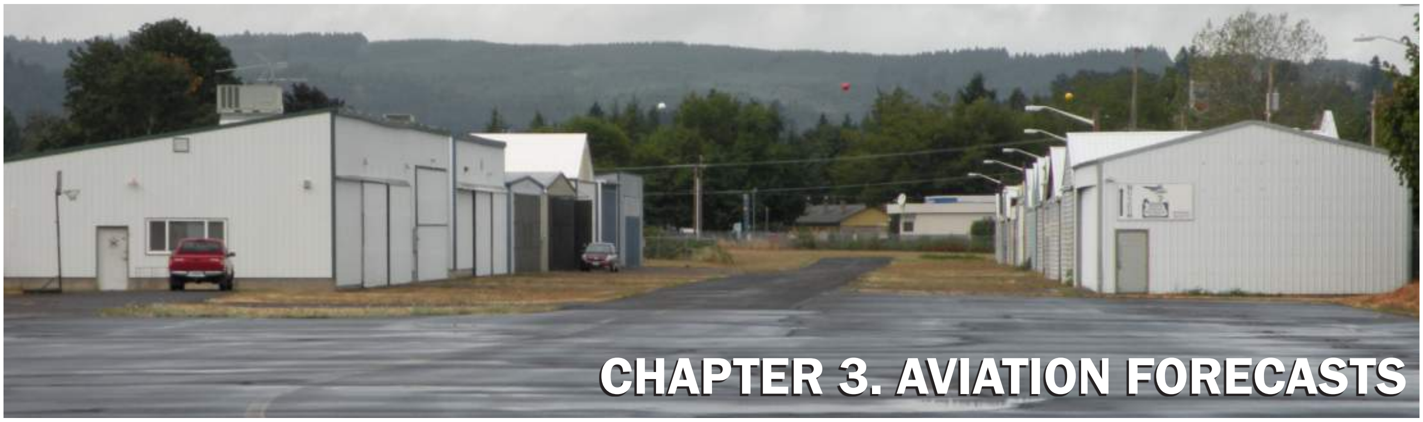


CHAPTER 3. AVIATION FORECASTS

3.1 INTRODUCTION

Aviation demand forecasts help determine the size and timing of needed airport improvements. This chapter indicates types and levels of aviation activity expected at Cottage Grove State (Airport) during a 20-year forecast period. Projections of Airport aviation activity were prepared for near-term (2022), mid-term (2027), and long-term (2037) planning period. These projections are generally unconstrained and assume that ODA has opportunity to develop the various facilities necessary to accommodate based aircraft and future operations.

The primary objective of a forecasting effort is to define the magnitude of change in aviation activity expected over time. Because of the cyclical nature of the economy, it is essentially impossible to predict with certainty year-to-year fluctuations in activity, especially when looking 20 years into the future. However, trends can be identified and used to study long-term growth potential. While a single line shown on a graph is often used to express anticipated growth, it is important to remember that actual growth may fluctuate above and below this projected line. Forecasts serve only as guidelines and planning must remain flexible to respond to unforeseen changes in aviation activity and resultant facility needs.

Aviation activity at general aviation airports like Cottage Grove State Airport is measured by the number of based aircraft and by the number of annual aircraft operations (takeoffs and landings). Forecasts for the following aviation activity parameters are presented in this chapter:

- **Based Aircraft**: Number and type of based aircraft help determine future aircraft hangar, tiedown apron, and auto parking facility requirements.
- **Aircraft Operations:** An operation is defined as either an aircraft landing or taking off. Forecasting aircraft operations data helps in analyzing runway capacity and determining runway, taxiway, and navigational aid requirements.
- **Critical Aircraft and Airport Reference Code**: The critical aircraft, with its airport reference code, determines airfield design requirements, such as runway / taxiway size and strength, as well as safety clearances around aircraft movement areas.

The FAA is responsible for reviewing and approving all aviation forecasts submitted to their agency in airport planning studies. The FAA reviews these forecasts with the objective of including them in its Terminal Area Forecasts (TAF) and the National Plan of Integrated Airport Systems (NPIAS), two important sources of forecasting data.

3.2 METHODOLOGY

This forecasting effort has developed realistic forecasts based on the latest available data that reflect the current conditions at the Airport. Supported with additional information in this study, the following methodology based on FAA guidance was utilized to ultimately provide an adequate justification for future airport planning and development proposals discussed later in the Airport Master Plan.

Identify Aviation Activity Parameters To Forecast

The first step in the forecasting process is to determine and select the aviation activity parameters to forecast. The parameters selected to forecast at general aviation airports are selected based on the level and type of aviation activity expected at the airport. For Cottage Grove State Airport, the forecasting effort is focused on based aircraft and aircraft operations.

Projecting operations is the most important activity forecast for airfield planning at general aviation airports. Understanding the existing aircraft operations at the Airport defines the level and type of aviation demand generated (as measured by aircraft operations). It is this demand that defines the runway and taxiway requirements.

Based aircraft activity is also an important activity that directly influences facilities at a general aviation airport. Based aircraft forecasts are utilized to determine the type and number of aircraft storage facilities and apron tiedowns needed throughout the forecast planning period.

Collect And Review Previous Airport Forecasts

After the aviation activity data to be forecast has been determined, the next step is to collect and evaluate previous forecast data developed from national, state, and local sources. The data collected should be current and relevant to the existing conditions for the airport as well as provide an overview of the national and regional aviation system.

Gather And Analyze Data

This step of the forecasting process expands on the previous two steps to insure that all relevant and pertinent data is being utilized for the forecasting process. Once the sources of forecast data have been determined and the data has been gathered, the next step in the forecasting process is to analyze the data to identify any trends or correlations in the data. It is also important to screen the data for reasonableness to determine if anomalies or errors in the data are present which could affect the outcome of the aviation forecasts. For general aviation airports like Cottage Grove State Airport, historical aviation data relevant to an airport (operations and based aircraft), FAA Aviation Forecasts like the TAF, other FAA and aviation industry forecasts, and socioeconomic data are recommended sources of data to be obtained for analysis.

Select Forecast Methods

The next step in preparing forecasts is to select the most appropriate method to develop the projections for the activities to be measured. A forecast for an airport can involve a number of different techniques. They include:

- Regression and Trend Analysis
- Share Analysis
- Exponential Smoothing
- Comparison with Other Airports
- Survey Techniques
- Cohort Analysis
- Choice and Distribution Models

While there are several acceptable techniques and procedures for forecasting aviation activity at a specific airport, as identified above, most forecasts at general aviation airports utilize basic techniques such as regression analysis or trend analysis.

Regression analysis is an econometric analysis that uses statistical methods to estimate the relationship between a dependent variable and one or more independent variables at a future point in time. Regression is most useful when forecasts of the independent variables are more readily available than the dependent variable to be forecasted. Most regression models for aviation demand at general aviation airports use gross economic measures like income, population, and employment.

Trend analysis is a method of projecting historic trends into the future. The trend analysis formula is similar to the regression analysis formula except time is the independent variable.

Apply Forecast Methods And Evaluate Results

After historical aviation activity and forecast data has been obtained and analyzed, appropriate forecast methodologies have been selected, the methods need to be applied in order to obtain the forecasts of aviation activity such as based aircraft and aircraft operations.

A useful way to evaluate the reasonableness of forecast results is to compare the data against historic trend rates or other relevant similar forecasts such as state system plans and FAA TAF forecasts.

Summarize And Document Results And Compare To FAA TAF

The next and final step in the forecast process is to summarize and document the results and compare the proposed preferred forecast to the FAA TAF. The planning forecast write-up should summarize each forecast element, explain the forecast methods used, highlight significant assumptions, clearly present the forecast results, and provide a brief evaluation of the forecast.

3.3 FORECAST GUIDANCE AND DATA SOURCES

A summary of data sources and forecasting guidance references used to prepare forecasts in this chapter are described here.

FAA Advisory Circular (AC) 150/5070-6B, Airport Master Plans

AC 150/5070-6B, Airport Master Plans, provides guidance for the preparation of airport master plans that range in size and function from small GA to large commercial service facilities. This AC contains the key guidance that explains steps required for development of master plans, including the preparation of aviation activity forecasts and which elements should be forecast.

Airport Cooperative Research Program Report (ACRP): Counting Aircraft Operations at Non-Towered Airports

Prepared for the ACRP, a research branch of the Transportation Research Board of the National Academies, this report provides methodologies used across the country to estimate operations at airports without an air traffic control tower, such as Cottage Grove State Airport.

ACRP Report: Airport Aviation Activity Forecasting

This document discusses methods and practices for aviation activity forecasting. This report identifies common aviation metrics, issues in data collection and preparation, and data sources.

Forecasting Aviation Activity by Airport

This document provides guidance for preparing airport activity forecasts. FAA also utilizes this guidance when developing the TAF.

FAA Terminal Area Forecasts (TAF)

The TAF is the official FAA forecast of aviation activity for US airports. It contains active airports in the NPIAS including FAA-towered airports, federal contract-towered airports, non-federal towered airports, and non-towered airports. Forecasts are prepared for major users of the National Airspace System including air carrier, air taxi / commuter, general aviation (GA), and military. Forecasts are prepared to meet the budget and planning needs of the FAA and provide information for use by state and local authorities, the aviation industry, and the public.

FAA Aerospace Forecasts, Fiscal Years 2017-2037

The FAA annually prepares this document to explain the current economic and aviation outlook, as well as macro level forecasts of aviation activity and the US aircraft fleet. The Fiscal years 2016-2037 report was released in March of 2017.

General Aviation Statistical Databook & Industry Outlook

The General Aviation Manufacturers Association (GAMA) publishes this document on an annual basis. The document contains the association's industry outlook for the coming year, as well as data on the GA fleet and flight activity, the US pilot population, airports, safety, international data, and forecast information. The report also contains the year-end shipments and billings for GA aircraft divided into four different segments: business jets, turboprops, piston engine airplanes, and helicopters.

Federal and State Data Sources

Historical and forecast socioeconomic data for the State of Oregon and Lane County was obtained from several sources including the US Census Bureau, the Bureau of Business and Economic Research, the US Bureau of Labor Statistics, and Portland State University.

Local Data Sources

Other sources of data, such as the Oregon Department of Aviation's Oregon Aviation Plan, Lane County Comprehensive Plans and economic development information for the county and region, were obtained and researched to understand local economic issues. Airport users and community organizations were also contacted through phone interviews and questionnaires to understand how the Airport is used and viewed by these groups.

3.4 TRENDS AFFECTING AVIATION

Trends in national, state, and local aviation activity can be correlated to the aviation activity at any particular GA airport. This section will assess these current trends and their possible influence on activity at the Airport.

3.4.1 National Trends and Forecasts

FAA publishes forecasts of aviation activity annually. Cottage Grove State Airport is part of an air transportation system and, as such, is subject to national and regional aviation trends. This means that the Airport is directly affected by trends impacting these larger systems. As a GA Airport, Cottage Grove State

Airport is mostly affected by trends in the GA segment of the industry. General Aviation refers to a wide range of flight activity and, by general definition, is all flight activity excluding commercial airline and military aircraft.

General Aviation in the US peaked in the 1970s, then experienced years of decline until growth returned in the 1990s. The growth in the 1990s was due not only to an expanding economy, but also to the General Aviation Revitalization Act (GARA) of 1994. GARA effectively protected most aircraft manufacturers and aircraft parts from liability for accidents involving products that are 18 years old or older (at the time of the accident), even if manufacturer negligence was a cause. Setting these limitations spurred production of single engine piston aircraft, as reduced product liability costs reduced the purchase price to a point that was more affordable. Single engine piston is the aircraft type that currently accounts for the majority of the nation's GA activity.

The number of Sport Aircraft is expected to grow at 4.1% over the next 20 years while the average annual hours flown for these aircraft is projected to grow at a higher rate of 4.6%.

The number of Turboprop Aircraft is expected to grow at 1.4% over the next 20 years while the average annual hours flown for these aircraft is projected to grow at a higher rate of 1.6%.

The number of Piston Single-Engine Aircraft is expected to shrink at -0.8% over the next 20 years and the average annual hours flown for these aircraft is also projected to decline at a slower rate of -0.6%.

The business aviation portion of GA grew rapidly in the 1990s and into the first part of the 21st century. Since 9/11, business aviation has benefited from the increased regulations and security processing required by airline travel. Additional imposed airline passenger and baggage security as well as reductions in air service, particularly to smaller communities, have stimulated business use of aircraft since the economic recovery. GA business aircraft ranges from small, single engine aircraft rentals to multiple aircraft corporate fleets supported by dedicated flight crews and mechanics. Airplanes used for business tend to be larger and faster than those typically chosen for personal use. Until 2008, business aviation grew rapidly as various chartering, leasing, time-sharing, fractional ownership, interchange agreements, partnerships, and management contracts emerged. Business aviation is predicted to show stronger growth than the personal and recreational aviation segments, as businesses avoid factors such as possible commercial airline flight delays, and security issues associated with airline travel.

General Aviation growth began to decline in 2008 and 2009, due primarily to the economic recession that began toward the end of 2007. Soaring fuel prices in mid-2008 only reinforced the decline. The recession dampened every aspect of GA, from flight training and aircraft production to the number of pilots and the hours aircraft were flown.

General Aviation aircraft are widely varied, although the majority of GA aircraft are piston-powered, fixed-wing airplanes. The FAA tracks individual aircraft in the fleet along with the number of hours flown by each aircraft type – common indicators of industry changes. Aircraft type is categorized by either body, fixed wing or rotorcraft, or engine type and number, piston or turbine. The source of historic numbers is the FAA GA and Air Taxi Activity Surveys. As the operational environment continues to evolve, the FAA Aerospace Forecast suggests that the timing and strength of a recovery in aviation demand remains highly uncertain, although the long-term outlook remains favorable due to growth in turbine aircraft.

3rd Class Medical Reform

In July 2016, as part of the FAA Extension, Safety and Security Act of 2016, third-class medical reform was signed in to law. The impacts of the new law are not yet certain. However, it is anticipated by many that the new law removing the third class medical requirement for private pilots may generate a boost in recreational flying opportunities and growth in GA and recreational flying overall.

Under the new provisions, pilots holding current driver's licenses and third-class medicals would never need to see an Airman Medical Examiner (AME) again. Instead, pilots would be required to visit their personal physician once every four years and make a notation in their logbook, as well as complete an online aeromedical test every two years and medically self-certify their fitness before each flight.

Pilots would be allowed to operate aircraft with up to six seats, up to 6,000 pounds (no limitations on horsepower, number of engines, or gear type) under day and night VFR and IFR with up to five passengers. Pilots cannot operate for compensation or hire, and are limited to altitudes of up to 18,000 feet msl and airspeeds up to 250 knots indicated airspeed.

National General Aviation Fleet

The FAA projects the number of all active GA aircraft will grow 0.1% annually over the next two decades. The more expensive and sophisticated turbine-powered fleet (including helicopters) will grow at an average of 1.9% annually over the next two decades. Of that fleet,turbine jets will see the strongest growth of 2.3% annually. In contrast, the piston-powered aircraft fleet is projected to decrease at -0.8% annually. The decline in piston fixed wing aircraft does not include the relatively new category of light sport aircraft which is expected to experience 4.1% annual growth in the fleet.

Table 3A - National Fleet Mix Average Annual Growth Rate

Aircraft Type	2016 (Estimated)	2010-2016 Historical	2016-2037 Forecast
Total Piston Fixed Wing	140,020	-1.7%	-0.8%
Single Engine	126,820	-1.6%	-0.9%
Multi-engine	13,200	-3.1%	-0.5%
Total Turbine Fixed Wing	23,230	1.8%	1.9%
Turboprop	9,460	0.2%	1.4%
Turbojet	13,770	3.1%	2.3%
Total Rotorcraft	10,700	1.0%	1.6%
Piston	3,335	-1.2%	1.3%
Turbine	7,365	2.1%	1.8%
Experimental	28,475	2.3%	1.0%
Sport Aircraft	2,530	N/A	4.1%
Other	4,950	-2.3%	0.1%
Total GA	209,905	-1.0%	0.1%
National Piston Growth Rate	-0.8%	-1.7%	-0.8%
National Turbine Growth Rate	0.7%	1.9%	1.9%

Source: FAA Aerospace Forecasts, 2016-2037

Table 3B - National Average Hours Flown			
Aircraft Type	2016 (Estimated)	2010-2016 Historical	2016-2037 Forecast
Total Piston Fixed Wing	12,794	-1.5%	-0.8%
Single Engine	11,191	-1.4%	-0.9%
Multi-engine	1,603	-2.1%	-0.1%
Total Turbine Fixed Wing	6,712	2.8%	2.5%
Turboprop	2,539	1.5%	1.6%
Turbojet	4,173	3.6%	3.0%
Total Rotorcraft	3,350	-0.3%	2.0%
Piston	784	-0.2%	1.7%
Turbine	2,565	-0.3%	2.1%
Experimental	1,335	1.4%	2.0%
Light Sport Aircraft	204	N/A	4.6%
Other	162	-1.8%	0.1%
Total GA	24,558	-0.2%	0.9%
National Piston Growth Rate	1.4%	-1.4%	-0.6%
National Turbine Growth Rate	3.7%	1.9%	2.4%

Source: FAA Aerospace Forecasts, 2016-2037

The FAA cautions its forecasts depend on many unknown factors. Some of these factors include the national and world economies, US unemployment, price of oil, and national fiscal issues. **Table 3A** on the previous page shows these projected growth rates.

National General Aviation Hours Flown

As the active aircraft fleet grows, the number of GA hours flown is projected to increase at 0.9% per year. FAA annual growth rate projections vary for hours flown, from a declining rate of -0.6% for piston fixed-wing aircraft, to a high growth of 3.0% for jet aircraft, and an even higher growth rate 4.6% for light sport aircraft. **Table 3B** presents the FAA's forecast for aircraft hours flown.

Rotorcraft hours were relatively immune to the recession compared to other categories. Turbine fixed wing aircraft utilization was also less impacted from the GA decline related to the recession when compared to other categories because turbine aircraft are flown primary for business rather than recreational flying. Growth in the light sport aircraft category has continued since its introduction in 2005.

Single engine piston airplanes (not including light sport aircraft) represent nearly 62% of the active fleet but fly less than 47% of the total hours flown, while the higher performance, more expensive turbine-powered aircraft often used for business represent a smaller portion of the fleet and a much larger portion of the total number of hours flown. For the first time in aviation history, turbine-powered aircraft are forecast to exceed piston-powered aircraft for total hours flown around the year 2025.

3.4.2 State And Local Aviation Trends

While broad industry trends influence aviation activity at individual airports, regional and local factors may have a greater influence. Primary sources for discussion of state and local aviation trends are local aviation activity information and data, the Oregon Aviation Plan (OAP) completed in 2007, and the FAA Terminal Area Forecast.

The OAP describes the following trends impacting aviation demand in Oregon:

- Continued migration into the state – new residents who depend on air transportation to maintain ties with family and friends.
- Continued increases in socioeconomic indicators, such as total employment, per capita income, and retail sales.

As of 2013, there were 97 public-use and over 360 private-use airports in the State of Oregon; all of those airports were included in the state airport system in 2007. The airports in the state system had an estimated

4,875 based aircraft in 2005 (the base year for data). In comparison, the aircraft registry shows 7,594 aircraft registered in the State of Oregon as of March 2016. The 2007 OAP projected that based aircraft in the state would grow 1.2% by 2030. For the same time-frame, GA operations were projected to grow at an estimated 1.6% annual growth rate, which is slightly above the based aircraft growth rate. These growth rates were prepared prior to the economic downturn of 2008, and are not seen as applicable to the post-recession economy.

Historic Based Aircraft

Based aircraft counts are the number of aircraft that are stored at an airport in a hangar or tied down on either a paved apron surface or a grassy area designated for such a use. The FAA's 2017 TAF data show an overall increase in based aircraft over the period of 1990 - 2015 (**Figure 3A**). Based on the TAF data, the number of based aircraft grew at an average annual rate of 1% over the 25-year period and 1.4% over the most recent 10-year period.

The TAF is the primary source for historical based aircraft numbers from which to discern trends at general aviation airports. However, in recognizing the importance of accurate based aircraft counts at each airport, the FAA established a National Based Aircraft Inventory Program. A website (www.basedaircraft.com) has been established to allow airport managers direct on-line entry of their based aircraft counts, which is then validated via cross-reference of aircraft tail numbers entered for other airports. For aircraft listed at more than one airport, there is a procedure for determining how the aircraft is counted.

In the latest based aircraft inventory update using the stricter validation methods for determining based aircraft inventory (**Table 3C**), ODA reports 26 actual based aircraft in 2017, which the Master Plan assumes to be accurate since it has been verified through the National Based Aircraft Inventory database. Of these based aircraft reported, all 26 are single-engine piston aircraft. There are no helicopters, multi-engine, turbine or turboprop aircraft based at the Airport. This adjusted baseline information will be used as the starting point for aviation activity forecasts projected to occur at the Cottage Grove State Airport over the planning period.

Table 3C - Based Aircraft at Cottage Grove State Airport

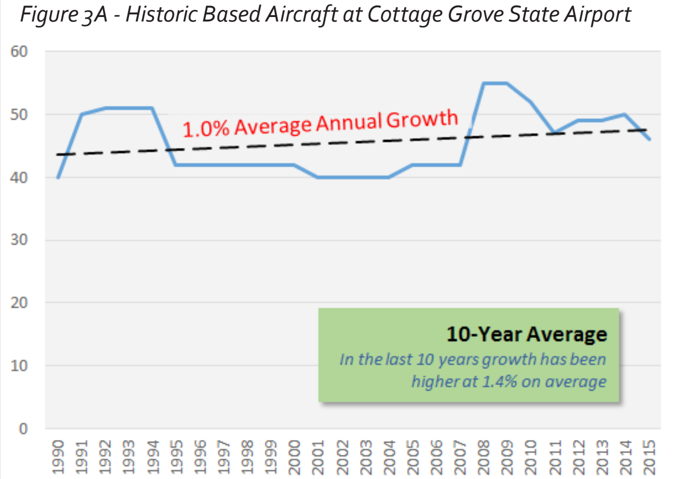
Aircraft Category	Number Based
Single-Engine Piston	26
Multi-Engine Piston	0
Jet/Turboprop	0
Helicopter	0
Total	26

Historic Aircraft Operations

Annual operations are the total number of aircraft takeoffs and landings occurring at the Airport in a year. Airport operations are divided between local and itinerant activity and further categorized by Air Taxi, General Aviation Local, General Aviation Itinerant, and Military. Local operations count as two operations, one take-off and one landing. Operations that remain within 20 miles of the Airport are categorized as local. Itinerant activity refers to all other operations that depart to or arrive from another Airport.

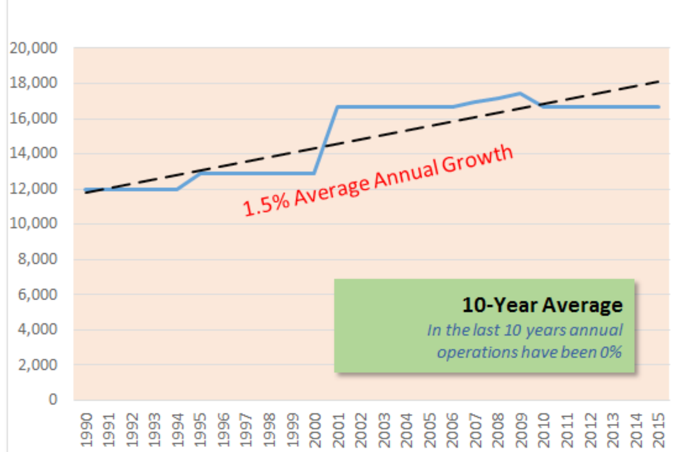
Operations estimates published in the TAF show an overall growth trend over the past 25-year period. Over that term, operations have increased at an average annual rate of 1.5%. However, since the recession, growth of operations at the Airport have stagnated,

Figure 3A - Historic Based Aircraft at Cottage Grove State Airport



Source: *FAA TAF, 2017*

Figure 3B - Historic Annual Operations at Cottage Grove State Airport



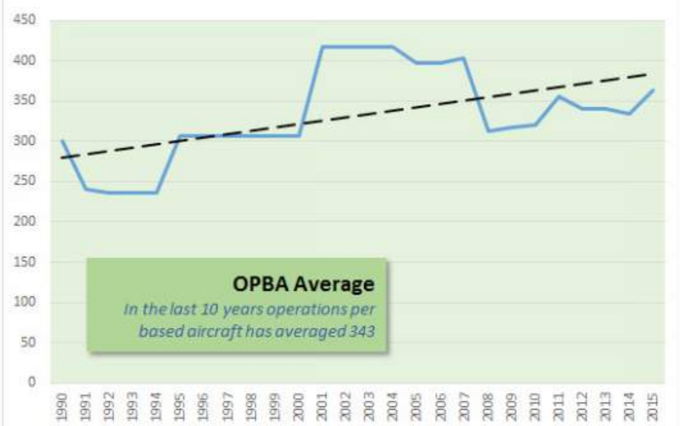
Source: *FAA TAF, 2017*

hovering near the 17,000 annual operations level for the past decade (**Figure 3B**).

A method to estimate operations at GA airports is the metric, Operations per Based Aircraft (OPBA). Over the 25-year period between 1990 and 2015 the TAF-based OPBA have ranged between 235 and 417. OPBA has averaged 343 OPBA over the past decade (**Figure 3C**).

Due to the adjustment in based aircraft noted in the

Figure 3C- Historic Annual OPBA at Cottage Grove State Airport



Source: FAA TAF, 2017

most recent validated counts, the OPBA was revisited in discussions with ODA and FAA personnel in order to ensure an appropriate level of operational data was established prior to finalizing aviation activity data and forecasts. Ultimately, the 10-year TAF average of 343 OPBA was determined to be an appropriate level to establish the latest operations estimates.

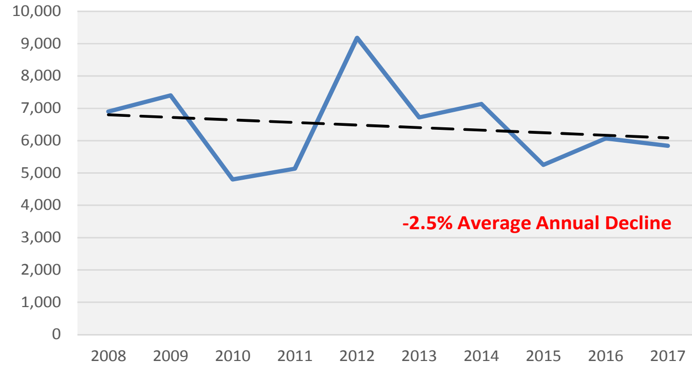
Historic Fuel Sales at Cottage Grove

Fuel sales can be an indicator of aviation activity at an airport. **Figure 3D** shows fuel purchased for the Airport from Fiscal Year (FY) 2008 through FY 2017. Overall, fuel purchase receipts depict no standard trend, but appear to range consistently between 5,000 and 7,000 gallons of Avgas. The average annual growth for fuel sales is -2.5%. However, in FY 2012 fuel sales rose to an all time high with 9,180 gallons of 100LL sold. The runway closure and Airport construction in 2013 could account for the steepest decline of fuel sales over the 10 year period.

Estimated Aircraft Operations

With the updated based aircraft count of 26 total aircraft and the selection of 343 OPBA, the planning team has estimated the total operations at Cottage Grove State Airport to be approximately 8,900 annual operations. When distributed by operations type, as shown in **Table**

Figure 3D- Historic Fuel Sales at Cottage Grove State Airport



Source: FAA TAF, 2017

Table 3D Operations Estimates at Cottage Grove State Airport last 12 Months	
Operation Type	**Operations**
Air Taxi	50
General Aviation Itinerant	5,075
General Aviation Local	3,775
Military	0
Total	**8,900**

3D, these relationships are consistent with the data in the FAA TAF.

3.5 AVIATION FORECASTS

Forecasts of aviation activity are developed to enable operators and other groups involved in the development of aviation facilities to properly plan for the future. During the forecasting process, data was collected and demand projections for based aircraft and aircraft operations were calculated. The following forecasts provide insight into how aviation activity at the Cottage Grove State Airport is projected to change over the next 20 years.

3.5.1 Based Aircraft Forecast

The number of aircraft based at the Airport is an important consideration when planning facilities. The based aircraft forecast will directly influence the type and number of aircraft storage facilities and apron tiedowns needed. Projections of based aircraft also provide one indication of the anticipated growth in flight activity expected to occur at the Airport.

The based aircraft forecast begins by analyzing historical numbers of based aircraft. Then various forecast models prepared for the Airport are analyzed and presented through the planning period.

Seven different forecasting models were analyzed to provide a range of the possible numbers of based aircraft. The average annual growth rates for these models range from -0.8% to 4.1%. All of the analyzed models are graphically summarized in **Figure 3E.**

National Sport Aircraft Growth Rate Model (4.1%)

As GA aviation needs are changing to meet the needs of users, the growth of smaller, lighter, and cheaper sport aircraft is significant. An increase in the number of these ultra light planes is expected over the course of the planning period. However, the majority of the based aircraft are still piston powered and the sport craft growth rate model is the most aggressive when compared to other models. This forecast model would increase the total based aircraft by 32 for a total of 58 by 2037.

Historic Trend (1.7%)

Using TAF based aircraft data from 2005 through 2015, the historic trend model projects a continuation of the based aircraft trends experienced at the Airport into the future. As previously mentioned, there have been discrepancies with historic based aircraft counts at Cottage Grove State Airport prior to online verification. Forecasting this historic trend out, an additional 11 based aircraft would base at the Airport for a total of 37 by 2037. Other models may be more reliable.

Terminal Area Forecast (1.6%)

The FAA's TAF for the Airport, prepared in 2017, shows an increase of 1.6% annual aircraft over the 20-year planning period. The TAF growth rate represents nationwide trends in GA airports and it is reasonable to apply this growth rate even though the starting inventory of based aircraft has been adjusted downward. As such the 1.6% growth trend was applied to the verified aircraft count (26) and projected out to 2013. This method resulted in an increase of 10 based aircraft for a total of 36 at the end of the planning period. This adjusted TAF model falls within the upper end of the mid-range forecast range.

Oregon Aviation System Plan Model (1.3%)

The forecast for the Airport in the Oregon Aviation Plan equates to 1.3% average annual growth. This forecast accounts for local socioeconomic factors; however, the national, state, and local economic climate has changed since the forecast was produced. Still, it reflects a slightly lower growth rate than airports statewide, which is consistent with the current economic indicators. This forecast would increase based aircraft by 8 to 34 by 2037.

National Experimental Aircraft (1.0%)

Figure 3E - Based Aircraft Forecasts

	2017	2022	2027	2032	2037
National Sport Aircraft (4.1%)	26	34	42	50	58
CG Historic Based Aircraft (1.7%)	26	29	31	34	37
Cottage Grove Adjusted TAF (1.6%)	26	28	31	33	36
State System Plan Growth Rate (1.3%)	26	28	30	32	34
National Experimental Aircraft (1.0%)	26	27	29	30	32
National Piston (-0.8%)	26	25	24	23	22
Cottage Grove Fuel Trends (-2.5%)	26	23	21	18	16

The forecast for the The National Experimental Aircraft is 1% average annual growth. While this rate is significantly less than the Sport Aircraft growth rate mode, the correlation between these two model should be noted. If the National Experimental Aircraft growth rate were applied to the based aircraft count of 26 independently, without consideration of any other model, the result would project a modest increase in based aircraft to a total 32 by 2037.

National Piston Growth Rate Model (-0.8%)

The majority of airplanes based at the Airport now and in the past have been piston-powered. Therefore, it would appear reasonable to apply the same growth rate at the Airport as forecast for piston-powered airplanes nationwide. However, this model does not take into consideration the expected influx of more affordable light sport aircraft into the Airport, as the national trends and local economics would indicate. This forecast model would decrease the total based aircraft by 4 for total of 22 by 2037.

Cottage Grove Fuel Trends (-2.5%)

Historic Avgas fuel sales at the Airport indicate declining sales at the Airport over the past decade. The downward revision of the based aircraft inventory may or may not be reflected in these trends as there are many more factors in how pilots decide where to purchase fuel. While fuel sales may not directly correlate with fluctuations in based aircraft, applying the -2.5% growth rate to all based aircraft at the Airport would result in a decrease of 10 based aircraft to a total of 16 by 2037.

3.5.2 Preferred Based Aircraft Forecast

The previously discussed based aircraft forecasts models were aggregated into three generalized forecast ranges representing high growth, moderate growth, and negative growth of based aircraft at the Airport. The High Growth Forecast range spans between the National Sport Aircraft Forecast (4.1%) and the 10-year Cottage Grove Based Aircraft model (1.7%). The Moderate Growth Forecast Range contains all models that predict positive growth, up to that of the 10-year Cottage Grove Based Aircraft model (1.7%). The Negative Growth range includes all forecasts that exhibit negative growth. The lowest extent of this range is represented by the Cottage Grove Fuel Trends model (-2.5%).

It should be noted that forecasting is not a precise science; it is an educated estimate based on approved methods and data. As such, in the event the Preferred Based Aircraft Forecast over- or underestimates demand, the range of error will likely be accounted for in the selection of the "Preferred Range". If demand falls in line with any of the forecast ranges, it is anticipated there is land available for hangar development to accommodate the full range of projections.

Figure 3D on the previous page graphically compares these forecast ranges. While the exhibit presents the forecasts as increasing year-by-year according to average growth rates, actual growth over time will occur in phases as facilities are constructed and made available for based aircraft.

High Growth Forecast

The High Growth Forecast is the most optimistic of the forecasts and accounts for growth in the recreational aviation market generated primarily from the growing light sport aircraft market. The high growth range scenario would likely result in the addition of 11 - 32 aircraft, many of which would be light sport models, with a few small multi-engine turbine aircraft. At the end of the 20 year planning period it is estimated the based aircraft count would fall between 37-58 based aircraft.

Moderate Growth Forecast

The slightly less optimistic Moderate Growth Forecast predicts positive growth,but at a rate less than the 10-year Cottage Grove Historic Based Aircraft Model (1.7%) . The range includes the Cottage Grove TAF Model (1.6%), the Oregon Aviation System Plan Model (1.3%), and the National Experimental Aircraft Growth Model (1.0%). This scenario presents moderate growth over the 20 year planning period and will likely add up to 10 new aircraft to the fleet at Cottage Grove State Airport. Similar to the High Growth scenario, it is anticipated that a portion of the new based aircraft at the end of the 20 year planning period would include small multi-engine turbine business aircraft based at the Airport seasonally. By the end of the 20 year planning period it is estimated the based aircraft count would range between 26-36 based aircraft.

Negative Growth Forecast

The Negative Growth Forecast Range is characterized by a decrease of aircraft based at the Airport. The range includes the National Piston Model (-0.8%), and the Cottage Grove State Airport Fuel Trends Model (-2.5%). The low range scenario projects the existing situation at the Airport out to the end of the 20 year planning period where small multi-engine turbine aircraft are still using the Airport seasonally and itinerantly but are not permanently based at the Airport. By the end of the 20-year planning period it is estimated the based aircraft count would fall between 16-26 aircraft.

Preferred Based Aircraft Forecast

The preferred forecast range is the Moderate Growth Forecast. The National Experimental Aircraft model falls very near to the center of the forecasted range and as such, is an appropriate representation of the preferred range and will be adopted as the preferred based aircraft forecast model. This forecast model represents an average annual growth rate of 1.0%. The model, when projected out across the 20 year planning period, estimates an additional 6 based aircraft over the planning period for a total of 32 aircraft.

Forecast Based Aircraft Fleet Mix

The fleet mix of aircraft based at the Airport may slightly change over the forecast period, although single engine, piston-powered aircraft will still be predominant. **Table 3E** presents the forecast based aircraft fleet mix.

Table 3E Forecast Based Aircraft Fleet Mix at Cottage Grove State Airport

Aircraft Category	2017	2037
Single-Engine Piston	26	28
Multi-Engine Piston	0	2
Jet/Turboprop	0	1
Helicopter	0	1
Total	26	32

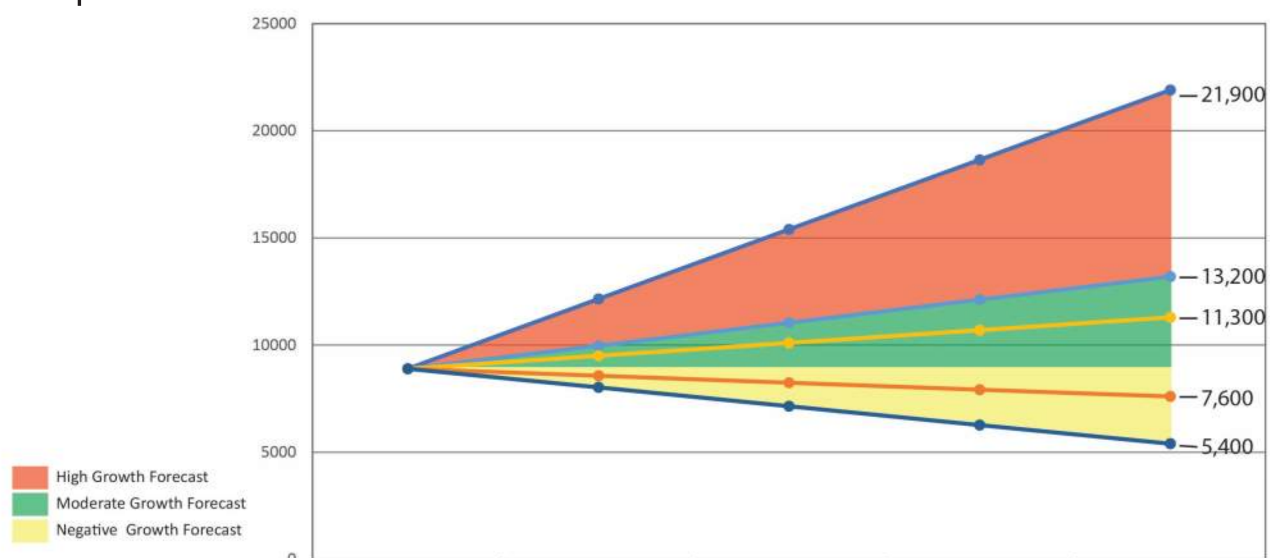
3.5.3 AIRCRAFT OPERATIONS FORECAST

Aircraft operation forecast data helps in analyzing runway capacity and determining runway, taxiway, and navigational aid requirements. The aircraft operations forecast begins with a review of historic trends in aircraft operations. Similar to the based aircraft forecast, various forecast models are then analyzed and presented through the forecast planning period. Forecast information presented in this section includes operations fleet mix, local vs. itinerant operations, peak activity, and critical aircraft and Runway Design Code (RDC).

Seven different forecasting models were analyzed to provide a range of the possible scenarios to depict aircraft operations at the Airport. The average annual growth rates for these models range from -2.5% to 4.6%. After the analysis, five models that depicted different potential scenarios, but generally covered the full range of the models analyzed, were selected for presentation in **Figure 3F.**

The FAA Aerospace Forecast indicates that GA aircraft usage will increase. While the nationwide fleet is projected to grow 0.2% per year, hours flown are projected to grow 1.2% per year. For the piston fleet,

Figure 3F - Operations Forecasts



	2017	2022	2027	2032	2037
National Sport Aircraft (4.6%)	8900	12150	15400	18650	21900
National Experimental Aircraft (2.0%)	8900	9975	11050	12125	13200
Cottage Grove Adjusted TAF (1.2%) State System Plan (1.2%)	8900	9500	10100	10700	11300
National Piston (-0.8%)	8900	8575	8250	7925	7600
Cottage Grove Fuel Trends (-2.5%)	8900	8025	7150	6275	5400

however, the hours flown are expected to decrease by -0.6% annually – alternatively, the turbine fleet is expected to increase usage by 2.1% annually. Although the piston and turbine fleet forecasts diverge, the overall trend is that aircraft use will increase at a faster rate than the total number of aircraft.

Terminal Area Forecast (1.2%)
The FAA's TAF model projects an average annual growth of 1.2% through 2037. Projecting the TAF-established growth rate from the estimated current operations count will yield an increase of 2,400 annual operations for a total of 11,300 in 2037.

National Sport Aircraft Growth Rate Model (4.6%)
The National Growth Rate model for sport craft is the most aggressive of those analyzed. While the growth of sport craft operations is expected at Cottage Grove State, an applied rate would increase annual operations to 21,900 which would likely overstate operations at the Airport.

National Experimental (2.0%)
The National Experimental Aircraft has an annual growth rate of 2% . The OAP uses base data from 2005 to project 2.0% average annual growth in aircraft operations at the Airport, which may be somewhat outdated. When the growth rate is applied to the model, the projected growth in operations could potentially reach 13,200 annual operations at the end of the planning period.

Oregon Aviation System Plan Model (1.2%)
The OAP uses base data from 2005 to project 1.2% average annual growth in aircraft operations at the Airport. While this plan was prepared prior to the economic recession, the growth in operations yields a growth of 2,400 operations over the planning period. In 2037 this plan projects 11,300 operations at the Airport.

Historic Trend (0.0%)
This forecast model analyzes historical growth from 2005 to 2016 provided by the TAF and continues that trend into the future. According to the most recent data, operations at Cottage Grove State Airport have remained nearly static over the last decade. Because the past based aircraft estimates in the TAF have been revised downward, the historic trends in the TAF data are no longer a reliable indicator of future activity.

National Piston Growth Rate Model (-0.8%)
Applying the piston-only growth rate would show a decrease in annual operations over the forecast period. The applied rate would result in a decrease of 1,300 operations over the planning period. In 2037 this plan projects 7,600 operations at the Airport.

Cottage Grove Fuel (-2.5%)
As discussed in the based aircraft forecast, historic Avgas fuel sales at the Airport indicate a reduction in fuel sales and by association, operations at the Airport over the past decade. Applying the -2.5% rate to the existing operations estimate of 8,900 would result in an estimated 5,400 annual operations at the end of the 20-year planning period.

3.5.4 Preferred Aircraft Operations Forecast

Much like with the Based Aircraft forecasts, the preceding established forecast models were aggregated into three generalized forecast ranges representing High Growth, Moderate Growth, and Negative Growth forecasts. The High Growth Forecast range is characterized by aggressive growth and spans between the National Sport Aircraft Forecast (4.6%) and the National Experimental Aircraft model (2.0%). The Moderate Growth range contains all models that forecast positive growth up to the rate of the National Experimental Aircraft model (2.0%). The Negative Growth range includes all forecasts that predict a decrease in operations over the planning period. This range includes the National Piston (-0.8%) and Cottage Grove State Airport Fuel Trends (-2.5%) models.

Again, forecasting is not a precise science; it is an educated estimate based on approved methods and data. As such, in the event the Preferred Aircraft Operations Forecast over or under-estimates demand, the range of error will likely be accounted for in the selection of the "Preferred Range".

Figure 3F graphically compares these forecast ranges. While the exhibit presents the forecasts as increasing year-by-year according to average growth rates, actual growth over time will occur in phases as facilities are constructed and made available for based aircraft.

High Growth Forecast
The High Growth Forecast range is the most optimistic of the scenarios presented and accounts for growth in the recreational aviation market generated partly from the growing light sport aircraft market as well as the growing turbine jet market. The high range scenario would likely result in an increase of 4,300 - 13,000 operations at the Airport. At the end of the 20 year planning period it is estimated there would be a range of 13,200 to 21,900 operations per year.

Moderate Growth Forecast

The Moderate Growth Forecast range predicts continued growth over the 20 year planning period but at a rate less than that of the High Growth Forecast range. The National Experimental Aircraft (2.0%), the Cottage Grove Adjusted TAF (1.2%), and the Oregon Aviation System Plan (1.2%) models are represented in this range. The anticipated increase of up to 4,300 operations per year will likely be due to slow steady growth in the light sport recreation markets along with a noticeable increase in the number of small multi-engine piston and turbine business aircraft operating at the Airport. In this scenario at the end of the 20 year planning period it is estimated there would be a range of 8,900 to 13,200 operations per year.

Negative Growth Forecast

The Negative Growth Forecast range is the scenario that depicts the least optimistic forecast for the planning period. The National Piston and Cottage Grove Fuel Trend models are represented in this forecast range. The forecast range predicts as many as 3,500 fewer annual operations at the Airport by the end of the planning period. The model projects the existing situation at the Airport out to the end of the 20 year planning period where small multi-engine piston and turbine aircraft are using the Airport seasonally and itinerantly on an occasional basis. At the end of the 20 year planning period it is estimated there would be a range of 5,400 to 8,900 operations per year.

Preferred Aircraft Operations Forecast

The Moderate Growth Forecast range the preferred scenario. This range is best represented by the Cottage Grove TAF Growth Rate and Oregon Aviation State System Plan models. Both of these models predict a 1.2% increase in operations per year. Applying that growth rate over the 20-year planning period, the model forecasts that operations will increase by 2,400 over the planning period for an anticipated 11,300 annual operations in 2037.

As discussed previously, th FAA also uses the relationship between the number of aircraft based at an airport and the number of operations at that airport. This measure, known as OPBA, can be compared regionally to see if the relationship is in line with what nearby airports are experiencing or forecasting (**Figure 3G**). With an OPBA of 343, the preferred forecast for Cottage Grove State Airport compares well with other nearby airports that have similar characteristics.

Operations Fleet Mix

Table 3F presents the fleet mix breakdown of the preferred forecast by single-engine piston, multi-engine piston, turboprop, turbojet, and helicopter.

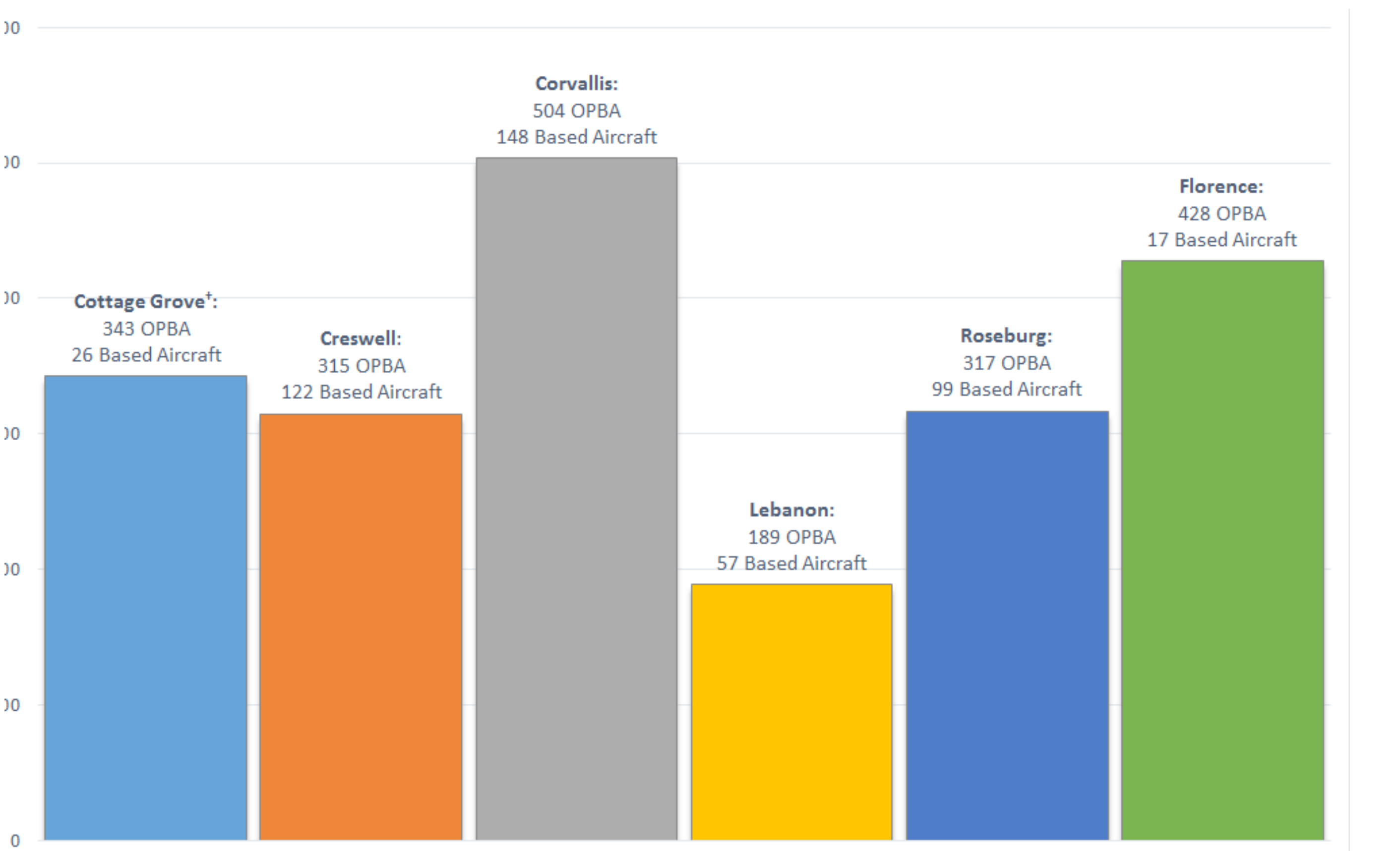


Table 3F Forecast Operations Fleet Mix		
	2017	2037
Single-Engine Piston	8,075	10,295
Single-Engine Turbine	50	70
Multi-Engine Piston	690	800
Turboprop & Turbojet	25	35
Helicopter	60	100
Total	**8,900**	**11,300**

Local and Itinerant Operations

Table 3G presents the breakdown of the preferred forecast for aircraft operations. The operation estimates represent a similar trending of the operations per based aircraft by category ratio as currently exists at the Airport**.**

Table 3G Forecast Local and Itinerant Operations		
Operation Type	**2017**	**2037**
Air Taxi - Itinerant	50	50
GA - Itinerant	5,075	6,000
GA - Local	3,775	5,250
Military	0	0
Total	**8,900**	**11,300**

Peak Demand

Airport activity fluctuates from month to month, day to day, and hour to hour; therefore, airfield and landside facilities are traditionally designed to accommodate reasonable peak levels of use. In reviewing local vacation destination and seasonal trends, and subsequently verifying with ODA Staff, it is clear the Airport is consistently busier in the summer than in the winter. Without clear airport operations data at the Airport it is difficult to determine the exact ratio of peak demand.

The values for average day peak month and for the peak hour were then calculated using the methodology in FAA Advisory Circular 150/5360-13, Planning and Design Guidelines for Airport Terminal Facilities. Under this methodology, the average day peak month is derived by taking the number of operations calculated for the peak month and dividing that figure by the number of days in the peak month (31 days). Peak hour is assumed to be 15% of the day peak. **Table 3H** summarizes the peak operations forecast.

Table 3H Peak Operations Forecasts		
	2017	2037
Annual Operations	8,900	11,300
Peak Month	1,780	2,260
Design Day	57	73
Design Hour	9	11

3.6 CRITICAL AIRCRAFT AND RUNWAY DESIGN CODE

According to FAA criteria, a runway's design is based on the characteristics of the critical aircraft, which is the most demanding aircraft that uses the runway "regularly" or "substantially." The FAA defines regular or substantial use as at least 500 annual itinerant operations. The Runway Design Code (RDC) can vary for individual runways by providing standards to serve different design aircraft on different runways and taxiways. The RDC also includes a component for instrument approach visibility minimums, which will be discussed further in the Facility Requirements chapter. The largest RDC at an airport dictates the overall Airport Reference Code (ARC) for a particular airport.

The RDC and ARC is defined by the Aircraft Approach Category and the Airplane Design Group of the critical aircraft. The Aircraft Approach Category is determined by the approach speed, or 1.3 times the stall speed of the aircraft in its landing configuration at its maximum landing weight, and is represented by the letters A, B, C, D, and E. The Airplane Design Group is based on the aircraft's wingspan or tail height, and is denoted by Roman numerals I, II, III, IV, V, and VI. **Table 3I** shows the RDC and ARC component definitions and typical aircraft that meet those definitions.

The current ARC and RDC for Runway 15-33 is B-I (small). The designation "small" refers to the size of the airplane as weighing less than 12,500 lbs. Prior planning efforts used the Beechcraft King Air B100, a B-I (small) aircraft, to define the ARC. Based on the aviation activity analysis, and discussions with airport users and ODA, there are very few actual turbine or turboprop aircraft that use the Airport. It is more fitting that the critical aircraft reflect the actual "typical" aircraft seen at the Airport on a regular basis, likely a piston driven aircraft.

Although all aircraft currently based at Cottage Grove State Airport are classified as A-I, current operations estimates, as well as aviation forecasts indicate that there are, and will continue to be more than 500 annual operations by itinerant B-I (small) aircraft throughout the planning period. The Airport also has facilities on site capable of accommodating B-I (small) aircraft, including a 60' x 60' hangar located on the ramp.

Considering these factors, B-I (small) is the appropriate ARC for Cottage Grove State Airport. The twin-engine piston driven Beechcraft Baron 58, which is a B-I (small) was identified as the critical aircraft for the 20-year planning period. The Baron has a wing span of 37' 10", an approach speed of 95 kts, and a gross weight of 5,400 lbs

3.7 SUMMARY OF FORECASTS

The long-term growth of the Airport will be influenced by national and regional trends outlined within this chapter. Elements of the aeronautical activity forecast for the Airport are summarized in **Table 3J**.

With this forecast data, the next step in the master planning process is to calculate the ability of existing facilities to meet the forecast demand. Additionally, the next chapter will identify needed enhancements of airside and landside facilities to accommodate forecast demand. It is noteworthy that the aviation industry tends to cycle through highs and lows. Actual growth may be more aggressive or passive at times over the forecast period. It is essential to identify opportunities within the forecast period and beyond so the State can pro-actively accommodate potential growth.

Table 3I Runway Design and Airport Reference Code Components with Typical Critical Aircraft					
Approach Category	**Approach Speed**	**Typical Aircraft**	**Airplane Design Group**	**Wingspan**	**Typical Aircraft**
A	Less than 91 knots	Cessna 150, 172, 206, Beech Bonanza	I	Less than 49 feet	Cessna 150, 172, 206, Learjet
B	91 to 120 knots	King Air, Piper Navajo, Gulfstream I	II	49 to 78 feet	King Air, Cessna Citation, Metroliner
C	121 to 140 knots	C-130 Hercules, Learjet, Challenger	III	79 to 117 feet	Bae 146, P2V, DC-6, MD-87
D	141 to 165 knots	Boeing 747, Gulfstream V	IV	118 to 171 feet	C-130 Hercules, DC-10

Source: WHPacific

A-I

- Beech Baron 55
- **Beech Bonanza**
- Cessna 150
- Cessna 172
- Piper Archer
- Piper Seneca

C-I, D-I

- **Lear 25**, 35, 55
- Isreali Westwind
- HS 125

B-I less than 12,500 lbs

- Beech King Air 100
- Beech Baron 58
- Cessna 402
- Piper Navajo
- **Piper Cheyenne**
- Metroliner
- Cessna Citation I

C-II, D-II

- **Gulfstream** II, III, **IV**
- Canadair 600
- Canadair Regional Jet
- Lockheed JetStar
- Super King Air 350

B-II less than 12,500 lbs

- **Super King Air 200**
- Cessna 441
- DHC Twin Otter

C-III, D-III

- Boeing Business Jet
- B 727-200
- MD-80, CD-9
- **B 737-300 Series**
- Fokker 70, 100
- A319, A320
- Gulfstream V
- Global Express

B-I, II over 12,500 lbs

- Super King Air 300
- Beech 1900
- Jetstream 31
- Falcon 10, 20, 50
- Falcon 200, 900
- **Citation** II, **III**, IV, V
- Saab 340

C-IV, D-IV

- **B-757**
- B-767
- DC-8-70
- DC-10
- MD-11
- L1011

A-III, B-III

- DHC Dash 7
- **DHC Dash 8**
- DC-3
- Convair 580
- Fairchild F-27
- ATR 72
- ATP

D-V

- **B-747 Series**
- B-777

Table 3J Summary of Preferred Aeronautical Activity Forecast				
Forecast Element	2017	2022	2027	2037
Based Aircraft				
Single Engine Piston	26	26	27	28
Multi-Engine Piston	0	1	1	2
Jets/Turboprop	0	0	1	1
Helicopter	0	0	0	1
Total	**26**	**27**	**29**	**32**
Aircraft Operations				
Air Taxi - Itinerant	50	50	50	50
GA - Itinerant	5,075	5,300	5,475	6,000
GA - Local	3,775	4,150	4,500	5,250
Military	0	0	0	0
Total	**8,900**	**9,500**	**10,025**	**11,300**
Operations Fleet Mix				
Single Engine Piston	8,075	8,650	9,145	10,295
Single Engine Turbine	50	55	60	70
Multi Engine Piston	690	700	710	800
Turboprop & Turbojet	25	25	30	35
Helicopter	60	70	80	100
Total	**8,900**	**9,500**	**10,025**	**11,300**
Peak Demand (Operations)				
Peak Month - (20%)	1,780	1,900	2,020	2,260
Design Day	57	61	65	73
Peak Design Hour (15%)	9	9	10	11
Preferred Based Aircraft Forecast vs TAF (Preferred/TAF)				
Preferred	**26**	**27**	**29**	**32**
TAF	50	53	57	67
Percent Difference	-48.0%	-47.2%	-47.4%	-52.2%
Preferred Operations Forecast vs TAF (Preferred/TAF)				
Preferred	**8,900**	**9,500**	**10,025**	**11,300**
TAF	**16,897**	**17,955**	**19,021**	**21,343**
Percent Difference	-47.3%	-47.1%	-46.9%	-47.1%
Preferred Operations per Based Aircraft (OPBA)				
OPBA	**343**	**352**	**346**	**353**