GNOSS FIELD AIRPORT

PROPOSED EXTENSION OF RUNWAY 13/31

PURPOSE AND NEED WORKING PAPER

DATE MAY 2, 2016

REQUEST FOR PUBLIC COMMENTS

GENERAL INFORMATION ABOUT THIS DOCUMENT

This Purpose and Need Working Paper has been developed to provide additional information to the public and regulatory agencies regarding the proposed extension of Runway 13/31 at Gnoss Field Airport, Marin County, California. This Working Paper describes a change in forecasted aviation activity at Gnoss Field Airport, includes a revised purpose and need for a runway extension project resulting from the change in aviation activity, and provides supporting documentation. Changes in aviation activity have reduced the total necessary runway length at Gnoss Field Airport from 4,400 feet, as identified in the June 2014 Final Environmental Impact Statement (EIS), to 3,600 feet. As Runway 13/31 is currently 3,300 feet long, the current total necessary runway length of 3,600 feet could be obtained with a 300-foot runway extension, instead of the 1,100-foot runway extension identified in the June 2014 Final EIS. The Federal Aviation Administration (FAA) will be preparing a Supplement to the June 2014 Final EIS to address these changes.

REQUEST FOR PUBLIC COMMENTS

The FAA is requesting public comments on this Working Paper as part of an additional National Environmental Policy Act (NEPA), public scoping effort for this project prior to preparing a Supplement to the Final EIS. You may submit comments by mail from May 2, 2016 to June 17, 2016, e-mail to douglas.pomeroy@faa.gov or submit oral or written comments in person at a public meeting on this Working Paper held on June 2, 2016 at the Marin County Civic Center, 3501 Civic Center Drive – Room 329, San Rafael, California, at 6:00 P.M.

Before including your name, address and telephone number, email or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

Please provide any written public comments to the point of contact below:

Mr. Doug Pomeroy
Federal Aviation Administration
San Francisco Airports District Office
1000 Marina Boulevard, Suite 220
Brisbane, California 94005-1835. Telephone 650-827-7612 FAX 650-872-1430

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1.0 INTRODUCTION

The Federal Aviation Administration (FAA) issued a Notice of Intent (NOI) in the *Federal Register* on July 11, 2008 announcing its intent to prepare an Environmental Impact Statement (EIS) for proposed improvements at Gnoss Field Airport (**DVO** or Airport) Novato, California, including an extension of Runway 13/31. The FAA issued a Notice of Availability and released the Draft EIS for a 60-day public review on December 9, 2011, held a public hearing to receive comments on the Draft EIS on January 10, 2012, and accepted public comments on the EIS through February 6, 2012. The FAA reviewed and responded to all comments on the Draft EIS in the Final EIS, which was published in June 2014. The FAA did not issue a Record of Decision (ROD) regarding the Federal actions in the Final EIS, but instead has decided to prepare a Supplement to the Final EIS to address changes in the forecasted aviation activity, and the critical aircraft at DVO, which will require changes in the Purpose and Need for the Proposed Action, and the Sponsor's Proposed Project. This working paper provides the public and regulatory agencies an additional opportunity to provide comments on information the FAA is considering as it develops a Supplement to the Final EIS.

2.0 PURPOSE AND NEED

This working paper describes a revised purpose and need, proposed improvements at DVO based on changes in forecasted aviation activity at DVO, and identifies FAA regulations and policies for aviation safety and the potential Federal approvals that would be required for the proposed project to be implemented. FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions* requires that an EIS fully address and convey the purpose and need for a proposed project. According to the Council on Environmental Quality (CEQ) and their implementing regulations for NEPA, the purpose and need shall briefly specify the underlying purpose and need. As part of the EIS for this project, the FAA will consider the reasonable alternatives that meet the purpose and need of DVO and Marin County. The purpose and need for the proposed improvements serves as the foundation for the identification of reasonable alternatives to the Proposed Project and the comparative evaluation of impacts of development. In order for an alternative to be considered viable and carried forward for detailed evaluation within the NEPA process and an EIS, it must address the need for the project, as described more fully in the following sections.

The FAA is making this working paper available to the public and governmental agencies for review and comment. Once that review is complete, the FAA may include the information presented in this working paper in the Purpose and Need chapter of the Supplement to the Final EIS for the proposed extension of Runway 13/31 at DVO. **The FAA is not making a decision regarding the proposed development in this working paper.** That decision would be made as part of a Record of Decision on the Final EIS including the Supplement to the Final EIS.

The Airport is located in unincorporated Marin County north of the City of Novato, California and serves as an essential regional transportation resource by providing general aviation facilities in the northern portion of the San Francisco Bay area.

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The FAA is making this working paper available to the public and governmental agencies for review and comment. Once that review is complete, the FAA may include the information presented in this working paper in the Purpose and Need chapter of the Supplement to the Final EIS for the proposed extension of Runway 13/31 at DVO. **The FAA is not making a decision regarding the proposed development in this working paper.** That decision would be made as part of a Record of Decision on the Final EIS including the Supplement to the Final EIS.

The Airport is located in unincorporated Marin County north of the City of Novato, California and serves as an essential regional transportation resource by providing general aviation facilities in the northern portion of the San Francisco Bay area.

People choose to use DVO for three primary purposes – flight training, recreation, and business travel. DVO has been defined by the FAA as a reliever airport in the Bay area and served approximately 82,500 arrivals and departures in 2014 (see Appendix A, *Aviation Activity Forecast*). A reliever airport is a high-capacity general aviation airport in a major metropolitan area.[1] The FAA defines "capacity" as the "throughput rate" of an airport, i.e., the maximum number of aircraft operations that can take place in an hour.[2]

Reliever airports provide pilots with attractive alternatives to using congested hub airports. They also provide general aviation access to the surrounding area. To be eligible for reliever designation, these airports must be open to the public, have 100 or more based aircraft, or have 25,000 annual itinerant operations. The 268 reliever airports have an average of 184 based aircraft, which in total represents 22 percent of the Nation's general aviation fleet.

The reliever program, which was established in 1962, has evolved over the years. Currently, many of the airports designated as relievers serve their own economic and operational role. DVO and other general aviation airports in the San Francisco Bay area designated as reliever airports serve to reduce congestion at San Francisco International Airport, Oakland International Airport, and San Jose International Airport. Therefore, the FAA has encouraged the development, maintenance, and expansion of general aviation airports in major metropolitan areas.

2.1 PURPOSE AND NEED FOR IMPROVEMENTS

The following sections present the Sponsor's and FAA's purpose and need.

2.1.1 Sponsor's Purpose and Need

Gnoss Field Airport is currently designed to accommodate aircraft with a wingspan of 49 feet or less, and an approach speed of 91 to 121 knots (FAA Airport Reference Code B-1). Examples of different sizes of aircraft by Airport Reference Code are shown in **Table 2-1**.

Marin County has prepared several evaluations of the Airport's operations and facilities, including the 1989 Airport Master Plan[3], the 1997 Update of the Airport Master Plan[4], and the 2002 Preliminary Design Report for the proposed runway extension[5]. The June 2014 Final EIS prepared by the FAA also discussed operations at DVO.[6] These studies identified the limitations regarding the Airport's ability to accommodate existing aircraft and aviation users for which the Airport was

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1 2013-2017 National Plan of Integrated Airport Systems (NPIAS).

2 FAA Advisory Circular 150/5060-5 *Airport Capacity and Delay*, September 23, 1983, page 1, paragraph 3.

3 *Airport Master Plan Marin County Airport Gnoss Field*, 1989.

4 Marin County Aviation Commission Resolution No. 97-1: *A Resolution Adopting Chapter 6.0 – Airport Development Program Update 1997 – Marin County Airport Master Plan (Gnoss Field) and Recommendation of Approval of Chapter 6.0 1997 Update to the Marin County Board of Supervisors, February 5, 1997.*

5 Cortright & Seibold, *Preliminary Design Report, Runway Extension, Gnoss Field*, 2002.

6 Landrum & Brown, *Gnoss Field Airport Runway Length Analysis, 2008, 2013, & 2016.*

designed. Specifically, the Airport cannot fully accommodate existing aviation activity, as represented by the family grouping of critical aircraft that regularly uses the Airport under hot weather conditions.[7]

TABLE 2-1
AIRPORT REFERENCE CODES FOR AIRCRAFT TYPICALLY OPERATING AT GNOSS FIELD AIRPORT
Gnoss Field Airport

AIRPORT REFERENCE CODE[1]	AIRCRAFT CHARACTERISTICS	EXAMPLE AIRCRAFT TYPE
A-I	**Approach Speed:** Less than 91 knots **Wingspan:** Less than 49 feet	**Cessna 172** 
B-I	**Approach Speed:** 91 knots or greater, but less than 121 knots **Wingspan:** Less than 49 feet	**Cessna 525** 
B-II	**Approach Speed:** 91 knots or greater, but less than 121 knots **Wingspan:** 49 feet or greater, but less than 79 feet	**Beechcraft Super King Air 200** 

1 Source: FAA Advisory Circular 150/5300-13A *"Airport Design"*

7 For the purpose of this working paper, hot weather is defined as the mean daily maximum temperature of the hottest month at the Airport (FAA A/C 150/5325-4B Chapter 2).

The existing runway at DVO is 3,300 feet long and as a result cannot fully accommodate the operations of the family grouping of critical aircraft. Therefore, the purpose of the Sponsor's Proposed Project is to:

> ***allow existing aircraft, as represented by the family grouping of critical aircraft at DVO, to operate without operational weight restrictions under hot weather conditions.***

2.1.2 FAA Purpose and Need

The FAA's statutory mission is to ensure the safe and efficient use of navigable airspace in the U.S. as set forth under 49 USC § 47101 (a)(1). The FAA must ensure that the proposed action does not derogate the safety of aircraft and airport operations at DVO. Moreover, it is the policy of the FAA under 49 USC § 47101(a)(6) that airport development projects provide for the protection and enhancement of natural resources and the quality of the environment of the United States.

2.1.3 Insufficient Runway Length

FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*[8] identifies that airport dimensional standards such as runway length and width, separation standards (distances) between runways and taxiways, surface gradients, and similar dimensions should be appropriate for the "critical aircraft" that will make "substantial use" of the airport in the planning period for improvements.

An aircraft or family of aircraft is called the "critical aircraft" because it is the most "demanding" aircraft in terms of the physical dimensions of the airport such as the length and width of the runways and taxiways, and separation distance between runways and taxiways required for that aircraft to operate at the airport. "Substantial use" of a general aviation airport is defined as 500 or more annual itinerant operations (i.e., 500 arrivals and/or departures from the airport). The FAA uses the requirements of an airport's critical aircraft as a basis for determining when new aviation development is justified. This type of evaluation is consistently applied across the aviation industry and is the recognized approach for determining the needs of an airport. See Appendix B, Attachment 1, *Basis for Determination of the Critical Aircraft for DVO*, for more information regarding the designation of the critical aircraft for DVO. Within the current fleet mix at DVO, the existing critical aircraft is the family of B-II Turboprop aircraft, which is the most demanding aircraft grouping with substantial use (see Appendix b, Table B-2).

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8 FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS) 3-4 Airport Dimensional Standards*. December 4, 2000.

The Marin County Aviation Commission Resolution No. 97-1: *A Resolution Adopting Chapter 6.0 Airport Development Program Update 1997*[9] identified a runway extension as a part of DVO's future development program and a proposed runway length was developed as part of the 2002 Preliminary Design Report[10]. During the preparation of this working paper, FAA Advisory Circular (AC) 150/5325-4B *Runway Length Requirements for Airport Design*, was used to verify an appropriate length for Runway 13/31 at DVO. FAA AC 150/5325-4B, Paragraph 202, *Design Approach*, provides the acceptable methods to determine a recommended runway length. For this working paper, Chapter 2 of that AC, *Runway Lengths for Small Airplanes with Maximum Certificated Takeoff Weight of 12,500 Pounds (5,670 Kg) or Less* was used to verify the necessary runway length for the family grouping of critical aircraft at DVO.

The runway length analysis is described in detail in Appendix B, *Runway Length Analysis.* The following summarizes the inputs that were used to calculate the recommended runway length requirement for DVO to meet the project purpose and need. The project purpose and need is to allow existing aircraft, as represented by the family grouping of critical aircraft at DVO, to operate without operational weight restrictions under hot weather conditions.

Input Data:

Airport elevation: Sea Level

Mean daily maximum temperature of the hottest month: 82° Fahrenheit[11]

Using Figure 2-1 from FAA AC 150/5325-4B, *Small Airplanes with Fewer than 10 Passenger Seats*, the inputs listed above analyzed along the curve.

(1) Step 1 – Find the mean daily maximum temperature of the hottest month: ***82° Fahrenheit (F)***.

(2) Step 2 – Proceed vertically to the airport elevation: ***Sea Level (two feet)***.

(3) Step 3 – Proceed horizontally to the runway length axis.

(4) Step 4 – Read runway length. The runway length requirement derived from Figure 2-1, FAA AC 150/5325-4B, is 3,550 feet and is rounded up to 3,600 feet per FAA guidance.[12]

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[9] Marin County Aviation Commission Resolution No. 97-1: *A Resolution Adopting Chapter 6.0 – Airport Development Program Update 1997 – Marin County Airport Master Plan (Gnoss Field) and Recommendation of Approval of Chapter 6.0 1997 Update to the Marin County Board of Supervisors, February 5, 1997.*

[10] Cortright & Seibold, *Preliminary Design Report, Runway Extension, Gnoss Field*, 2002.

[11] United States Department of Commerce, National Oceanic & Atmospheric Administration, National Climatic Data Center (NCDC), Summary of Monthly Normal 1981-2010, Petaluma Airport, CA US. Webpage accessed on April 13, 2016, http://www.ncdc.noaa.gov/cdo-web/datatools/normals.

[12] See Appendix B, *Runway Length Analysis*, for information on the calculation of the final runway length requirement.

Based on the runway length analysis described above, the need at DVO is to address insufficient runway length that precludes the family grouping of critical aircraft from operating without operational weight restrictions under hot weather conditions.

3.0 SPONSOR'S PROPOSED PROJECT

Marin County developed the Sponsor's Proposed Project through the Master Plan for Marin County Airport[13] the Marin County Aviation Commission Resolution No. 97-1: *A Resolution Adopting Chapter 6.0 Airport Development Program Update 1997*[14] and the Preliminary Design Report Runway Extension Gnoss Field.[15] **Exhibit 3-1** shows the existing Airport location and facilities. The primary elements of the Sponsor's Proposed Project, which are shown on **Exhibit 3-2,** include the following:

- Shift Runway 13/31 106 feet to the north and extend Runway 13/31 300 feet to the northwest from 3,300 feet to a total length of 3,600 feet while maintaining the 75-foot width of the runway;
- Relocate existing taxiways accessing south end of Runway 13/31 to new runway end.
- Extend the parallel taxiway to the full length of the runway maintaining the existing runway to taxiway separation distance of 155 feet[16];
- Widen the existing Runway Safety Area (RSA) along the sides of Runway 13/31 from its existing width of 120 feet centered on the runway centerline to a RSA width of 150 feet centered on the runway centerline to meet current FAA B-II airport design standards;
- Extend RSA to 300 feet long beyond each end of the shifted Runway 13/31 to meet current FAA B-II airport design standards;
- Corresponding realignment of drainage channels to drain the extended runway and taxiway;
- Corresponding levee extension to protect the extended runway and taxiway from flooding; and
- Relocate the existing Precision Approach Path Indicator (PAPI) navigational aids that pilots use to land at the Airport to reflect the extended runway.

Marin County intends to keep DVO open during construction of the proposed project. Any modifications to Airport operations necessary to maintain safety

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13 *Airport Master Plan Marin County Airport Gnoss Field*, 1989.

14 Marin County Aviation Commission Resolution No. 97-1: *A Resolution Adopting Chapter 6.0 – Airport Development Program Update 1997 – Marin County Airport Master Plan (Gnoss Field) and Recommendation of Approval of Chapter 6.0 1997 Update to the Marin County Board of Supervisors, February 5, 1997.*

15 Cortright & Seibold, *Preliminary Design Report, Runway Extension, Gnoss Field*, 2002.

16 FAA AC 1500/5300-13A, Airport Design A/C, identifies a minimum runway centerline to parallel taxiway centerline separation distance standard of 150 feet for B-1 small aircraft and 225 feet for B-1 and B-II aircraft. The existing Gnoss Field Airport runway to parallel taxiway separation of 155 feet meets the B-1 small standard. Marin County is anticipated to seek a Modification of Standards to retain the 155-foot runway to parallel taxiway separation distance, rather than relocate the existing parallel taxiway to meet the B-1 and B-2 taxiway separation standard.

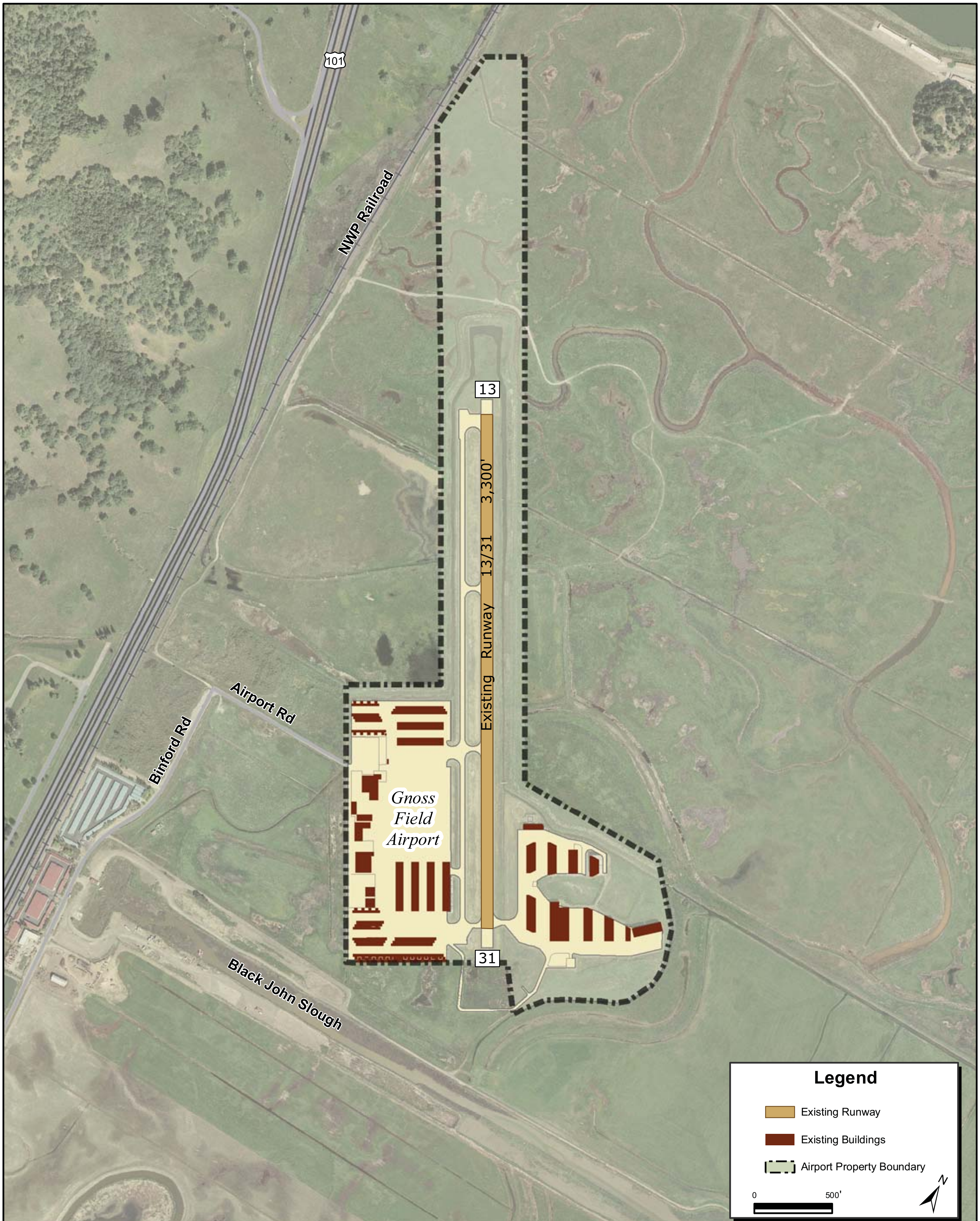
during construction would be addressed in a Construction Safety and Phasing Plan prepared in accordance with FAA AC 150/5370-2F, *Operational Safety on Airport During Construction,* and approved by the FAA.

4.0 PROPOSED FEDERAL ACTIONS

Several Federal actions are directly or indirectly proposed to occur. Implementation of the Sponsor's Proposed Project or other build alternatives would require several Federal actions and approvals. These include:

- Unconditional approval of the Airport Layout Plan (ALP) to depict the proposed runway shift/extension and parallel taxiway extension pursuant to 49 United States Code (USC) §§ 40103(b) and 47107(a)(16);
- Development of air traffic control and airspace management procedures designed to affect the safe and efficient movement of air traffic to and from the proposed runway development. Such actions would include, but are not limited to, the establishment or modification of flight procedures and the installation and/or relocation of Navigational Aids (NAVAIDs) associated with the proposed runway and taxiway extension.
- Determination of eligibility for federal assistance for the proposed projects under the Federal grant-in-aid program authorized by the Airport and Airway Improvement Act of 1982, as amended (49 USC § 47101 et seq.);
- Determinations under 49 USC §§ 47106 and 47107 relating to the eligibility of the Proposed Action for federal funding under the Airport Improvement Program (AIP) to assist with construction of potentially eligible development items shown on the ALP;
- Determination of the effects of the proposed shift/extension of the runway and parallel taxiway and the corresponding increase in size of the associated runway safety area upon the safe and efficient use of navigable airspace pursuant to Title 14 Code of Federal Regulations (CFR) Part 77, *Safe, Efficient Use, and Preservation of Navigable Airspace*. The FAA must determine if the proposed improvements, as proposed by Marin County are consistent with the existing airspace utilization and procedures;
- Determination under 49 USC § 44502(b) that the airport development is reasonably necessary for use in air commerce or in the interests of national defense;
- Approval of further processing of an application for federal assistance for near-term eligible projects using federal funds from the Airport Improvement Program, as shown on the ALP; and
- Approval of a Construction Safety and Phasing Plan to maintain aviation and airfield safety during construction pursuant to FAA Advisory Circular 150/5370-2F *Operational Safety on Airports During Construction*.

The proposed improvements described in this working paper are designed to allow the Airport to accommodate existing aviation traffic and demand.

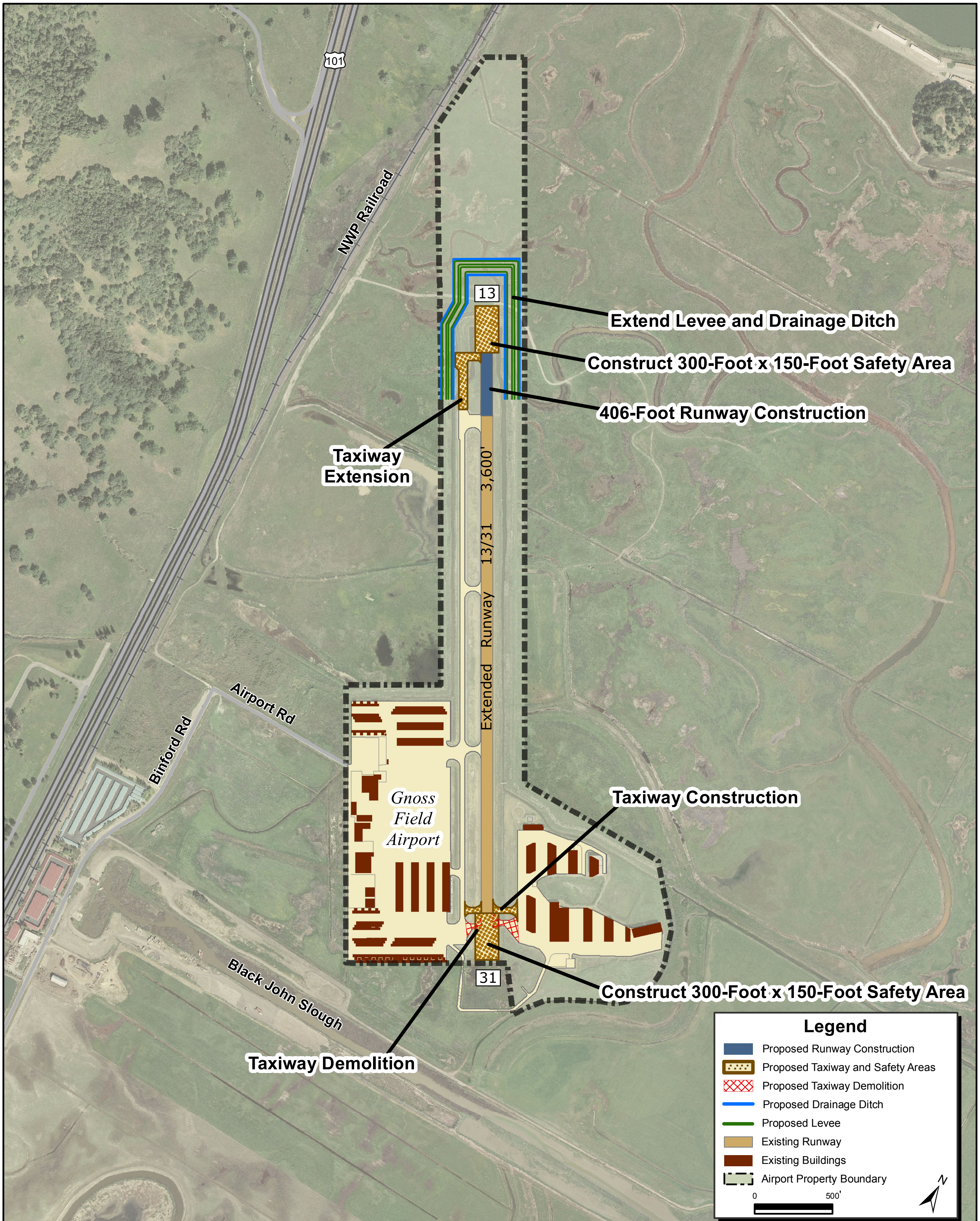


Environmental Impact Statement
Gnoss Field Airport

FINAL
7/10/2013 Prepared by Landrum & Brown
Filename: P:\DVO-Gnoss Field\GIS\MXD\EIS\EIS_Exhibits\EIS_Document\2-1_Existing Airport Layout.mxd

Existing Airport Layout

Exhibit: 3-1



Environmental Impact Statement
Gnoss Field Airport

DRAFT
4/12/2016 Prepared by Landrum & Brown
Filename: P:\DVO-Gnoss Field\Interim Airport Development Drawing\300 FOOT EXTENSION\3-2_Sponsors Proposed Project Revised.mxd

Sponsor's Proposed Project (Revised)

Exhibit: 3-2

5.0 RELATIONSHIP OF WORKING PAPER TO OTHER ENVIRONMENTAL IMPACT STATEMENT DOCUMENTS

The FAA issued a *Federal Register* Notice on July 11, 2008, announcing its intent to prepare an EIS for the proposed improvements at DVO. The FAA issued a Notice of Availability and released the Draft EIS for a 60-day public review on December 9, 2011, held a public hearing to receive comments on the Draft EIS on January 10, 2012, and accepted public comments on the EIS through February 6, 2012. The FAA reviewed and responded to all comments on the Draft EIS in the Final EIS, which was published in June 2014. The FAA did not issue a Record of Decision (ROD) regarding the Federal actions in the Final EIS, but instead has decided to prepare a Supplement to the Final EIS to address changes in the critical aircraft at DVO. This working paper provides the public and regulatory agencies an additional opportunity to provide comments on information the FAA is considering as it develops the Supplement to the Final EIS.

If the FAA issues a ROD to support proceeding with the Sponsor's Proposed Project, Marin County could then seek Federal funding through the Airport Improvement Program grant program to assist in implementation of the project. Marin County would have to meet Federal, state and local environmental requirements, including complying with the California Environmental Quality Act, in order to proceed with the project.

APPENDIX A

AVIATION ACTIVITY DEMAND FORECAST

GNOSS FIELD AIRPORT

Prepared By:
Landrum & Brown
April 2016

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1.0 PURPOSE AND CONTEXT

This report presents the forecast of aviation demand for Gnoss Field Airport (DVO or the Airport). DVO exclusively serves general aviation (GA) and air taxi activity and does not have any scheduled commercial passenger air service. The term “general aviation” refers to any aircraft not operated by the commercial airlines (passenger or cargo) or the military. Typical GA activity includes recreational and flight training activities, business travel, news reporting, traffic observation, environmental surveys, police patrol, emergency medical evacuation, and crop dusting aircraft. Air taxi activity typically includes “for hire” aircraft chartered for specific trips on an on-demand basis. Air taxi operations are usually made up of larger GA aircraft, such as large turboprop aircraft and an array of corporate jets.

In 2009, a forecast of aviation demand for DVO was developed as part of the Airport’s Environmental Impact Statement/Environmental Impact Report (2009 Forecast). Since the 2009 Forecast was published previously unforeseen events have resulted in lower than anticipated activity at DVO and significant changes to GA activity nationwide. Therefore, the forecast presented herein replaces the 2009 Forecast.

The Federal Aviation Administration (FAA) provides an update to the National Plan of Integrated Airport Systems (NPIAS) every two years. The NPIAS identifies nearly 3,400 existing and proposed airports that are significant to national air transportation. The airports identified in this plan are eligible to receive Federal grants under the Airport Improvement Program (AIP). The purpose of the plan is to provide Congress with a five-year estimate of AIP eligible development to occur and the cost of funding such development. The NPIAS contains all commercial service airports, all reliever airports (including DVO), and selected public-use GA airports.

The NPIAS categorizes all the airports into either Primary or Nonprimary. Primary airports are defined as public airports receiving scheduled air carrier service with more 10,000 or more enplaned passenger per year. Nonprimary airports are mainly used by GA aircraft. Nonprimary airports are further grouped into five categories based on their role within the national airport system. These categories are the following: (1) National, (2) Regional, (3) Local, (4) Basic, and (5) Unclassified.

DVO is in the airport group identified by the FAA as a **nonprimary regional airport**. DVO is also a reliever airport. Reliever airports are “high-capacity general aviation airports in major metropolitan areas.”[1] These reliever airports provide an attractive alternative to the larger and more congested primary airports in the area such as the San Francisco International Airport (SFO) and the Oakland International Airport (OAK). There are 264 reliever airports in the United States.

[1] Federal Aviation Administration, Report to Congress: National Plan of Integrated Airport Systems (NPIAS) 2015 – 2019, September 30, 2014.

This report provides an analysis of historical trends at the Airport and nationally, an overview of other San Francisco Bay area GA airports, and a forecast of operations at DVO. The forecast presented herein is "unconstrained" and as such does not take facility constraints or other outside limited factors into consideration. In other words, for the purposes of estimating future demand, the forecast assumes facilities can be provided to meet the demand.

2.0 PRIOR FORECASTS

2.1 1989 AIRPORT MASTER PLAN

In 1989, Marin County adopted an Airport Master Plan which was subsequently updated in 1997. The 1989 Master Plan included a forecast of aircraft operations and aircraft based at DVO, which was not updated in 1997.

An initial forecast of based aircraft was prepared in 1985. The forecast used a Marin County population forecast from the Association of Bay Area Governments (ABAG) and a GA aircraft forecast from the Metropolitan Transportation Commission (MTC) of the San Francisco Bay Area. The ABAG and MTC forecasts went through 2000. In order to determine the future based aircraft a ratio of population to aircraft was used through 2000. The result was that there would be 311 aircraft at DVO by 2000. The forecast that the closure of Smith Ranch Airport, which was assumed to occur by 1991, would result in 80 of the 112 based aircraft relocating to DVO.[2] In order to extend the forecast through 2006, a two percent growth rate was then applied. Utilizing the same methodology as the initial forecast, the Master Plan forecast was updated based on the 1986 actual number of based aircraft which was 283, compared to 291 in 1985. The result was that based aircraft would increase from 283 in 1986 to 510 by 2006, representing an average annual growth rate of 3.0 percent.

The Master Plan used the based aircraft forecast detailed above and estimates for annual operations per based aircraft to develop a forecast of GA aircraft operations. National estimates from the FAA in the 1970's indicated that operations per based aircraft should typically range between 600 and 800. California Department of Transportation (CalTrans) Division of Aeronautics (DOA) estimated this number is close to 650 for the state of California. However, due to the economic conditions and rapidly escalating costs at the time, an assumed value of 500 operations per based aircraft was used in order to estimate the 1986 annual operations of 142,000. It was assumed that the operations per based aircraft would decrease to 400 by 2006 due to the FAA national forecasts indicating a downward trend in operations per based aircraft. The result was an estimated 204,000 operations by 2006. The forecast also assumed a distribution of these operations to be 45 percent itinerant and 55 percent local, as that was the estimate provided by the FAA for a typical non-towered GA airport.

[2] Smith Ranch Airport was not closed as predicted. It now operates as a private airport named the San Rafael Airport.

The forecast presented above was reiterated in the 1991 Airport Land Use Plan. Although the document points out that the actual number of based aircraft in 1986 was 230. It was assumed that the Airport would recover these relocated aircraft when aircraft owners relocated their aircraft back from other regional airports.

3.0 CATCHMENT AREA

DVO is located to the north the San Francisco Bay in unincorporated Marin County, California. The Airport is located approximately two miles north of Novato, 27 miles north of San Francisco, and 28 miles northwest of Oakland. The Airport serves as an essential regional transportation resource by providing GA facilities in the northern portion of the San Francisco Bay Area. A majority of the traffic at DVO is from residents of Marin County

The San Francisco Bay Area is the second largest metropolitan region in California, behind the Greater Los Angeles area, and is the fifth largest in the United States. The San Francisco Bay Area is divided into five sub-regions: the North Bay which includes Marin County, Sonoma County, Napa County, and Solano County; the East Bay which includes Contra Costa County, and Alameda County; the South Bay which includes Santa Clara County; the Peninsula which includes San Mateo County; and San Francisco County. It has been determined that the South Bay, being over an hour drive from DVO, is located beyond the reach of DVO. However, the remaining sub-regions were deemed within a reasonable range from which the Airport may draw new based aircraft. In the remaining four sub-regions, all but one county are represented by current based aircraft. Therefore, these four sub-regions are defined as the Airport's catchment area.

4.0 HISTORICAL NATIONAL AND LOCAL TRENDS

Understanding the history and current state of the air taxi and GA industry can help predict future aviation demand. Additionally, the health of the economy and fuel prices can have a significant impact on the ability of operators to afford the cost of flying GA and air taxi operations. This section discusses nationwide historical, emerging and forecast trends in these areas.

4.1 NATIONAL AND LOCAL ECONOMY

Historically, the U.S. economy, as measured by Gross Domestic Product (GDP), has grown at a relatively steady rate; averaging 3.1 percent per year between 1960 and 2014. The rate of growth, particularly since 1985, has been remarkably stable reflecting both the size and maturation of the U.S. economy. Individual years have fluctuated around the long-term trend for a variety of reasons including pure macro-economic factors, fuel shocks, war, and terrorist attacks.

There have been two official economic recessions in the U.S. thus far in the 21st Century. The first occurred between March and November of 2001 and was compounded by the September 11, 2001 terrorist attacks. The negative impact of these events on the airline industry is well documented. The recession itself was short-lived by historical standards and the economy return to more normal growth rates quite quickly, fueled in large part by a gradual but prolonged reduction in interest rates.

The second recession, often referred to as the "Great Recession", occurred between December 2007 and June 2009.[3] The Great Recession was the worst financial crisis to affect the U.S. since the Great Depression and it was the longest recession since airline deregulation[4] in 1978. The nation's unemployment rate rose from 5.0 percent in December of 2007 to a high of 10.0 percent in October 2009.[5] In 2009, the American Recovery and Reinvestment Act (ARRA), was implemented in response to the economic crisis. This stimulus plan invested over $800 billion, with over half of it being spent during 2010.[6] The economy grew at an average annual rate of 1.2 percent in FY2011 and 2.7 percent in FY2012.

Since 2001, the economy of Marin County has closely mirrored the growth of the economy of the state of California and the U.S. as a whole. In 2002, Marin County's GDP grew 5.6 percent from the previous year, more than twice the rate of the U.S. and California. However, from 2003 through 2006 the average annual growth rate for Marin County's GDP was 3.5 percent which was in line with California and the U.S. as a whole. Starting in 2007, Marin County's GDP began to decline and while the U.S. was amidst the Great Recession in 2009 Marin County's GDP dropped 7.1 percent. In 2010, Marin County had a significant recovery at a growth of 4.6 percent and is now growing in line with that of the U.S. and California. **Exhibit 4–1** shows the year over year growth rate of GDP for the U.S., California and Marin County since 2001.

The GDP of Marin County is forecast to continue to mirror the state of California. From 2014 to 2050, the GDP is forecast to grow from $17.8 billion (constant 2009 dollars) to $35.9 billion (constant 2009 dollars), representing an average annual growth rate of 2.0 percent. This growth is identical to the state as a whole and is slightly higher than forecast growth of the national GDP at 1.9 percent.

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3 National Bureau of Economic Research, US Business Cycle Expansions and Contractions, September 20, 2010.

4 Deregulation refers to the Airline Deregulation Act of 1978 which reduced government control over the commercial aviation industry.

5 National Bureau of Economic Research, US Business Cycle Expansions and Contractions, September 20, 2010.

6 Congressional Budget Office, Estimated Impact of the American Recovery and Reinvestment Act on Employment and Economic Output from October 2011 Through December 2011, February 2012.

EXHIBIT 4–1
NATIONAL AND LOCAL ECONOMIC GROWTH

Sources: Woods & Poole 2015.

4.2 POPULATION

Since 2001, the population in Marin County has grown from 247,900 to 259,400 residents. The 0.4 percent growth per annum was less than half the growth in California and the nation as a whole at 0.9 percent during that same span. The population of Marin County is forecast to continue to grow at a rate well below the state of California and the United States. **Table 4–1** provides a comparison of Marin County's historical and forecast population to California and the United States.

TABLE 4–1
POPULATION (IN THOUSANDS)

	Population (in thousands)		
Year	United States	State of California	Marin County
Actual			
2001	284,969.0	34,479.5	247.9
2002	287,625.2	34,871.8	246.2
2003	290,107.9	35,253.2	245.1
2004	292,805.3	35,574.6	243.8
2005	295,516.6	35,827.9	244.2
2006	298,379.9	36,021.2	244.6
2007	301,231.2	36,250.3	246.2
2008	304,094.0	36,604.3	248.4
2009	306,771.5	36,961.2	250.9
2010	309,326.3	37,333.6	252.9
2011	311,582.6	37,668.7	255.3
2012	313,873.7	37,999.9	255.8
2013	316,128.8	38,332.5	258.4
2014	318,698.8	38,659.2	259.4
Forecast			
2020	336,499.6	40,897.3	267.3
2025	352,281.0	42,861.1	274.0
2030	368,462.4	44,855.9	280.5
2035	384,207.8	46,776.9	286.0
2040	399,180.8	48,580.6	290.4
2045	413,622.5	50,293.7	293.8
2050	427,950.9	51,964.6	296.7
AAGR			
2001-2014	0.9%	0.9%	0.4%
2014-2050	0.8%	0.8%	0.4%

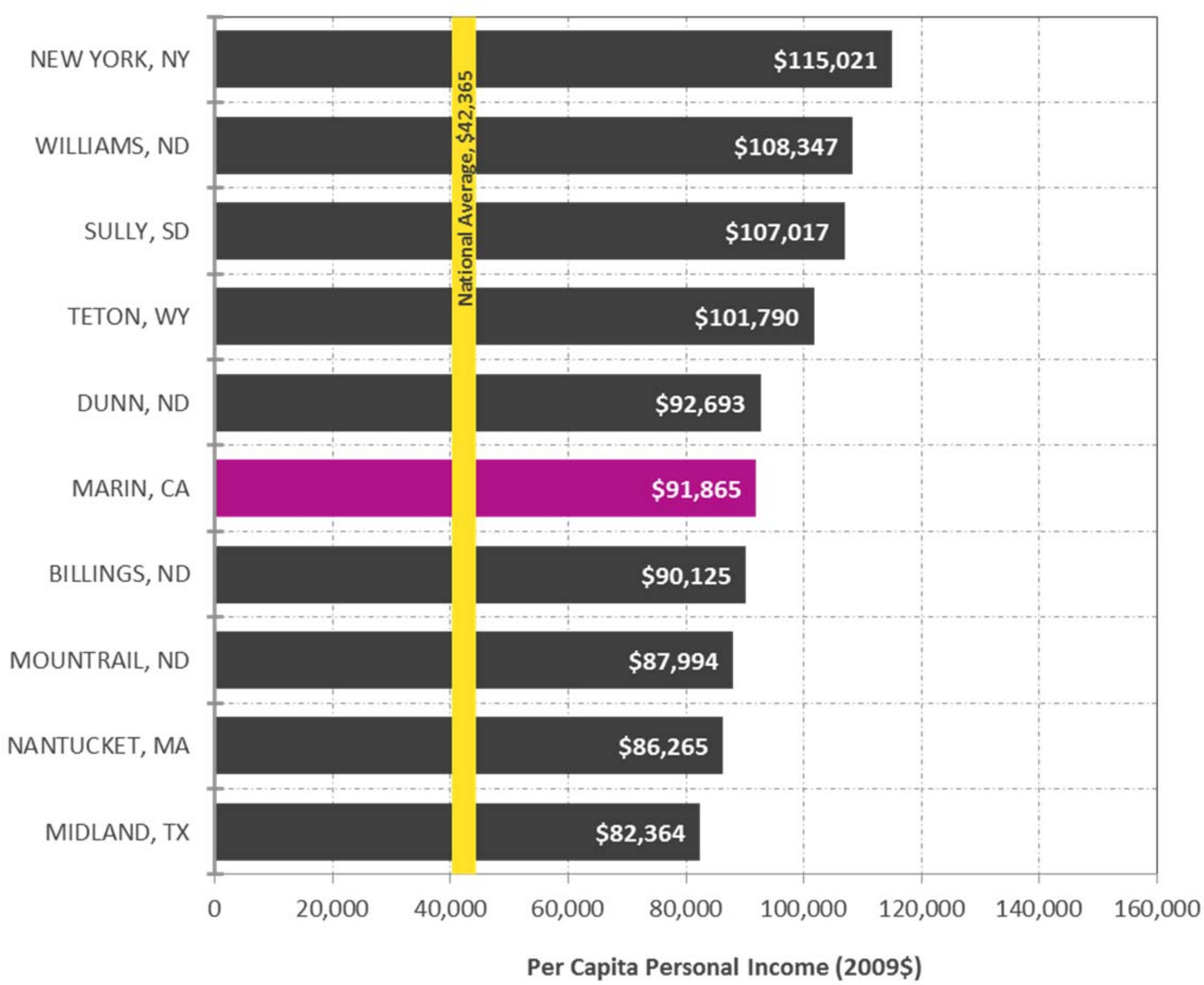
Sources: Woods & Poole 2015.

4.3 PER CAPITA PERSONAL INCOME (PCPI)

Income statistics are a broad indicator of the relative earning power and wealth of the region and inferences can be made to the residents' ability to purchase and operate GA aircraft. Per capita personal income (PCPI) is such a statistic that corresponds to the average income per inhabitant and is calculated by dividing total income by total population.

Marin County is one of the most affluent counties in the United States. According to Woods & Poole, Marin Count had a PCPI of $91,865 (constant 2009$) in 2014 which was the sixth highest in the nation and the highest in California. The second highest income county in California was the County of San Francisco with a PCPI of $79,575. In comparison, California had a PCPI of $45,791 and the national average was $42,365. **Exhibit 4–2** graphically depicts the PCPI of the top ten counties in the United States.

EXHIBIT 4–2
TOP 10 COUNTIES IN U.S. BY PCPI



Sources: Woods & Poole 2015.

Marin County is poised to continue to be one of the highest counties in the nations in terms of PCPI as it is forecast to grow at an average annual growth rate of 1.3 percent through 2050. During the same span, the PCPI of the state of California and the United States are forecast to grow at just 0.9 percent.

4.4 CALIFORNIA DEPARTMENT OF TRANSPORTATION ECONOMIC FORECASTS

The California Department of Transportation (CalTrans) provides county-level economic forecasts for all of the 58 counties in California. These long-term forecasts are updated annually and are released in the fall with the most recent release being the 2014 forecast. Some of the highlights presented in the forecast regarding Marin County include the follow:

- Population will grow at an average annual rate of 0.3 percent through 2040, compared to Woods & Poole's forecast of 0.4 percent.
- Net migration will be positive throughout the forecast period, accounting for approximately 80 percent of the total population growth.
- Total employment is forecast to grow at an average annual rate of 0.6 percent through 2040. The difference in growth from population and employment will result in a drop of the unemployment rate from 4.7 percent in 2014 to 3.6 percent in 2040.
- PCPI will growth at an average annual rate of 1.9 percent, compared to 1.3 percent indicated by Woods & Poole.

4.5 ASSOCIATION OF BAY AREA GOVERNMENTS SOCIO-ECONOMIC FORECASTS

In 2013, the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC) adopted the Plan Bay Area, a long-range integrated transportation and land-use/housing strategy. Plan Bay Area included population and employment forecasts by county for the Bay Area. **Table 4–2** provides the forecasts presented in the Plan Bay Area document.

TABLE 4–2
BAY AREA FORECASTS

Category	2010	2040	Growth 2010-2040 Total	Growth 2010-2040 Percent
Population	7,150,740	9,299,150	2,148,410	30.0%
Alameda	1,510,270	1,987,950	477,680	31.6%
Contra Costa	1,049,030	1,338,440	289,410	27.6%
Marin	252,410	285,400	32,990	13.1%
Napa	136,480	163,680	27,200	19.9%
San Francisco	805,240	1,085,730	280,490	34.8%
San Mateo	718,450	904,430	185,980	25.9%
Santa Clara	1,781,640	2,423,470	641,830	36.0%
Solano	413,340	511,600	98,260	23.8%
Sonoma	483,880	598,460	114,580	23.7%
Jobs	3,385,300	4,505,220	1,119,920	33.1%
Alameda	694,450	947,650	253,200	36.5%
Contra Costa	344,920	467,390	122,470	35.5%
Marin	110,730	129,140	18,410	16.6%
Napa	70,650	89,540	18,890	26.7%
San Francisco	568,720	759,500	190,780	33.5%
San Mateo	345,200	445,080	99,880	28.9%
Santa Clara	926,260	1,229,530	303,270	32.7%
Solano	132,350	179,930	47,580	36.0%
Sonoma	192,010	257,460	65,450	34.1%

Note: Sum of county totals may not match regional totals due to rounding.
Sources: Association of Bay Area Governments (ABAG), Bay Area Plan, 2013.

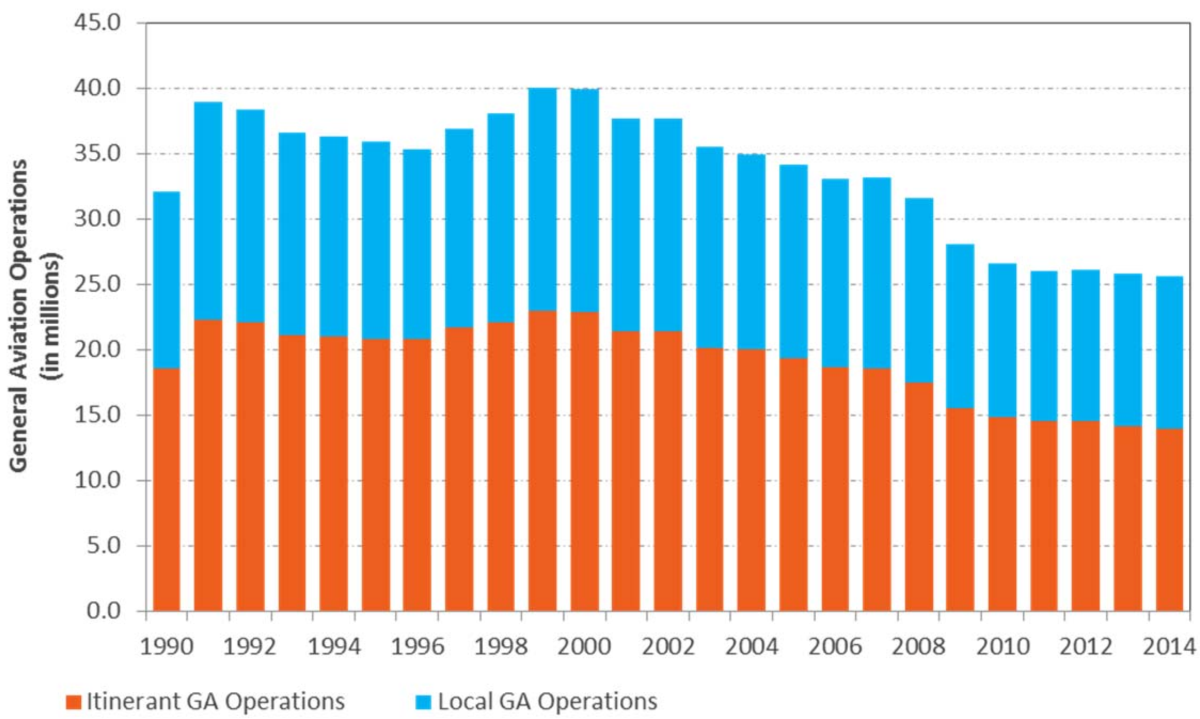
4.6 HISTORICAL NATIONAL GA ACTIVITY

The civil aviation industry in the U.S. has experienced major changes over the past several decades. GA activity levels were at their highest in the late 1970s through 1981. GA activity levels and new aircraft production reached all-time lows in the early 1990s due to a number of factors including increasing fuel prices, increased product liability stemming from litigation concerns, and the resulting higher cost of new aircraft. The passage of the 1994 General Aviation Revitalization Act (GARA)[7] combined with reduced new aircraft prices, lower fuel prices, resumed production of single-engine aircraft, continued strength in the production and sale of business jets, and a recovered economy led to growth in the GA industry in the latter half of the 1990s.[8]

7 GARA imposes an 18-year statute of repose on product liability lawsuits for GA aircraft.
8 Based on information from the General Aviation Manufacturers Association (GAMA).

The following information is recorded and reported by the Fiscal Year (FY) of the federal government, which extends from October 1 to September of each year (i.e. federal fiscal year FY2000 started on October 1, 1999). The rebound in the U.S. GA industry that began with GARA started to subside by FY2000. GA traffic at airports with air traffic control service slowed considerably in FY2001 due largely to a U.S. economic recession and to some extent the terrorist attacks of September 11, 2001. GA traffic at airports with air traffic control service continued to decline through FY2006 as spikes in fuel costs occurred and the economy grew at a relatively even pace. For the first time since FY1999, GA traffic at airports with air traffic control service increased in FY2007, but just slightly (0.2 percent over FY2006). However, GA operations declined by 4.7 percent at airports with air traffic control service the following year. The decline in GA traffic continued due to the recent economic downturn and increases in fuel prices. GA operations decreased 11.3 percent in FY2009, 5.1 percent in FY2010, and 2.3 percent in FY2011. In FY2012, GA operations increased 0.6 percent but subsequently decreased 0.8 percent and an estimated 1.1 percent in the following years. **Exhibit 4–3** shows the number of GA operations at U.S. airports since FY1990.

EXHIBIT 4–3
GA OPERATIONS AT U.S. AIRPORTS



Sources: FAA Air Traffic Activity Data System (ATADS); Landrum & Brown analysis.

4.7 FAA NATIONAL FORECAST

The FAA annually publishes forecasts of the U.S. aviation industry. The FAA forecast is considered to be one of the most complete and reliable forecasts available for civil activity in the U.S. The FAA forecasts[9] project the following trends in the U.S. GA industry from 2014 to 2035:

- The number of active GA aircraft is forecast to increase by 0.4 percent annually.
- Growth of 1.4 percent per annum is expected in the number of GA hours flown.
- The number of student pilots is expected to decline by 0.3 percent per annum through FY2035.
- GA operations at airports with air traffic control service are forecast to increase by 0.4 percent annually through FY2035.
- Business use of GA aircraft has experienced historically high growth rates and will continue to grow more rapidly than recreational use.

As part of its forecasting effort, the FAA prepares national forecasts of active GA aircraft, fleet mix and general aircraft operations. The active aircraft forecast by fleet mix is presented in **Table 4–3**. It should be remembered that this is a national forecast and is not representative of any particular airport or region.

The overall number of active GA aircraft is projected to grow at an average annual rate of 0.4 percent for the next 21 years. However, there is variation both with respect to the mix of aircraft and the growth rate within each category. Starting in 2005, the FAA added “sport” aircraft as a registration category. Originally the FAA was expecting high registration in this category, but the growth rates have been modest and over the 21-year period the category is anticipated to grow at an annual rate of 4.3 percent. Other areas of growth include the turbine jets, turboprops, and rotorcraft. Single-engine and multi-engine piston aircraft are expected to decline at an average annual rate of 0.6 percent and 0.4 percent, respectively.

9 FAA Aerospace Forecast, Fiscal Years 2015-2035.

TABLE 4–3
U.S. ACTIVE GENERAL AVIATION AIRCRAFT

	Fixed Wing												
	Piston			Turbine			Rotorcraft						Total General Aviation
Year	Single-Engine	Multi-Engine	Total	Turbo-Prop	Turbo Jet	Total	Piston	Turbine	Total	Experimental	Sport Aircraft	Other	Fleet
Historical													
2007	147,569	19,337	166,906	9,514	10,385	19,899	2,769	6,798	9,567	23,228	6,066	5,940	231,606
2008	145,497	17,515	163,012	8,907	11,042	19,949	3,498	6,378	9,876	23,364	6,811	5,652	228,664
2009	140,649	16,474	157,123	9,055	11,268	20,323	3,499	6,485	9,984	24,419	6,547	5,480	223,876
2010	139,519	15,900	155,419	9,369	11,484	20,853	3,588	6,514	10,102	24,784	6,528	5,684	223,370
2011	136,895	15,702	152,597	9,523	11,650	21,173	3,411	6,671	10,082	24,275	6,645	5,681	220,453
2012	128,847	14,313	143,160	10,304	11,793	22,097	3,292	6,763	10,055	26,715	2,001	5,006	209,034
2013	124,398	13,257	137,655	9,619	11,637	21,256	3,137	6,628	9,765	24,918	2,056	4,277	199,927
2014E	123,440	13,215	136,655	9,485	11,750	21,235	3,235	6,850	10,085	24,480	2,200	4,205	198,860
Forecast													
2015	122,435	13,175	135,610	9,390	11,915	21,305	3,335	7,105	10,440	24,880	2,355	4,190	198,780
2020	117,770	12,920	130,690	9,315	13,115	22,430	3,785	8,410	12,195	26,795	3,170	4,130	199,410
2025	113,905	12,545	126,450	9,855	15,000	24,855	4,165	9,595	13,760	28,875	3,970	4,060	201,970
2030	110,635	12,230	122,865	11,155	17,565	28,720	4,555	10,805	15,360	30,975	4,705	4,055	206,680
2035	108,810	12,135	120,945	12,970	20,815	33,785	4,990	12,120	17,110	33,040	5,360	4,020	214,260
AAGR													
2007-14	-2.5%	-5.3%	-2.8%	0.0%	1.8%	0.9%	2.2%	0.1%	0.8%	0.8%	-13.5%	-4.8%	-2.2%
2014-15	-0.8%	-0.3%	-0.8%	-1.0%	1.4%	0.3%	3.1%	3.7%	3.5%	1.6%	7.0%	-0.4%	0.0%
2014-24	-0.7%	-0.5%	-0.7%	0.2%	2.2%	1.3%	2.4%	3.2%	2.9%	1.5%	5.6%	-0.4%	0.1%
2014-35	-0.6%	-0.4%	-0.6%	1.5%	2.8%	2.2%	2.1%	2.8%	2.5%	1.4%	4.3%	-0.2%	0.4%

Sources: FAA Aerospace Forecast, Fiscal Years 2015-2035.

4.8 EMERGING AIRCRAFT OWNERSHIP

The concept of purchasing hours of jet time began to emerge in the 1990s with the fractional ownership of business jets gaining popularity. Fractional ownership, as it suggests, involves purchasing a share in a GA aircraft. The user also typically pays an hourly usage fee and a monthly management fee. Companies such as NetJets, FlexJet, Citation Shares, and others provide these types of services. The fractional ownership concept began with jets but has also begun to expand to all types of aircraft including single-engine piston aircraft. Fractional ownership has significantly contributed to the revitalization of the GA manufacturing industry in the 21st century. For example, NetJets alone has purchased hundreds of corporate jet aircraft of varying sizes ranging up to the Boeing BBJ (typically a derivative of the Boeing 737 aircraft). Projected increases in fractional ownership activity levels are a large part of the FAA's projected growth in GA operations through 2035.

4.9 FLEET DIVERSIFICATION

In 1980, approximately 91.5 percent of all active U.S. GA and air taxi aircraft were piston airplanes. Since then active piston airplanes have been decreasing at an average annual rate of 1.0 percent resulting in the share of piston airplane dropping to an estimate of 68.7 percent of all active U.S. GA aircraft in 2014. The FAA forecast that piston airplanes will continue to decline at a rate of 0.6 percent annually through 2035. [10]

During this span, business jets have been the fastest growing segment. The business jet fleet grew from 2,992 active aircraft in 1980 to an estimated 11,750 active aircraft in 2014, representing an average annual growth rate of 4.1 percent. A majority of this growth occurred between 1995 and 2004 when growth averaged 9.4 percent annually. Business jets now account for 5.9 percent of all active GA and air taxi aircraft. The FAA forecast that business jets will continue to grow at 2.8 percent annually through 2035.[11]

In 2007, a new category of personal jets, referred to as very light jets (VLJs), began delivery. A VLJ is defined as a small jet that seats four to eight people, is certified for single-pilot operations, and has a maximum takeoff weight of less than 10,000 pounds. The jets are aimed at owners of twin-engine piston and turboprop aircraft. The VLJs are able to operate at smaller airports with shorter runways, between 3,000 and 3,500 feet in length. Initial forecasts for VLJ called for over 400 aircraft to be delivered a year. However, in 2008 Eclipse Aviation, one of the largest manufacturers of VLJs, and DayJet, one of the largest users of VLJs, declared bankruptcy. In 2013, only 77 VLJs were delivered worldwide.[12]

[10] FAA Aerospace Forecast, Fiscal Years 2015-2035.
[11] FAA Aerospace Forecast, Fiscal Years 2015-2035.
[12] FAA Aerospace Forecast, Fiscal Years 2014-2034.

From 1980 through 2014, turboprop airplane and rotorcraft had experience modest growth of 2.6 percent and 1.5 percent respectively. In 2014, turboprop airplane and rotorcraft accounted for approximately 4.8 percent and 5.1 percent of all active GA and air taxi aircraft, respectively; up from a combined 4.8 percent in 1980 (1.9 percent turboprop and 2.8 percent rotorcraft). Turboprop airplane is forecast to grow at 1.5 percent annually while rotorcraft is forecast to grow at 2.5 percent annually through 2035.[13]

The category, light-sport aircraft of aircraft was established on September 1, 2004. The category is built to industry consensus standards rather than requiring type and production certificates thereby reducing development costs which results in lower acquisition costs. The design of the aircraft in this category is limited to slow (less than 120 knots) and simple. The FAA is forecasting light-sport aircraft fleet to grow from an estimate of 2,200 aircraft in 2014 to 5,360 in 2035, representing an average annual growth rate of 4.3 percent.

4.10 FUEL PRICES

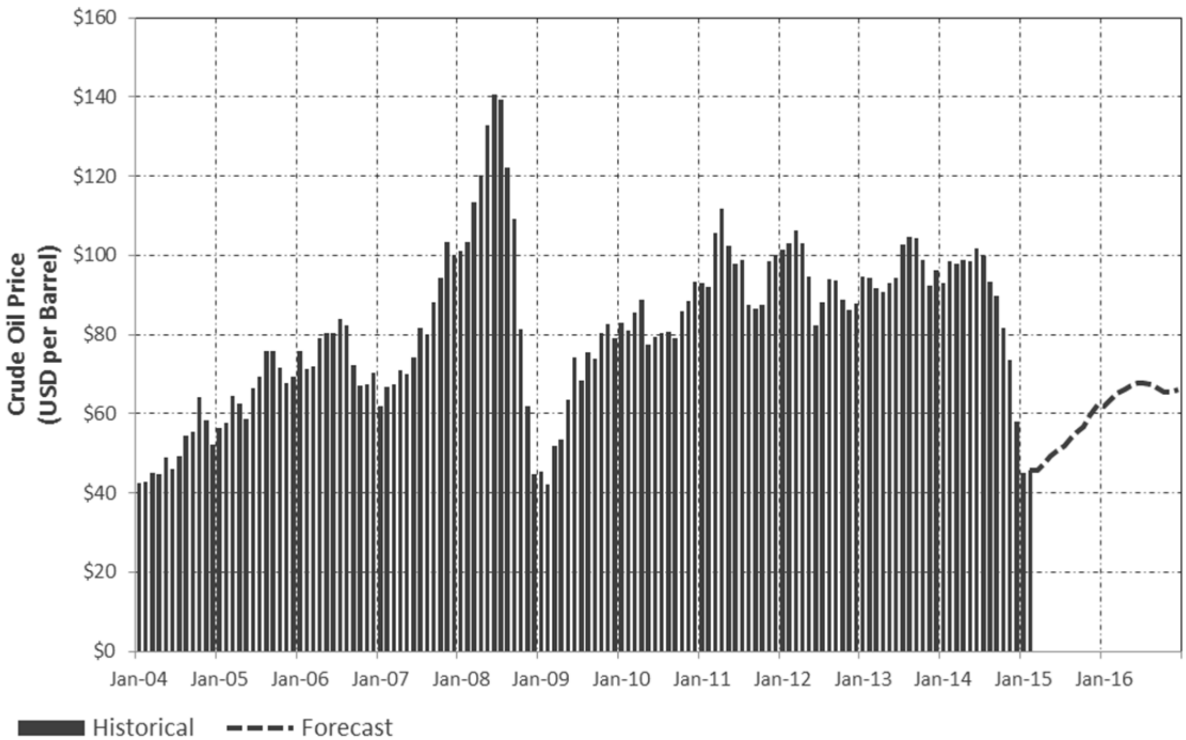
The price of fuel is one of the biggest costs to the airlines and GA aircraft owners. The price of West Texas Intermediate (WTI) crude oil increased dramatically in the 2006 to 2008 time period, posting a 290 percent increase in June 2008 compared to January 2004. After averaging $20 to $30 per barrel in the 2000 to 2003 time period, spot crude oil prices surged to about $140 per barrel in June/July 2008. Several factors drove the increase such as strong global demand, particularly in China and India, a weak U.S. dollar, commodity speculation, political unrest, and a reticence to materially increase supply.

The price of oil subsequently declined sharply in 2009 due to reduced demand resulting from the global financial crisis and resulting economic recession. However, oil prices increased in the subsequent three years as the economic climate slowly improved and unrest in the Middle East contributed to rising oil prices. In 2012, oil averaged 94 USD per barrel.

Starting in July 2014, the price of crude oil began to drop significantly. In February 2015, Energy Information Administration (EIA) released their short-term energy outlook which projects the price of oil, adjusted for inflation, to reach 66 USD by the end of 2016, far below the reference case of 89 USD. The short-term outlook is more in-line with the low oil price case which projects fuel prices to reach 73 USD per barrel by 2040. It is unlikely that oil prices would remain at these levels through the forecast period. Consequently, it is likely that the cost of fuel will continue to put upward pressure aircraft operating costs. **Exhibit 4–4** shows the crude oil prices, adjusted for inflation, since January 2004 and the forecast presented in EIA's short-term outlook.

[13] FAA Aerospace Forecast, Fiscal Years 2015-2035.

EXHIBIT 4–4
CRUDE OIL PRICES (2013$)



Sources: Energy Information Administration (EIA); Landrum & Brown analysis.

4.11 BUSINESS USE OF GENERAL AVIATION

Companies and individuals use aircraft as a tool to improve their business's efficiency and productivity. The terms business and corporate aircraft are often used interchangeably, as they both refer to aircraft used to support a business enterprise. The FAA defines corporate transportation as "any use of an aircraft by a corporation, company or other organization (not for compensation or hire) for the purposes of transporting its employees and/or property, and employing professional pilots for the operation of the aircraft." Regardless of the terminology used, the business/corporate component of GA is an important one.

After growing rapidly for most of the past decade, the demand for business jet aircraft has decelerated over the past few years. While new products, including very light jets, and increasing foreign demand helped to spur this growth in the early 2000s, the past few years have seen the dramatic impact of the recession on the business jet market. Issues such as reduced corporate profits, bankruptcies, and mergers have resulted in reductions in corporate GA activity, especially in the business jet sector.

Increased personnel productivity has been stated as one of the most important benefits of using business aircraft. Companies flying GA aircraft for business have more control of their travel. Itineraries can be changed as needed, and the aircraft can fly into destinations not served by scheduled airlines. Business aircraft usage provides:

- Employee time savings
- Increased enroute productivity
- Minimized time away from home
- Enhanced industrial security
- Enhanced personal safety
- Management control over scheduling

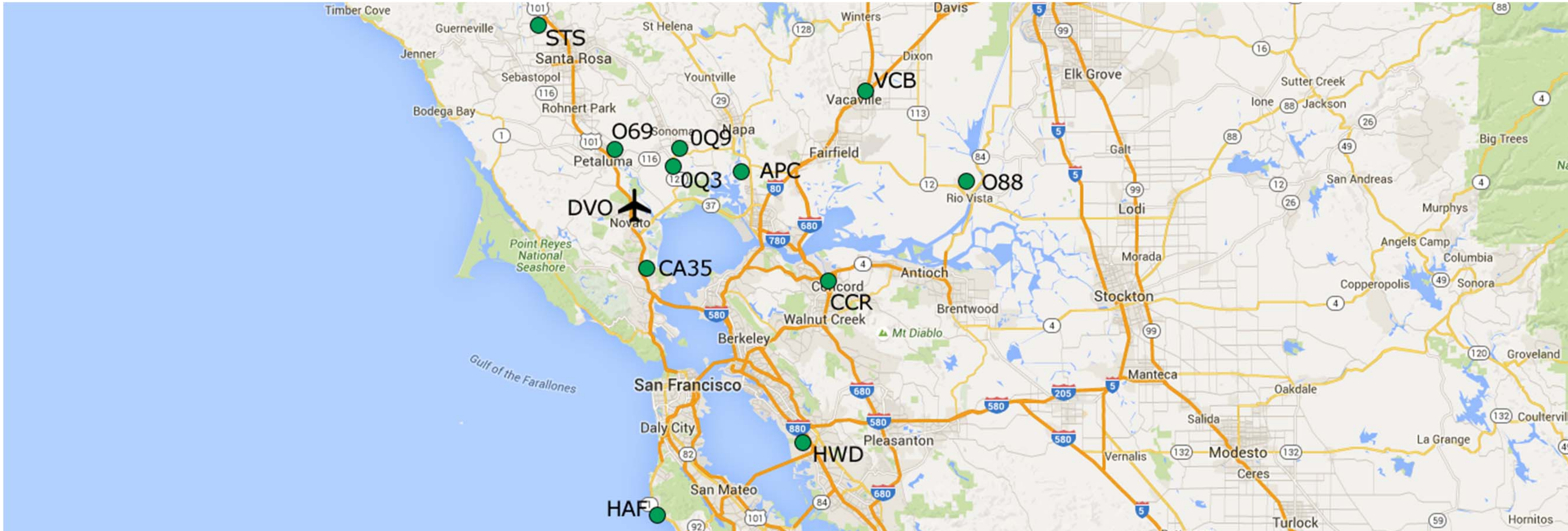
Business use of GA aircraft ranges from small, single-engine aircraft rentals to multiple aircraft corporate fleets supported by dedicated flight crews and mechanics. GA aircraft use allows employers to transport personnel and air cargo efficiently. Businesses often use GA aircraft to link multiple office locations and reach existing and potential customers. Business aircraft use by smaller companies has escalated as various chartering, leasing, time-sharing, interchange agreements, partnerships, and management contracts have emerged. Businesses and corporations have increasingly employed business aircraft in their operations.

5.0 OVERVIEW OF SAN FRANCISCO BAY AREA'S GA AIRPORTS

There are nine other airports serving GA demand that have similar characteristics as DVO and are located within a reasonable driving distance (60 miles) of the Airport: Sonoma Valley Airport (0Q3), San Rafael Airport (CA35), Napa County Airport (APC), Buchanan Field Airport (CCR), Half Moon Bay Airport (HAF), Hayward Executive Airport (HWD), Charles M. Schulz – Sonoma County Airport, Nut Tree Airport (VCB), Petaluma Municipal Airport (O69), Sonoma Skypark (0Q9), and Rio Vista Municipal Airport (O88). All of the airports listed are within the catchment area. **Exhibit 5–1** provides the location of each of the airports in relationship to DVO and summarizes the major facilities and key aviation activity characteristics of each of the aforementioned airport as compared to DVO.

In Fiscal Year (FY) 2013, DVO handled approximately 14.3 percent of the activity at these airports and accommodated approximately 8.6 percent of the based aircraft. Each of the remaining airports is discussed below.

EXHIBIT 5–1
SAN FRANCISCO BAY AREA'S GA AIRPORTS



Airport Name	Gnoss Field	Sonoma Valley Airport	San Rafael Airport	Napa County Airport	Buchanan Field Airport	Half Moon Bay Airport	Hayward Executive Airport	Charles M Schulz - Sonoma County Airport	Nut Tree Airport	Petaluma Municipal Airport	Sonoma Skypark	Rio Vista Municipal Airport
Airport Code	DVO	0Q3	CA35	APC	CCR	HAF	HWD	STS	VCB	O69	0Q9	O88
Asset Category	Regional	n.a.	n.a.	National	National	Local	National	-	Regional	Regional	n.a.	Local
Service Level	Reliever	n.a.	n.a.	Reliever	Reliever	Reliever	Reliever	Primary	General Aviation	Reliever	n.a.	General Aviation
Driving Distance from DVO in Miles	n.a.	16	10	30	38	49	49	36	47	14	19	58
Distance from DVO in Nautical Miles	n.a.	7	8	14	26	38	36	24	31	7	10	47
Control Tower	NO	NO	NO	YES	YES	NO	YES	YES	NO	NO	NO	NO
Acreage	90	79	100	820	495	325	543	1,014	262	220	33	273
Number of Runways	1	2	1	3	4	1	2	2	1	1	1	2
Runway Dimensions (Length x Width; in feet)	13/31: 3,300 x 75	07/25: 2,700 x 45 17/35: 1,500 x 50	04/22: 2,140 x 30	18R/36L: 5,930 x 150 06/24: 5,007 x 150 18L/36R: 2,510 x 75	01L/19R: 5,001 x 150 14L/32R: 4,602 x 150 14R/32L: 2,799 x 75 01R/19L: 2,770 x 75	12/30: 5,000 x 150	10R/28L: 5,694 x 150 10L/28R: 3,107 x 75	14/32: 6,000 x 150 02/20: 5,202 x 100	02/20: 4,700 x 75	11/29: 3,602 x 75	08/26: 2,480 x 40	07/25: 4,199 x 75 15/33: 2,199 x 60
Instrument Landing System	NO	NO	NO	YES	NO	NO	NO	YES	NO	NO	NO	YES
Annual Operations												
FY2003	135,000	n.a.	n.a.	124,650	124,737	60,150	127,518	117,748	101,500	50,200	n.a.	35,000
FY2013	98,000	16,000	n.a.	42,784	81,837	50,150	117,930	75,702	101,500	53,200	15,000	35,000
Based Aircraft												
FY2003	235	n.a.	n.a.	248	594	70	496	382	247	203	n.a.	57
FY2013	191	120	100	173	401	33	375	314	185	209	62	50

Note: Annual operations and based aircraft data were obtained from the FAA TAF for all airports with the exception of Sonoma Valley, San Rafael, and Sonoma Skypark. These airports are not included in the NPIAS and therefore are not forecasted by the FAA. Operations and based aircraft counts for these airports were obtained from FAA Form 5010-1, Airport Master Record.

Sources: Landrum & Brown Analysis; FAA Form 5010-1, Airport Master Record; FAA TAF; airnav.com

5.1 SONOMA VALLEY AIRPORT (0Q3)

Sonoma Valley Airport, also known as Schellville Airport, is the closest alternative airport to DVO. 0Q3 is a privately owned and open for public use of light aircraft during the daytime hours. The airport is limited to light aircraft (i.e. single- and multi-engine piston aircraft) due to the runway dimensions. 0Q3 has two runways; Runway 7/25 is 2,700 feet in length and 45 feet in width and Runway 17-35 is 1,513 feet in length and 50 feet in width. The Sonoma Valley Airport is not included in the NPIAS. According to the Airport Master Record, Sonoma Valley Airport had 16,000 total operations in 2011 and had 120 based aircraft. Privately owned airports are not required to report operating levels and as such 2011 data is the best available data.

5.2 SAN RAFAEL AIRPORT (CA35)

The San Rafael Airport is a privately owned GA airport. The airport has a single runway, Runway 4/22, that measures 2,140 feet in length and 30 feet in width. The dimension of the runway limits the type of aircraft capable of operating at the airport. According to the Airport Master Record, there are 100 aircraft currently based at CA35.

5.3 NAPA COUNTY AIRPORT (APC)

The Napa County Airport is the closest airport to DVO that has the facilities to handle turbine GA aircraft operations without restrictions unlike DVO. APC has three runways, Runway 18R/36L, Runway 6/24, and Runway 18L/36R, measuring at lengths of 5,930, 5,007, and 2,510 feet respectively. APC also is served by an FAA Air Traffic Control Tower (ATCT). Like DVO, the airport is designated as a reliever airport by the FAA. It has a national role per the NPIAS. In FY2013, APC reported 42,784 operations, nearly a third of the operations in FY2003, and had 173 based aircraft.

5.4 BUCHANAN FIELD AIRPORT (CCR)

The Buchanan Field Airport is a county-owned airport opened to the public. CCR is designated as a national reliever airport by the FAA and is served by an FAA ATCT. The airport is able to handle turbine GA aircraft operations. CCR has the following four runways: Runway 1L/19R at 5,001 feet in length, Runway 14L/32R at 4,602 feet in length, Runway 14R/32L at 2,799 feet in length, and Runway 1R/19L measuring at 2,770 feet in length. In FY2013, CCR reported 81,837 operations and had 401 based aircraft.

5.5 HALF MOON BAY AIRPORT (HAF)

The Half Moon Bay Airport is owned by San Mateo County and is located south of the city of San Francisco. Although HAF is categorized as a reliever airport, the airport is also classified as local as it only supplements the local communities, unlike DVO which supports the region. The airport has a single runway, Runway 12/30 that measures 5,000 feet in length and 150 feet in width. In FY2013, HAF reported 50,150 operations and had 33 based aircraft.

5.6 HAYWARD EXECUTIVE AIRPORT (HWD)

In FY2013, the Hayward Executive Airport accounted for 18.5 percent of the activity at the GA airports with 117,930 operations and 375 based aircraft. HWD is a city-owned, public-use airport categorized as a national reliever airport by the FAA. The airport has a FAA ATCT and two runways, Runway 10R/28L and Runway 10L/28R, measuring at 5,694 feet and 3,107 feet in length respectively.

5.7 CHARLES M. SCHULZ – SONOMA COUNTY AIRPORT (STS)

The Charles M. Schulz is categorized as a nonhub primary airport by the FAA, the only primary airport identified in the group. The designation of a primary airport for STS is due to the daily scheduled passenger service provided by Alaska Airlines to Los Angeles International Airport (LAX), San Diego International Airport (SAN), Portland International Airport (PDX), and the Seattle-Tacoma International Airport (SEA). Although the airport has scheduled service, a majority, 88.6 percent, of the operations are GA. STS is served by a FAA ATCT and has two runways, Runway 14/32 and Runway 2/20, measuring at 6,000 feet and 5,202 feet in length respectively. In FY2013, STS had 75,702 operations (67,046 GA operations) and 314 based aircraft.

5.8 NUT TREE AIRPORT (VCB)

The Solano County-owned, public-use Nut Tree Airport has a single runway, Runway 2/20, which measures at 4,700 feet in length. The airport is designated as a regional GA airport by the FAA. In FY2013, VCB had the second most operations out of the GA airports in the region with 101,500 operations and 185 based aircraft; nearly all of which are single-engine piston.

5.9 PETALUMA MUNICIPAL AIRPORT (O69)

Owned by the city of Petaluma, the Petaluma Municipal Airport is categorized by the FAA as a regional, reliever airport. The airport is restricted in its use due to the dimensions of the single runway, Runway 11/29, which measure in at 3,602 feet in length and 75 feet in width. As such, a majority (91.9 percent) of the 209 based aircraft are single engine piston. In FY2013, O69 had 53,200 operations.

5.10 SONOMA SKYPARK (0Q9)

Sonoma Skypark is a privately owned airport and open for public use by light aircraft. The airport is limited to light aircraft due to the runway dimensions. 0Q9 has one runway; Runway 8/26 is 2,480 feet in length and 40 feet in width. The Sonoma Skypark is not included in the NPIAS. According to the Airport Master Record, 0Q9 had 15,000 total operations and 62 based aircraft in 2014.

5.11 RIO VISTA MUNICIPAL AIRPORT (O88)

The Rio Vista Municipal Airport is the furthest alternative to DVO in the catchment area. O88 is owned by the City of Rio Vista and is open to the public. O88 has two runways, Runway 7/25 and Runway 15/33, measuring 4,199 and 2,199 feet, respectively, in length. The airport is classified as local as it only supplements the local communities, unlike DVO which supports the region. In FY2013, O88 reported 35,000 operations and had 50 based aircraft.

6.0 DVO HISTORICAL TRENDS

Background data on DVO traffic was gathered from the FAA Form 5010-1, FAA Terminal Area Forecasts (TAF), and DVO Airport Management. A Form 5010-1 states the previous year's count of operations broken down by category, as well as the based aircraft for the airport. The FAA TAF uses the 5010-1 forms as a basis for defining historical and forecast traffic. Operational counts for airports such as Gnoss Field Airport that do not have an ATCT are often overestimated and are carried over year-after-year. A review of the 5010-1 form indicated that this is the case for Gnoss Field Airport. As a result, the FAA Form 5010-1 and the FAA TAF for DVO were found to be unreliable. Therefore, operational numbers and based aircraft counts are based upon information provided by DVO Airport Management.

The Airport Manager of DVO conducted a count of current based aircraft in May of 2015. This count revealed 226 aircraft based at DVO, consisting of 202 single-engine piston aircraft, 10 multi-engine piston aircraft, 13 turbine aircraft, and one helicopter. **Table 6–1** provides a summary of the aircraft based at DVO.

TABLE 6–1
DVO 2014 BASED AIRCRAFT FLEET MIX

Category	Number of Aircraft
Single-Engine Piston	202
Multi-Engine Piston	10
Turbine	13
Rotorcraft	1
Total	226

Sources: Marin County Airport-Gnoss Field Airport Management, Landrum & Brown Analysis.

FAA radar flight track data for aircraft operations at DVO was evaluated for calendar year 2014. DVO is located within airspace managed by the Oakland Air Route Traffic Control Center (ARTCC). The data received is limited to operations which submitted flight plans; the majority of aircraft with flight plans are operating under instrument flight rules (IFR), regardless of weather conditions at the airport. The radar data provided information for 3,923 total operations for DVO (2,956 arrivals and 967 departures).

For both jet and multi-engine turboprop operations, the number of arrivals and departures recorded in the radar data was generally consistent. This is because these aircraft classes normally operate under IFR and therefore file flight plans, and so are recorded by FAA radar databases. For other aircraft classes, in particular the piston aircraft, the number of arrivals and departures recorded is not always consistent. This is because many piston aircraft may depart using visual flight rules (VFR), but then return to the airport on an IFR clearance. The VFR flight, while tracked by radar at the time, would not normally be recorded by FAA since VFR flight records are not maintained in the FAA radar databases.

In order to account for the discrepancy in arrivals to departures, the max value for each aircraft (either arrival or departure) was assigned to the particular aircraft. For example, the Pilatus PC-12 had 213 arrivals and 135 departures in the radar data but was assigned 213 arrivals and 213 departures, totaling 426 operations. Essentially, this is a logical assumption that the number of takeoffs must equal the number of landings at an airport over time.

In an effort to identify the critical design airplane at the Airport, the radar data was summarized by Airport Reference Code (ARC). ARC as defined in FAA Advisory Circular 150/5300-13A Change 1, *Airport Design*, has two components; the Aircraft Approach Category (AAC) and the Airplane Design Group (ADG). The AAC is depicted by a letter and determined by the reference landing speed (V_{REF}) or the approach speed of the aircraft. If the V_{REF} is unavailable, the number refers to 1.3 times the stall speed (V_{SO}). The ADG is depicted by a Roman numeral and is based on the physical characteristics of the aircraft, i.e. wingspan and tail height of the aircraft, whichever is more restrictive. **Table 6–2** provides the limits for the AAC and the ADG.

TABLE 6–2
AIRPORT REFERENCE CODE

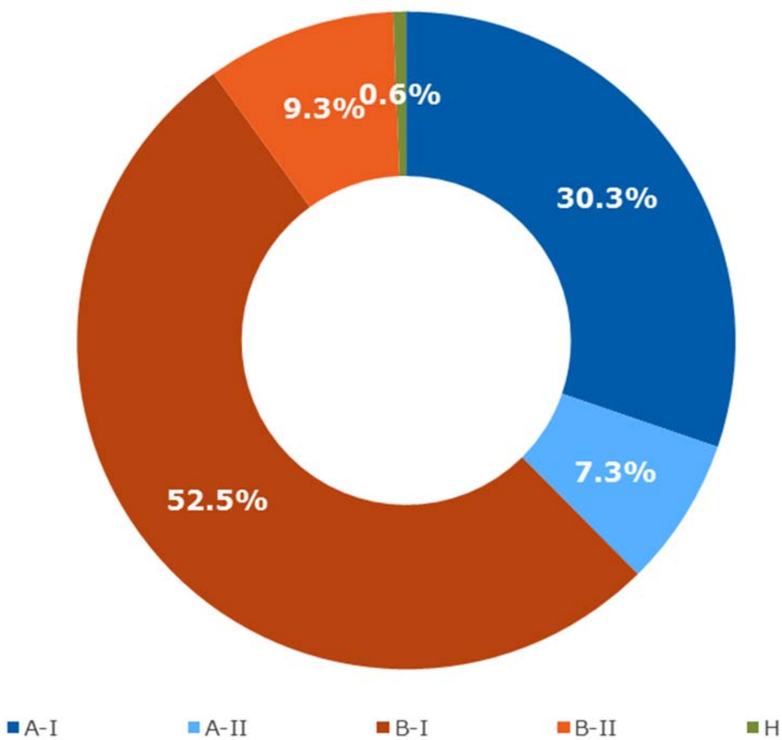
	V_{REF}/Approach Speed	
AAC	MIN	MAX
A	0 kt	91 kt
B	91 kt	121 kt
C	121 kt	141 kt
D	141 kt	166 kt
E	166 kt	

	Tail Height		Wingspan	
ADG	MIN	MAX	MIN	MAX
I	0.0'	20.0'	0.0'	49.0'
II	20.0'	30.0'	49.0'	79.0'
III	30.0'	45.0'	79.0'	118.0'
IV	45.0'	60.0'	118.0'	171.0'
V	60.0'	66.0'	171.0'	214.0'
VI	66.0'	80.0'	214.0'	262.0'

Sources: AC 150/5300-13A, Airport Design, CHG1 pages 13-14

In 2014, B-I aircraft comprised of aircraft such as the Cirrus SR-22, Cessna 182 Skylane and the Piper PA-46 Malibu were the most predominate aircraft at DVO accounting for 52.5 percent of the total radar operations. The second largest group, with 30.3 percent of radar operations, was A-I aircraft composed primarily of the Cessna 172 Skyhawk, the Beechcraft B36 Bonanza, and the Mooney M20. The most demanding category at DVO, the B-II aircraft, including aircraft such as the Beechcraft Super King Air 200, the Cessna CitationJet C525A/B, and the Cessna Citation V accounted for 9.3 percent of radar operations. The Pilatus PC-12 and Beechcraft Model 18 were the only aircraft in group A-II, and combined accounted for 7.3 percent of radar operations. With only 0.6 percent of the radar operations, helicopters or rotorcraft was the smallest group of aircraft at DVO. **Exhibit 6–1** provides a graphical summary of the aircraft operating at DVO.

EXHIBIT 6–1
RADAR FLEET MIX AT DVO



Sources: Radar Data; Landrum & Brown analysis.

7.0 AIRCRAFT REGISTERED IN CATCHMENT AREA

The FAA maintains a database of GA aircraft registered in the United States. The aircraft registry serves as a valuable tool in determining the total number of aircraft located in a specific area as the information is available at the county level. Aircraft owners typically base their aircraft at locations (i.e., airports) in relative proximity to where they are registered.

Information from this resource was used to determine the potential based aircraft opportunity through analyzing registered aircraft in the Airport catchment area. The area includes four of the five sub-regions of the San Francisco Bay: the North Bay; the East Bay; the Peninsula; and San Francisco County. The registration numbers from the FAA database were compared to the registration numbers provided by the airport during their count of based aircraft. There are 226 aircraft currently based at DVO of which 177 are registered in the catchment area (137 in Marin County alone) and 49 are not registered in the catchment area. Ten of the remaining 49 based aircraft were registered in California outside of the catchment area, 31 were registered in other states, and the remaining eight were either deregistered or not listed in the register. **Table 7–1** provides a summary of the aircraft within the catchment area and those that are based at DVO.

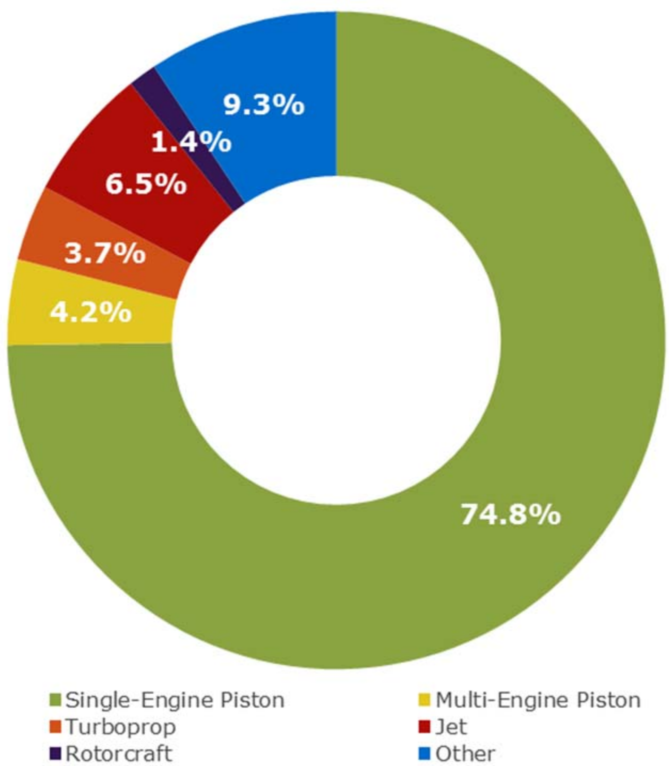
TABLE 7–1
REGISTERED AIRCRAFT IN CATCHMENT AREA

	Number of Aircraft	
County	Registered	Based at DVO
Alameda	966	4
Contra Costa	673	3
Marin	351	137
Napa	303	4
San Francisco	332	19
San Mateo	647	2
Solano	271	8
Sonama	764	0
Total	4,307	177

Note: The based aircraft only includes aircraft registered within the Bay Area.
Sources: FAA Registered Aircraft Database; Airport.

A majority of the aircraft based at DVO (77.4 percent) are registered in Marin County. Therefore, the registered aircraft in Marin County were classified by engine type to better understand the potential changes in the fleet mix at the Airport. These aircraft only represent a potential change in the fleet mix at the Airport due to natural migration of aircraft. The forecast does not assume that any specific aircraft will relocate in order to take advantage of the proposed additional runway length at DVO. The 137 aircraft currently based at DVO registered in Marin County were removed from the 351 aircraft registered in Marin County to determine the aircraft with the potential of moving to the Airport. The majority of 214 aircraft registered are single-engine piston (74.8 percent). The remaining aircraft fall into the following categories: multi-engine piston (4.2 percent), turboprop (3.7 percent), jet (6.5 percent) helicopter (1.4 percent), and other – i.e. ultra-light aircraft & gliders (9.3 percent). **Exhibit 7–1** displays the breakdown of the aircraft fleet mix currently registered in the Marin County not based at DVO.

EXHIBIT 7–1
REGISTERED MARIN COUNTY FLEET MIX WITHOUT DVO



Sources: FAA Registration Database; Airport; Landrum & Brown analysis.

8.0 DVO AVIATION ACTIVITY FORECAST

8.1 AIRCRAFT OPERATIONS FORECAST

National annual growth rates from the *FAA Aerospace Forecast – Fiscal Years 2015-2035, Table 32 Total Combined Aircraft Operations at Airports with FAA and Contract Control Service,* were applied to the base year GA annual operations numbers to determine the forecast of annual GA operations. National annual growth rates for fixed wing turbine aircraft from the *FAA Aerospace Forecast – Fiscal Years 2015-2035, Table 29 Active General Aviation and Air Taxi Hours Flown,* were applied to the base year air taxi annual operations numbers to determine the forecast of annual air taxi operations.

Itinerant and local GA operations are projected to continue to make up the majority of operations at DVO. It was assumed that itinerant operations would increase its share in GA operations. There is currently no military activity at DVO and no scheduled commercial airline passenger service and none is expected in the future. Overall, aircraft operations at DVO are forecast to increase from an estimated 82,500 operations in 2014 to 92,260 operations in 2035, representing an average annual growth rate of 0.5 percent. **Table 8–1** summarizes the resulting aircraft operations forecast for DVO.

TABLE 8–1
AIRCRAFT OPERATIONS FORECAST

Year	GA Itinerant	GA Local	Air Taxi	Military	Total
Actual					
2014	23,925	55,275	3,300	0	82,500
Forecast					
2020	24,750	56,610	3,790	0	85,150
2025	25,670	57,310	4,350	0	87,330
2030	26,620	58,010	5,050	0	89,680
2035	27,620	58,680	5,960	0	92,260
AAGR					
2014-2020	0.6%	0.4%	2.3%	n.a.	0.5%
2014-2035	0.7%	0.3%	2.9%	n.a.	0.5%

Sources: County Airport-Gnoss Field Airport Management, FAA Aerospace Forecast, Landrum & Brown Analysis

8.2 BASED AIRCRAFT FORECAST

The based aircraft forecast was derived by applying the average of the growth rates presented in the *FAA Aerospace Forecast – Fiscal Years 2015-2035, Table 28 Active General Aviation and Air Taxi Aircraft* except for rotorcraft. The FAA Aerospace Forecast has a 2.5 percent annual growth for rotorcraft. However, the Airport's Master Record previously indicated four rotorcraft and therefore has been on the decline over the past few years. Therefore, it is assumed based rotorcraft aircraft will remain at the 2014 level of one throughout the forecast period.

As shown in **Table 8–2**, the number of aircraft based at DVO is forecast to increase by 0.1 percent annually, from 226 in 2014 to 229 in 2035. The number of single-engine piston based aircraft and multi-engine piston aircraft are expected to decrease at average annual rates of 0.1 percent and 0.4 percent, respectively. These trends result from the fact that most of these aircraft become expensive to operate and maintain due to their old age. Turbine aircraft, which are expected to be the fastest growing GA segment, are projected to grow at an average annual rate of 2.2 percent.

TABLE 8–2
BASED AIRCRAFT FORECAST

Year	Single-Engine Piston	Multi-Engine Piston	Turbine	Rotorcraft	Total
Actual					
2014	202	10	13	1	226
Forecast					
2020	199	10	14	1	224
2025	197	9	15	1	222
2030	197	9	18	1	225
2035	198	9	21	1	229
AAGR					
2014-2020	-0.3%	-0.4%	0.9%	0.0%	-0.1%
2014-2035	-0.1%	-0.4%	2.2%	0.0%	0.1%

Sources: Marin County Airport-Gnoss Field Airport Management, FAA Aerospace Forecast, Landrum & Brown Analysis

8.3 OPERATIONAL FLEET MIX FORECAST

An operational fleet mix for DVO was developed utilizing the radar data, the airport's operations count, the operations forecast, and the based aircraft forecast. The total counts from the radar data for each aircraft category is provided in **Table 8–3**.

TABLE 8–3
RADAR COUNTS BY AIRCRAFT

Aircraft	Radar Counts
Jet	
B-I Small	144
B-II Small	200
B-II Large	60
Total	404
Multi-Engine Turboprop	
B-I Small	156
B-II Small	214
B-II Large	30
Total	400
Single-Engine Turboprop	
A-I Small	2
A-II Small	426
B-I Small	296
B-II Small	44
Total	768
Multi-Engine Piston	
A-I Small	72
A-II Small	8
B-I Small	378
Total	458
Single-Engine Piston	
A-I Small	1,720
B-I Small	2,142
Total	3,862
Helicopter	38
Grand Total	5,930

Note: Small airplane is defined as an airplane of 12,500 pounds (5,670 kg) or less maximum certificated takeoff weight. Anything larger is defined as a large airplane.
Sources: Radar Data; Landrum & Brown analysis.

For 2014, it was determined that all of the jet operations were captured by the radar data while only a portion of the remaining aircraft activity was captured. It was assumed that the majority of the jet operations were for air taxi. The remaining operations would likely be operated by turboprops. Therefore, the 3,300 air taxi operations, excluding the jet operations, were divided among the turboprop categories by their share of the radar data. These segments were then forecast to grow at the same rate as the air taxi operations at the airport.

Typically, aircraft based at the Airport will generate a majority of the traffic. The estimated 23,925 itinerant operations were segmented into the aircraft categories based on the number of based aircraft, excluding jet aircraft. A majority of the 58,680 local operations were assumed to be handled using piston aircraft. Jet operations are forecast to account for 0.8 percent of the total operations at DVO by 2035. Meanwhile, turboprop aircraft activity is forecast to increase from 4.4 percent of the annual operations in 2014 to 7.2 percent in 2035. In contrast, as the number of based single-engine piston aircraft begins to decrease at DVO they will account for a smaller percentage of the annual operations. As a result, single-engine piston operations are forecast to account for 87.5 percent of the total operations at DVO by 2035, compared to 90.2 percent in 2014. Similarly multi-engine piston aircraft are expected to decrease their share of operations at DVO. It was assumed that helicopter operations will remain at the 2014 level of 0.5 percent through the forecast period. **Table 8–4** provides a summary of the fleet forecast at DVO by engine type and ARC.

TABLE 8–4
OPERATIONAL FLEET MIX FORECAST

	Operations					Percent of Annual				
Aircraft	2014	2020	2025	2029	2035	2014	2020	2025	2029	2035
Jet										
B-I Small	144	160	180	210	250	0.2%	0.2%	0.2%	0.2%	0.3%
B-II Small	200	230	270	320	370	0.2%	0.3%	0.3%	0.4%	0.4%
B-II Large	60	70	80	90	110	0.1%	0.1%	0.1%	0.1%	0.1%
Total	404	460	530	620	730	0.5%	0.5%	0.6%	0.7%	0.8%
Multi-Engine Turboprop										
B-I Small	506	590	660	770	920	0.6%	0.7%	0.8%	0.9%	1.0%
B-II Small	690	800	900	1,060	1,270	0.8%	0.9%	1.0%	1.2%	1.4%
B-II Large	100	120	140	160	190	0.1%	0.1%	0.2%	0.2%	0.2%
Total	1,296	1,510	1,700	1,990	2,380	1.6%	1.8%	1.9%	2.2%	2.6%
Single-Engine Turboprop										
A-I Small	10	10	20	20	20	0.0%	0.0%	0.0%	0.0%	0.0%
A-II Small	1,300	1,480	1,700	1,980	2,350	1.6%	1.7%	1.9%	2.2%	2.5%
B-I Small	900	1,030	1,180	1,380	1,630	1.1%	1.2%	1.4%	1.5%	1.8%
B-II Small	130	150	170	200	240	0.2%	0.2%	0.2%	0.2%	0.3%
Total	2,340	2,670	3,070	3,580	4,240	2.8%	3.1%	3.5%	4.0%	4.6%
Multi-Engine Piston										
A-I Small	580	600	590	590	590	0.7%	0.7%	0.7%	0.7%	0.6%
A-II Small	60	60	60	60	60	0.1%	0.1%	0.1%	0.1%	0.1%
B-I Small	3,040	3,160	3,110	3,100	3,100	3.7%	3.7%	3.6%	3.5%	3.4%
Total	3,680	3,820	3,760	3,750	3,750	4.5%	4.5%	4.3%	4.2%	4.1%
Single-Engine Piston										
A-I Small	33,110	33,960	34,660	35,310	35,940	40.1%	39.9%	39.7%	39.4%	39.0%
B-I Small	41,280	42,340	43,210	44,020	44,800	50.0%	49.7%	49.5%	49.1%	48.6%
Total	74,390	76,300	77,870	79,330	80,740	90.2%	89.6%	89.2%	88.5%	87.5%
Helicopter	390	390	400	410	420	0.5%	0.5%	0.5%	0.5%	0.5%
Grand Total	82,500	85,150	87,330	89,680	92,260	100.0%	100.0%	100.0%	100.0%	100.0%

Note: Small airplane is defined as an airplane of 12,500 pounds (5,670 kg) or less maximum certificated takeoff weight. Anything larger is defined as a large airplane.
Sources: Marin County Airport-Gnoss Field Airport Management, FAA Aerospace Forecast, Landrum & Brown Analysis

The FAA defines the critical design airplanes as a list of airplanes (or a single airplane) that results in the longest recommended runway length. Federally funded projects, such as the proposed runway extension, require that critical design airplanes have 500 or more annual itinerant operations at the airport for an individual airplane or a family grouping of airplanes[14].

In order to determine the potential critical design airplane for DVO, the predominate aircraft types for each class were identified using the radar data. The 2014 itinerant operations for each of these aircraft were estimated based on the percent mix for each class (i.e. the Pilatus PC-12 had 55.5 percent of the single-engine turboprop operations in the radar data and was thus estimated to have 1,298 itinerant operations in 2014). It was assumed that the percent mix of aircraft under each class would remain constant through the forecast period. Therefore, the operations for each aircraft are forecast to grow at the rate of its respective class. **Table 8–5** provides a summary of the itinerant operations of the potential critical design airplane at DVO.

The runway length analysis conducted as part of the 2009 Forecast determined that the Cessna 525 was the most demanding aircraft that had more than 500 annual operations. Therefore, the analysis identified the Cessna 525 as the critical aircraft for DVO. However, the 2009 Forecast did not account for the changes in the economic climate resulting from the "Great Recession." These changes have had a direct impact on the GA industry which resulted in a significant decrease in GA operations at airports nationwide (see **Section 4.6**) including DVO. The Cessna 525 is no longer forecast to have more than 500 operations and is therefore not considered the critical aircraft at DVO in this forecast.

A detailed runway length analysis will be conducted to determine the aircraft or family of aircraft that requires the longest runway length at DVO. Based on the forecast fleet mix, the multi-engine turboprop Beechcraft Super King Air 200 (BE20) is likely the most demanding individual aircraft with more than 500 operations in 2014. The BE20 is part of the small aircraft family with less than 10 seats and is likely the family with the most demanding runway length.

[14] FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, Paragraph 3-4, *Airport Dimensional Standards*

TABLE 8–5
ITINERANT OPERATIONS OF REPRESENATIVE DEMANDING AIRCRAFT BY TYPE CLASS

Aircraft	ARC	2014	2020	2025	2030	2035
Jet						
C25B CitationJet Model 525B	B-II	124	141	163	190	224
C525 CitationJet Model 525	B-I	114	130	150	175	206
Other Jets		166	189	217	255	300
Multi-Engine Turboprop						
BE20 Beechcraft Super King Air	B-II	551	642	723	846	1,012
PAY4 Piper Cheyenne 400	B-I	266	310	349	408	488
Other Multi-Engine Turboprops		479	558	628	736	880
Single-Engine Turboprop						
PC12 Pilatus PC-12	A-II	1,298	1,481	1,703	1,986	2,352
P46T Piper Malibu Meridian	B-I	372	424	488	569	674
TBM7 Aerospatiale TPM TB-700	B-I	378	431	496	578	685
Other Single-Engine Turboprops		292	334	383	447	529
Multi-Engine Piston						
C414 Cessna Chancellor 414	B-I	223	229	231	233	237
C310 Cessna 310	B-I	180	185	187	189	192
Other Multi-Engine Piston		685	700	710	716	728
Single-Engine Piston						
C172 Cessna Skyhawk 172	A-I	2,355	2,429	2,514	2,594	2,673
BE36 Beech Bonanza 36	A-I	2,036	2,100	2,174	2,243	2,311
BE35 Beech Bonanza 35	A-I	1,195	1,232	1,275	1,316	1,356
M20P Mooney Mark 20	A-I	899	927	959	990	1,020
Other Single-Engine Piston		15,483	15,967	16,528	17,053	17,574

Sources: Radar Data; Landrum & Brown analysis

9.0 PEAK OPERATIONS

The traffic demand patterns imposed upon an airport are subject to seasonal, monthly, daily, and hourly variations. In order to evaluate the peaking patterns at an airport, the annual enplanements and aircraft operations forecasts are distributed to monthly, daily, and hourly equivalents. According to the radar data, August was the peak month in 2014 with 9.8 percent of the recorded operations. A typical day during the peak month accounts for 3.2 percent of the monthly operations. It is estimated that 9.0 percent of the daily operations occur during the peak hour. It was assumed that these factors would remain constant from 2014 to 2035. **Table 9–1** provides the peak operations at DVO through the forecast period.

TABLE 9–1
PEAK OPERATIONS FORECAST

Statistic	2014	2020	2025	2030	2035
Annual Operations	82,500	85,150	87,330	89,680	92,260
Peak Month % of Annual	*9.8%*	*9.8%*	*9.8%*	*9.8%*	*9.8%*
Peak Month Operations	8,107	8,368	8,582	8,813	9,066
Average Day % of Peak Month	*3.2%*	*3.2%*	*3.2%*	*3.2%*	*3.2%*
Average Day Operations	262	270	277	284	292
Peak Hour % of Average Day	*9.0%*	*9.0%*	*9.0%*	*9.0%*	*9.0%*
Peak Hour Operations	24	24	25	26	26

Sources: Radar Data; Landrum & Brown analysis

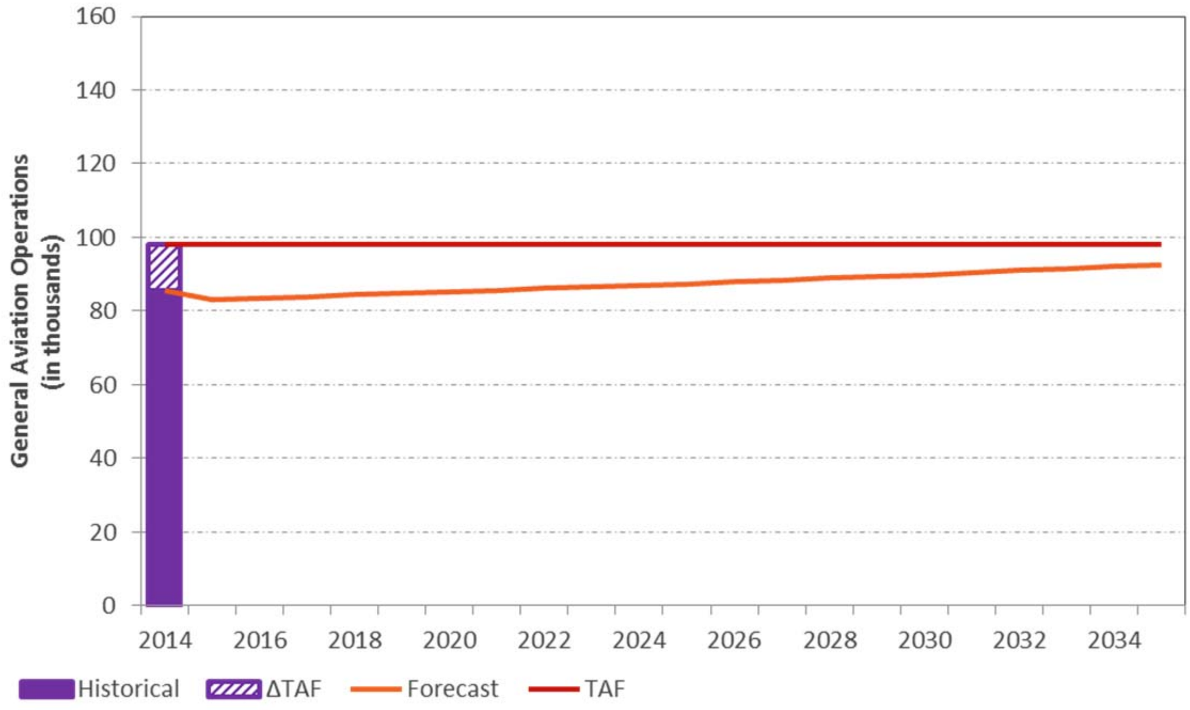
10.0 COMPARISON TO FAA TAF

The FAA develops the TAF on an annual basis for all active airports in the U.S. that are included in the NPIAS. The TAF is "prepared to meet the budget and planning needs of FAA and provide information for use by state and local authorities, the aviation industry, and the public."[15] The 2014 TAF was issued in January 2015 and is compared to the forecast for DVO herein. The FAA records aircraft operations as air carrier, commuter & air taxi, GA, or military.

The historical values for DVO in the TAF have not been updated since 2009 when operations at DVO were 98,000. Therefore, the base operations in 2014 for the forecast presented in this document did not match the 2014 TAF resulting in a variation of -13.2 percent in the base year. The 2014 TAF for DVO assumed that operations would remain at the 2009 level through the forecast period. **Exhibit 10–1** and **Table 10–1** present a comparison of DVO's aircraft operations forecast with the most recent FAA TAF.

15 http://aspm.faa.gov/main/taf.asp

EXHIBIT 10–1
FORECAST TO TAF COMPARISON



Sources: FAA Terminal Area Forecast (TAF); Landrum & Brown analysis.

TABLE 10–1
FORECAST TO TAF COMPARISON

Year		Forecast	2014 TAF	Variance (% Difference)
Base Year	2014	82,500	95,000	-13.2%
Base Year + 5 Years	2019	84,740	95,000	-10.8%
Base Year + 10 Years	2024	86,880	95,000	-8.5%
Base Year + 15 Years	2029	89,190	95,000	-6.1%

Sources: FAA Terminal Area Forecast (TAF); Landrum & Brown analysis

11.0 FORECAST SCENARIOS

In addition to the baseline operations forecast presented in the above sections, high and low scenarios were developed. The high case forecast assumes that operations would grow at a faster rate than the base case due to changes in the socio-economic conditions in Marin County. The overall operations were assumed to grow at 1.5 times the rate of the base case. The low case forecast assumes that operations would reflect the growth in the 2014 TAF, i.e. zero growth through the forecast period. **Table 11–1** provides a summary of the low, base, and high case scenario forecasts.

TABLE 11–1
SUMMARY OF FORECAST SCENARIOS

Year	Low Forecast	Base Forecast	High Forecast
Actual			
2014	82,500	82,500	82,500
Forecast			
2020	82,500	85,150	86,550
2025	82,500	87,330	90,070
2030	82,500	89,680	93,730
2035	82,500	92,260	97,540
AAGR			
2014-2020	0.0%	0.6%	0.8%
2014-2035	0.0%	0.5%	0.8%

Sources: FAA Terminal Area Forecast (TAF); Landrum & Brown analysis

APPENDIX B

RUNWAY LENGTH ANALYSIS

GNOSS FIELD AIRPORT

Prepared By:
Landrum & Brown
April 2016

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RUNWAY LENGTH ANALYSIS

1.0 INTRODUCTION

Marin County has prepared several evaluations of the Gnoss Field Airport's (DVO or Airport) operations and facilities, including the 1989 Airport Master Plan[1], the 1997 Update of the Airport Master Plan, the 2002 Preliminary Design Report for the proposed runway extension[2], and the evaluations leading up to the preparation of the Draft and Final EIS.[3] These studies identified the limitations regarding the Airport's ability to accommodate existing aircraft and aviation users for which the Airport was designed. Specifically, prior evaluations found the Airport's 3,300 foot long runway could not fully accommodate existing aviation activity of the critical aircraft. This evaluation updates those prior evaluations based on the current critical aircraft identified in Attachment 1 of this analysis.

FAA Advisory Circular (AC) 150/5325-4B *Runway Length Requirements for Airport Design*[4], is the FAA's guidance document for identifying the appropriate runway length for airport runways. AC 150/5325-4B, Paragraph 101 *Background*, describes runway length factors and evaluations as follows:

> "Airplanes today operate on a wide range of *available* runway lengths. Various factors, in turn, govern the *suitability* of those available runway lengths, most notably airport elevation above mean sea level, temperature, wind velocity, airplane operating weights, takeoff and landing flap settings, runway surface condition (dry or wet), effective runway gradient, presence of obstructions in the vicinity of the airport, and, if any, locally imposed noise abatement restrictions or other prohibitions. Of these factors, certain ones have an operational impact on available runway lengths. That is, for a given runway the usable length made available by the airport may not be entirely *suitable* for all types of airplane operations."

AC 150/5300-13A, *Airport Design,* Paragraph 105b *Design Aircraft*, states describing aircraft using an airport that:

> "The first consideration of the airport planner should be the safe operation of aircraft likely to use the airport… However, it is not the usual practice to base the airport design on an aircraft that uses the airport infrequently…"

1 *Airport Master Plan Marin County Airport Gnoss Field*, 1989.
2 Cortright & Seibold, *Preliminary Design Report, Runway Extension, Gnoss Field*, 2002.
3 Landrum & Brown, *Gnoss Field Airport Runway Length Analysis, 2008 & 2013.* (Appendix D of this EIS).
4 Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*, Federal Aviation Administration, July 1, 2005, errata July 31, 2008.

As stated in AC 150/5300-13A *Airport Design*, Paragraph 105a, *Applicability of Airport Design Standards*:

> "Airport designs that are based on large aircraft never likely to be served by the airport are not economical."

The general approach to the selection of airport dimensional design standards is described in FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, Paragraph 3-4 *Airport Dimensional Standards* which states:

> "Airport dimensional standards (such as runway length and width, separation standards, surface gradients, etc.) should be selected which are appropriate for the critical aircraft that will make substantial use of the airport in the planning period. Substantial use means either 500 or more annual itinerant operations or scheduled commercial service. The critical aircraft may be a single aircraft or a composite of the most demanding characteristics of several aircraft. The critical aircraft is used to identify the appropriate Airport Reference Code for airport design criteria."

In regard to the critical aircraft AC 150/5325-4B, Paragraph 102 b (1) states:

> "Identify the list of critical design airplanes that will make regular use of the proposed runway for an established planning period of at least five years. For Federally funded projects, the definition of the term *"substantial use"* quantifies the term "regular use."

As described in detail in Attachment 1, *Basis for Determination of the Critical Aircraft for DVO*, the critical aircraft (also called the design aircraft, or critical design aircraft) for determining runway length at DVO is the family grouping of small aircraft with fewer than 10 passengers (with a maximum certificated takeoff weight of 12,500 pounds or less).

AC 150/5325-4B *Runway Length Requirements for Airport Design* provides guidelines for airport designers and planners to determine recommended runway lengths for new runways or extensions to existing runways. AC 150/5325-4B, Paragraph 101 states regarding runway length determinations that:

> "In summary, the goal is to construct an available runway length for new runways or extensions to existing runways that is suitable for the forecasted critical design aircraft."

AC 150/5325-4B, Paragraph 103 further states:

> "The design objective for the main primary runway is to provide a runway length for all airplanes that will regularly use it without causing operational weight restrictions."

For airport projects receiving Federal funding, the use of the methods described in AC 150/5325-4B to determine runway length is mandatory. This Runway Length Analysis used the procedures in AC 150/5325-4B to verify the necessary runway length to meet the purpose and need of this project, which, consistent with AC 150/5325-4B, is: allow existing aircraft, as represented by the family grouping of critical aircraft at DVO, to operate without operational weight restrictions (i.e. at Maximum Gross Take Off Weight) under hot weather conditions (i.e., mean daily maximum temperature of the hottest month).[5]

AC 150/5325-4B Paragraph 201, *Design Guidelines,* identifies five specific variable factors that affect runway length that must be considered in determining the recommended runway length for an airport using the family grouping methodology. These are:

- Airplane Type
- Approach Speed
- Number of Passengers
- Airport Elevation
- Mean Daily Maximum Temperature of the Hottest Month

For aircraft with a Maximum Certificated Takeoff Weight (MTOW) of 12,500 pounds or less, AC 150/5325-4B, Paragraph 202, *Design Approach*, provides a small airplane design concept for considering the five factors described above in order to determine a recommended runway length. Airport planners can use the appropriate "runway length curves" in AC 150/5325-4B for the weight and characteristics of a critical aircraft or a family grouping of critical aircraft under consideration to establish the necessary runway length. The current runway length determination for this project is based on the appropriate runway length curve for a family grouping of critical aircraft.

AC 150/5325-4B also allows the airport planner to consider the runway length requirements of a specific critical aircraft using that aircraft's airplane flight manual if the aircraft's requirements are not met using the runway length curves. Although that method was used to calculate the necessary runway length at Gnoss Field Airport in the June 2014 Final EIS, that method is no longer applicable because the Cessna 525 business jet it was based on is not currently forecasted to have the minimum 500 annual operations at the airport necessary to be considered to regularly use the airport.

5 Hotter air is less dense than cooler air so that an aircraft wing creates less lift in hotter air. Therefore, other factors being equal, aircraft require a longer runway to attain sufficient speed to take off on a hot day, as compared to a cooler day.

2.0 RUNWAY LENGTH ANALYSIS

AC 150/5325-4B Chapter 2, Runway Lengths for Small Airplanes with Maximum Certificated Takeoff Weight of 12,500 Pounds (5,670 Kg) or Less, describes procedures for calculating necessary runway lengths using a small airplane design concept. Paragraph 205 applies to Small Airplanes with Approach Speeds of 50 Knots or More with Maximum Certificated Takeoff Weight of 12,500 Pounds (5,670 Kg) or Less. Paragraph 205 references two distinct runway length curves based on seating capacity and the mean daily maximum temperature of the hottest month of the year at the Airport. Using the most demanding aircraft category at DVO, it was determined the Small Airplane with Fewer than 10 Passenger Seats chart (i.e., Figure 2-1 of AC 150/5325-4B) also portrayed the most demanding runway length requirement. The following inputs were used to determine the recommended runway length requirement for DVO to meet the project purpose and need. The project purpose and need is to allow existing aircraft, as represented by the family grouping of critical aircraft at DVO, to operate without operational weight restrictions under hot weather conditions.

Input Data:

Airport elevation: Sea Level

Mean daily maximum temperature of the hottest month: 82° Fahrenheit[6]

Using Figure 2-1 from FAA AC 150/5325-4B, *Small Airplanes with Fewer than 10 Passenger Seats*, the inputs listed above analyzed along the curve (see **Exhibit B-1**).

(1) Step 1 – Find the mean daily maximum temperature of the hottest month, 82° Fahrenheit (F).

(2) Step 2 – Proceed vertically to the airport elevation, which for DVO is sea level (two feet).

(3) Step 3 – Proceed horizontally to the runway length axis.

(4) Step 4 – Read runway length. The runway length requirement derived from Figure 2-1, FAA AC 150/5325-4B, is 3,550 feet and rounded up to 3,600 feet per FAA guidance.

AC 150/5325-4B Paragraph 205 states:

> "Figure 2-1 categorizes small airplanes with less than 10 passenger seats (excludes pilot and co-pilot) into two family groupings according to "percent of fleet," namely, 95 and 100 percent of the fleet. Figure 2-2 categorizes all small airplanes with 10 or more passenger seats into one family grouping."

6 United States Department of Commerce, National Oceanic & Atmospheric Administration, National Climatic Data Center (NCDC), Summary of Monthly Normal 1981-2010, Petaluma Airport, CA US. Webpage accessed on April 13, 2016, http://www.ncdc.noaa.gov/cdo-web/datatools/normals.

Paragraph 205a goes on to state:

> "The differences between the two percentage categories are based on the airport's location and the amount of existing or planned aviation activities. The airport designer should make the selection based on the following criteria."

Paragraph 205a (1) states:

> "95 Percent of Fleet. This category applies to airports that are primarily intended to serve medium size population communities with a diversity of usage and a greater potential for increased aviation activities. Also included in this category are those airports that are primarily intended to serve low-activity locations, small population communities, and remote recreational areas. Their inclusion recognizes that these airports in many cases develop into airports with higher levels of aviation activities."

Paragraph 205a (2) states:

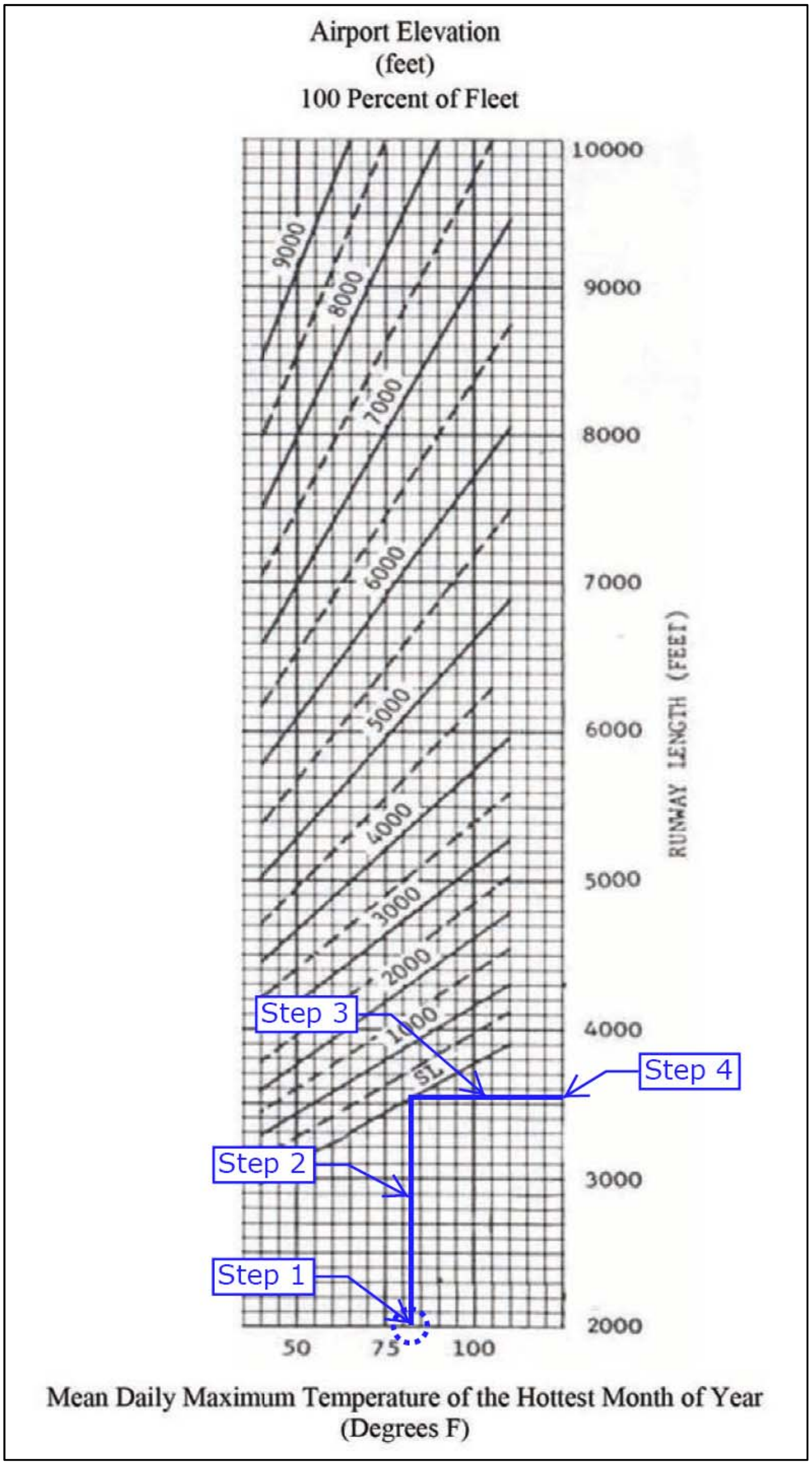
> "100 Percent of Fleet. This type of airport is primarily intended to serve communities located on the fringe of a metropolitan area or a relatively large population remote from a metropolitan area."

DVO is located northeast of the City of Novato in Marin County. As Marin County is is at the northern end of the San Francisco-Oakland-Hayward Metropolitan Statistical Area, the airport serves communities on the fringe of the metropolitan area.[7] Therefore, the 100 Percent of Fleet category curve is appropriate to use in the analysis.

The runway length requirement derived from the 100 Percent of Fleet runway length curve in Figure 2-1 of AC 150/5325-4B and shown in Exhibit B-1 is 3,550 feet. FAA AC 150/5325-4B Appendix 3, Paragraph 1-3, *Calculations,* includes a provision for rounding calculated lengths of 30 feet and over up to the next 100-foot interval when using specific Aircraft Performance Manuals. Because the analysis using Figure 2-1 relies upon some visual interpretation, the same approach to round up to the next highest 100-foot runway length interval is applied to account for potential inaccuaracies in the visual interpretation process. Thus, the runway length of 3,550 feet is rounded up to 3,600 feet to establish the runway length requirement.

7 U.S. Department of Commerce, Economics and Statistics Administration U.S. Census Bureau, 2012 Combined Statistical Arean and Metropolitan/Micropolitan Statistical Areas boundaries and names as of February 2013. Map at www2.census.gov/geo/maps/econ/ec2012/csa/ECON2012_330M200US488M.pdf dated 9 May 2014 Accessed February 29, 2016.

EXHIBIT B-1
RUNWAY LENGTH DETERMINATION USING RUNWAY LENGTH CURVES PROCESS
Gnoss Field Airport



Sources: Runway length for 100 percent of Fleet at Gnoss Field Airport based on FAA AC 150/5325-4B Runway Length Requirements for Airport Design, Figure 2-1; Landrum & Brown analysis.

ATTACHMENT 1

BASIS FOR DETERMINATION OF THE CRITICAL AIRCRAFT FOR DVO

Attachment 1, *Basis for Determination of the Critical Aircraft for DVO*

FAA Order 5090.3C *Field Formulation of the National Plan of Integrated Airport Systems (NPIAS)*, Paragraph 3-4 *Airport Dimensional Standards*, defines the critical aircraft (also called the design aircraft or critical design aircraft) as the single aircraft or composite of the most demanding characteristics of several aircraft that make substantial use of the airport. "Substantial use" of a general aviation airport is defined as 500 or more annual itinerant operations or scheduled commercial service. Per AC 150/5325-4B the definition of the term "substantial use" quantifies the "regular use" of an airport. As there is no scheduled commercial airline service at DVO, the most demanding aircraft with 500 annual itinerant operations at DVO (i.e., is the most demanding aircraft with regular user of the airport) is identified as the critical aircraft for the airport. The grouping of small airplanes with fewer than 10 passenger seats were identified as the critical aircraft for DVO, in terms of runway length considerations, using the small airplane runway design concept (i.e., runway length curves) described in AC 150/5325-4B, Chapters 1 and 2. The process for this determination is described below.

An updated aviation forecast (Appendix A) for DVO was approved in April 2016. Like most non-towered airports, DVO does not keep a daily record of the exact number of aircraft operations that occur, or the type of aircraft that are operated. Therefore, determining the exact number of operations by a specific aircraft type at DVO required integration of various data sources and the application of professional judgment based on the best available data.

Background data on DVO traffic was gathered from the Federal Aviation Administration (FAA) Form 5010-1, FAA Terminal Area Forecasts (TAF), and DVO Airport Management. A Form 5010-1 states the previous year's count of operations broken down by category, as well as the based aircraft for the airport. The FAA TAF uses the 5010-1 forms as a basis for defining historical traffic. Operational counts for airports such as Gnoss Field Airport that do not have an ATCT are often incorrectly estimated and are carried over year-after-year. A review of the DVO data contained in Form 5010-1 form indicated that this is the case for Gnoss Field Airport. As a result, the annual operations in the FAA TAF for DVO was found to be higher than actual operations. Therefore, operational numbers and based aircraft counts are based upon information provided by DVO Airport Management.

FAA radar flight track data covering the DVO area was collected for calendar year 2014. DVO is located within airspace managed by the Oakland Air Route Traffic Control Center (ARTCC). The data received is limited to operations which submitted flight plans; the majority of aircraft with flight plans are operating under instrument flight rules (IFR), regardless of weather conditions at the airport. The radar data provided information for 3,923 total operations for DVO (2,956 arrivals and 967 departures).

For both jet and multi-engine turboprop operations, the number of arrivals and departures recorded in the radar data was generally consistent. This is because these aircraft classes normally operate under IFR and therefore file flight plans, and so are recorded by FAA radar databases. For other aircraft classes, in particular the piston aircraft, the number of arrivals and departures recorded is not always consistent. This is because many piston aircraft may depart in visual flight rules (VFR), but then return to the airport on an IFR clearance. The VFR flight, while tracked by radar at the time, would not normally be recorded by FAA since VFR flight records are not maintained in the FAA radar databases.

In order to account for the discrepancy in arrivals to departures, the max value for each aircraft (either arrival or departure) was assigned to the particular aircraft. For example, the Pilatus PC-12 had 213 arrivals and 135 departures in the radar data but was assigned 213 arrivals and 213 departures, totaling 426 operations. Essentially, this is a logical assumption that the number of takeoff must equal the number of landings at an airport over time.

In an effort to identify the critical design airplane at the Airport, the aircraft operations radar data was summarized by Airport Reference Code (ARC) for different categories of aircraft. ARC as defined in FAA AC 150/5300-13A Change 1, Airport Design, has two components; the Aircraft Approach Category (AAC) and the Airplane Design Group (ADG). The AAC is depicted by a letter and determined by the reference landing speed (VREF) or the approach speed of the aircraft. If the VREF is unavailable, the number refers to 1.3 times the stall speed (VSO). The ADG is depicted by a Roman numeral and is based on the physical characteristics of the aircraft, i.e. wingspan and tail height of the aircraft, whichever is more restrictive. **Table B-1** provides the limits for the AAC and the ADG.

TABLE B-1
AIRPORT REFERENCE CODE

AAC	V_{REF}/Approach Speed MIN	V_{REF}/Approach Speed MAX
A	0 kt	91 kt
B	91 kt	121 kt
C	121 kt	141 kt
D	141 kt	166 kt
E	166 kt	

ADG	Tail Height MIN	Tail Height MAX	Wingspan MIN	Wingspan MAX
I	0.0'	20.0'	0.0'	49.0'
II	20.0'	30.0'	49.0'	79.0'
III	30.0'	45.0'	79.0'	118.0'
IV	45.0'	60.0'	118.0'	171.0'
V	60.0'	66.0'	171.0'	214.0'
VI	66.0'	80.0'	214.0'	262.0'

Sources: AC 150/5300-13A, Airport Design, CHG1 pages 13-14

In 2014, B-I aircraft (i.e. those aircraft with approach speeds between 91 knots and 121 knots, with a tail height of less that 20 feet and a wingspan of less than 49 feet) comprised of aircraft such as the Cirrus SR-22, Cessna 182 Skylane and the Piper PA-46 Malibu were the most predominate aircraft at DVO accounting for 52.5 percent of the total radar operations. The second largest group, with 30.3 percent of radar operations, was A-I aircraft composed primarily of the Cessna 172 Skyhawk, the Beechcraft B36 Bonanza, and the Mooney M20. The most demanding category at DVO, the B-II aircraft, including aircraft such as the Beechcraft Super King Air 200, the Cessna CitationJet C525A/B, and the Cessna Citation V accounted for 9.3 percent of radar operations. The Pilatus PC-12 and

Beechcraft Model 18 were the only aircraft in group A-II, and combined accounted for 7.3 percent of radar operations. With only 0.6 percent of the radar operations, helicopters or rotorcraft was the smallest group of aircraft at DVO.

The aircraft and family grouping of aircraft at DVO are listed in **Table B-2** below.

TABLE B-2
FLEET MIX AT DVO (2014 CONDITION)

AIRCRAFT GROUP	EXAMPLE AIRCRAFT	ANNUAL OPERATIONS AT DVO
A-I		
	(M20P) Mooney Mark 20	899
	(BE35) Beech Bonanza 35	1,195
	(BE36) Beech Bonanza 36	2,037
	(C172) Cessna Skyhawk 172	2,356
	Other A-I Aircraft	27,213
	Total A-I	33,700
A-II		
	(PC12) Pilatus PC-12	1,298
	Other A-II Aircraft	62
	Total A-II	1,360
B-I		
	(C525) CitationJet Model 525	114
	(C310) Cessna 310	180
	(C414) Cessna Chancellor 414	223
	(PAY4) Piper Cheyenne 400	266
	(P46T) Piper Malibu Meridian	372
	(TBM7) Aerospatiale TBM TB-700	378
	Other B-I Aircraft	44,337
	Total B-I	45,870
B-II		
	(C25B) CitationJet Model 525B	124
	(BE20) Beechcraft Super King Air	551
	Other B-II Aircraft	505
	Total B-II	1,180
	Grand Total	82,110

Note: Helicopter counts are not included in Table 2. There were 390 helicopter operations at DVO in 2014, resulting in 82,500 total operations at DVO for 2014.

Sources: Aviation Forecast, Landrum & Brown.

The runway length needed at DVO was derived using the small airplane design concept from FAA AC 150/5325-4B. All of the existing aircraft types operating at DVO are small airplanes with fewer than 10 seats. Within the current fleet mix at DVO, the existing critical aircraft is the family of B-II Turboprop aircraft, which is the most demanding aircraft grouping with regular use.