its market share from approximately 35.99 percent to 38.25 percent. Linn County, conversely, has realized a decline in market share from 64.01 percent to 61.75 percent.

TABLE 2G Registered Aircraft Distribution Benton and Linn Counties			
Year/%	**Benton**	**Linn**	**Total Two Counties**
HISTORIC DISTRIBUTION			
1994 Percent	149 35.99%	265 64.01%	414 100.00%
2011 Percent	192 38.25%	310 61.75%	502 100.00%
Total Change (1994-2011)	43	45	88
Total Change (1994-2011)	2.26%	-2.26%	21.26%
FORECAST DISTRIBUTION			
2017 Trend Percent	206 39.04%	322 60.96%	528 100.00%
2022 Trend Percent	220 39.71%	335 60.29%	555 100.00%
2032 Trend Percent	255 41.03%	366 58.97%	620 100.00%
Total Change (2011-2032)	63	56	118
Total Change (2011-2032)	2.79%	-2.79%	23.60%

Source: Coffman Associates analysis

In the bottom half of the table a forecast of the future distribution of registered aircraft between the two counties has been developed. As can be seen, Benton County is forecast to have 63 new aircraft registrations between 2011 and 2032, while Linn County is forecast to have 56 new registered aircraft.

BASED AIRCRAFT FORECAST

The based aircraft forecast for Corvallis Municipal Airport is a function of the registered aircraft forecast completed in the previous section. In the registered aircraft forecast, socioeconomic elements such as population, employment, income, and national aircraft forecasts from the FAA were utilized. Several market share forecasts of registered aircraft were presented which provided a planning envelope. The selected registered aircraft forecast was an average of the forecasting techniques.

The FAA has recently requested that airports provide detailed information regarding based aircraft at all NPIAS airports. This task has been completed by the airport administration for Corvallis Municipal Airport. There are a total of 156 aircraft currently based at the airport. Based on the mailing address or the registration address, whichever is closest to Corvallis, a determination of the distribution of based aircraft has been made. Of the based aircraft, 109 are from Benton County, 13 are from Linn County, 16 are from other places in Oregon, and 18 are from out of state. **Table 2H** shows the breakdown of based aircraft owners.

Approximately 70 percent of the based aircraft at Corvallis Municipal Airport are registered or have a primary billing address in Benton County. Approximately eight percent of the based aircraft have a primary address in Linn County. Since a portion of Linn County is considered within the primary airport service area,

the distribution of registered aircraft for both counties should be considered.

TABLE 2H Location of Based Aircraft Owners Corvallis Municipal Airport	
Benton County	
Corvallis	99
Monroe	2
Philomath	8
Subtotal	109
Linn County	
Albany	11
Harrisburg	1
Halsey	1
Subtotal	13
Total Two Counties	122
Other Oregon	16
Out of State	18
TOTAL BASED AIRCRAFT	**156**
Benton County % of Total	70%
Linn County % of total	8%

In years past HTSI has had a significant presence at Corvallis Municipal Airport. They have leased two of the larger hangars at the airport and based as many as 20 helicopters of various types. Due to business circumstances, HTSI is in the process of relocating their operations to Aurora State Airport. Most of the helicopters have been relocated by this writing (December 2011) and they anticipate completing the move by September 2012. As a result of this move, the existing HTSI helicopters and operations are not considered in the baseline forecast calculations.

Two market share forecasts for based aircraft have been developed and are presented in **Table 2J**. The first market share forecast considers the airport maintaining its 2011 share of the two-county registered aircraft (31.08 percent). This forecast results in 164 based aircraft in 2017, 172 in 2022, and 193 in 2032. This percent is nearly an average of the previous 10 years' market share for the airport. This forecast results in the addition of 37 new based aircraft over the next 21 years and an average annual growth rate of 1.05 percent.

The second market share forecast utilizes the information regarding the distribution of registered aircraft presented in **Table 2J** (Increasing Share). By calculating that 70 percent of the Benton County registered aircraft will base at the airport along with eight percent of the Linn County registrations, a forecast emerges. In 2017, 170 based aircraft are forecast, in 2022, 181 based aircraft are forecast, and in 2032, a total of 207 based aircraft are forecast. This is an annual average growth rate of 1.37 percent.

The selected forecast is an average of the two market share forecasts presented. The subsequent chapters of this Master Plan will utilize the selected forecast of 167 based aircraft by 2017, 177 based aircraft by 2022, and 200 based aircraft by 2032.

TABLE 2J
Based Aircraft Forecasts
Corvallis Municipal Airport

Year	Two-County Registered Aircraft	Percent Based at CVO	Number Based at CVO*
2002	448	31.70%	142
2003	455	31.65%	144
2004	464	30.60%	142
2005	474	30.38%	144
2006	471	31.21%	147
2007	486	30.66%	149
2008	488	31.15%	152
2009	507	30.37%	154
2010	507	30.77%	156
2011	502	31.08%	156
Average Annual Growth Rate 2002-2011:			1.05%
Constant Share of Registered Aircraft			
2017	528	31.08%	164
2022	555	31.08%	172
2032	620	31.08%	193
Average Annual Growth Rate 2011-2032:			1.01%
Increasing Share of Registered Aircraft			
2017	528	32.21%	170
2022	555	32.62%	181
2032	620	33.44%	207
Average Annual Growth Rate 2011-2032:			1.37%
Selected Forecast - Average			
2017	528	31.64%	167
2022	555	31.85%	177
2032	620	32.26%	200
Average Annual Growth Rate 2010-2030:			1.19%

*Historical based aircraft interpolated from 2007 OAP; 2010 figure is actual count.
Source: Coffman Associates Analysis

Comparative Based Aircraft Forecasts

There are several forecasts of based aircraft for Corvallis Municipal Airport that were completed in previous studies and reports. The first to be considered is the FAA *Terminal Area Forecast*. The current TAF estimates there are 140 based aircraft at the airport in 2011. The TAF shows a forecast growth rate of 1.28 percent annually.

The next comparative forecast is from the previous Airport Master Plan, which estimated 174 based aircraft in 2011. The 2001 Master Plan had a long term forecast year of 2020, so future years have been extrapolated based on an annual growth rate of 1.17 percent.

The Oregon Aviation Plan – 2007 (OAP) had a base year of 2005 and estimated that there were 144 based aircraft at the time. The OAP 2007 forecast an annual growth rate of 1.10 percent. The last year of the OAP forecast was 2025, so future years have been extrapolated to the plan years of this Master Plan.

As a point of comparison, the annual growth rate of the TAF (1.28 percent) was applied to the actual 2011 based aircraft

figure of 156. With this adjustment, the long term forecast results in 204 based aircraft. The selected forecast of based aircraft for use in this Airport Master Plan, as well as the comparative forecasts, is summarized in **Table 2K**.

TABLE 2K
Based Aircraft Forecast Summary
Corvallis Municipal Airport

	2011	2017	2022	2032	AAGR 2011-2032
Comparison Projections*					
2010 FAA Terminal Area Forecast	140	150	162	183	1.28%
2001 Master Plan	174	186	198	222	1.17%
2007 Oregon Aviation Plan	159	170	179	200	1.10%
FAA TAF% with Adjusted Baseline	156	168	179	204	1.28%
SELECTED FORECAST	**156**	**167**	**177**	**200**	**1.19%**

* Figures interpolated and extrapolated to plan years.

Source: Coffman Associates analysis

Based Aircraft Summary

A forecast of based aircraft has been presented. As of 2011, there are 156 based aircraft. By 2032, the long term planning period for this Master Plan, 200 based aircraft are estimated. The based aircraft forecasts have been compared with several other existing forecasts. These forecasts assume that as demand dictates more aircraft storage will be made available. If the city or private developers do not construct new facilities, growth could be slowed.

The Master Plan will consider the need for facilities to accommodate the addition of 44 based aircraft over the next 21 years. **Exhibit 2C** shows the based aircraft forecast scenarios and the selected forecast.

BASED AIRCRAFT
FLEET MIX PROJECTIONS

Forecasting the aircraft fleet mix expected to utilize the airport is necessary to properly plan facilities that will best serve the level and type of activity occurring at the airport. As detailed previously, the growth areas in the general aviation fleet nationally is in turboprop and jet aircraft, as well as helicopters. Single engine piston-powered aircraft are forecast to grow slightly, while multi-engine piston aircraft are forecast to decrease slightly. Growth within each based aircraft category at the airport has been determined, in part, by comparison with national projections and consideration of local economic conditions.

There are 156 aircraft based at the airport in 2011. Of this total, 135 are single engine piston powered aircraft, 11 are multi-engine piston aircraft, three are turboprops, five are helicopters, and two are jets. The business jet is a Cessna Citation CJ1 Model 525; the other jet is a Spanish military fighter jet.

Table 2L presents the forecast fleet mix for the 20-year planning horizon of the Master Plan. Single engine piston-powered aircraft will continue to account for the vast majority of based aircraft at the airport. Multi-engine piston aircraft are forecast to remain fairly steady in the next few years then decline in the long

term. Turboprops are forecast to increase from three to seven by 2032. Jet powered aircraft are forecast to grow from two currently to 10 by the long term. Helicopters are forecast to grow from five currently to 11 in the long term.

TABLE 2L
Based Aircraft Fleet Mix
Corvallis Municipal Airport

Aircraft Type	2011	Percent	2017	Percent	2022	Percent	2032	Percent
Single Engine Piston	135	86.54%	141	84.45%	147	83.03%	163	81.51%
Multi-Engine Piston	11	7.05%	11	6.58%	10	5.66%	9	4.50%
Turboprop	3	1.92%	4	2.39%	5	2.83%	7	3.50%
Jet	2	1.28%	4	2.39%	6	3.39%	10	5.00%
Helicopters	5	3.21%	7	4.19%	9	5.09%	11	5.50%
Total	**156**	**100.00%**	**167**	**100.00%**	**177**	**100.00%**	**200**	**100.00%**

Source: Coffman Associates analysis of FAA Registered Aircraft Database

ANNUAL OPERATIONS

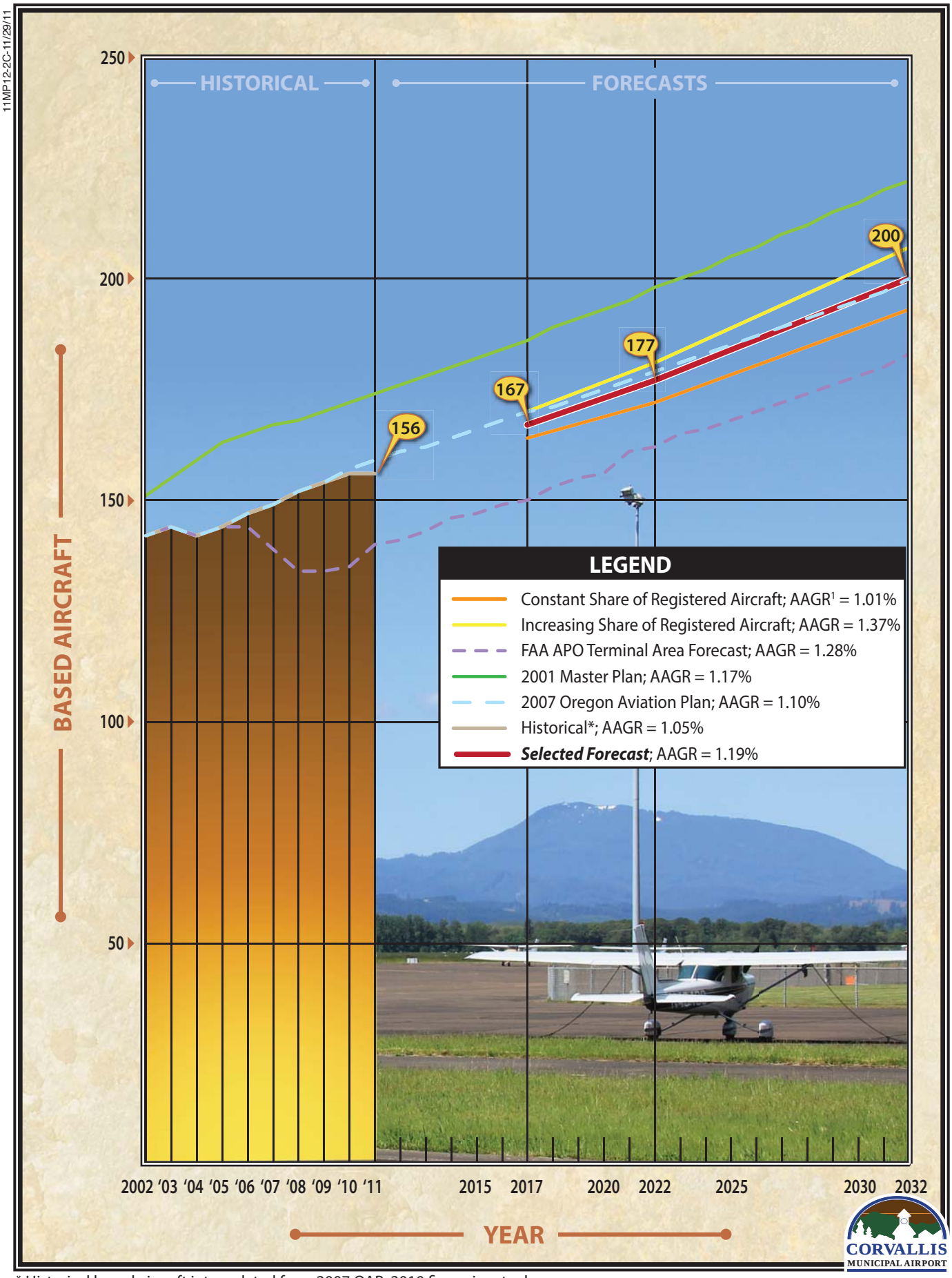
Airport operations can be characterized as local or itinerant. A local operation is a takeoff or landing performed by an aircraft that operates within sight of the airport or which executes simulated approaches or touch-and-go operations at the airport. Itinerant operations are those performed by aircraft with a specific origin or destination away from the airport. Generally, local operations are characterized by training operations.

Operations at an airport are further classified as general aviation, air taxi, air carrier, or military. Air taxi is generally considered on-demand service that includes charter and fractional activity. Operations by the air cargo operators and by the air ambulance helicopter are considered air taxi and are itinerant in nature. Air carrier activity is scheduled passenger operations, which is not currently or forecast to be available at Corvallis Municipal Airport. Military activity does occur at general aviation airports and can include both local and itinerant. Military activity at Corvallis Municipal Airport is minimal, as documented by the airport administration. Typically, itinerant operations increase with business and commercial use as business aircraft are used primarily to transport people from one location to another. The FAA estimates that 50 percent of the general aviation activity at the airport is itinerant in nature.

Existing Operations Forecasts

Corvallis Municipal Airport is a non-towered facility which means that actual operations counts are not available. Therefore, estimates must be made based on interviews with airport operators and management and from historical documentation and studies. **Table 2M** presents three sets of total operations forecasts obtained from existing sources. Each of the datasets have been interpolated and extrapolated to the plan years of this master plan.

The oldest operational forecast examined is from the 2001 Airport Master Plan. The history and base year (1999) for this forecast utilized the FAA TAF. The long term forecast year is 2020. These forecasts were extrapolated to the plan years of this forecasting effort.



* Historical based aircraft interpolated from 2007 OAP; 2010 figure is actual
[1] 2011-2032 Average Annual Growth Rate
Source: Coffman Associates Analysis

Exhibit 2C
BASED AIRCRAFT FORECASTS

TABLE 2M
Existing Total Operations Forecasts
Corvallis Municipal Airport

Year	2001 MP[1]	2007 OAP[2]	2010 TAF[3]
2011	121,579	125,963	122,050
2017	133,408	141,409	139,925
2022	144,103	155,891	154,821
2032	168,136	189,458	186,341
AAGR 2011-2032	1.56%	1.96%	2.04%

[1]2001 Airport Master Plan - Interpolated and Extrapolated to Plan Years
[2]2007 Oregon Aviation Plan - Interpolated and Extrapolated to Plan Years
[3]TAF - FAA Terminal Area Forecast
AAGR: Average Annual Growth Rate

Source: Coffman Associates analysis.

The next operational forecast presented is from the OAP-2007. The OAP-2007 utilized a base year of 2005, as established in the FAA TAF. The last forecast year is 2025, so they were extrapolated to the plan years of this forecast.

The third operational forecast is the current (2010) FAA TAF. The TAF estimated there are more than 122,000 operations in 2011. By 2032, more than 186,000 operations are forecast.

Each of the operational forecasts shown in the table utilizes the FAA TAF as a baseline. By way of interviews with airport management, airport businesses, and by personal observation, there is consensus that the base year of each of the forecasts is inaccurate and inflated. For general aviation airports the FAA TAF forecast is simply a function of the previous year forecast meaning if the forecast starts with an incorrect figure then future data points will also be inaccurate. When more reliable forecasts are developed, the FAA can update the FAA TAF.

New General Aviation Operations Forecasts

An effort has been undertaken to develop new operational forecasts for Corvallis Municipal Airport. Several sources and methodologies that do not employ the FAA TAF as a baseline have been utilized to develop four new general aviation operations forecasts for the airport.

The first of the four new operations forecasts utilizes FAA Form 5010 for the baseline year (2011). The 5010 is another FAA source for individual airport information that provides an annual point-in-time baseline for operations but does not provide historical information. According to the 5010 for Corvallis Municipal Airport, there were 52,300 operations as of February 2011. A forecast has been developed utilizing this baseline data. The FAA forecasts that general aviation operations across the nation will increase by 1.00 percent through 2031. By applying this growth rate, a forecast emerges. By 2032, 64,545 operations are forecast for the airport.

FAA Order 5090.3C, *Field Formulation of the National Plan of Integrated Airport Systems*, suggests two methodologies for estimating operations at non-towered general aviation airports. The first is to apply the state wide forecast growth rate from the FAA TAF. In Oregon, general aviation operations are forecast to grow from approximately 1.41 million in 2011 to 1.92 million in 2032 for an average annual growth rate of 1.35 percent. The FAA Form 5010 base year of 52,300 operations was utilized and a long term general aviation operations figure of 69,311 results.

The second methodology from the *Field Formulation of the National Plan of Integrated Airport Systems* provides a general formula for estimating operations at non-towered general aviation airports utilizing based aircraft. For busy general aviation airports with more itinerant traffic such as Corvallis Municipal Airport, an estimate of 350 operations per based aircraft can be used as a guideline. This would result in a current year operations estimate of 54,600. By applying this factor to the forecast of based aircraft, a long term estimate of operations is 70,054. The average annual growth rate is 1.19 percent.

The last forecast utilizes a statistical regression model approved by the FAA to estimate operations at non-towered airports. The report entitled *Model for Estimating General Aviation Operations at Non-Towered Airports Using Towered and Non-Towered Airport Date (GRA, Inc. 2001)* presents the methodology and formula for the model. Independent variables used in the model include airport characteristics, demographics, and geographic features. The model was derived using a combined data set for small towered and non-towered GA airports and incorporates a dummy variable to distinguish the two airport types. Specifically, the model utilizes the following variables:

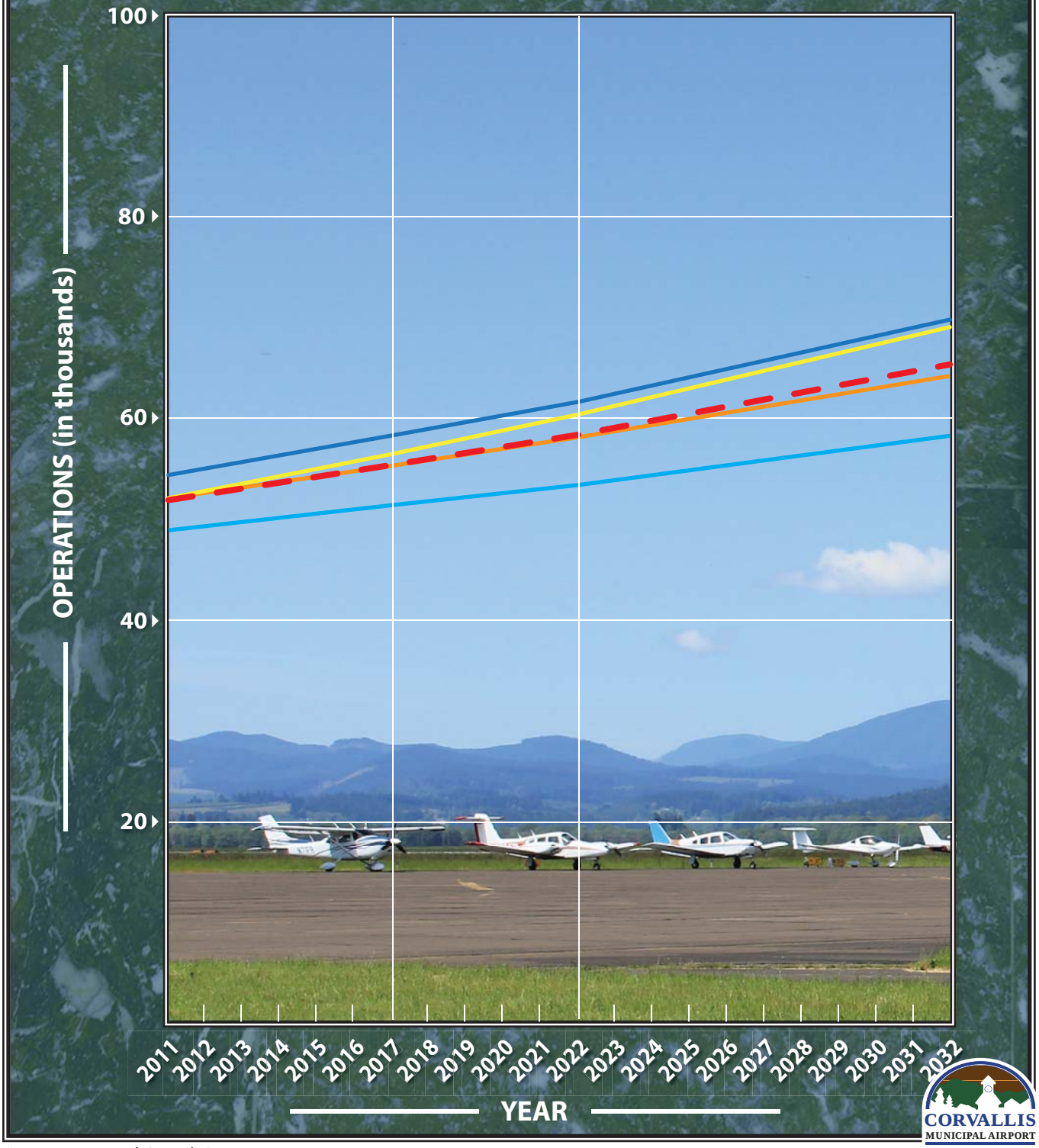
- Based aircraft;
- Percent of aircraft based at the airport among general aviation airports within 100 miles;
- Number of FAR 141 flight training schools at the airport;
- Population within 100 miles;
- Ratio of population within 25 miles and within 100 miles.

The model factors each of these variables so that both local and national factors are considered when estimating operations. The results of the model show an annual growth rate of 0.84 percent. **Table 2N** presents the calculations of operations for Corvallis Municipal Airport.

Table 2P presents a summary of the four new general aviation operations forecasts for Corvallis Municipal Airport. The selected forecast of operations is the average of the four new forecasts. In 2011, it is estimated that the airport experienced approximately 52,100 operations. By 2017, this total is anticipated to increase to 55,600 annual operations. By the long term planning period, a total of 65,600 operations are forecast. The new forecasts of general aviation operations are presented in **Exhibit 2D** along with the selected forecast.

11MP12-1_-11/03/11

LEGEND	AAGR*
FAA National General Aviation (GA) Forecast Growth Rate with FAA 5010 Baseline	1.00%
State TAF Growth Rate with FAA 5010 Baseline	1.35%
NPIAS Formula: 350 Operations Per Based Aircraft	1.19%
Model for Estimating GA Operations at Non-Towered Airports (FAA 2001)	0.84%
Selected Forecast	***1.10%***



* Average Annual Growth Rate
Source: Coffman Associates Analysis

Exhibit 2D
GENERAL AVIATION
OPERATIONS FORECASTS

TABLE 2N
Model for Estimating Operations at Non-Towered Airports

Function	Category	2011	2017	2022	2032
	775	775	775	775	775
+	241 (BA)	37,596	40,300	42,599	48,237
-	0.14 (BA2)	3,407	3,915	4,374	5,609
+	31,478 (% in 100 mi)	2,097	2,097	2,097	2,097
+	5,557 (VITFSnum)	11,114	11,114	11,114	11,114
+	0.001 (Pop100)	3,455	3,818	4,020	4,459
-	3,736 (WACAORAK)	3,736	3,736	3,736	3,736
+	12,121 (Pop25/100)	1,183	1,135	1,135	1,135
=	Rounded Total	49,100	51,600	53,600	58,500

Function Definitions

BA	Total Based Aircraft
BA2	Based Aircraft Squared
%in100mi	% of based aircraft among based aircraft at GA airports within 100 miles
VITFSnum	# of FAR 141 pilot schools on airport
Pop100	Population within 100 miles
WACAORAK	1 if CA, OR, WA, AK; 0 otherwise
Pop25/100	Ratio of Pop25 to Pop100 (proportion between 0 and 1)

Source: Model for Estimating General Aviation Operations at Non-Towered Airports (GRA, Inc. 2001)

TABLE 2P
New General Aviation Operations Forecasts
Corvallis Municipal Airport

Year	FAA National Growth Rate[1]	Statewide TAF Growth Rate[2]	NPIAS Formula[3]	Non-Towered Equation[4]	Selected Forecast
2011	52,300	52,300	54,600	49,100	52,100
2017	55,518	56,682	58,527	51,600	55,600
2022	58,349	60,613	61,866	53,600	58,600
2032	64,454	69,311	70,054	58,500	65,600
AAGR 2011-2032	1.00%	1.35%	1.19%	0.84%	1.10%

[1]FAA National GA Forecast Growth Rate with FAA 5010 Baseline
[2]State TAF Growth Rate with FAA 5010 Baseline
[3]NPIAS Formula: 350 Operations Per Based Aircraft
[4]Model for Estimating General Aviation Operations at Non-Towered Airports (FAA 2001)
AAGR: Average Annual Growth Rate

Source: Coffman Associates analysis

Air Taxi Operations

The air taxi category includes aircraft involved in on-demand passenger service (charter and fractional), small parcel transport (cargo), and air ambulance activity. This category of operations is regulated under FAR Part 135 and would include air ambulance, air cargo, and some on-demand/charter/fractional operations.

The FAA surveys general aviation and air taxi activity on an annual basis. The information obtained from the survey ena-

bles the FAA to monitor the general aviation fleet so that it can:

- Anticipate and meet demand for National Airspace facilities and services;
- Evaluate the impact of safety initiatives and regulatory changes;
- Build more accurate measures of the safety of the general aviation community.

The data collected are also used by other government agencies, the general aviation industry, trade associations, and private businesses to pinpoint safety problems and to form the basis for critical research and analysis of general aviation issues. This data is consolidated in the annual FAA Aerospace Forecasts. For air taxi operations, the FAA forecasts an annual growth rate of 1.6 percent between 2010 and 2031.

All existing estimates of air taxi operations utilize the FAA TAF for a baseline. The 2010 TAF indicated that air taxi operations represented 6.87 percent of total operations. Therefore, the baseline for this study is 6.87 percent of 52,100 operations, or 3,579. Following this methodology, a forecast of air taxi operations can also be developed and is presented in **Table 2Q**.

TABLE 2Q
Air Taxi Forecasts
Corvallis Municipal Airport

Year	Air Taxi Operations	CVO Itinerant Operations	Percent of CVO Itinerant Operations	U.S. Air Taxi Operations	Percent of US Air Taxi Ops
2011	3,579	26,050	13.74%	9,408,800	0.0380%
Constant Share of US Air Taxi Operations (AAGR = 1.67%)					
2017	4,031	27,800	14.50%	10,596,800	0.0380%
2022	4,358	29,300	14.88%	11,456,700	0.0380%
2032	5,069	32,800	15.45%	13,324,470	0.0380%
Constant Share of CVO Itinerant Operations (AAGR = 1.10%)					
2017	3,820	27,800	13.74%	10,596,800	0.0360%
2022	4,026	29,300	13.74%	11,456,700	0.0351%
2032	4,507	32,800	13.74%	13,324,470	0.0338%
Relative Percent of TAF Air Taxi to Forecast GA Operations (AAGR = 2.62%)					
2017	4,324	27,800	15.56%	10,596,800	0.0408%
2022	4,907	29,300	16.75%	11,456,700	0.0428%
2032	6,165	32,800	18.79%	13,324,470	0.0463%
Selected Forecast - Rounded Average (AAGR = 1.79%)					
2017	4,100	27,800	14.75%	10,596,800	0.0387%
2022	4,400	29,300	15.02%	11,456,700	0.0384%
2032	5,200	32,800	15.85%	13,324,470	0.0390%

AAGR = Annual Growth Rate
Sources: FAA TAF; FAA Aerospace Forecasts FY 2011-2031

Two market share projections of air taxi operations have also been developed. The first considers the airport maintaining a constant share of total air taxi operations in the U.S. as forecast by the FAA. The second considers the airport maintaining a constant share of its total itinerant operations as air taxi operations. Both of these are also presented in the table. The selected air taxi forecast is an average of the three forecasting methods. Air taxi operations will be considered in

addition to general aviation operations previously forecast.

Military Operations

At some general aviation airports, military operations can be common. Corvallis Municipal Airport does not experience regular military operations. The FAA TAF forecasts 900 itinerant military operations annually from 2010 through 2030. Forecasting military operations is complicated by the lack of actual operational data (primarily for national security reasons) and the fact that the mission for military posts can change quickly. Therefore, for planning purposes, this Master Plan will include 400 military itinerant operations for each of the plan years.

Total Operations Summary

Table 2R presents the selected operations forecast for Corvallis Municipal Airport. It is estimated that the airport experienced slightly more than 56,000 operations in 2011. A "planning envelope" was created by employing several forecasting methodologies for each category of activity at the airport. This included separate forecasts for general aviation, air taxi, and military activity. When combined, a forecast average annual growth rate of 1.14 percent emerged. This equates to 60,100 operations by 2017, 63,400 operations by 2022, and 71,200 operations by 2032.

TABLE 2R
Total Operations Forecast
Corvallis Municipal Airport

Year	General Aviation Ops (Local)	General Aviation Ops. (Itinerant)	Air-Taxi (Itinerant)	Military (Itinerant)	Total Operations
2011	26,050	26,050	3,579	400	56,079
2017	27,800	27,800	4,100	400	60,100
2022	29,300	29,300	4,400	400	63,400
2032	32,800	32,800	5,200	400	71,200
Average Annual Growth Rate: 1.14%					

Source: Coffman Associates analysis

OPERATIONS FLEET MIX

Estimating the number of operations by aircraft type helps to identify facility requirements and various environmental impacts. Operations by multi-engine, turboprop, and business jet aircraft are generally considered itinerant in nature.

Table 2S presents the forecast operations activity by aircraft type. General assumptions based on typical aircraft utilization have been made and are applied to the fleet mix at Corvallis Municipal Airport. Multi-engine piston activity is estimated at 200 operations per based aircraft, turboprop at 250 operations per based aircraft, jet activity at 300 operations per based aircraft, and helicopters at 600 operations per based aircraft. An adjustment has been made to account for the 800 annual air taxi operations conducted by the air ambulance helicopter. These operations estimates account for all activity by that aircraft type and are not estimates of the actual number of operations attributable to a particular based aircraft.

TABLE 2S
Fleet Mix Operations Forecast
Corvallis Municipal Airport

	2011	%	2017	%	2022	%	2032	%
Local Operations								
Piston	24,370	93.55%	25,280	90.94%	25,940	88.53%	28,600	87.20%
Helicopter	1,680	6.45%	2,520	9.06%	3,360	11.47%	4,200	12.80%
Total Local	26,050	100.00%	27,800	100.00%	29,300	100.00%	32,800	100.00%
Itinerant Operations								
Single Piston	23,254	77.44%	23,950	74.15%	24,530	71.94%	26,410	68.78%
Multi-Piston	2,200	7.33%	2,200	6.81%	2,000	5.87%	1,800	4.69%
Turboprop	1,287	4.29%	1,615	5.00%	1,910	5.60%	2,530	6.59%
Jet	1,674	5.57%	2,430	7.52%	3,120	9.15%	4,560	11.88%
Helicopters	1,615	5.38%	2,105	6.52%	2,540	7.45%	3,100	8.07%
Total Itinerant	30,029	100.00%	32,300	100.00%	34,100	100.00%	38,400	100.00%
Total Operations	56,079		60,100		63,400		71,200	

Source: Coffman Associates analysis

PEAKING OPERATIONS

Many aspects of facility planning relate to levels of peaking activity – times when the airport is busiest. For example, the appropriate size of a terminal building can be estimated by determining the number of people that could reasonably be expected to use the facility at a given time. The following planning definitions apply to the peak periods:

- **Peak Month** -- The calendar month when peak aircraft operations occur.
- **Design Day** -- The average day in the peak month.
- **Busy Day** -- The busy day of a typical week in the peak month.
- **Design Hour** -- The peak hour within the design day.

It is important to note that only the peak month is an absolute peak within a given year. All other peak periods will be exceeded at various times during the year. The peak period forecasts represent reasonable planning standards that can be applied without overbuilding or being too restrictive.

Without the availability of records from a tower, peak periods must be estimated. The forecast of peak month operations assumes approximately 12 percent of annual operations. This is typical for a general aviation airport that may have some seasonal changes to activity levels, such as is experienced in western Oregon.

The design day was then calculated by dividing the peak month operations by 30. The busy day has been estimated at 40 percent higher than the average day in the peak month and was calculated by multiplying the design day by 1.4. Design hour operations were calculated at 17.5 percent of design day operations. **Table 2T** summarizes the general aviation peak activity forecasts.

TABLE 2T
Peak Operations Forecast
Corvallis Municipal Airport

	2011	2017	2022	2032
Annual Operations	56,079	60,100	63,400	71,200
Peak Month (12%)	6,730	7,212	7,608	8,544
Busy Day	314	337	355	399
Design Day	224	240	254	285
Design Hour (17.5%)	39	42	44	50

Source: Coffman Associates analysis

ANNUAL INSTRUMENT APPROACHES

An instrument approach, as defined by the FAA, is "an approach to an airport with the intent to land by an aircraft in accordance with an Instrument Flight Rule (IFR) flight plan, when visibility is less than three miles and/or when the ceiling is at or below the minimum initial approach altitude." To qualify as an instrument approach, aircraft must land at the airport after following one of the published instrument approach procedures in less than visual conditions. Forecasts of annual instrument approaches (AIAs) provide guidance in determining an airport's requirements for navigational aid facilities such as an instrument landing system. It should be noted that practice or training approaches do not count as annual AIAs, nor do instrument approaches conducted in visual conditions.

During poor weather conditions, pilots are less likely to fly and rarely would perform training operations. As a result, an estimate of the total number of AIAs can be made based on a percent of itinerant operations regardless of the frequency of poor weather conditions. An estimate of two percent of itinerant operations is utilized to forecast AIAs at Corvallis Municipal Airport, as presented in **Table 2U**.

TABLE 2U
Annual Instrument Approach (AIAs) Projections
Corvallis Municipal Airport

	AIAs	Itinerant Operations	Ratio
2017	646	32,300	2.00%
2022	682	34,100	2.00%
2032	768	38,400	2.00%

Source: Coffman Associates analysis

In the future, Corvallis Municipal Airport will be increasingly utilized by more sophisticated turboprop and jet aircraft (as is the trend nationally). Also, the increased availability of low-cost navigational equipment could allow for smaller and less sophisticated aircraft to utilize instrument approaches. National trends indicate an increasing percentage of instrument approaches given the greater availability of approaches at airports with GPS and the availability of more cost-effective equipment.

SUMMARY

This chapter has outlined the various activity levels that might reasonably be anticipated over the next 21 years for Corvallis Municipal Airport. **Exhibit 2E** presents a summary of the aviation demand forecasts. The baseline year for forecast data is 2011. The forecasting effort extends 21 years to the year 2032.

Corvallis Municipal Airport is a general aviation facility as defined by the FAA. The primary runway, Runway 17-35, is 5,900 feet long and 150 feet wide and the crosswind runway, Runway 9-27, is 3,545 feet long and 75 feet wide. The airport provides several sophisticated instrument approaches, including an instrument landing system (ILS) that allows pilots to land even in poor visibility conditions to Runway 17.

General aviation activity often trends with national and local economies. The country was in a recessionary period from December 2007 through the third quarter of 2009 and has been slow to recover. Activity at both commercial service airports and general aviation airports has been down. The Corvallis Municipal Airport has, to date, weathered the economic downturn fairly well. The number of based aircraft has remained fairly steady. The most significant change is the scheduled departure of HTSI, the heavy helicopter operator, from the airport.

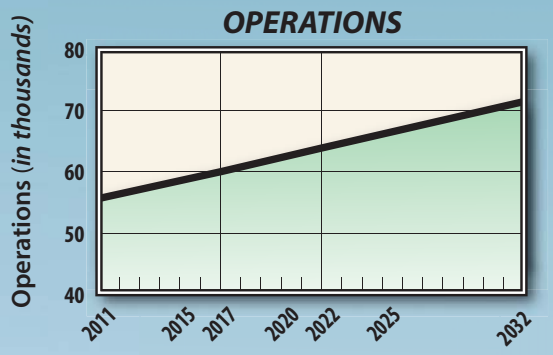
Forecasts of aviation activity, including based aircraft and operations, is key to determining future facility requirements. There are currently 156 aircraft based at the airport, and this is forecast to grow to 200 aircraft by 2032. It is estimated that the airport currently experiences approximately 56,079 annual operations. This is forecast to grow to approximately 71,200 operations annually by 2032.

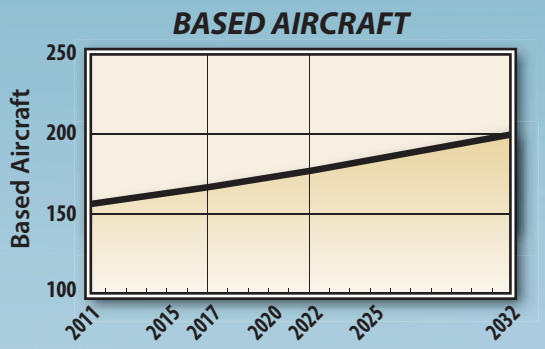
The fleet mix operations, or type and frequency of aircraft use, is important in determining facility requirements and environmental impacts. While single engine piston powered aircraft are expected to represent the majority of based aircraft, the long term forecast considers the possibility of four additional turboprop aircraft and growth in business jets from two currently to 10 by 2032.

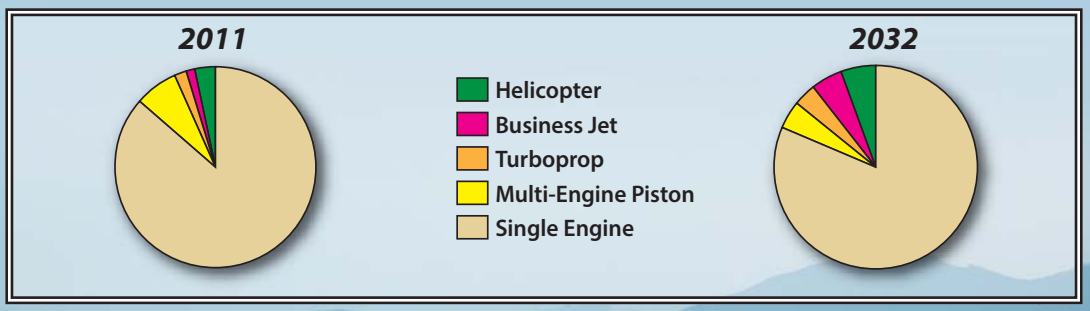
The next step in the Master Plan process is to use the forecasts to determine development needs for the airport through 2032. Chapter Three – Facility Requirements will address airside elements, such as safety areas, runways, taxiways, lighting, and navigational aids, as well as landside requirements, including hangars, aircraft aprons, and support services. As a general observation, the Corvallis Municipal Airport is well-positioned for growth into the future. The local economy is forecast to emerge from the recession soon. The remaining portions of the Master Plan will lay out how that growth can be accommodated in an orderly, efficient, and cost-effective manner.

11MP12-2E-11/30/11

	ACTUAL	FORECASTS		
	2011	2017	2022	2032
ANNUAL OPERATIONS				
General Aviation				
Itinerant	26,050	27,800	29,300	32,800
Local	26,050	27,800	29,300	32,800
Military				
Itinerant	400	400	400	400
Air Taxi	3,579	4,100	4,400	5,200
Total Itinerant	**30,029**	**32,300**	**34,100**	**38,400**
Total Local	**26,050**	**27,800**	**29,300**	**32,800**
Total Operations	***56,079***	***60,100***	***63,400***	***71,200***
BASED AIRCRAFT				
Single Engine Piston	135	141	147	163
Multi-Engine Piston	11	11	10	9
Turboprop	3	4	5	7
Business Jet	2	4	6	10
Helicopter	5	7	9	11
Total Based Aircraft	***156***	***167***	***177***	***200***







CORVALLIS MUNICIPAL AIRPORT

Exhibit 2E
FORECAST SUMMARY