APPENDIX C. OAKLAND INTERNATIONAL AIRPORT COMPREHENSIVE AVIATION ACTIVITY FORECAST

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OAK

Oakland International Airport Comprehensive Aviation Activity Forecast Report

JULY 28, 2020, UPDATED JULY 2022

PREPARED FOR:
THE PORT OF OAKLAND

PREPARED BY:
INTER*VISTAS* CONSULTING INC.
AND
LANDRUM & BROWN INCORPORATED

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1 Executive Summary

This document presents comprehensive aviation activity forecasts including passenger and operations activity for commercial airline, cargo, general aviation, and military operations at Oakland International Airport ("OAK" or the "Airport") for use in the Airport's planning efforts. As a Medium Hub Airport, the Airport plays a critical role in the system of three commercial service airports serving the San Francisco Bay Area ("Bay Area"). The Bay Area is the 4th largest metropolitan population base in the country. OAK also serves as a connecting point on Southwest Airlines' network.

Annual and peak hour forecasts were prepared through 2038 with a base year of 2019[1], 2020, and 2021. Forecasted enplaned passengers include both domestic and international traffic. Aircraft operations include Air Carrier, Commuter Air Taxi, General Aviation ("GA"), Military, and Cargo activity. Two consulting firms assisted OAK with this effort; Inter*VISTAS* Consulting, Inc. prepared the Passenger-related activity forecasts, while Landrum & Brown prepared the Cargo, GA, and Military activity forecasts.

The forecasts have been prepared using a combination of traditional top-down econometric modeling and bottom-up analysis of carrier networks. The bottom-up approach is used in the short term forecast as estimates of economic activity in the near term tend to diverge, and the published capacity of the airline is more reliable. Over the long term, the relationship between the economic and demographic drivers is more reliable.

At the onset of the pandemic, public health directives, the lack of vaccines and effective treatments, and the negative impact on economic activity severely limited demand for air transportation. Passenger traffic at OAK decreased 96% in March of 2020 compared to March of 2019.

As vaccines and treatments became available, passenger demand increased, especially in the leisure and visiting friends and relatives segments. OAK's Passenger traffic at the end of 2020 was approximately 70% below pre-pandemic levels in 2019. Throughout 2021, passenger demand increased at OAK to levels approximately 30% below pre-pandemic levels.

While national demand flagged somewhat during the Delta and Omicron variant surges in COVID-19 infections in early 2022, passenger traffic at OAK has been approximately 28% below 2019 levels. Business and long-haul international demand recovery has lagged other segments, especially considering the varying approaches to international border closures and some shifts to virtual meeting environments, but airlines have begun to report the return of business travel from small and medium sized businesses. (e.g., Deloitte 2022 study on corporate travel)

The forecasts presented in this report are long-term forecasts. While the COVID-19 Pandemic has had a significant impact on aviation demand since 2020, the impact of the pandemic is not expected to change future aviation trends over the long term. Passengers are forecast to recover to pre-pandemic levels in 2023. Passenger operations are forecast to recover to pre-pandemic levels in 2025. Passenger operations recovery is expected to lag total passengers due to higher load factors and up-gauged aircraft. Air cargo and general aviation demand was not negatively impacted by the COVID-19 Pandemic, so those forecasts have not been changed.

[1] The Port prepared a forecast report issued in June 2021, but has since updated it at the request of the FAA. 2019 is used as the base year in the report for the purposes of the California Environmental Quality Act analysis, and was the last year that was not impacted by the COVID-19 Pandemic.

An update to OAK's Comprehensive Forecast Report, conducted in Spring of 2021, includes a shift of the years associated with the planning activity levels ("PAL") by three years. PAL 1 has shifted from 2025 to 2028, and PAL 2 has shifted from 2035 to 2038. Because planning activity levels are based on demand rather than specific years, the shift of associated years demonstrates the ability of the planning activity level to be responsive to changes in aviation demand, in this case caused by the COVID-19 Pandemic.

As more people have been vaccinated in the United States, public health restrictions have been relaxed, and people have resumed leisure travel and some business travel. In response to strong demand, Southwest Airlines is planning to operate 103% of their pre-pandemic systemwide capacity during summer 2022, and other U.S. airlines are planning to operate 84% to 94% of pre-pandemic capacity. The surge in demand and the airlines' capacity deployment is a testament to the recovery underway.

OAK Planning Forecasts

In order to quantify future facility requirements for the planning horizon, two planning activity levels were identified for use in planning documents. This report, issued in June 2021, and updated July 2022, reflects the impacts of the pandemic on aviation traffic, including a shift in the years that the PALs are forecasted to occur. PAL 1 is defined as 8.8 million annual enplaned passengers or 17.6 Million Annual Passengers ("MAP"); PAL 2 is defined as 12.3 million annual enplaned passengers or 24.7 MAP. Total air cargo tonnage is forecast to increase from 694,685 U.S. tons in 2021 to 884,087 U.S. tons by 2038 for an annual growth rate of 1.4%. Total aircraft operations are forecast to increase from 186,096 operations in 2021 to 323,501 operations by 2038 for an annual growth rate of 3.3%. The cargo forecast is in U.S. short tons ("tons"). Results of the forecast for the PALs, in calendar years ("CY") and federal fiscal years ("FFY") are summarized in Table 1-1.

Table 1-1 PAL Forecast Summary

	Forecast in Calendar Years				
	2019	**2020**	**2021**	**PAL 1 2028**	**PAL 2 2038**
Passenger Activity					
Passenger Enplanements	6,689,457	2,306,666	4,083,962	8,792,855	12,342,518
CAGR (%) (a)				*11.6%*	*6.7%*
Million Annual Passengers ("MAP")	13.4	4.6	8.1	17.6	24.7
CAGR (%) (a)				*11.6%*	*6.7%*
Freighter Cargo Tonnage					
Belly Cargo (U.S. Tons)	9,678	8,902	9,406	16,905	24,650
Freighter Cargo (U.S. Tons)	632,727	630,133	685,279	757,987	859,437
Total Air Cargo Tonnage (U.S. Tons)	*642,405*	*639,035*	*694,685*	*774,892*	*884,087*
CAGR (%) (a)				*1.6%*	*1.4%*
Aircraft Operations					
Passenger Airline Operations	113,272	61,544	72,922	132,830	181,270
Freighter Operations	20,698	21,444	22,142	23,200	24,800
Business/General Aviation	107,861	74,631	90,194	110,758	116,431
Military	926	832	837	1,000	1,000
Total Aircraft Operations	*242,757*	*158,451*	*186,096*	*267,788*	*323,501*
CAGR (%) (a)				*5.3%*	*3.3%*

	Forecast in Federal Fiscal Years				
	2019	2020	2021	PAL 1 2028	PAL 2 2038
Passenger Activity					
Passenger Enplanements	6,708,620	3,460,280	3,368,590	8,757,199	12,252,702
CAGR (%) (a)				*14.6%*	*7.9%*
Million Annual Passengers ("MAP")	13.4	6.9	6.7	17.5	24.5
CAGR (%) (a)				*14.6%*	*7.9%*
Freighter Cargo Tonnage					
Belly Cargo (U.S. Tons)	10,478	9,096	8,995	16,715	24,450
Freighter Cargo (U.S. Tons)	638,909	630,782	671,493	754,835	856,857
Total Air Cargo Tonnage (U.S. Tons)	*649,387*	639,878	680,488	*771,550*	*881,307*
CAGR (%) (a)				*1.8%*	*1.5%*
Aircraft Operations					
Passenger Airline Operations	115,752	74,475	70,077	131,614	180,022
Freighter Operations	20,691	21,258	21,968	23,150	24,775
Business/General Aviation	106,996	79,311	84,167	109,836	115,128
Military	1,002	811	690	1,000	1,000
Total Aircraft Operations	*244,441*	175,855	176,902	*265,600*	*320,925*
CAGR (%) (a)				*6.0%*	*3.6%*

(a) CAGR: Compound annual growth rate. CAGRs shown are for 2021-2028 and 2021-2038.
Source: Airport statistics; InterVISTAS analysis

FAA Terminal Area Forecast

The Federal Aviation Administration's ("FAA") 2021 Terminal Area Forecast ("TAF"), published in March 2022, provides an unconstrained forecast of airport activity at OAK that reflects continued growth. This document presents OAK's independent forecast of activity and compares its results to those of the FAA's TAF, and discusses various factors that could influence deviations from the TAF and explains the differences between the two forecasts results. These factors include:

- Differences in actual activity performance in the early years of the forecast;
- An understanding of economic development in the San Francisco Bay Area over the forecast period and how that will impact OAK vis-à-vis the region's other airports;
- The influence of Southwest Airlines' fleet and network plans over the forecast period as the largest airline at OAK by capacity, as well as the impact of other passenger airline fleet and network plans;
- The influence of cargo airlines' fleet and network plans including those of FedEx and UPS and;
- The impact of general aviation activity including new business models such as JSX (formerly JetSuiteX).

As discussed herein, OAK's forecasts were developed using techniques that are similar to those used to develop the TAF, with additional airport-specific input. TAF forecasted passengers are lower than the OAK forecast and operations track similar to TAF. The primary differences between the TAF results and the OAK results are based on OAK's analysis:

- That OAK will have higher activity growth when compared to other airports serving the San Francisco Bay Area because of the comparative convenience of OAK to the most rapidly growing areas in the region;
- The fleet and network plans of the airlines serving and likely to serve OAK.

The results of the forecasts for the TAF Base Year and forecast years in five-year increments are presented in Table 1-2. A full discussion of the comparison to the TAF can be found in section 7, and Appendix B.

Table 1-2 Summary of Oakland International Airport Forecast

	Forecast in Federal Fiscal Years						
	2019	2020	TAF Base Year 2021	TAF Base Year+1 2022	TAF Base Year+5 2026	TAF Base Year+10 2031	TAF Base Year+15 2036
Passenger Enplanements							
Air Carrier	6,569,964	3,323,325	3,203,202	4,955,681	8,096,989	9,563,927	11,334,299
Commuter/Air Taxi	138,656	136,955	165,388	157,425	164,656	182,189	198,420
Total Enplanements	**6,708,620**	**3,460,280**	**3,368,590**	**5,113,106**	**8,261,645**	**9,746,116**	**11,532,719**
Aircraft Operations							
Air Carrier	131,544	94,914	86,716	103,132	141,848	167,112	192,458
Commuter/Air Taxi	31,622	26,123	25,876	26,579	28,650	31,789	34,695
Subtotal	*163,166*	*121,037*	*112,592*	*129,711*	*170,498*	*198,901*	*227,153*
General Aviation	80,273	54,007	63,620	77,488	81,929	81,833	81,517
Military	1,002	811	690	959	1,000	1,000	1,000
Total Operations	**244,441**	**175,855**	**176,902**	**208,158**	**253,427**	**281,734**	**309,670**
Cargo/Mail							
Enplaned and Deplaned Tons	655,441	639,878	680,488	701,602	747,638	803,373	859,070
Operational Factors: Air Carrier – Passenger							
Average Aircraft Size (Seats)	149	151	152	157	162	165	167
Average Enplaning Load Factor	79.3%	49.2%	72.3%	79.5%	80.2%	80.3%	80.8%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.

Design Day Flight Schedules

Design day flight schedules ("DDFS") are beneficial for establishing peak period demands used to calculate facility requirements and test facility sizing. To support both terminal facility planning and airfield facility planning, two design day flight schedules were developed that correspond to PAL 1, anticipated to occur by 2028, and to PAL 2, anticipated to occur by 2038. Due to unique circumstances affecting aviation over the past several years, historical schedule patterns at OAK dating back to 2018 were analyzed. 2018 was considered the last typical year and allowed for events such as the Boeing 737 MAX grounding, which began in 2019, and the COVID 19 pandemic, which began in 2020, to be better understood.

The DDFS, which was re-baselined with a July 2021 schedule to account for post-pandemic recovery and the deployment of new fuel-efficient aircraft such as the Boeing 737 MAX, is informed by (1) annual increases in the relevant activity, (2) trend analysis of how activity during the peak periods tends to increase vis-à-vis annual increases, and (3) consultations with the relevant Airport users. Future flight schedules were grown based on forecast passengers and operations, as well as interviews conducted with select airlines serving the Airport. One set of derivative forecasts focuses on commercial passenger activity to drive terminal requirements and the other focuses on freighter, general aviation, and military flight operations to support airfield and airspace simulations and cargo facility requirements.

A summary of the design day passengers and operations for each of the planning levels is provided in Table 1-3.

Table 1-3 Peak Period Commercial Passenger Activity Results

	2018	2019	2020	2021	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	4,622,029	8,142,320	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	61,544	72,922	132,830	181,270
Daily						
Deplaned Passengers	21,361	20,658	5,572	15,114	27,451	38,630
Domestic Passengers	19,876	19,640	5,426	14,497	24,219	33,286
International Passengers	1,485	1,018	146	618	3,232	5,344
Enplaned Passengers	21,302	20,600	5,584	15,114	27,491	38,689
Domestic Passengers	19.818	19,587	5,438	14,497	24,216	33,270
International Passengers	1,484	1,013	146	618	3,275	5,420
Operations	356	346	90	232	414	562
Arriving Operations	178	173	45	116	207	281
Departing Operations	178	173	45	116	207	281
Peak Rolling Hour						
Deplaned Passengers	2,107	1,973	750	2,079	2,431	3,218
Domestic Passengers	2,107	1,704	750	2,079	2,107	2,835
International Passengers	596	480	146	159	691	847
Enplaned Passengers	2,167	1,874	868	2,077	3,045	3,334
Domestic Passengers	1,830	1,795	868	2,077	2,923	2,856
International Passengers	479	479	146	159	654	801
Operations	27	27	18	26	31	46
Arriving Operations	17	15	12	16	17	23
Departing Operations	17	15	13	16	24	25

Source: InterVISTAS analysis

Note: Actual historical flight schedules and load factors from the peak month (an average day in July) were analyzed to determine the peak period activity. Peak period activity is the same for FFY and CY because it occurs in the summer.

Table 1-4 provides the forecasts of estimated peak period operations at OAK for freighter, general aviation, and military through the forecast period ending in 2038.

Table 1-4 Freighter Peak Period Operations Forecast (Peak General Month)

	2018	2019	2020	2021	PAL 1 2028	PAL 2 2038
Freighter (for Commercial Passenger Design Day)						
Annual	20,671	20,698	21,444	22,142	23,200	24,800
Average Day	99	99	100	106	111	119
Peak Hour Arrivals	9	9	10	10	11	11
Peak Hour Departures	11	11	12	12	13	14
Peak Hour Total Ops	11	11	12	12	13	14
Freighter (for Cargo Facility Planning)						
Annual	20,671	20,698	21,444	22,142	23,200	24,800
Average Day	127	127	134	135	142	152
Peak Hour Arrivals	10	10	11	11	12	12
Peak Hour Departures	12	12	13	13	14	15
Peak Hour Total Ops	14	14	15	15	16	17
General Aviation						
Annual	104,399	107,861	74,631	90,194	109,991	115,237
Average Day	327	337	268	282	341	357
Peak Hour Arrivals	31	32	25	28	32	34
Peak Hour Departures	27	28	22	26	29	30
Peak Hour Total Ops	46	47	37	42	48	50
Military						
Annual	1,230	926	832	837	1,000	1,000
Average Day	6	6	6	6	6	6
Peak Hour Arrivals	2	2	2	2	2	2
Peak Hour Departures	2	2	2	2	2	2
Peak Hour Total Ops	2	2	2	2	2	2

Sources: Airport Statistics; Landrum & Brown

Note: Peak Hour Military operations were rounded up; historical peak month daily flight activity profiles were prepared from historical data analysis and used to estimate peak hour GA flight operations and similar hourly percentages were used in determining future peak hour operations demand. Peak period activity is the same for FFY and CY because it occurs in the summer.

2 Introduction

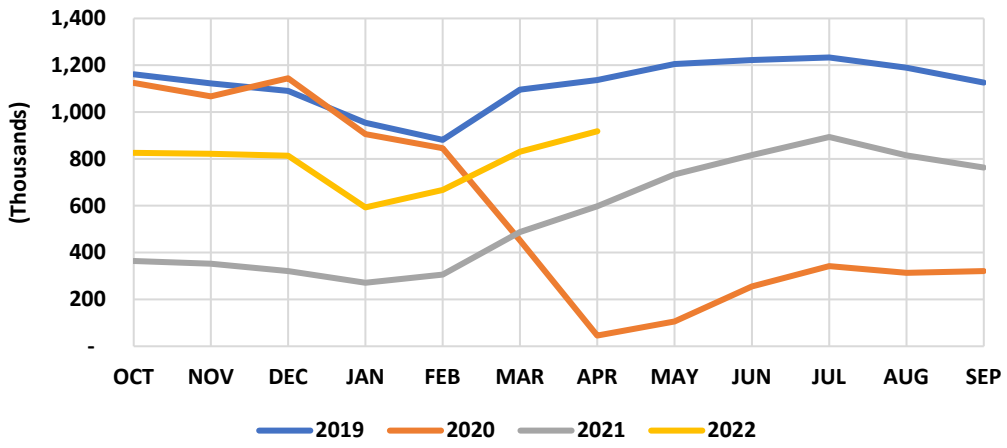
This report was prepared for the Port of Oakland to present the analysis of the historical traffic at OAK, as well as the methodology and results of the planning activity forecast. The most recent calendar year of data available at the time of this analysis was 2021; therefore 2021 was selected as the TAF base year to meet FAA requirements. The Port prepared a forecast report issued in June 2021, but has since updated it at the request of the FAA. 2019 is used as the base year in the report for the purposes of the California Environmental Quality Act ("CEQA") analysis, and was the last year that was not impacted by the COVID-19 Pandemic. In addition to showing the results of the forecast, this report also compares the Port's forecast to the FAA TAF.

The forecasts presented herein are "unconstrained" and as such do not take facility constraints or other outside limiting factors into consideration. In other words, for the purposes of estimating future demand, the forecast assumes facilities can accommodate the projected demand. Prior to finalizing the forecast report, the Coronavirus ("COVID-19") Pandemic began, which has had an immediate impact of aviation traffic at the Airport.

At the onset of the pandemic, public health directives, the lack of vaccines and effective treatments, and the negative impact on economic activity severely limited demand for air transportation. Passenger traffic at OAK decreased 96% in March of 2020 compared to March of 2019.

As vaccines and treatments became available, passenger demand increased, especially in the leisure and visiting friends and relatives segments. OAK's Passenger traffic at the end of 2020 was approximately 70% below pre-pandemic levels in 2019. Throughout 2021, passenger demand increased at OAK to levels approximately 30% below pre-pandemic levels.

Figure 2-1 OAK Monthly Passengers (thousands); FFY 2019-2022



Source: Airport Reported Statistics

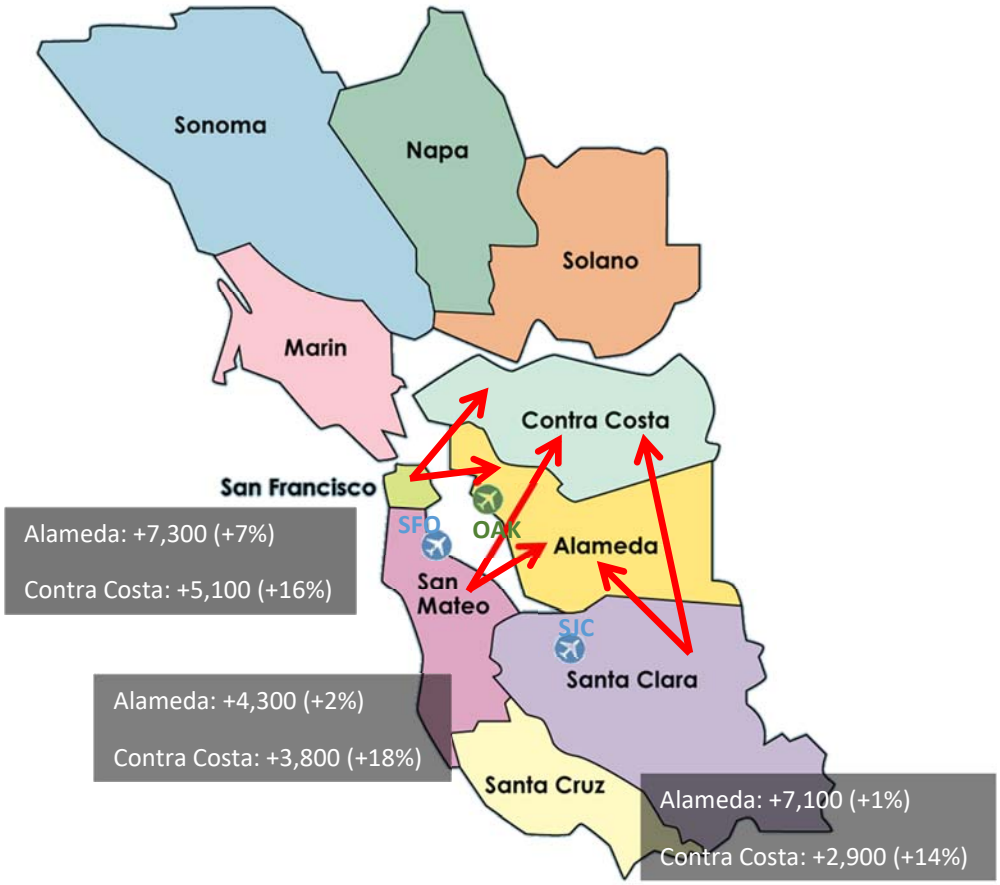
While national demand flagged somewhat during the Delta and Omicron variant surges in COVID-19 infections in early 2022, passenger traffic at OAK has been approximately 27% below 2019 levels. Business and long-haul international demand recovery has lagged other segments, especially considering the varying approaches to international border closures and some shifts to virtual meeting

environments, but airlines have begun to report the return of business travel from small and medium sized businesses. (e.g., Deloitte 2022 study on corporate travel)

While the COVID-19 Pandemic has had a significant impact on aviation demand since 2020, the impact of the pandemic is not expected to change future aviation trends over the long term. Those trends have resulted in a strong recovery in demand at OAK compared to other Bay Area airports, and is similar to OAK's performance following the events and aftermath of September 11, 2001. OAK benefits from migration patterns within the Bay Area, the growth strategies of low-cost and ultra low-cost airlines that use OAK for their primary operation in the Bay Area, and a lower reliance on international long-haul demand than SFO and SJC.

Through the Pandemic, migration within the Bay Area has shifted from the Peninsula and the South Bay to the East Bay toward Sacramento, which means that more residents have moved to OAK's catchment area from the catchment areas of SFO and SJC. United States Postal Service Data reports that approximately 30,500 people have relocated from San Francisco, San Mateo, and Santa Clara counties to Alameda and Contra Costa counties. [2]

Figure 2-2 Net Bay Area Migration, 2020-2021 vs 2018-2019

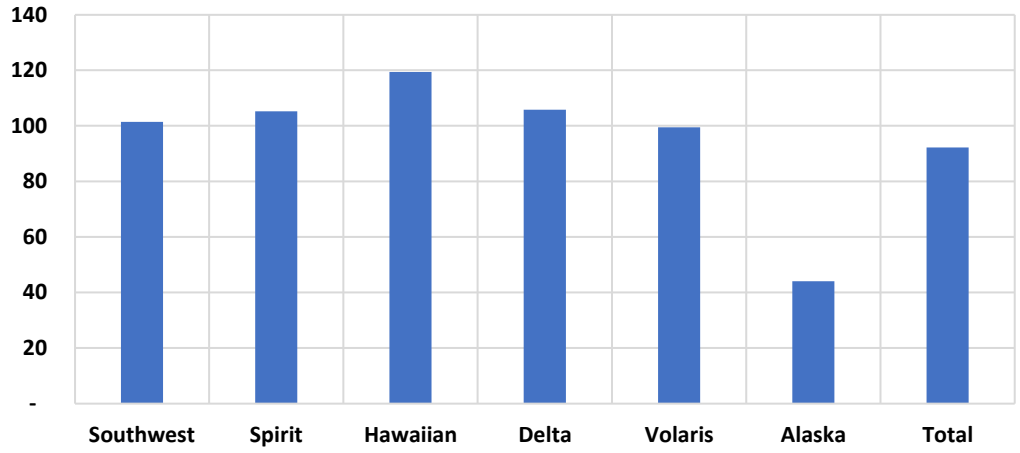


Source: University of California Consumer Credit Panel via California Policy Lab, Dec 2021

[2] https://www.sfchronicle.com/projects/2021/california-bay-area-migration-maps/

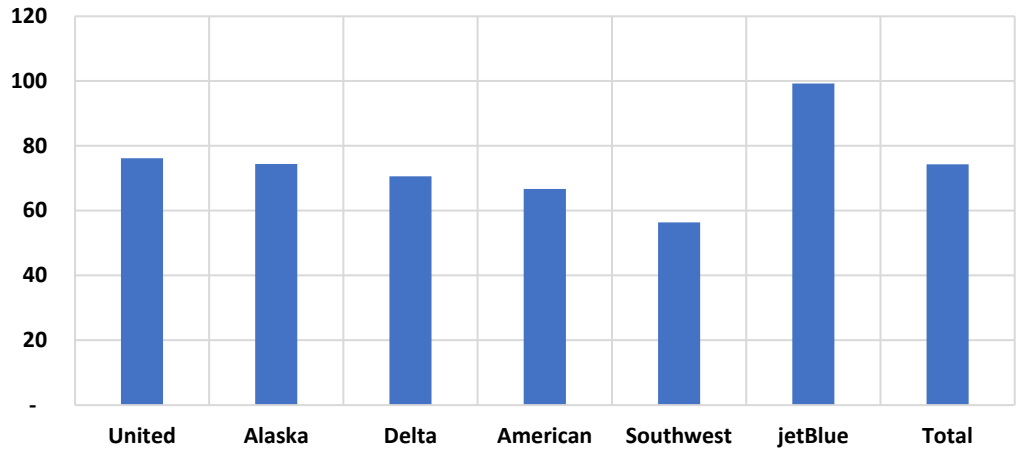
To date, passenger demand recovery has been strongest in the domestic and short-haul international segments, which are strengths of OAK. Because OAK has had limited scheduled Trans-Atlantic services, and no long-haul services to Asia or South America, it has experienced a faster recovery in capacity and demand than have SFO or SJC.

Figure 2-3 OAK Schedule Seat Departures by Airline; June-August 2022 (2019=100)



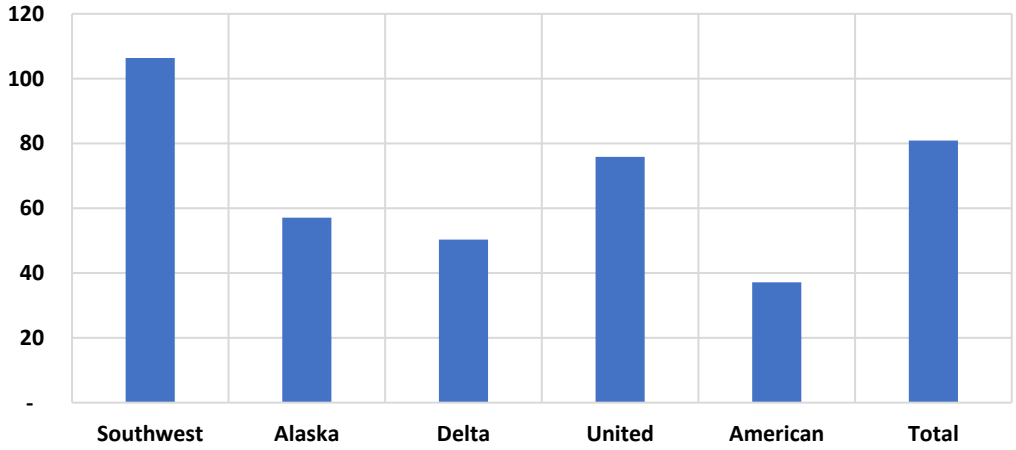
Source: Innovata Schedule Data (Schedule data pulled June 1, 2022)

Figure 2-4 SFO Schedule Seat Departures by Airline; June-August 2022 (2019=100)



Source: Innovata Schedule Data (Schedule data pulled June 1, 2022)

Figure 2-5 SJC Schedule Seat Departures by Airline; June-August 2022 (2019=100)



Source: Innovata Schedule Data (Schedule data pulled June 1, 2022)

The airlines that use OAK as their primary Bay Area Airport, including Southwest Airlines, Spirit Airlines, Allegiant Air, and Frontier Airlines are growing more rapidly than other competitors. Southwest Airlines is the largest airline at OAK by passengers and seats and offers approximately 78.4% of scheduled seat capacity for June through August 2022. Spirit Airlines is the second largest airline at OAK and offers 7.4% of seat capacity over the same period. In published schedules for June through August 2022, these two airlines plan to offer more capacity at OAK than pre-pandemic levels in the summer of 2019.

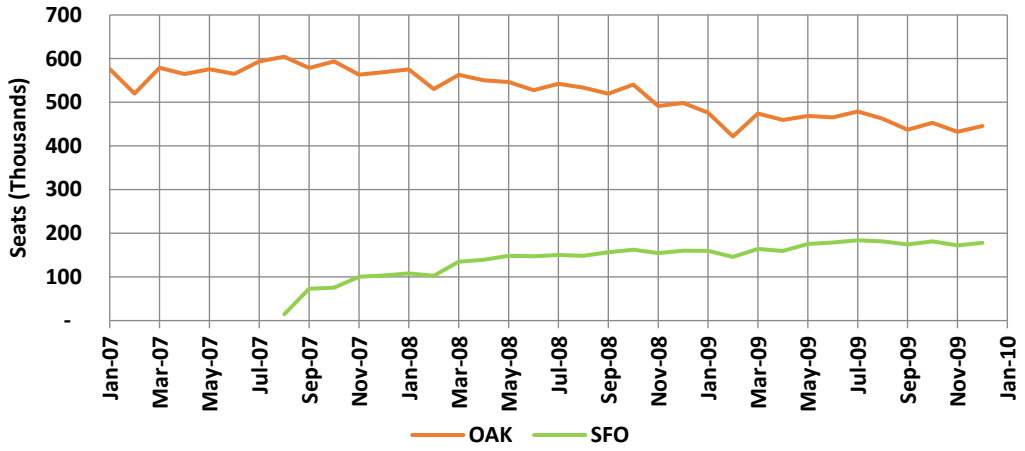
OAK's activity forecasts are based on long-term thirty-year historical relationships between economic activity and demand. Given the favorable changes in OAK's catchment area, the growth bias of the airlines serving OAK, and the focus on domestic and short-haul international by airlines at OAK, it is reasonable that OAK will return to long-term trends prior to PAL1.

The forecasts presented in this report are long-term forecasts. While the COVID-19 Pandemic has had a significant impact on aviation demand since 2020, the impacts of the COVID-19 Pandemic are not expected to alter passenger or cargo demand at OAK over the horizon of planning forecasts.

Prior to the COVID-19 Pandemic, there were two exogenous shock events that impacted demand for air travel: the terrorist attacks and aftermath of September 11, 2001, and the Global Financial Crisis of 2008-2009. While OAK experienced a decrease in traffic following the Global Financial Crisis, it was not driven by lack of demand, but rather a reallocation of capacity by airlines among the Bay Area airports. Virgin America inaugurated service at SFO in the summer of 2007, adding significant seat capacity there. As a competitive response, other airlines including Southwest Airlines shifted capacity from OAK to SFO to meet the competitive threat of Virgin America. As shown on

Figure 2-6, Southwest Airlines began to reduce seat capacity at OAK in September 2007 from approximately 600,000 monthly departure seats to approximately 425,000 monthly departure seats in March 2009. Over the same period, Southwest Airlines added 175,000 monthly departure seats to SFO.

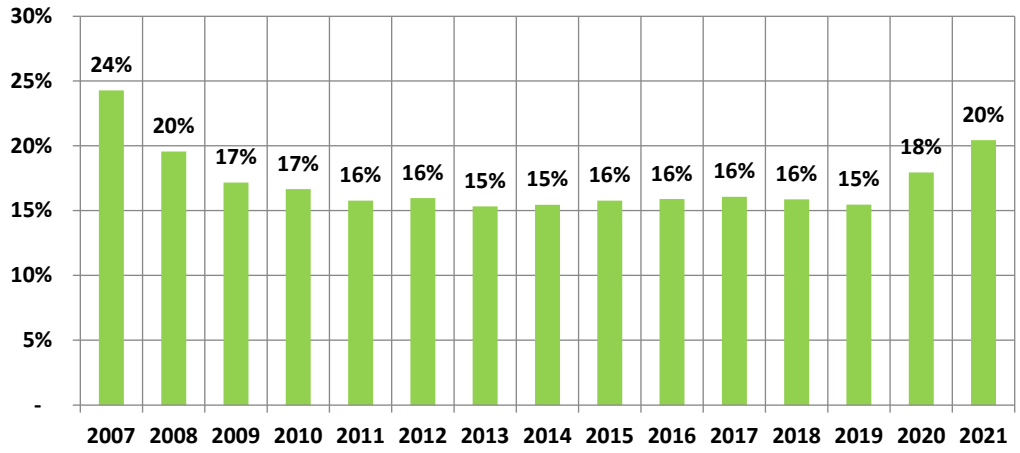
Figure 2-6 Southwest Airlines Seats at SFO and OAK



Source: Innovata Schedule Data

This reallocation lasted through 2017 and caused OAK's share of Bay Area traffic to decrease to approximately 15-16%. Alaska Airlines acquired Virgin America and has rationalized its capacity at SFO since 2017. Other airlines including Southwest Airlines have reduced capacity at SFO. As a result, OAK's share of Bay Area traffic has increased to pre-Global Financial Crisis levels.

Figure 2-7 OAK Share of Bay Area Passenger Traffic



Source: Airport Statistics Data; US DOT T100

In contrast, traffic at OAK was not heavily impacted by the terrorist events and aftermath of September 11, 2001 because Southwest added capacity at OAK while competitors reduced capacity, and because OAK is relatively less exposed to international and long-haul traffic that took longer to recover. For these reasons, the recovery from September 11, 2001 at OAK is similar to what is being experienced following COVID-19. In 2022, Southwest, Spirit, Allegiant, and Frontier, among others are expanding at OAK while demand recovery at SFO and SJC is more muted.

Following a similar pattern to exogenous shocks to passenger demand at OAK in the past, passengers are forecast to recover to pre-pandemic levels in 2023. Passenger operations will recover to pre-pandemic levels in 2025. Passenger operations recovery is expected to lag total passengers due to higher load factors and upgauged aircraft. Air cargo and general aviation demand was not negatively impacted by the COVID-19 Pandemic, so those forecasts have not been changed.

An initial update to OAK's Comprehensive Forecast Report was conducted in Spring of 2021 and included a shift of the years associated with the planning activity levels ("PAL") by three years. PAL 1 has shifted from 2025 to 2028, and PAL 2 has shifted from 2035 to 2038. Because planning activity levels are based on demand rather than specific years, the shift of associated years demonstrates the ability of the planning activity level to be responsive to changes in aviation demand, in this case caused by the COVID-19 Pandemic.

As more people have been vaccinated in the United States, public health restrictions have been relaxed, and people have resumed leisure travel and some business travel. In response to strong demand, Southwest Airlines planned to operate 90% of their pre-pandemic systemwide capacity during summer 2021, and other U.S. airlines planned to operate 70% to 90% of pre-pandemic capacity. OAK is planned to be at 95% of their pre-pandemic capacity during summer 2022. The surge in demand and the airlines' capacity deployment is a testament to the recovery underway.

3 Overview of the Catchment Area

Demand for aviation activity is derived demand related to economic and demographic development of the airport's catchment area, as well as economic and demographic conditions in source markets of destination traffic. This chapter addresses OAK's catchment area.

3.1 Commercial Activity Catchment Area

OAK is located on the "East Bay" side of the highly competitive Bay Area region. The Bay Area includes the cities of San Francisco, Oakland, and San Jose, as well as the surrounding suburbs. In the Bay Area, there are three commercial airports: two medium hubs, OAK and Norman Y. Mineta San Jose International Airport ("SJC") and one large hub airport, San Francisco International Airport ("SFO") as shown on Figure 3-1. OAK is located approximately 10 road miles south of Downtown Oakland, 20 road miles east of San Francisco, and approximately 30 road miles northeast of San Francisco International Airport. In CY 2021 SFO served 12.2 million enplaned passengers, while OAK and SJC served 4.1 million and 3.7 million enplaned passengers, respectively.

Figure 3-1 Bay Area Airports

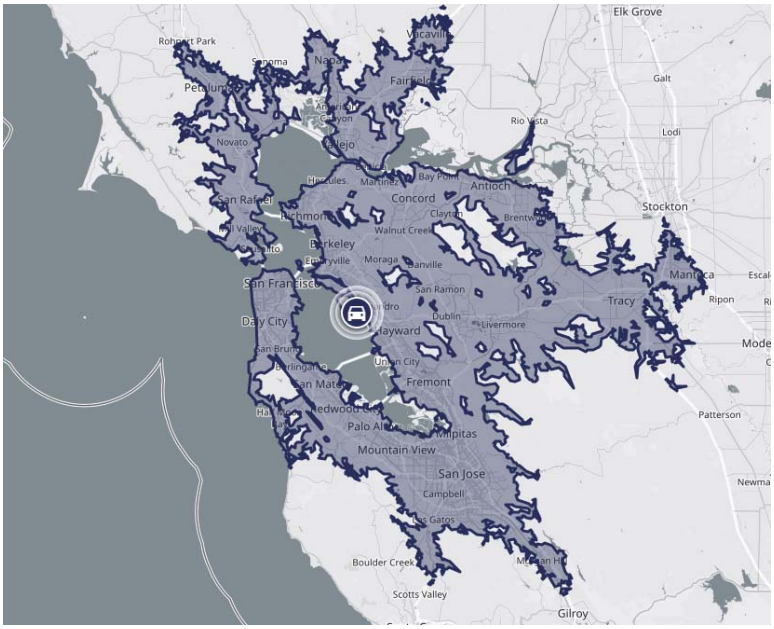
The Bay Area is comprised of four regions, North Bay/Wine Country, the East Bay, the South Bay, and the counties of Marin, San Francisco, and San Mateo. As illustrated in Figure 3-2, OAK is the most convenient airport in terms of time and distance to the East Bay and Wine Country regions. The catchment area regions, highlighted in Figure 3-2, have a population base of 7.7 million inhabitants. The East Bay is largely comprised of Alameda and Contra Costa counties, while the North Bay/Wine Country includes Napa, Sonoma, and Solano counties. The South Bay, which has a population of 1.9 million, includes Santa Clara County, where SJC is the most convenient airport. Lastly, Marin, San Francisco, and San Mateo counties have easiest access to SFO. The combined population of Marin, San Francisco, and San Mateo Counties is 1.9 million.

Figure 3-2 OAK Commercial Operations Catchment Area

Destination	Miles	Drive Time
East Bay		
Alameda	10.6	20 mins
Contra Costa	43.1	1 hr 10 mins
South Bay		
Santa Clara	36.6	50 mins
Marin	**35.3**	**45 mins**
San Francisco	**20.4**	**35 mins**
San Mateo	**24.6**	**30 mins**
North Bay/Wine Country		
Napa	52.4	1 hr 10 mins
Sonoma	57.1	1 hr 10 mins
Solano	61.4	1 hr 13 mins

OAK is approximately a one hour drive time of the entire immediate Bay Area as well as the only Bay Area airport a nearly one hour drive from population centers in Napa, Sonoma, and Solano Counties as well as the Central Valley, as shown in Figure 3-3. It has the largest drivable catchment area of the three primary Bay Area airports, covering all the major population bases.

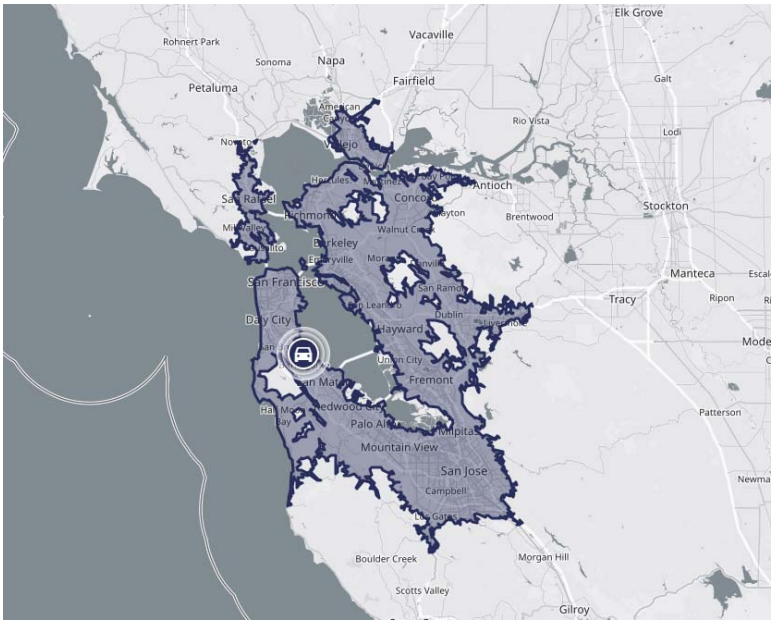
Figure 3-3 OAK One-hour Drive Time



Source: app.traveltime.com, one hour drive times during midday

From SFO, the one-hour drive time radius shown in Figure 3-4 captures much of the same catchment area as OAK, but does not reach as far into the North Bay/Wine Country or East Bay, including the cities of Napa, Sonoma, and Fairfield.

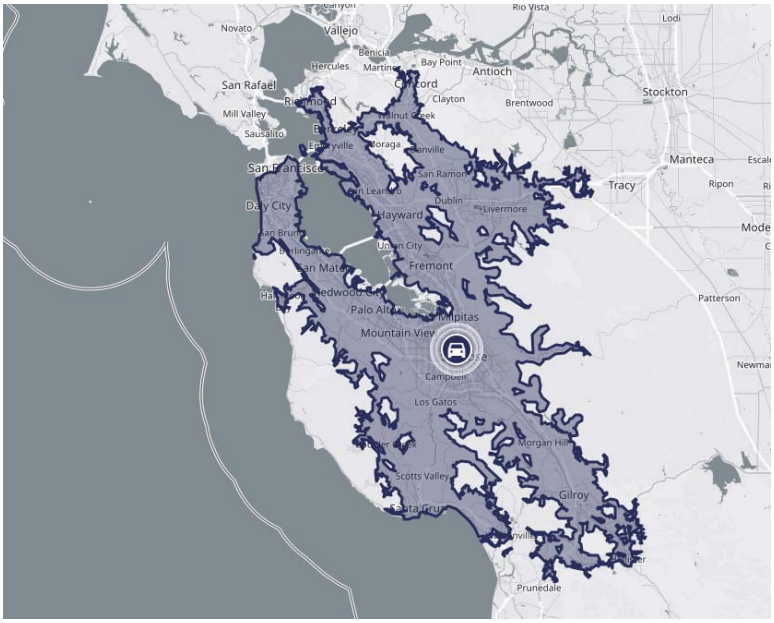
Figure 3-4 SFO One-hour drive time



Source: app.traveltime.com, one hour drive times during midday

Given SJC's geographic location in comparison to OAK and SFO, as shown in Figure 3-5, the one-hour drive radius covers a catchment area focused further south. Much of the East Bay and all of the North Bay is outside of this one-hour radius.

Figure 3-5 SJC One-hour drive time



Source: app.traveltime.com, one hour drive times during midday

A consumer's choice of airport in the Bay Area is also defined by the availability and convenience of air service at the region's airports. Table 3-1 presents air service available at the Bay Area's three primary airports as well as smaller airports located within approximately 100 road miles of OAK. Historically, air service at OAK has been primarily domestic with a broad portfolio of non-stop routes and airlines serving U.S. markets. Of the competitive airports, it is most similar in size and air service to Sacramento Metropolitan Airport ("SMF") and SJC. While SJC is located in the Bay Area, SMF's service area is primarily the City of Sacramento. SFO is a larger airport with significantly more international air service as well as service to a variety of smaller domestic markets that are available as a result of United Airlines' hub operation there. Charles M. Schulz Sonoma County ("STS"), Modesto City-County, and Monterey Regional airports are located on the periphery of the Bay Area and have significantly less air service.

There is commercial air service at STS located in the northern part of the Bay Area that accommodated approximately 217,000 enplaned passengers in CY 2021. Alaska Airlines, American Airlines, Avelo Airlines, and United Airlines provide service to six airports in California as well as to Dallas/Fort Worth, Denver, Las Vegas, Phoenix, Portland, and Seattle/Tacoma. Alaska Airlines has the largest passenger market share at STS.

The markets served non-stop from STS are largely along the west coast with limited connectivity to hub airports located in the western U.S. As such, STS serves a niche market in the North Bay, whereas OAK, SFO, and SJC service millions of enplaned passengers per year with flights throughout the U.S. and abroad. STS does not compete with OAK, SFO, and SJC for the core passenger market surrounding the San Francisco Bay.

The forecast logic recognizes the continuing role of STS in the Bay Area serving a limited portion of traffic bound to and from the North Bay. STS has experienced a doubling of enplaned passengers between 2012 and 2018 and is projected in the FAA TAF to double again over the forecast period. Given the limited breadth and depth of air service at STS when compared with OAK, SFO, and SJC, and the lower population bases in Napa and Sonoma counties when compared to the counties surrounding the San Francisco Bay, OAK's forecast does not include any share-shift to or from STS in its projections of demand at OAK.

Table 3-1 Commercial Air Service at Airports in and around the Bay Area CY 2021

Airport	Code	Road Miles from OAK (a)	Typical Drive Time from OAK (a)	Number of Airlines (b)	Non-stop Domestic Destinations (b)	Non-stop International Destinations (b)	Average Daily Departure Seats (b)
Oakland International	OAK	--	--	9	43	5	15,347
San Francisco International	SFO	31	35m	41	80	47	45,009
Norman Y. Mineta San Jose	SJC	34	45m	9	35	7	14,609
Charles M. Schulz Sonoma County	STS	76	1h 22m	4	10	--	829
Modesto City-County	MOD	78	1h 35m	--	--	--	--
Sacramento Metropolitan	SMF	96	1h 36m	12	36	5	17,384
Monterey Regional	MRY	106	1h 50m	4	9	--	728

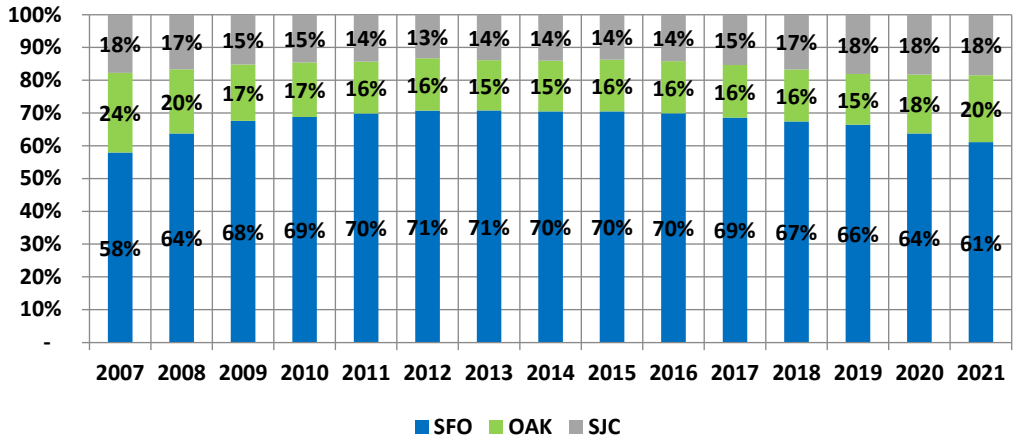
Source: (a) Mapquest.com, (b) Innovata Schedule Data

3.2 OAK's Share of Bay Area Passengers

In CY 2021, OAK accommodated 20% of the Bay Area's passenger traffic, up from 15% in 2019. The proximity of alternative airports in the Bay Area results in passengers having three airports from which to choose as discussed in the previous section. Typically, passengers select airports based on proximity to home, work, or their destination; ease and speed of ground access; and availability of convenient and competitively priced flights.

At its peak in 2007, OAK's share of the total Bay Area passenger traffic was 24%, as shown in Figure 3-6, however, OAK's share of passenger traffic has since remained below 2007 levels. Inversely, from 2007 to 2019, SFO has increased its share of Bay Area traffic by 8 percentage points, however, SFO's share of the Bay Area passengers is down from its peak in 2012 and 2013 of 71%.

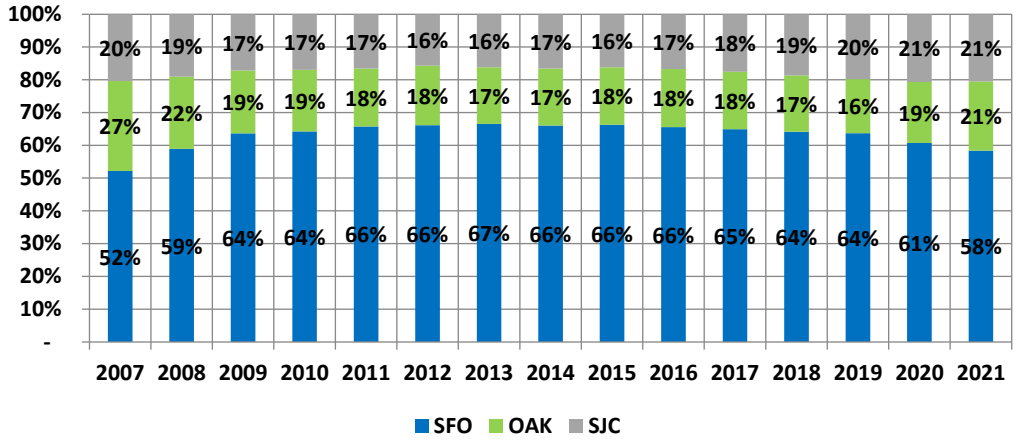
Figure 3-6 Share of Bay Area Passenger Total Traffic, CY 2007 – 2021



Source: Airport Statistics Data; US DOT T100

Compared to total passenger traffic, both OAK and SJC have historically had larger shares of the Bay Area's Origin and Destination ("O&D") passengers. This is because SFO accommodates a larger share of connecting passengers among Bay Area airports as it is a United Airlines hub and the Bay Area's primary international gateway. As shown in Figure 3-7, OAK had a 16% share of O&D passengers in 2019, which increased to 21% in 2021, down 6 percentage points from its 2007 peak of 27%.

Figure 3-7 Share of Bay Area O&D Traffic, CY 2007 – 2021



Source: US DOT O&D Survey and T-100 Data

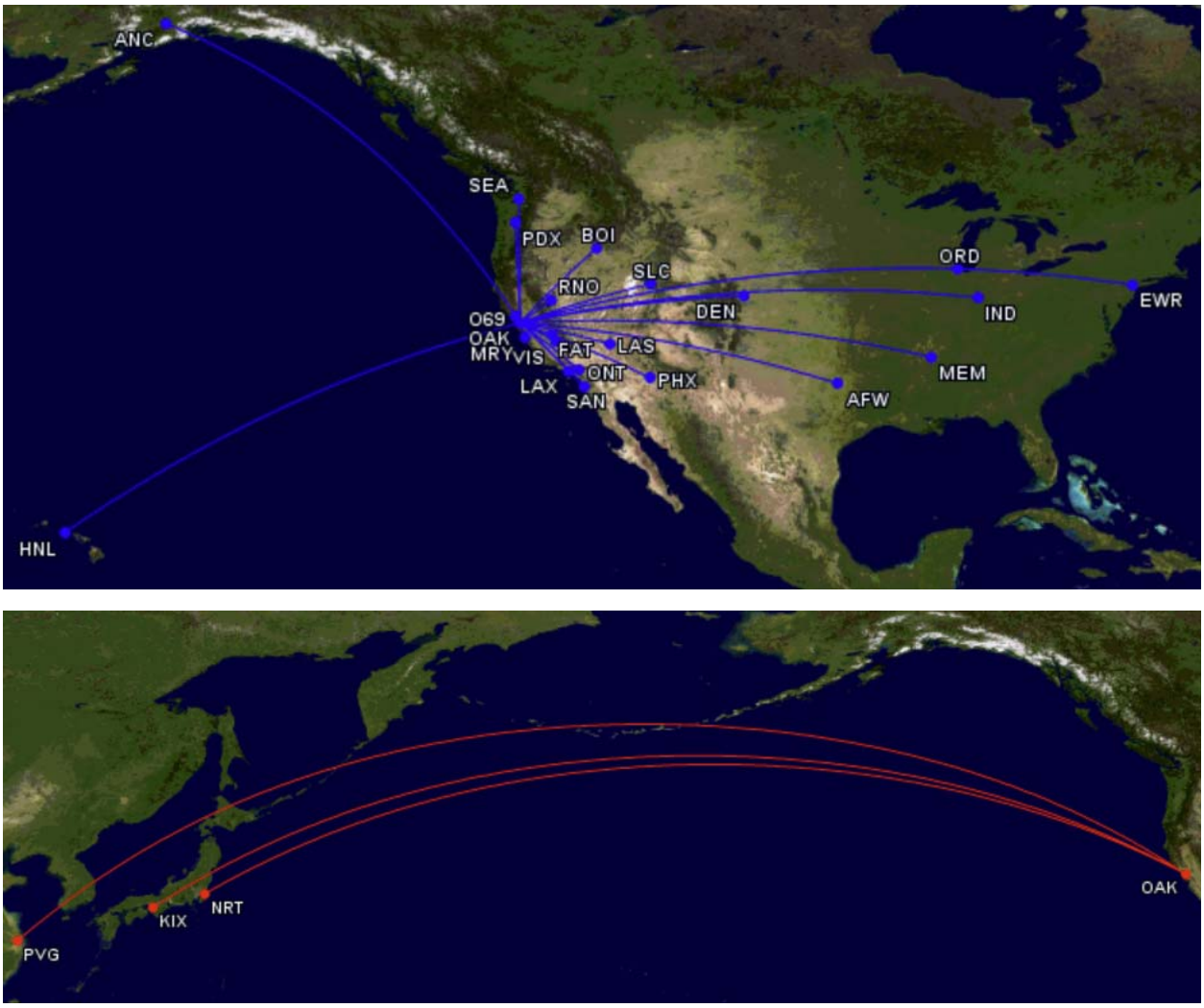
During the Global Financial Crisis of 2008-2009, SFO's share of O&D passengers increased from 52% in 2007 to 64% in 2009. During this period, new entrant Virgin America began service at SFO and JetBlue Airways and Southwest Airlines shifted flights from OAK to SFO as a competitive response to Virgin America. SFO hub carrier United Airlines also added service to compete with Virgin America. These capacity decisions caused Bay Area O&D passenger share at SFO to increase to a peak in 2013 of 67%. Since 2013, SFO's share has decreased by 9 percentage points to 58% in 2021.

SJC's share of the region's O&D passenger was 21% in 2021, back to their pre-recession levels, and the same levels achieved pre-pandemic. In 2019, OAK's share of Bay Area O&D passengers had been negatively impacted by the grounding of the Boeing 737 MAX aircraft that caused Southwest Airlines and American Airlines to reduce planned capacity throughout their U.S. network, including at OAK.

3.3 OAK Cargo Demand

Demand for origin and destination of commercial cargo traffic is based on the specific needs of the local base of shippers, businesses, and pilots. In addition, there may be significant influences of external regions and carrier strategies driving air cargo demand at an airport. FedEx is the largest freight airline at OAK, where it operates its west coast regional hub as shown on Figure 3-8. The FedEx operation is dependent on local demand of origin and destination freight, as well as influenced by the broader FedEx network demand and system strategies. Figure 3-8 represents the route system of FedEx airport markets connected to the OAK regional hub. UPS is the second largest freight airline at OAK, but its operation is focused on serving the local demand with its regional hub located at Ontario International Airport in the Los Angeles basin. Note that both FedEx and UPS have sortation facilities at Anchorage International Airport ("ANC"). They also strategically use ANC, as needed, as a technical stop for fuel between North America and Asia.

Figure 3-8 OAK FedEx West Coast Regional Hub Catchment Area



Sources: U.S. DOT Schedule T-100 data; Landrum & Brown analysis; Great Circle Mapper

In 2019, 642,405 tons of cargo was handled at OAK. Of the total freighter cargo, FedEx handled about 79%, and UPS handled 21%. Approximately 89% of cargo handled at OAK was domestic, while approximately 11% was international. Approximately 98% of cargo at OAK was accommodated on freighter aircraft, while approximately 2% was accommodated in the belly compartment of passenger aircraft. During the Pandemic, the mix of freighter cargo at OAK only shifted slightly with the FedEx and UPS ending up at roughly 80%/20% in 2021 while the domestic cargo share increased to 95% and the freighter share reached almost 99% with reduced passenger operations (especially among international routes).

In contrast to OAK, FedEx and UPS service to SFO and SJC pursue distinct strategies that make them both competitive and complementary to OAK. UPS does not serve SFO at all, and FedEx operates only a direct service from SFO to its hub at Memphis. FedEx handles a significant amount of international cargo transferred at SFO from other airlines' as belly cargo. SFO reported 601,862 ton of cargo and mail in 2019, of which 72% was belly cargo and 65% was international cargo. United Airlines is by far the largest cargo carrier at SFO. In 2021, air cargo at SFO had recovered from the 2020 Pandemic drop to an

estimated 582,893 tons while the belly cargo share decreased to 47% and international cargo decreased a little to 59% of total cargo due to the impact of the Pandemic on air service offerings.

SJC has limited cargo services by FedEx and UPS focused on O&D cargo. SJC handled approximately 53,000 tons of cargo in 2019, of which 76% was domestic and 68% was handled on freighter aircraft. FedEx handled 40% and UPS handled 28% of the 2019 cargo tonnage at SJC. The Pandemic's impact on air cargo at SJC is similar to those of SFO; 2021 tonnage was down to 36,369 tons with nearly 100% being domestic and 90% handled on freighter aircraft.

3.4 General Aviation Catchment Area

The catchment area for OAK's general aviation ("GA") activity represents the local population and economy that is assumed to support the Airport as the main source driving demand for these segments of aviation activity.

The Airport's GA catchment area is more limited by the numerous competing nearby airports shown on Table 3-2 that accommodate civil aviation demand, whereas the catchment area for the commercial forecasts is larger and affected by several other factors including: fewer competing airports, airline mix, airfares, market frequency, and the number of passenger markets served. GA operations are often split into two categories, "Heavy GA," operations that typically includes business aviation operations on larger aircraft including jets, and "Light GA" operations that includes smaller aircraft favored by owner-operators and flight schools. Passengers flying via large business aviation are time sensitive and price inelastic and tend to choose an airport based on proximity or convenience, while smaller GA operators are typically more price sensitive and select an airport based on price of landing fees, fuel flowage fees, and facilities rentals. As shown on Table 3-2, OAK ranks seventh in GA activity among the twelve airports in the Bay Area. As such, OAK's catchment area for GA activity is more limited than the catchment area for commercial air service.

Table 3-2 General Aviation Airports in and around the Bay Area

Airport	Code	Road Miles from OAK (a)	Typical Drive Time from OAK (a)	FFY 2019 GA Operations (b)	2021
Oakland International	OAK	--	--	80,273	63,620
San Francisco International	SFO	30	35m	11,135	6,195
Norman Y. Mineta San Jose International	SJC	33	45m	36,248	33,164
Hayward Executive Airport	HWD	10	18m	109,865	133,039
Livermore Municipal Airport	LVK	24	27m	151,371	183,842
San Carlos Airport	SQL	26	30m	70,281	61,359
Buchanan Field Airport	CCR	30	31m	92,589	100,924
Palo Alto Airport	PAO	29	35m	154,225	154,689
Reid-Hillview Airport	RHV	39	42m	196,632	158,639
Napa County Airport	APC	46	53m	40,066	65,567
Byron Airport	C83	49	1h 3m	83,000	83,000
Sonoma County Airport	STS	74	1h 15m	69,822	73,556

Sources: (a) Google Maps; (b) FAA TAF (excludes JSX operations)

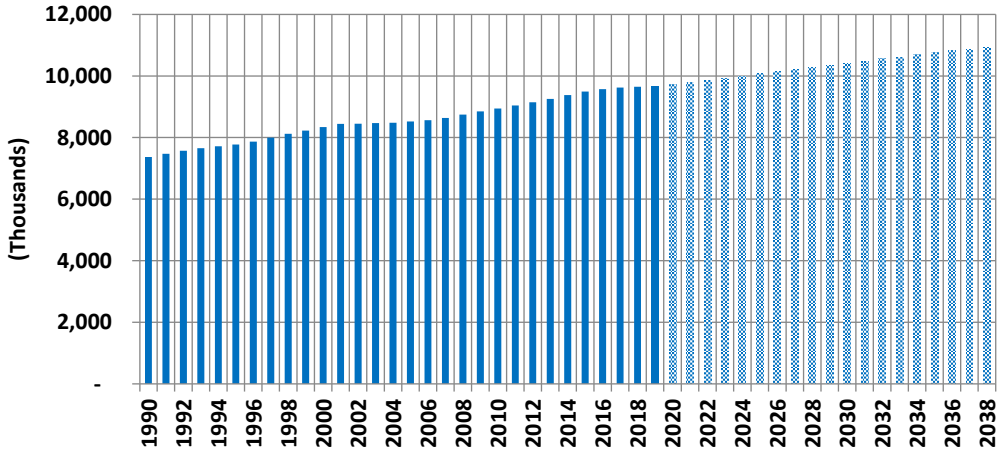
4 Catchment Area Demographics and Economy

The data presented in this section reflects the historical changes in socioeconomic variables that may impact demand for aviation activity at OAK and the historical aviation data from the Airport. This data provides the context for understanding historical trends and potential correlations between aviation traffic and the variables discussed for passenger activity, air cargo and GA.

4.1 Population

As of 2019, the Bay Area's total population reached 9.7 million residents, achieving a 1.0% growth per annum since 1990 as shown on Figure 4-1. For the past decade, the region's population maintained a rate of 1.0% annually. Population projections for the Bay Area estimate the region will increase by 1.3 million residents by 2038 to 10.9 million people, or at an average annual rate of 0.7% per annum. A growing population drives the potential pool of travelers and is an indicator for future demand level.

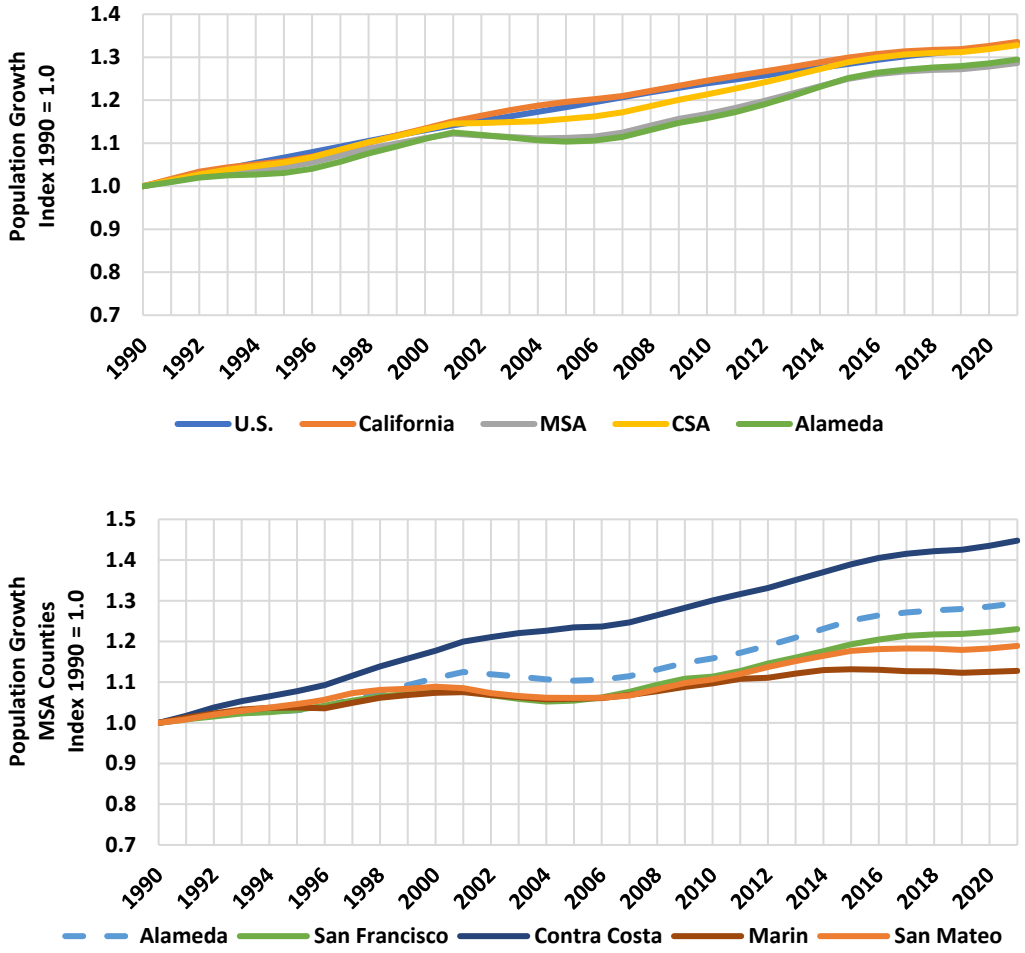
Figure 4-1 Bay Area Population, CY 1990-2038, thousands



Note: Woods + Poole historical data through 2019.
Source: Woods + Poole 2021

Since 2009, the population of the San Francisco-Oakland-Berkeley MSA increased at an average growth rate of 1.1% reaching an estimated 4.8 million people in 2021. The MSA population is forecast to increase to an estimated 5.3 million in 2038, representing an average growth rate of 0.6% during the forecast period. Within the MSA, Alameda and Contra Costa counties have experienced higher rates of population growth than San Francisco, San Mateo, and Marin counties. The following index charts in Figure 4-2 show a comparison to broader and narrower population bases, with the MSA population growing at a very similar pace to the U.S., California, the San Jose-San Francisco-Oakland, CA combined statistical area ("CSA") and Alameda County.

Figure 4-2 Population Comparisons, CY 1990 – 2021

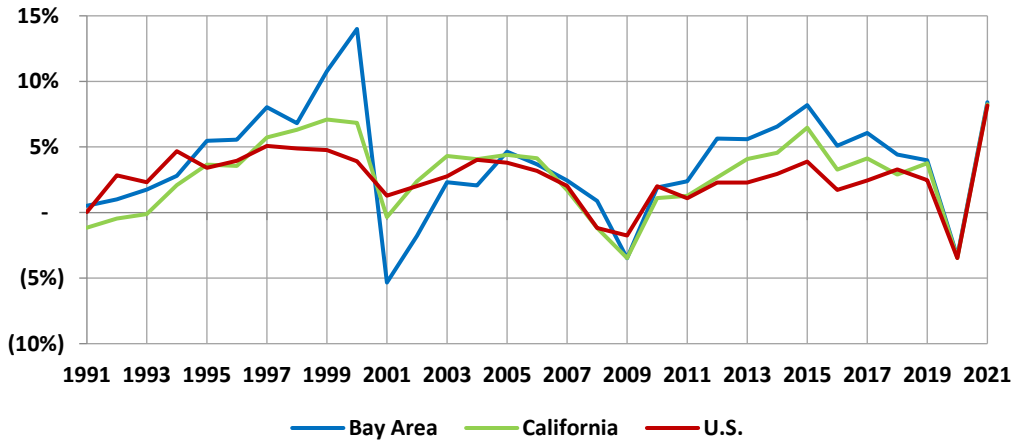


Note: Woods + Poole historical data through 2019, 2020 and 2021 are projections.
Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2021; Landrum & Brown

4.2 Economy

The San Francisco Bay Area is a hub of economic activity, and home to a diverse range of industries. San Francisco is the center of the region's financial and tourism industry; the East Bay (including Oakland) enjoys a diversified economic base discussed further below; San Jose is the heart of Silicon Valley and technology industry; and lastly the North Bay is a major player in agriculture and wine industry. Given these diverse economic sectors, the Bay Area has experienced 12 years of increases in Gross Regional Product between 1.9% and 8.2% since 2009. Following the 2008-2009 Economic Recession, the Bay Area's economy rebounded at a faster rate than both the U.S. and the California economies, as shown in Figure 4-3.

Figure 4-3 Year-Over-Year Change in GRP, CY 1990-2021



Note: Woods + Poole historical data through 2019, 2020 and 2021 are projections.
Source: Woods + Poole 2021

The economy of OAK's catchment area is diverse and growing as evidenced by companies headquartered in the area, the private sector employers in the area, the presence of the University of California at Berkeley and the Lawrence Livermore National Labs, and recent real estate development. OAK's catchment area benefits from a diverse group of companies, a highly educated workforce, and an expanding supply of both housing and commercial real estate. These dynamics drive demand for air service at OAK, to which the airlines have responded by reinstating pre-pandemic services levels at OAK more rapidly than SFO and SJC. No employment sector in the Bay Area accounts for more than 12.2% of employment as shown in Table 4-1. The economy of the East Bay has a broad base of employers from the Technology, Health Care, and Services sectors.

Table 4-1 Bay Area Employment by Sector

Employment Sector	Share
Professional & Technical Services	12.2%
Health Care & Social Assistance	10.7%
State & Local Government	8.5%
Retail Trade	7.6%
Accommodation & Food Services	7.4%
Manufacturing	7.0%
Administration & Waste Services	5.6%
Other Services Except Public Admin	5.3%
Construction	5.1%
Finance & Insurance	4.9%
Transportation & Warehousing	4.8%
Real Estate	4.6%
Information	4.0%
Educational Services	2.8%
Wholesale Trade	2.6%
Arts, Entertainment & Recreation	2.5%
Other	4.3%
Total	**100.0%**

Source: Woods + Poole 2021

Table 4-2 lists the twenty largest public companies headquartered in Alameda and Contra Costa Counties. These companies represent a variety of business sectors including energy, technology, heath care, retail, services, and consumer and industrial goods that provide OAK's catchment area with a broadly based economy that is not reliant on any one sector. The largest public companies headquartered in OAK's catchment area employee 850 to 280,000 people globally. These companies have revenues ranging from $0.8 billion to $94.7 billion per year indicating a balance of large companies as well smaller businesses that have led the early recovery of business travel.

Table 4-2 Largest Public Companies by Revenue Headquartered in Alameda and Contra Costa Counties

Rank	Business name	Industry	Annual revenue (billions)	Employees
1	Chevron Corporation	Energy	94.7	47,736
2	Synnex Corporation	Services	24.7	280,000
3	Ross Stores	Retail	12.5	93,700
4	Lam Research Corporation	Technology	11.9	11,300
5	Clorox Company	Consumer Goods	7.3	8,800
6	Logitech International	Technology	5.3	9,000
7	Workday	Technology	4.3	12,500
8	Trinet Group Incorporated	Services	4.0	2,700
9	Grocery Outlet Holding Corporation	Retail	3.1	946
10	Central Garden & Pet	Consumer Goods	2.7	6,300
11	Bio-Rad Laboratories Incorporated	Health Care	2.6	8,000
12	Cooper Companies	Health Care	2.4	12,000
13	Corsair Gaming Incorporated	Technology	1.7	2,411
14	Veeva Systems Incorporated	Technology	1.5	4,506
15	Ultra Clean Holdings Incorporated	Technology	1.4	4,996
16	Simpson Manufacturing	Industrial Goods	1.3	3,562
17	Smart Global Holdings Incorporated	Technology	1.1	3,926
18	Exelis Incorporated	Health Care	1.0	773
19	Ishor Holdings Incorporated	Technology	0.9	1,600
20	Enphase Energy	Technology	0.8	850

Source: San Francisco Business Times East Bay Book of Lists 2022

Table 4-3 lists the twenty largest nonprofit, private, and publicly held company employers in Alameda and Contra Costa counties. Similar to the companies headquartered in OAK's catchment area, these companies represent a diversity of business sectors from health care, manufacturing, energy and utilities, financial services, and technology. These companies' employee between 1,474 and 34,666 people in Alameda and Contra Costa counties. While some of these companies are large, many are smaller businesses that have been among the first to resume business travel following the onset of the COVID-19 Pandemic.

Table 4-3 Largest Nonprofit, Private, and Publicly Held Company Employers in Alameda and Contra Costa Counties

Rank	Company	Business description	Employees in Alameda and Contra Costa counties
1	Kaiser Permanente	Health Care System	34,666
2	Tesla	Electric Vehicle Manufacturer	13,000
3	Safeway	Grocery Stores	9,731
4	Sutter Health	Heath Care System	9,377
5	John Muir Heath	Health Care System	6,300
6	Pacific Gas & Electric	Electric and Gas Utilities	5,100
7	Workday	Enterprise Cloud Application Provider	5,098
8	Chevron Corporation	Energy Production Company	4,700
9	Wells Fargo & Company	Financial Services	4,354
10	Allied Universal	Security Services	3,454
11	Lam Research Corporation	Semiconductor Manufacturing	3,300
12	Southwest Airlines	Airline	2,619
13	The Save Mart Companies	Grocery Store Operator	2,500
14	Washington Hospital Healthcare System	Health Care System	2,054
15	Penumbra Incorporated	Medical Services	2,000
16	Bank of America	Financial Services	1,898
17	Bank of the West	Financial Services	1,735
18	Manos Home Care	Senior and Disability Care	1,722
19	Oracle Corporation	Business Software and Cloud Applications	1,493
20	Robert Half International	Staffing	1,474

Source: San Francisco Business Times East Bay Book of Lists 2022

In addition to the largest private companies headquartered in OAK's catchment area, the University of California at Berkeley, the systemwide headquarters for the University of California, and Lawrence Livermore National Labs drive demand for air services at OAK. The University of California system spent approximately $61 million on travel in 2019-2020.[3] While it is spending approximately 20% of that amount this year, travel spending is expected to recover in the future, especially by the system's premier research institution at Berkeley. The Lawrence Livermore National Labs employee 7,900 people and had an annual operating budget of $2.5 billion in fiscal year 2020. That budget increased 7% from the previous year and increased 45% since 2016.[4] These two public institutions drive significant demand for air service at OAK.

In its Multifamily Metro Outlook for Oakland in the fourth quarter of 2021, Fannie Mae notes a number of positive trends in the market. Oakland and Berkeley are experiencing the highest increases in housing inventory in the Bay Area as a result of "transformative projects" that have delivered over 20,000 new units over the past six years.[5] The availability of housing at relatively attractive prices in the Bay Area supports migration trends to Alameda and Contra Costa counties.

The East Bay also has abundant industrial and office space at comparatively attractive prices in the Bay Area. Companies such as Tesla and Wester Digital have located in the East By to take advantage of

[3] University of California Operating Budget.

[4] Lawrence Livermore National Labs Economic Impact Fiscal Year 2020.

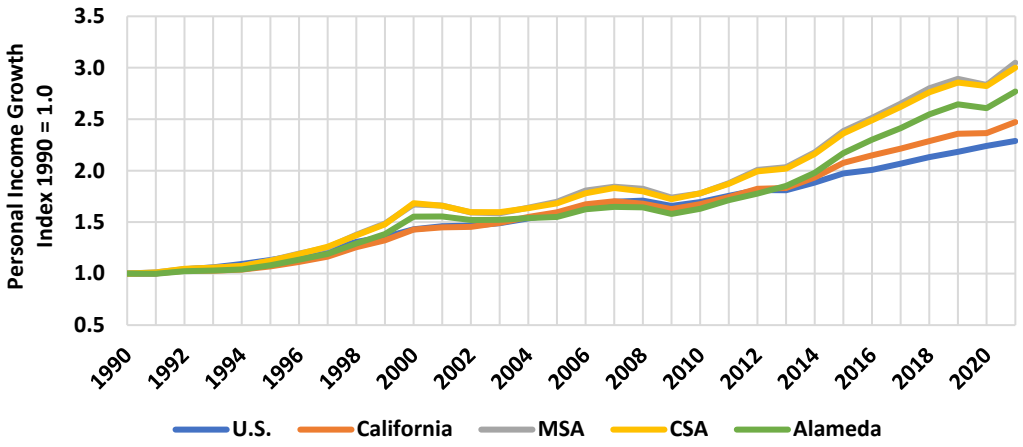
[5] Fannie Mae Multifamily Metro Outlook: Oakland 4Q 2021.

available real estate. Financial technology firms including Marqueta, Square, and Credit Karma are based in Oakland as are many biotech startups such as 10x Genomics, Amyris, and Zymergen.[6]

The University of California at Berkeley supplies a well-educated workforce as over 50% of the population age 25 and over have a bachelor's degree or higher. Fannie Mae notes that this attracts a diverse group of employers with well-paying STEM jobs including the Lawrence Berkeley and Livermore labs, Chevron, Bayer, bio-tech firm Grifols, and health care systems including Kaiser Permanente, John Muir Health, and the UCSF Medical Center.[7]

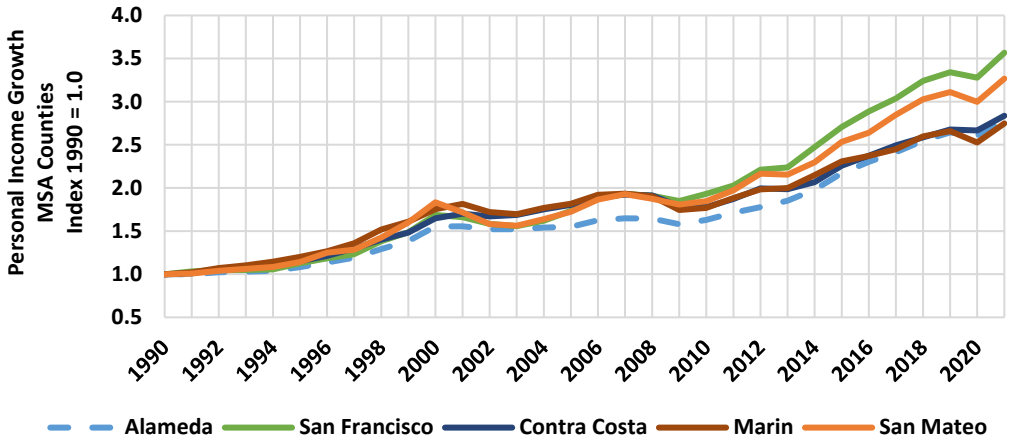
Demand for air travel and for goods movement by air is very dependent upon financial ability of businesses and individuals. Increased economic output, wages, and disposable income generally lead to greater opportunity to choose air travel over traveling or transporting goods by ground. From 2009 to 2019, personal income in the MSA increased at an average growth rate of 4.6% per annum, reaching almost $452 billion (2012 USD). During the Pandemic, personal income was estimated at $477 billion (2012 USD) for 2021. The higher growth rate in personal income compared to employment indicates potential for higher levels of disposable income if inflation is stable. Personal income growth is forecast to continue to outpace employment growth at a rate of 2.1% per year through 2038, reaching nearly $677 billion (2012 USD). Between 2012 and 2019, Alameda County, has experienced a similar growth pattern in personal income to other counties in the MSA, though it started from a lower level. The immigration patterns within the MSA favor Alameda Counties between 2019 and 2022, which should reduce the gap in PCPI growth.

Figure 4-4 Personal Income Comparisons



[6] Fannie Mae Multifamily Metro Outlook: Oakland 4Q 2021.

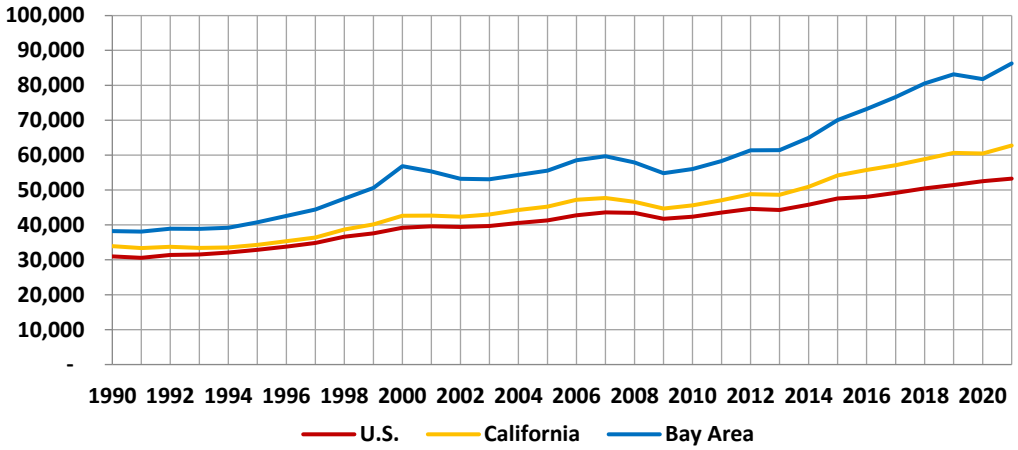
[7] Fannie Mae Multifamily Metro Outlook: Oakland 4Q 2021.



Note: Woods + Poole historical data through 2019, 2020 and 2021 are projections.
Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2021; Landrum & Brown

The San Francisco Bay Area is an affluent community in which per capita personal income ("PCPI") is higher than that of both California and the United States average as shown on Figure 4-5. Per capita personal income corresponds to the average income per inhabitant and is calculated by dividing total income by total population. In 2019, the regions personal income per capita was 62% and 37% higher than the United States and California, respectively.

Figure 4-5 Total Personal Income Per Capita, 2012 $, CY 1990-2021



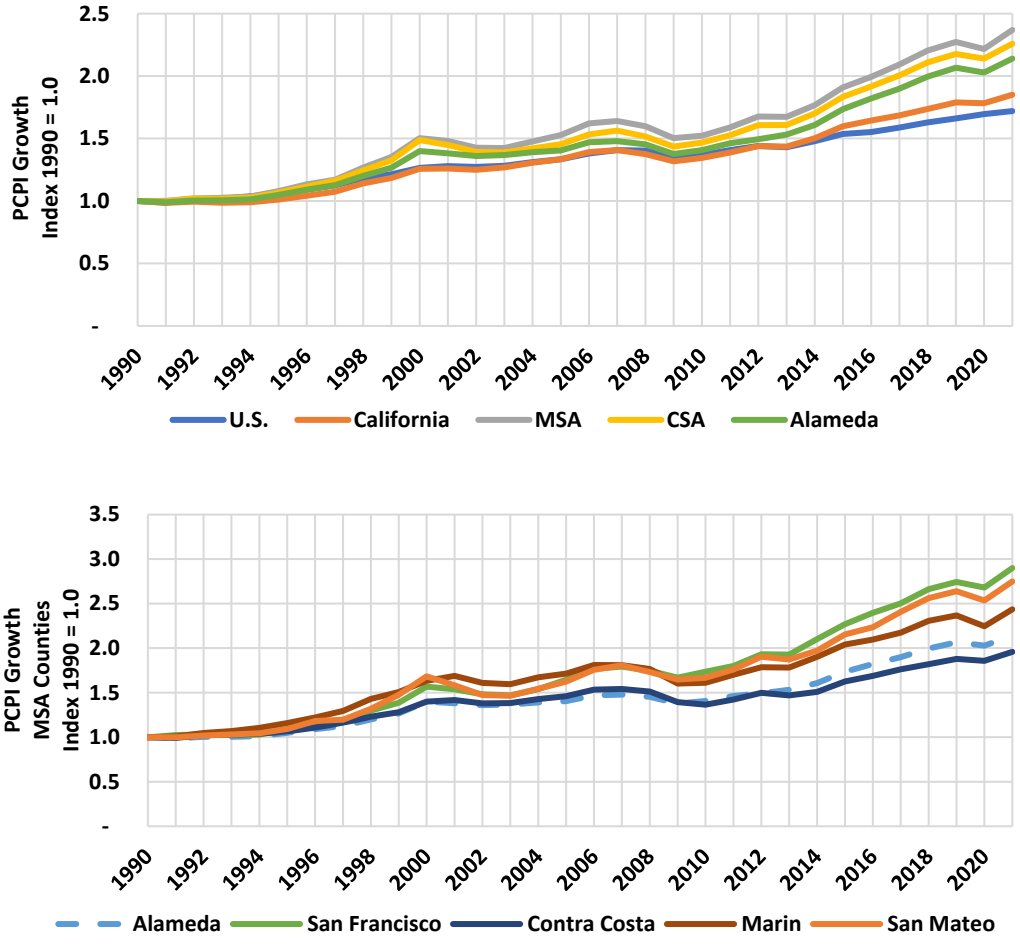
Note: Woods + Poole historical data through 2019, 2020 and 2021 are projections.
Source: Woods + Poole 2021

Income in the Bay Area has also increased at a faster rate from 1990 to 2019 at 2.7% per annum compared to 1.8% and 2.0% for the United States and California, respectively. While the Bay Area experienced higher cyclicality during the dot-com bubble burst in 2000-2001, and the Global Financial Crisis of 2008-2009, the diversification of the economy in recent years is expected to result in less cyclicality in the future.

From 2009 to 2019, PCPI in the MSA increased at an average growth rate of 3.5% per annum. PCPI during the Pandemic increased from $95,512 (2012 USD) in 2019 to an estimated $99,583 in 2021.

During the forecast period, PCPI is projected to grow at a modest rate of 1.5% annually, reaching $127,783 (2012 USD) by 2038. The following growth index charts show the MSA leading the broader regional groups with Alameda County near the median point, still growing slightly faster than California and the U.S. At the county level in the MSA, Alameda and Contra Costa experienced similar growth patterns of PCPI as other counties, though they started from a lower level. The immigration patterns within the MSA favor Alameda and Contra Costa counties between 2019 and 2022, which should reduce the gap in PCPI growth.

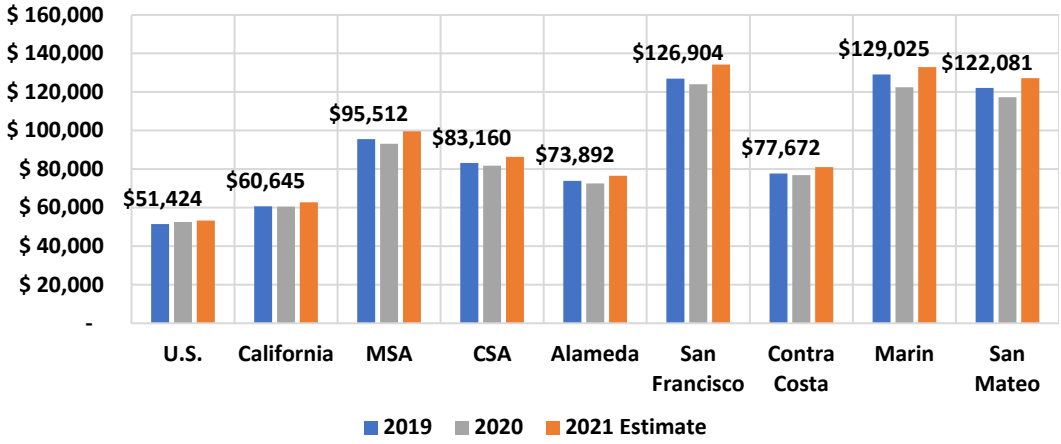
Figure 4-6 Personal Income per Capita Comparisons, CY 1990-2021



Note: Woods + Poole historical data through 2019, 2020 and 2021 are projections.
Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2021; Landrum & Brown

Figure 4-7 shows the MSA to have had a higher average PCPI than Alameda County where the Airport is located, and Contra Costa County, but notably lower than the three other counties in the MSA. However, the immigration patterns within the MSA favor Alameda and Contra Costa counties between 2019 and 2022, which should reduce the gap in PCPI.

Figure 4-7 2019-2021 Estimated Average PCPI, 2012 USD



Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2021; Landrum & Brown

4.3 Fuel Prices

All the listed socioeconomic variables or demand drivers project some growth. Fuel prices are generally expected to keep pace with growth in U.S. Gross Domestic Product ("GDP") and inflation, not causing any significant deterrent to GA traffic growth. Spikes or unexpected significant increases to jet fuel or Avgas could certainly decrease the probability of growth as predicted in these forecasts. Other than higher fuel prices, increases to airport usage fees, taxes, and aircraft maintenance and purchase prices could also limit growth at OAK, especially in the general aviation segment.

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% 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 per barrel.

Around July 2014, the price of crude oil began to drop significantly, and during 2015-2016 the U.S. dollar gained strength and oil prices reached a bottom of nearly $36 per barrel in April 2016. In January 2019, Energy Information Administration ("EIA") released their long-term energy outlook, which projected the price of oil, adjusted for inflation, to reach $98 per barrel by the end of 2039 (in 2018 U.S. Dollars). In the 2018 outlook, the EIA had estimated the 20-year projection slightly higher, at about $101 per barrel for 2038 (in 2017 U.S. Dollars). In 2020 from February through May, the cost of fuel fluctuated with the COVID-19 Pandemic and looks to have smaller influences on aircraft operating costs in the near term, with significant changes in supply and demand due to the pandemic. As of June 2022, crude oil production and prices are subject to increased levels of volatility due to a number of factors including

Russia's invasion of Ukraine. The EIA Short Term Energy Outlook (May 2022) forecasts West Texas Intermediate Spot Prices to remain around $100 per barrel in 2022, decreasing to between $93-$95 per barrel in 2023. Additionally, U.S. crude oil production is forecast to average 11.9 million barrels per day in 2022, up 0.7 million barrels per day from 2021, and will increase to more than 12.8 million barrels per day in 2023, surpassing the previous annual average record of 12.3 million barrels per day set in 2019.

5 OAK Facilities and Historical Activity

5.1 OAK Historical Passenger Activity and Airline Service

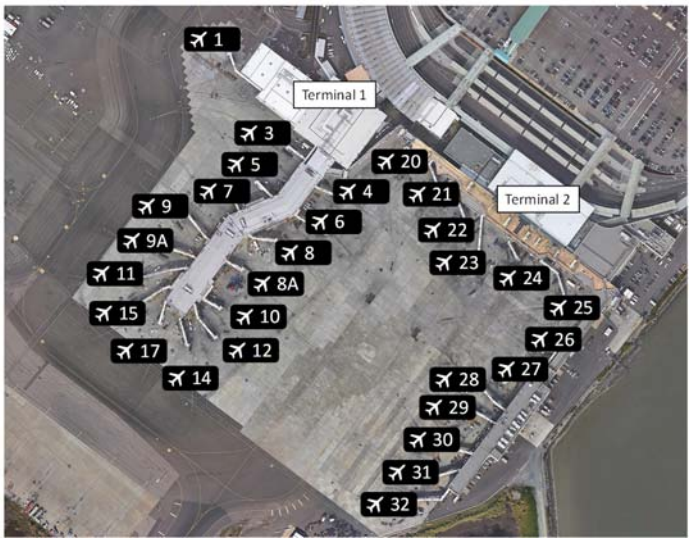
Owned and operated by the Port of Oakland, OAK is the fifth largest airport, in terms of passengers, in California. The Airport, which is located roughly 10 miles south of Downtown Oakland, covers 2,600 acres and has four runways as shown on Figure 5-1. The Airport can be divided into the South Field, shown at the left of the image below, which has one 10,000 feet runway along with the commercial passenger and cargo facilities, and the North Field at the right of the image below, which has three runways (6,212; 5,458; and 3,376 feet) along with the Airport's GA facilities. The South Field primarily serves commercial aviation operations, while the North Field primarily serves GA operations.

Figure 5-1 Aerial View of Oakland International Airport

Sources: Google

OAK has two passenger terminals, Terminal 1 and Terminal 2, that each have dedicated check-in and baggage claim facilities, but are connected post security as seen in Figure 5-2. In total, there are 29 gates at OAK. Southwest Airlines operates from Terminal 2 and utilizes gates in both Terminal 2 and Terminal 1 while all other airlines operate from Terminal 1. Federal Inspections Services are available in Terminal 1.

Figure 5-2 OAK Terminal Map



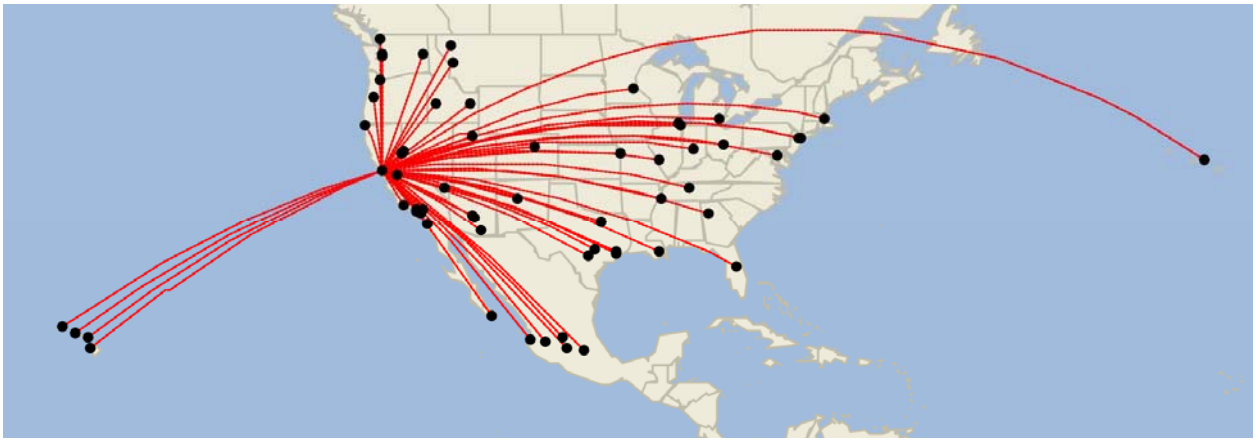
Source: Google Earth, Oakland Airport

5.1.1 Airline Service

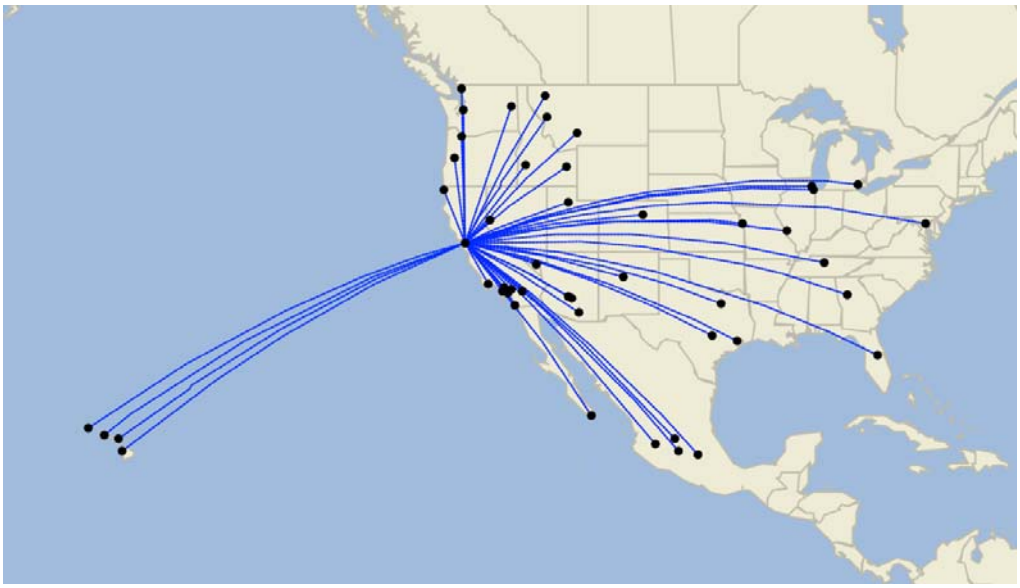
Airlines that serve OAK provide passenger services to cities in the United States, and Mexico. As of CY 2021, OAK had service to 48 markets, of which, 43 are domestic points and 5 are international, compared to 63 markets (56 domestic and 7 international) in CY 2019. Additionally, in CY 2021 OAK had nonstop service to 14 of the 30 large hub airports in the United States including 19 of the 50 states, compared to 21 large hubs airports in 26 states in CY 2019. OAK's non-stop service is largely focused West of the Mississippi River, resulting in underrepresentation in eastern markets. In 2021, OAK had service to five markets in Mexico including one business market (Mexico City), three visiting friends and relatives (Guadalajara, Leon/Guanajuato, and Morelia) and one leisure market (Los Cabos) as seen in Figure 5-3.

Figure 5-3 Oakland International Airport Service Map

CY 2019



CY 2021



Note: CY 2019 excludes Norwegian Air Shuttle and Norwegian Air UK.
Source: Innovata Schedule Data, CY 2019 and CY 2021

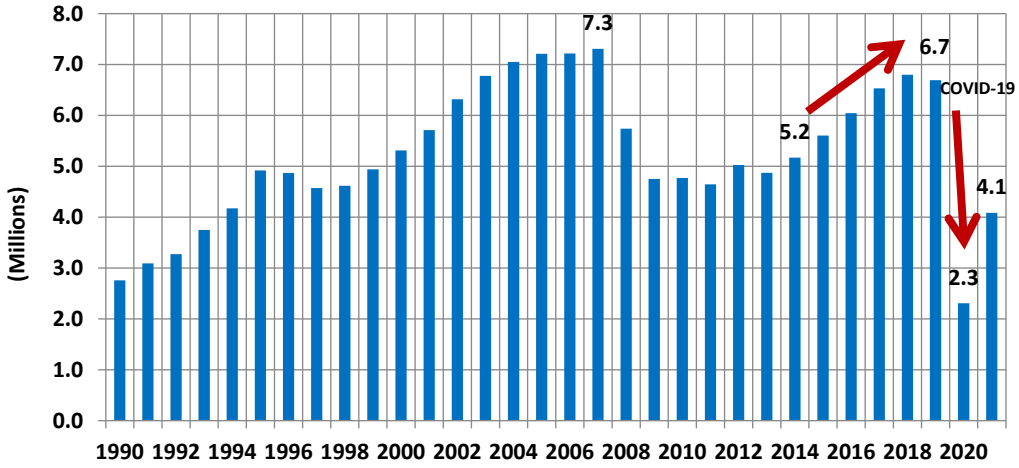
5.1.2 Passenger Development

In 2021, OAK served 4.1 million enplaned passengers as shown on Figure 5-4, 61% of 2019 levels. Prior to the pandemic OAK served 6.7 million enplaned passengers. While this remains below the record levels of 2007, enplanements have increased 30% since 2014. After experiencing relatively steady passenger growth between 1990 and 2007, Oakland was impacted by the Global Financial Crisis, during which the airport saw enplanements decrease by 21.5% and 17.2% in 2008 and 2009, respectively. While all Medium Hub airports were negatively impacted by the economic recession, OAK experienced one of the most significant declines because there was a shift in capacity from OAK to SFO by Southwest and JetBlue as a competitive response to Virgin America.

While OAK's traffic recovery following the Global Financial Crisis was muted by airline network planning decisions, the Airport's passenger performance following September 11, 2001 was considerably more robust. OAK's traffic never decreased following September 11, 2001, and continued to increase for the succeeding six years, unlike what was experienced at most airports, which experienced a multi-year recovery. Much of OAK's growth during this time was due to Southwest, which continued to add capacity while other airlines were shrinking.

Between 2010 and 2013, traffic at the Airport stabilized, and from 2014 through 2018, passenger traffic at the Airport experienced a period of continued growth. In 2019, passenger traffic at OAK decreased slightly, largely as a result of the Boeing 737 MAX grounding. From 2014 through 2019 passenger traffic increased an average of 5.3% per annum, and from 1990 through 2019, OAK's enplaned passenger traffic increased an average of 3.1% annually.

Figure 5-4 Historic OAK Annual Enplaned Passengers (CY 1990-2021)



Source: Airport website

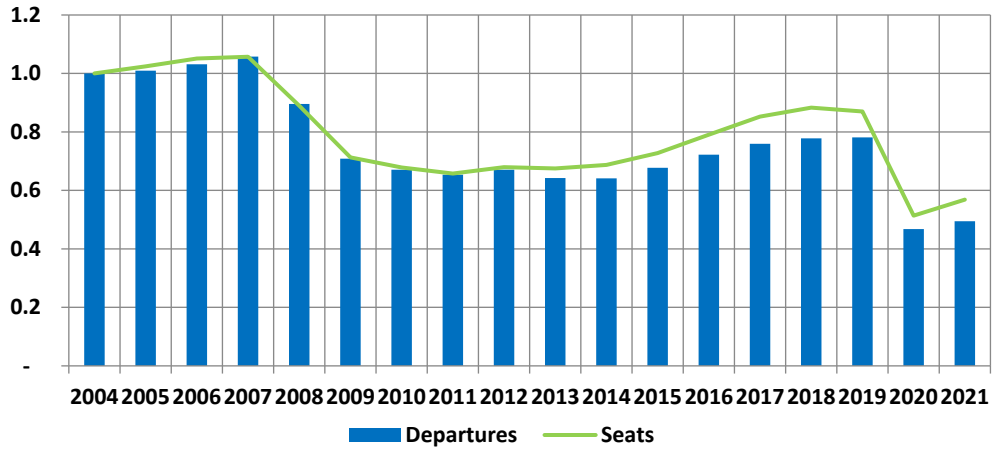
5.1.3 Seat Capacity

Similar to passenger traffic, departures and seat capacity at OAK also peaked in 2007 as shown on Figure 5-5. While departures and seats decreased from 2007 to 2008, they did so at a slower rate than passenger traffic, shrinking by 15% and 16%, respectively, compared to enplaned passengers which declined by 21.5%. Following the Global Financial Crisis and higher fuel prices, the U.S. carriers entered into a period of capacity discipline. Southwest accounted for 28% of the decrease in seat departures between 2007 and 2008. This was related to both the economic recession and a shift in Southwest's Bay Area strategy by adding capacity at SFO in addition to OAK and SJC. Additionally, JetBlue moved capacity to SFO from OAK between 2007 to 2008.

Since 2014, departing seat capacity has increased 4.8% per annum. Seats increased faster than flight departures due to the use of larger aircraft as Southwest Airlines and other airlines increased the gauge of aircraft serving OAK. Additionally, airlines serving OAK have more than doubled the number of non-stop destinations served from 2011 to 2019.

In 2019, passenger traffic at OAK was negatively impacted by the Boeing 737 MAX grounding. Several airlines, including Southwest Airlines and American Airlines, were the most affected by the global grounding as they have the largest numbers of these models in their fleets. As a result, American Airlines delayed the expansion of service from OAK to Dallas/Fort Worth International Airport, and Southwest Airlines paused its planned expansion of capacity at OAK. The impact of the Boeing 737 MAX grounding on passenger traffic at OAK in 2018 was estimated to be 400,000 annual passengers, inclusive of enplaned and deplaned passengers. The Boeing 737 MAX quickly regained its share in OAK following recertification in mid-2021.

Figure 5-5 Index of Historic Schedule Data at OAK (CY 2004-2021)



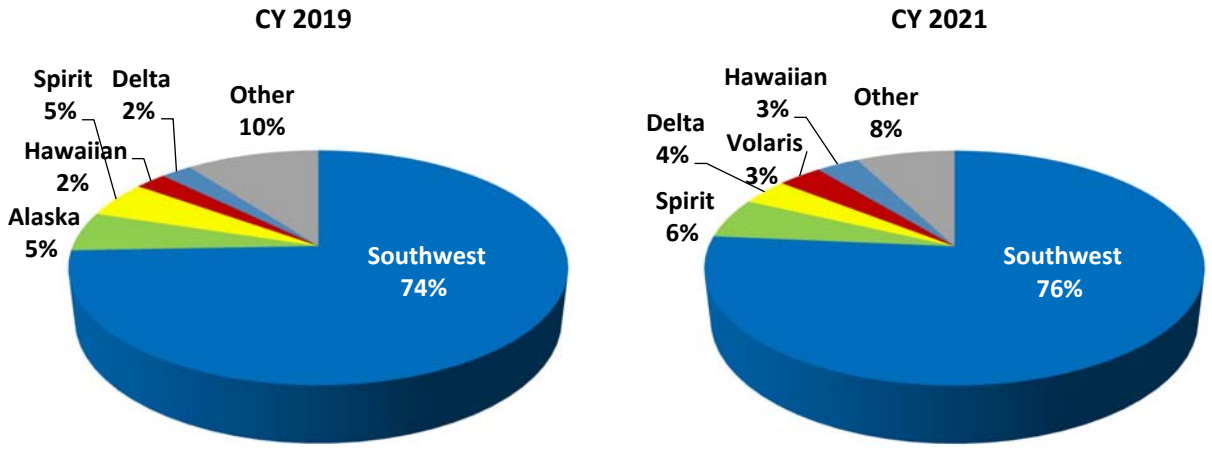
Source: Innovata Schedules, Calendar Year; Indexed to 2004

5.1.4 Airline Market Share

In CY 2021, OAK was served by 10 carriers compared to sixteen carriers in CY 2019. The largest carrier is Southwest Airlines with a 76% share of seat capacity. This is an increase from 74% in CY 2019, as shown in Figure 5-6. As the dominant carrier, Southwest offered an average of 74 daily departures in CY 2021, versus 115 daily departures in 2019, with a majority of its service to other points in the western United States. During the airport's 2007 peak, Southwest had an average of 138 daily departures. Spirit is currently OAK's second largest carrier with a 6% capacity share. Spirit has been increasing capacity rapidly at OAK since it entered the market in 2011. The carrier currently serves five markets. Delta accounts for 4% of capacity at OAK. Volaris, Hawaiian, and Alaska are the next largest airlines at OAK; each operates 3% of capacity at OAK. Alaska, which prior to the pandemic was the second largest carrier at OAK with a 5% share, has yet to reinstate capacity at levels seen in 2019. Other airlines that serve OAK include Frontier Airlines, which inaugurated service to OAK in 2021, Allegiant Airlines, Contour Airlines, and Azores Airlines.

Six airlines have eliminated service to OAK since 2019. Norwegian Air Shuttle became insolvent and went out of business. British Airways and Level moved OAK operations to SFO. American Airlines suspended service to OAK as a result of the Boeing 737 MAX grounding and has yet to return to the market. JetBlue eliminated service to OAK as part of a reduction in western markets served and its elimination of operations at Long Beach Airport. Boutique Air Essential Air Services flights at OAK were transferred to Contour Airlines.

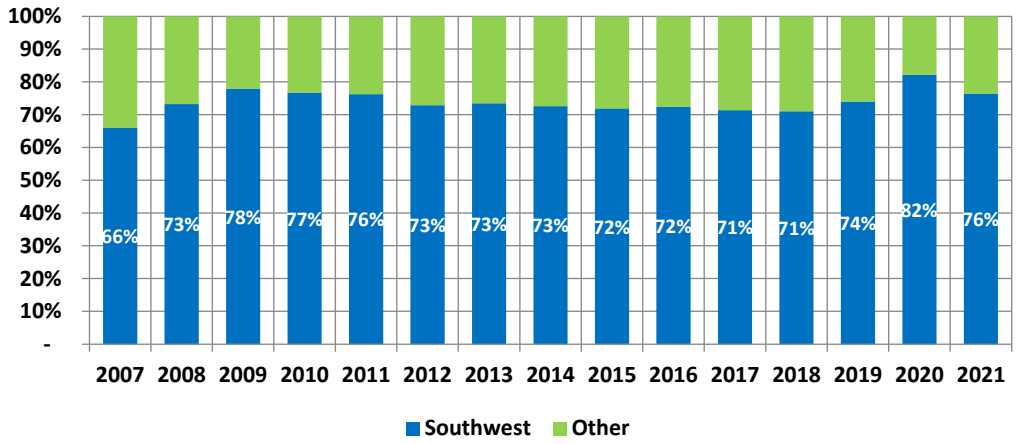
Figure 5-6 Carrier's Share of OAK's Seat Departures (CY 2019 vs. CY 2021)



Source: Innovata Schedule Data

Southwest has historically made up a majority of OAK's departing seat capacity, peaking in 2009 with 78% as seen in Figure 5-7. While the carrier's share has been consistently in the low 70's since 2012, Southwest's share of capacity reached a seven-year high of 74% in 2019. Although this remains below its peak in 2009, Southwest's absolute number of seats at OAK has increased from 5.5 million in 2009 to 6.4 million in 2019, or at an average annual rate of 16.2%. Additionally, while Southwest's capacity share spiked to 82% in 2020, the absolute number of seats were below 2019 levels due to the pandemic.

Figure 5-7 Southwest's Share of Seat Departures (CY 2007-2021)



Note: Data was pulled on March 21, 2022.
Source: Innovata Schedule Data

Southwest's dominance and importance at OAK is evident by the fact that in 2019 the carrier served 35 of the 55 non-stop, domestic markets from OAK. Additionally, OAK is an important part of Southwest network; the airport was one of the carrier's first two gateways to Hawaii. At OAK, Southwest currently offers the most departures and seats to the Hawaiian Islands from any of its mainland stations. Furthermore, in 2017, Southwest introduced international service to two Mexican destinations, making OAK one of 21 airports in Southwest's system that has international service.

5.1.5 O&D Passenger Markets

The Bay Area generates a large demand for O&D passengers, passengers who begin or end their trip in the Bay Area, and the region's growing economy provides strong potential for continued growth. Los Angeles is currently OAK's largest O&D market, making up over 20% of the airport's total O&D passengers. While Los Angeles is also served nonstop from SFO and SJC, local passengers typically choose to use the most convenient airport as opposed to the largest. OAK's largest O&D markets or CY 2019 and 2021, as seen in Table 5-1 and Table 5-2 respectively, reflect airline service at the airport as all 20 markets are served non-stop.

Table 5-1 OAK's Top 20 Domestic O&D Markets (CY 2019)

Rank	Market[1]	Code	Nonstop Miles	O&D Passengers	Average Fare	Share of Total
1	Los Angeles	LAX	336	2,994,350	$98	27.4%
2	Las Vegas	LAS	406	927,888	$74	8.5%
3	San Diego	SAN	447	779,624	$99	7.1%
4	Seattle	SEA	671	615,137	$114	5.6%
5	Phoenix	PHX	644	515,632	$121	4.7%
6	Portland	PDX	543	455,598	$106	4.2%
7	Salt Lake City	SLC	587	311,989	$121	2.9%
8	Honolulu, Oahu	HNL	2,406	303,907	$193	2.8%
9	Denver	DEN	955	300,821	$144	2.8%
10	Kahului, Maui	OGG	2,346	275,408	$189	2.5%
11	Houston	HOU	1,638	251,385	$152	2.3%
12	Chicago	CHI	1,831	240,989	$165	2.2%
13	Washington, D.C.	WAS	2,402	181,727	$205	1.7%
14	Lihue, Kauai	LIH	2,453	165,349	$234	1.5%
15	Dallas-Fort Worth	DFW	1,452	160,373	$157	1.5%
16	Albuquerque	ABQ	886	157,361	$141	1.4%
17	New York	NYC	2,568	133,307	$181	1.2%
18	Atlanta	ATL	2,124	131,489	$198	1.2%
19	New Orleans	MSY	1,899	115,133	$181	1.1%
20	Kona, Hawaii	KOA	2,376	106,830	$206	1.0%
	Other			1,805,333	$171	16.5%
	Total			**10,929,631**	**$130**	**100.0%**

Note: 1/ O&D markets are on a city-to-city basis and the following cities include multiple airports: Los Angeles (BUR, LAX, LGB, ONT, SNA), Phoenix (AZA, PHX), Houston (HOU, IAH), Chicago (MDW, ORD), Washington, D.C. (BWI, DCA, IAD), Dallas-Fort Worth (DAL, DFW), New York (EWR, JFK, LGA, SWF)

Source: US DOT O&D Survey

Table 5-2 OAK's Top 20 Domestic O&D Markets (CY 2021)

Rank	Market[1]	Code	Nonstop Miles	O&D Passengers	Average Fare	Share of Total
1	Los Angeles	LAX	336	1,411,183	$83	20.7%
2	Las Vegas	LAS	406	744,296	$72	10.9%
3	Phoenix	PHX	644	395,390	$80	5.8%
4	San Diego	SAN	447	364,832	$105	5.3%
5	Seattle	SEA	671	361,235	$96	5.3%
6	Denver	DEN	955	269,949	$98	4.0%
7	Honolulu, Oahu	HNL	2,406	231,271	$177	3.4%
8	Salt Lake City	SLC	587	193,866	$105	2.8%
9	Portland	PDX	543	188,633	$112	2.8%
10	Kahului, Maui	OGG	2,346	168,190	$183	2.5%
11	Dallas-Fort Worth	DFW	1,452	147,221	$126	2.2%
12	Chicago	CHI	1,831	146,753	$144	2.1%
13	Houston	HOU	1,638	144,838	$141	2.1%
14	Palm Springs	PSP		99,914	$89	1.5%
15	Lihue, Kauai	LIH	2,453	95,681	$210	1.4%
16	Boise	BOI		88,277	$90	1.3%
17	Austin	AUS		85,262	$141	1.2%
18	Washington, D.C.	WAS	2,402	81,619	$189	1.2%
19	Nashville	BNA		81,320	$181	1.2%
20	Atlanta	ATL	2,124	79,326	$155	1.2%
	Other			1,454,251	$170	21.3%
	Total			**6,833,307**	**$119**	**100.0%**

Note: 1/ O&D markets are on a city-to-city basis and the following cities include multiple airports: Los Angeles (BUR, LAX, LGB, ONT, SNA), Phoenix (AZA, PHX), Houston (HOU, IAH), Chicago (MDW, ORD), Washington, D.C. (BWI, DCA, IAD), Dallas-Fort Worth (DAL, DFW)
Source: US DOT O&D Survey

Overall, OAK has a strong market that has been exhibiting significant increases since 2013 and will continue into the forecast period. Economic and demographic trends in the Bay Area are driving demand for passenger activity. The population and economy of the region are expanding and diversifying making the increases in economic activity and passenger activity sustainable over the forecast period.

- The location of OAK is closest to the most rapidly expanding parts of the Bay Area including the East Bay and Wine Country, and these circumstances are forecast to continue in the future.
- Since 2014, OAK's passenger traffic has increased 30%. In 2019, prior to the COVID-19 Pandemic, OAK accommodated 13.4 million passengers, which was 1.6% lower than 2018.
- Similarly, departure seat capacity has increased 27% between 2014 and 2019. Prior to the pandemic, OAK had service to 70 markets, including 14 international markets.
- Southwest is the largest airline at OAK and is invested in growing the airport. Currently, OAK has service to Mexico and Hawaii on Southwest, both of which are new regions to the airline served non-stop from a limited number of markets. This demonstrates the importance of OAK to the Southwest Airlines network.

This underpinning of the OAK market is key to the activity forecast. Current market dynamics inform the short-term forecast and enhance the long-term forecast by providing insight into carrier strategy and long-terms trends among Bay Area airports.

5.2 OAK Historical Cargo and Freighter Operations

Air cargo traffic at OAK exhibited a 5.7% increase in 2017 reaching 620,832 tons and 7.1% increase in 2018 reaching 670,333 tons, but demand pulled back some in 2019 with a decrease of 4.2% to 642,405 tons. During the Pandemic, air cargo tonnage was flat in 2020 with 639,035 tons then increased by 8.7 percent in 2021 to 694,685 tons. Freighter activity increased by 3.0% in 2017 reaching 19,246 operations, with a larger increase of 7.4% in 2018 with 20,671 operations and no real change in 2019 with 20,698 operations. Cargo freighter operations during the pandemic showed small but steady growth. Freighter operations increased in 2020 by 3.6 percent to 21,444 operations and then increased in 2021 by 3.3 percent to an estimated 22,142 operations.

Air cargo activities at the Airport are consolidated mainly in the north end of the central terminal core consisting primarily of the 75-acre FedEx west coast regional hub, a UPS origin & destination gateway facility, the belly cargo building with adjacent apron parking, and shared remote hardstands near the Oakland Maintenance Center ("OMC").

Figure 5-8 presents the general areas and major operators at OAK for cargo activities as of December 2021.

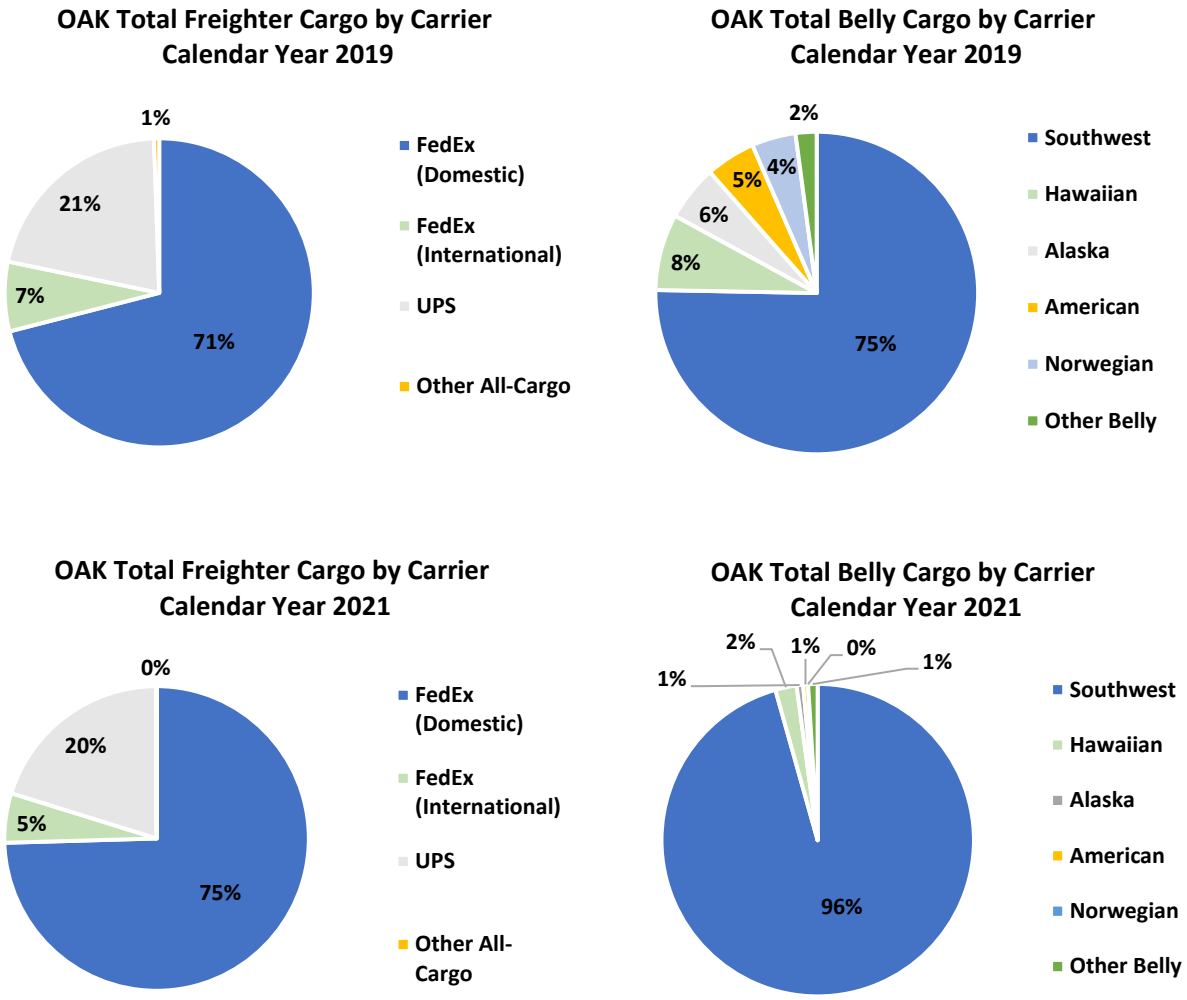
Figure 5-8 OAK Cargo Areas

Sources: Google Earth imagery; Landrum & Brown

5.2.1 Historical Cargo Tonnage

Air cargo tonnage at the Airport is predominantly driven by all-cargo (freighter) operations, which transport only air cargo (freight and mail) and represented nearly 99% of total air cargo tonnage in 2021 and 98% in 2019, up from 97% in 2017. Belly air cargo at OAK, which transports air cargo (freight and mail) in the belly hold of commercial passenger aircraft, makes up the remaining share as seen in Figure 5-9.

Figure 5-9 2021 vs. 2019 Cargo Activity Splits



Sources: Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown

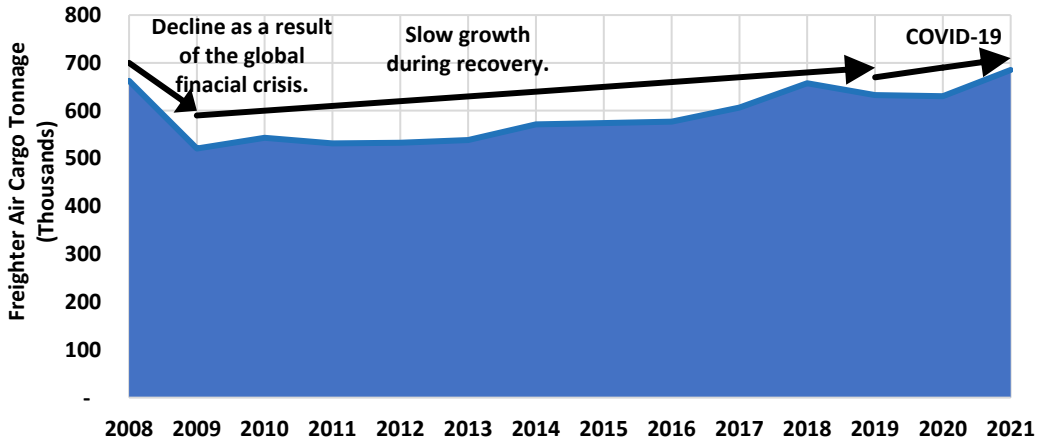
Freighter traffic at the Airport from 2017 to 2021 was mostly comprised of FedEx and UPS services with FedEx accounting for nearly 82% of the freighter operations and freighter cargo tonnages (loaded and unloaded) in 2017 but decreasing to 78% in 2019 with UPS exhibiting the most growth among all carriers at the Airport, before FedEx regained some share in 2021 with 80% of total. Freighter cargo volumes at OAK decreased by 21.4% in 2009 following the global financial crisis, but from 2009 to 2019 freighter air cargo volumes increased at a compound annual growth rate ("CAGR") of 2.0%, reaching 632,727 tons in 2019. During the Pandemic, freighter volumes were slightly lower in 2020 before showing a large increase in 2021 to 685,279 tons.

Freighter cargo at OAK is mainly domestic, and nearly 89% was transported to or from domestic markets in 2019 before climbing to 95% in 2021 due to the Pandemic. International freighter air cargo has been increasing faster than domestic cargo, growing at an average rate of 7.4% per annum, as compared to its

domestic counterpart at 1.7% per annum from 2009 to 2017. The international air cargo base is significantly smaller, which contributes heavily to the difference in growth rates.

Figure 5-10 presents a graphical history of freighter cargo tonnages at OAK up to 2021.

Figure 5-10 Freighter Cargo Tonnage History

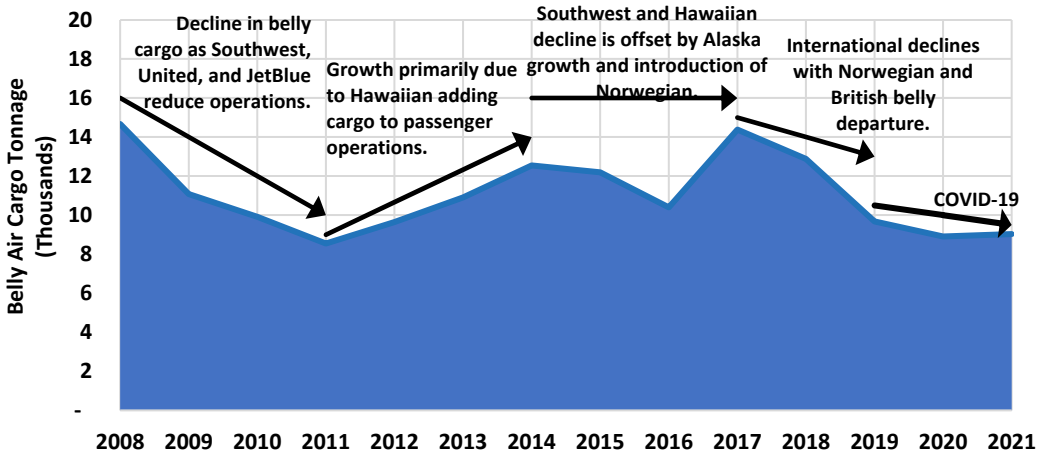


Sources: Airport Statistics; Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown.

Belly cargo declined at a rate of -16.5% per annum from 2008 through 2011 as Southwest Airlines, United Airlines, and JetBlue Airways decreased operations at the Airport. In 2012, Hawaiian Airlines began handling air cargo at the Airport, which helped to reverse the trend of losses in belly cargo. Hawaiian and Southwest airlines had reduced air cargo levels in 2015 and 2016, respectively, which were somewhat offset by Alaska and Norwegian cargo growth. Both Southwest and Hawaiian airlines showed increases in 2017 and total belly cargo was higher again in 2017 reaching 14,377 tons and nearly matching the tonnage from 2008. Among the commercial passenger airlines, most airlines are operating at levels below their 2008 activities, with only Southwest, Spirit, JetBlue, and Norwegian Air Shuttle that exhibited notable growth in scheduled operations at OAK from 2016 to 2018. In 2019, belly cargo retracted with the loss of Norwegian belly cargo services and the departure of British Airways. During the Pandemic at OAK, belly cargo continued to decline slightly in 2020 before showing some recovery in 2021, growing by just 1.4% to 9,025 tons. Southwest airlines carried most of the belly cargo in 2021 with 96% of total belly cargo.

Figure 5-11 presents a graphical history of belly cargo tonnages at OAK up to 2021.

Figure 5-11 Belly Cargo Tonnage History

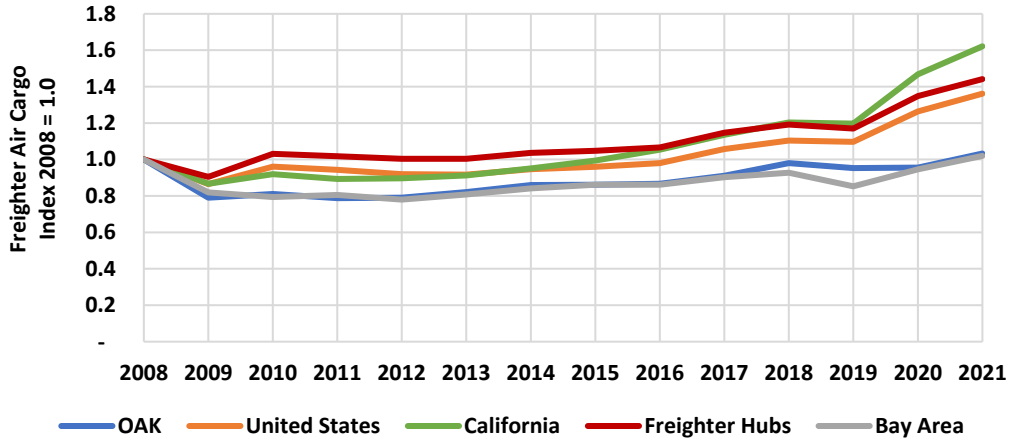


Sources: Airport Statistics; Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown.

5.2.2 Freighter Air Cargo Benchmarks

Freighter air cargo market growth and magnitude of cargo volumes are dependent upon a number of factors that are partially related to the base demand of the region, and some that are more strategic in nature and linked to the geographic position and carrier route networks. OAK is a western U.S. regional cargo hub for FedEx; and therefore, processes large volumes of packages that connect to the rest of the U.S. and some international regions (mainly Asia). Freighter air cargo at OAK declined sharply in 2009, as did air cargo at most airports around the world due to the recession and world financial crisis. Despite the recession ending nearly ten years ago, freighter air cargo remains just below pre-recession levels at the Airport. This is consistent with the other Bay Area airports. Figure 5-12 compares freighter air cargo tonnages at OAK to other regions and categories to emphasize general growth or recovery potential. It is evident in Figure 5-12 that after an observed pause in freighter cargo growth in 2019, the Pandemic has shown a noticeable impact in restarting national and global air cargo growth.

Figure 5-12 Freighter Tonnage Comparison; Indexed: 2008=1.0

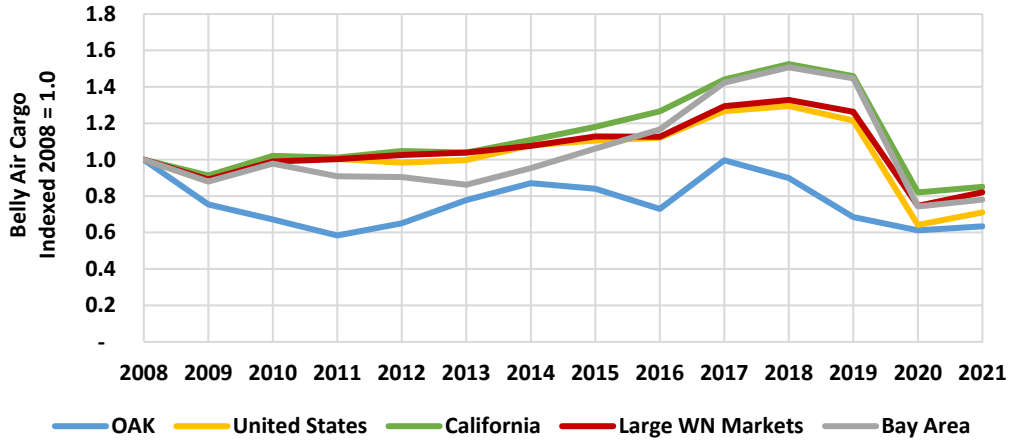


Note: Freighter Hub Benchmark Airports include the top 9 U.S. airports from 2021 (based on total air cargo) –MEM, ANC, SDF, LAX, MIA, ORD, JFK, IND, CVG; Bay Area – SFO, SJC
Source: Diio, U.S. DOT Reports Air Carrier Statistics Database (T-100).

5.2.3 Belly Air Cargo Benchmarks

Belly air cargo is linked to commercial passenger operations and the focus of the operating airlines on marketing cargo transport and utilization of belly hold capacity. Belly cargo at OAK declined sharply until 2011, before recovering to near 2008 levels later in 2017. Due to a decline in international belly cargo at the Airport, total belly cargo in 2019 was back down to the levels seen in 2010 to 2012. Belly cargo had been increasing at an average rate of 9.4% per annum from 2011 to 2017 and is still trailing the growth at some other benchmarking airports. Most airports saw a small rise in belly cargo for 2021 due the impacts of the Pandemic. See Figure 5-13.

Figure 5-13 Belly Tonnage Comparison; Indexed: 2008=1.0



Note: Belly cargo benchmark airports "Large WN Markets" include the top 30 Southwest Airlines (WN) airports
Source: Diio, US DOT Reports Air Carrier Statistics Database (T-100).

5.2.4 Historical Freighter Operations

Dedicated freighter aircraft operations at OAK decreased by 26.6% in 2009 following general industry reductions after the global financial crisis. The freighter operations decrease was somewhat greater than the decrease in freighter cargo tonnage after 2009 as smaller increases in available capacity led to increased utilization and higher efficiencies among the remaining aircraft operations.

Between 2009 and 2021, freighter air cargo operations increased at an average annual rate of 2.4%. The rate of growth for freighter aircraft operations was a little higher than the 2.3% rate of growth for freighter air cargo tonnage. Typically, tonnage growth is slightly higher due to higher load factors with larger aircraft, but during the Pandemic efficiency gains were not as consistent and many carriers faced capacity constraints at times. Passenger aircraft operations were reduced during the Pandemic, thereby reducing belly cargo capacity. Domestic cargo began a shift to dedicated freighters due to reduced belly cargo capacity. At the same time, there was increasing demand for e-commerce, which was accelerated by Pandemic-related shifts in consumer shopping trends. The shift to freighters from belly is generally expected to return as belly capacities return with regular operations and are incentivized by higher air freight costs.

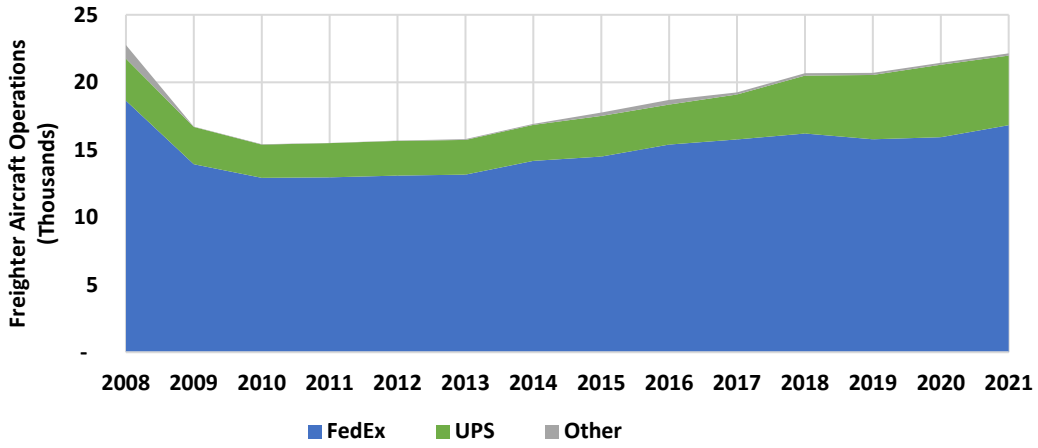
The impact on cargo demand overall from growth in e-commerce will likely remain and continue to grow, as previously forecasted. Freighter operations have historically been mainly domestic and reached a new high of 97% of total freighter traffic in 2021. Table 5-3 and Figure 5-14 provide a history of freighter cargo traffic at OAK from 2008 to 2021.

Table 5-3 Freighter Utilization History

	Freighter Tonnage (tons)			Freighter Operations			Average Tons per Operation		
Year	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total
2008	639,576	22,811	662,387	21,446	1,318	22,764	29.8	17.3	29.1
2009	499,740	21,147	520,887	16,280	432	16,712	30.7	49.0	31.2
2010	522,602	20,622	543,224	15,078	327	15,405	34.7	63.1	35.3
2011	509,982	21,519	531,501	15,140	360	15,500	33.7	59.8	34.3
2012	511,089	21,930	533,019	15,313	361	15,674	33.4	60.7	34.0
2013	515,171	23,540	538,711	15,357	428	15,785	33.5	55.0	34.1
2014	531,367	40,064	571,431	16,318	595	16,913	32.6	67.3	33.8
2015	542,399	31,740	574,139	17,293	455	17,748	31.4	69.8	32.3
2016	550,614	26,348	576,962	18,247	443	18,690	30.2	59.5	30.9
2017	569,697	36,758	606,455	18,685	561	19,246	30.5	65.5	31.5
2018	607,313	50,143	657,456	19,979	692	20,671	30.4	72.5	31.8
2019	589,545	43,182	632,727	20,078	620	20,698	29.4	69.6	30.6
2020	600,695	29,438	630,133	20,970	474	21,444	28.6	62.1	29.4
2021	648,694	36,585	685,279	21,640	502	22,142	30.0	72.9	31.3

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC).

Figure 5-14 Freighter Operations History



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC).

There are typically about two flights per week flying to OAK by way of ANC from Asia. About one third of all FedEx outbound flights to Asia have a scheduled stop-over at ANC due to weight and range limitations of the aircraft. New and improved aircraft being used in the freighter fleet are reducing that need to stop over in ANC, so there will likely be increases in international air cargo freight due to the progression of more direct flights between Asia and OAK. Currently, flights to and from Asia by way of a stop-over in ANC are reported as domestic flights and domestic cargo tonnages. If this fully shifts in the future, there will be a small impact to the segment shares of domestic and international cargo.

5.3 OAK General Aviation Historical Operations

Typical GA activity includes recreational and flight training activities, business travel, news reporting, traffic observation, environmental surveys, local police patrol, and emergency medical evacuation. 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 Heavy GA aircraft, such as large turboprop aircraft and an array of corporate jets. General aviation activity for OAK in this forecast is segmented into two major groups: Business Aviation (“BA”) and GA. BA was observed and classified as large jet and small aircraft, while all other small aircraft and some non-identified aircraft as the typical general aviation segment (itinerant and local). Military and government aircraft use of small aircraft similar to typical GA aircraft are included in the Military operations segment.

GA traffic at the Airport exhibited an 8.0% increase in 2017 driven by local GA activity reaching 102,578 operations. In 2018 and 2019 GA operations increased 5.1% and 2.9%, respectively, with continued growth in business aviation and itinerant GA operations. GA activities at the Airport are consolidated on the North airfield along the northeast side of Runways 10L/28R and 15/33.

Figure 5-15 presents the general areas and major operators at OAK for GA activities in December 2019.

Figure 5-15 OAK General Aviation Area

Sources: Google Earth imagery; Landrum & Brown

Key components of GA include two fixed-based-operators ("FBOs"), numerous corporate flight groups, two flying clubs, other aircraft maintenance and storage related groups, and a new 'on demand' Air Taxi service, JSX.

JSX (formerly JetSuiteX) is an on-demand air taxi service operating used/recently retired 30 seat Embraer 135/145 jet aircraft to provide "hop-on jet service" from OAK to popular markets on the West Coast and popular leisure markets of Las Vegas and Phoenix. The JSX business model is dependent upon demand from cost conscience consumers who want to skip the lines and congestion of the typical passenger terminal while still getting most of the typical commercial air service benefits. JSX was planning on adding two new aircraft per month into the near future before COVID-19. Due to the Part 135 operating status, JSX was not reporting operations or passenger traffic counts to U.S. DOT and had not started reporting traffic to the Port of Oakland. Service from OAK began in November 2017 with flights to Burbank and later expanded to Orange County, Las Vegas, and other cities. Discussions with JSX suggest early success on most flights with load factors between 67-83% but a clear observation of actual traffic levels is not yet available. If a route underperforms, JSX has been known to make changes mere months after initiating a service. Target starting fares were initially at $89 each way but no financial information was available to analyze and understand break even operating levels.

5.3.1 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 increased fuel prices, increased product liability stemming from litigation concerns, and increased cost of new aircraft.

The passage of the 1994 General Aviation Revitalization Act ("GARA")[8] 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.[9]

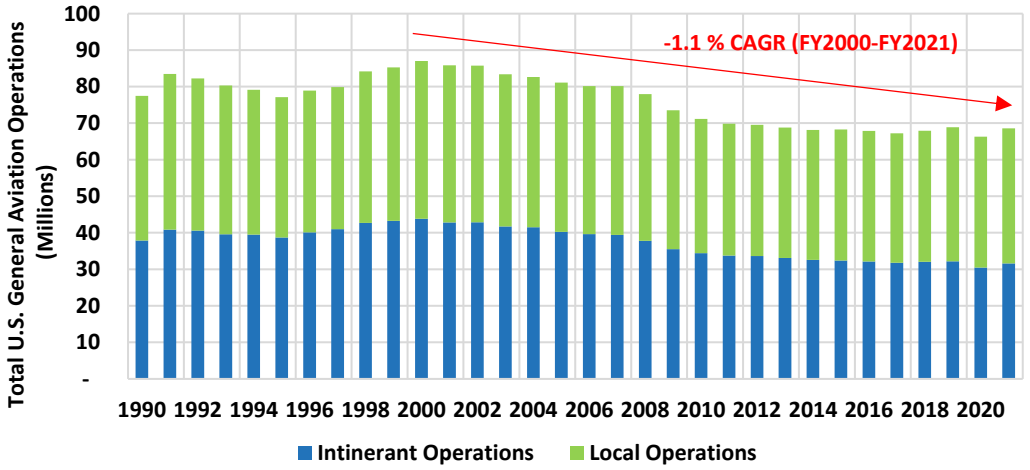
The rebound in the U.S. GA industry that began with GARA started to subside by FY2000. GA traffic at airports with air traffic control service slowed considerably in FY2001 due largely to a U.S. economic recession and to some extent the terrorist attacks of September 11, 2001. GA traffic at airports 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 in the U.S. with air traffic control service increased in FY2007, but just slightly at 0.2% over FY2006. However, GA operations declined by 4.7% at airports with air traffic control service the following year. The decline in GA traffic continued due to the economic downturn and world financial crisis in 2008 and increased in fuel prices. GA operations decreased by 11.3% in FY2009, 5.1% in FY2010, and 2.3% in FY2011. In FY2012, GA operations increased 0.6%, but subsequently decreased each of the following years. Since 2000, total GA operations in the U.S. decreased at a rate of -1.1% per annum, and activity levels have been mostly flat since 2014. During the Pandemic, GA operations did drop by 3.7% in 2020 before returning nearly back to the pre-COVID-19 levels of 2019 in 2021. Traditional general aviation and recreational traffic is still lagging in the recovery, whereas business aviation has improved somewhat faster than expected, unlike the commercial business segment of commercial passenger traffic.

Figure 5-16 shows the number of GA operations at U.S. airports since FY1990. Since 2000, total GA operations in the U.S. decreased at a rate of -1.1% per annum, and activity levels have been mostly flat since 2014. During the Pandemic, GA operations did drop by 3.7% in 2020 before returning nearly back to the pre-COVID-19 levels of 2019 in 2021. Traditional general aviation and recreational traffic is still lagging in the recovery, whereas business aviation has improved somewhat faster than expected, unlike the commercial business segment of commercial passenger traffic.

[8] GARA imposes an 18-year statute of repose on product liability lawsuits for GA aircraft. FY is a federal fiscal year of Oct 1st to September 31st.

[9] Based on information from the General Aviation Manufacturers Association ("GAMA").

Figure 5-16 U.S. General Aviation Operations History



Sources: FAA Terminal Area Forecast; Landrum & Brown

5.3.2 Business Aviation and Small GA

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.

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:

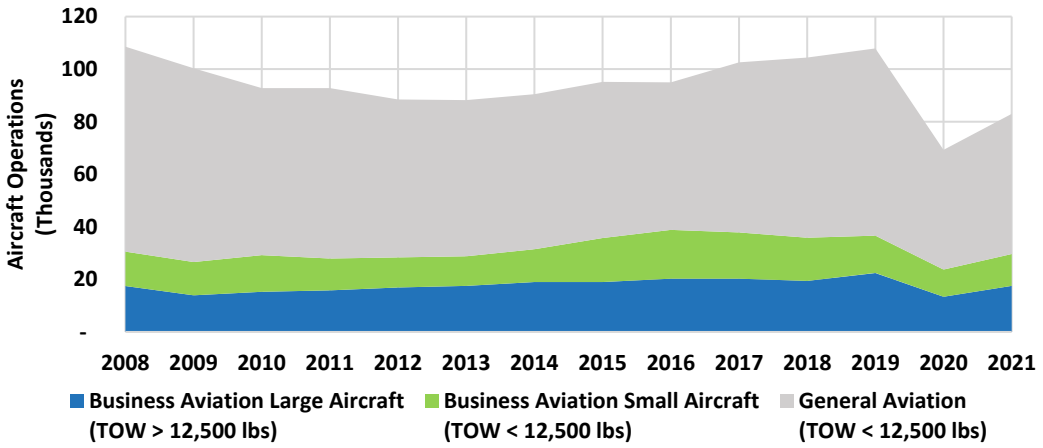
- Employee time savings
- Increased en-route productivity
- Minimized time away from home
- Enhanced industrial security
- Enhanced personal safety
- Management control over scheduling

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 become more diverse as various chartering, leasing, time-sharing, interchange agreements, partnerships, and management contracts have emerged, demonstrating that businesses and corporations have come to value the use of business aircraft in their operations.

After growing rapidly for most of the past decade, the demand for business jet aircraft 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 recent years leading up to 2016 had seen a dramatic impact of the recession on the business jet market. Issues such as reduced corporate profits, bankruptcies, mergers, and an intense scrutiny on GA as a result of corporate collapses resulted in reductions in corporate GA activity, especially in the business jet sector. Since 2016, there have been some renewed growth in corporate aviation and fractional or shared jet ownership, which has lowered the financial burden and reduced the risk of business jet ownership while still providing the benefits of convenience. New to OAK in late 2019 was on-demand air taxi service using small regional passenger jets, which are considered large business jets in this forecast.

Figure 5-17 shows a graphical history of all general aviation operations at OAK. Overall, total combined business and small GA aircraft operations at OAK declined from 108,554 operations in 2008 to 88,218 operations in 2013, and then increased back to near 2008 levels in 2019 with 107,861 operations. Small GA aircraft operations declined from 78,006 in 2008 to 71,207 in 2019, representing a decrease of -0.8% per annum. Large business aviation aircraft operations increased from 17,422 in 2008 to 22,428 in 2019, representing a growth rate of 2.3% per annum. Small business aviation aircraft operations increased from 13,126 in 2008 to 14,226 in 2019, representing an average growth rate of 0.7% per annum. The low point in recent historical traffic occurred in 2013, and total general aviation operations at OAK has shown a recovery from 2013 to 2019, with an increase of 5.2% per annum. There was a slight shift in trends in 2017 where records show a drop in the number of business aviation operations and an increase in small GA operations. This recent shift is expected to be temporary with longer historical trends returning to general aviation traffic levels at the Airport. During the Pandemic, GA traffic at OAK declined considerably in 2020 by nearly one third of the 2019 traffic level before regaining about one third of that lost traffic in 2021. Business aviation was impacted the least, with most of the traffic decline coming from the traditional small general aviation segment heavily linked to leisure and recreation.

Figure 5-17 OAK General Aviation Operations History

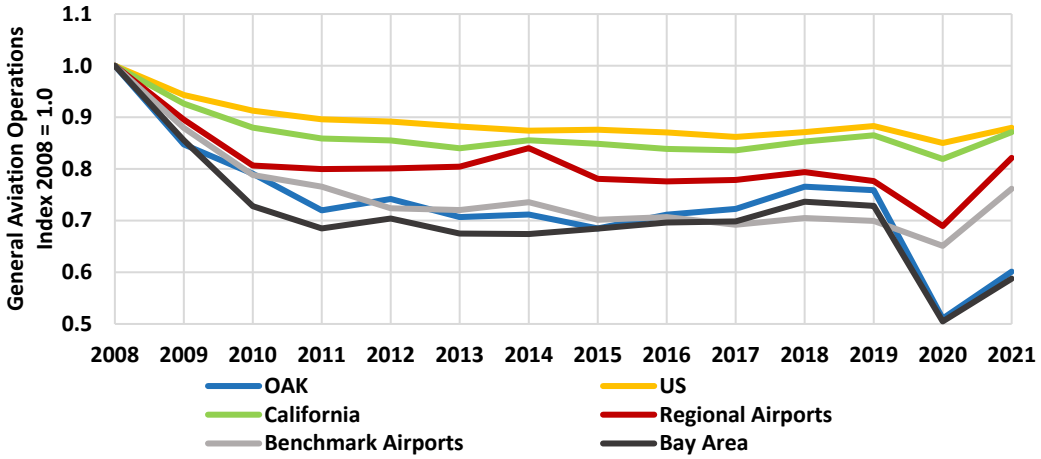


Sources: Airport Statistics; Diio, U.S. DOT Reports Air Carrier Statistics Database (T-100); FAA, Traffic Flow Management System Counts (TFMSC).

5.3.3 General Aviation Benchmarks

Itinerant and local GA aircraft operations, as reported in the FAA Terminal Area Forecast (includes some business aviation but no Air Taxi), have decreased significantly at almost every airport in the U.S. since FY2008. However, the GA benchmark airports in California with emphasis in business aviation, including OAK and the Bay Area airports, have decreased at a faster rate during that time. The faster decline may be partly due to the average price of fuel in California and the Bay Area already being higher than the U.S. national average. During the Pandemic, that trend impacting the Bay Area has continued with the impact from COVID-19 hitting GA operations more in the Bay Area (due to more forceful local policy measures implementation) than in California or the rest of the U.S. See Figure 5-18.

Figure 5-18 General Aviation Operations Comparison; indexed 2008=1.0

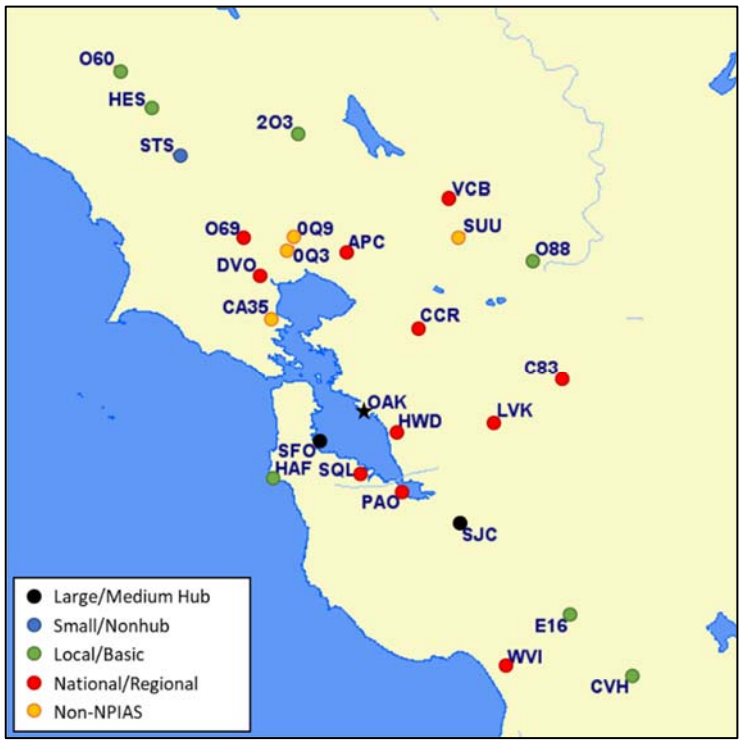


Note: General Aviation Benchmark Airports include nine California airports selected for business aviation and market size (HWD, SJC, SAC, FAT, CRQ, LAX, SMO, LGB and VNY).
Sources: FAA, Terminal Area Forecast (TAF) historical FY data; Landrum & Brown analysis

5.3.4 Regional Airport Benchmarks

Regional airports were selected for a benchmark comparison and include 23 National Plan of Integrated Airport Systems (NPIAS) airports within approximately 70 nautical miles from OAK to the Northwest and Southeast of the Airport; excluding the Sacramento, Stockton, and Monterey regions. There are additionally four airports not listed in the FAA NPIAS registry that are within the OAK general aviation benchmark region, but operations activity for these airports was not available to include in the dataset. Figure 5-19 shows a map of the regional benchmark airports evaluated in the comparison.

Figure 5-19 OAK Benchmark Airports Map

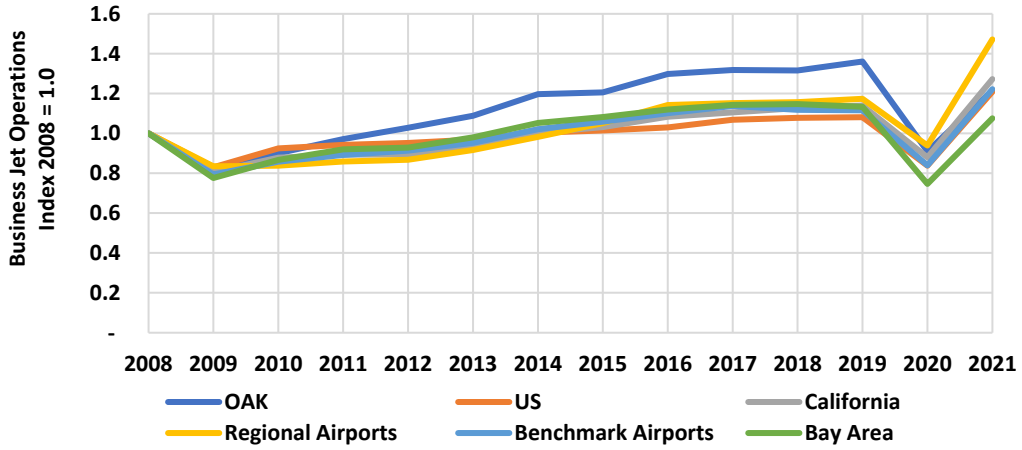


Sources: Landrum & Brown analysis, gcmap.com maps

5.3.5 Business Jet Operations Benchmarks

Business Jet activity, as reported by the FAA Traffic Flow Management System Counts ("TFMSC"), includes certain types of business/corporate aircraft that are not used for scheduled operations. While small GA traffic at OAK has decreased since 2008, business jet traffic at OAK increased at a faster rate than all of the selected benchmarks, including the other Bay Area airports. Bay Area Gross Regional Product ("GRP") has been recently growing faster than the U.S. average by nearly two times due to healthy business development and the Bay Area's position as the second largest patent developing region after Silicon Valley. Further supporting potential growth in business jet activity is the lower cost of doing business in Oakland and a highly ranked business environment. During the Pandemic, growth in the business jet segment at OAK was more in line with general growth in California and the U.S. but still somewhat stronger than seen at the other Bay Area airports. See Figure 5-20.

Figure 5-20 Business Jet Segment – Operations Comparison; indexed 2008=1.0



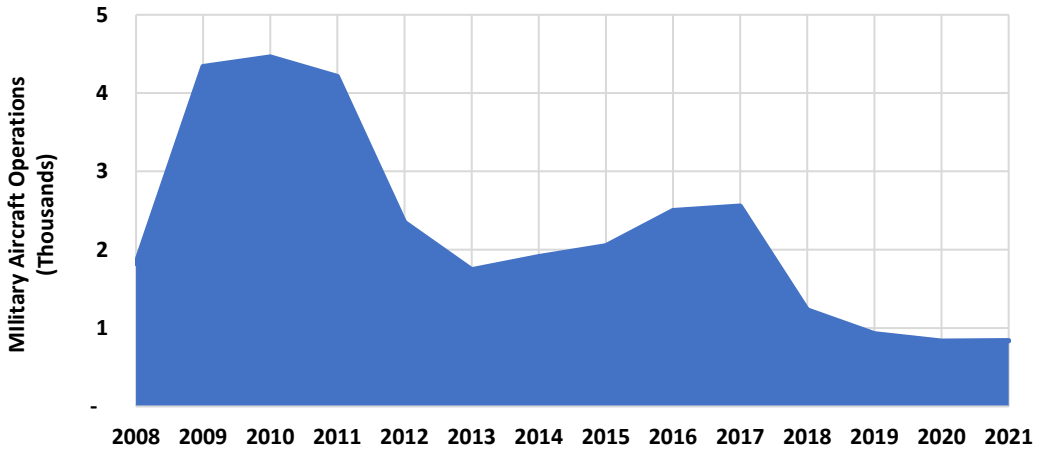
Sources: FAA, Traffic Flow Management System Counts (TFMSC) historical data; Landrum & Brown analysis

5.4 Military

Military operations are highly variable and a small fraction of overall activity, but have high priority on runway utilization ranging from true emergency conditions to training operations and basic government transports. Military activity is located at the North airfield with based activity from the Sheriff's Office and Civil Air Patrol, as well as other government transport needs. From 2008 to 2009, Military aircraft operations at OAK increased by 137.7% to more than 4,000 annual operations, but by 2013, military aircraft operations decreased to near 2008 levels. From 2013 to 2017, military aircraft operations increased at a rate of 10.0% per annum, before they decreased again from 2018 and 2021 to just 837 total military operations. See Figure 5-21.

The majority of military operations appear to be largely government activity from the Police, Civil Air Patrol ("CAP"), FAA, and other U.S. Government traffic. Although military operations are distinct and separate from cargo and general aviation operations, they are included in the general operations forecasting efforts of this study and included in the total operations comparison to the FAA TAF predictions for OAK and other potential analyses supporting planning efforts by the Port of Oakland.

Figure 5-21 OAK Military Operations History



Sources: Airport Statistics; FAA, OPSNET traffic counts

6 Forecast Methodology, Assumptions and Results

6.1 Passenger Forecast

The forecasts of aviation activity at OAK were prepared using a combination of methodologies including a review of recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and statistical analyses of the relationship between historical demand and local and national economic conditions to inform the longer-term forecasts. This is similar to the to the methodology used by the FAA to develop the TAF. The FAA notes the TAF assumes a demand driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to furnish the capacity required to meet demand.

6.1.1 Overview of Methodology

Inter*VISTAS* developed annual forecasts of passenger and aircraft activity at OAK. The OAK forecast was developed using a combination of both a bottom-up (short term) microeconomic methodology and a top-down macro-economic methodology to produce unconstrained forecasts. However, given OAK's position in a multiple airport market, predicting future traffic levels at individual airports cannot be done in isolation and one must consider the trends and dynamics occurring at other airports in the region. That said, several key factors were analyzed as drivers for OAK unconstrained demand forecast, including:

- The growing Bay Area Catchment Area economy
- The shift in share toward Oakland as a result of the convenience of the airport to the fastest growing parts of the Bay Area
- Southwest's anchor tenant position and network growth plans at OAK
- Connecting passenger traffic was forecast to increase by 1.5 percentage points over the life of the forecast

As a result, the forecast was developed using a two-step process:

- A forecast of the O&D passenger activity in the Bay Area was developed based on historical relationships with macro-economic variables and airline market plans from the years 2019 and 2021 through 2038; and
- The demand was allocated to OAK based on its historic relationship to the region and the short-term forecast. In other words, OAK will regain its historical share of Bay Area traffic experienced prior to the inauguration of Virgin American service at SFO and the competitive response thereto, which included airlines moving service from OAK to SFO, and as a result of economic and demographic shifts in the MSA that favor Alameda and Contra Costa counties and OAK.

6.1.2 Bottom-Up Forecasts

The bottom-up forecast developed for OAK was based on the short-term network and fleet planning decisions by airlines currently serving and likely to serve the airport, most notably Southwest Airlines ("WN"). As the largest carrier at OAK, Southwest's continued growth is vital to the airport's overall growth. Between 2018 and 2019, WN increased capacity by 3.4%, and following review of the published schedule data as well as additional discussions with the airline, Southwest during the pandemic reaffirmed their commitment to OAK. Additionally, Southwest has continued to pursue its business plans at OAK. Prior to the Pandemic, Southwest was limited in growth by the Boeing 737 MAX

grounding, but since that was lifted, has continued to add capacity at OAK to new markets as well as rebuild its frequency to existing markets. While the short-term forecast projects growth for WN, growth for other airlines at the airports are projected to slow based on published schedule data.

This short-term approach models the relative attractiveness of the catchment areas of each of the Bay Area's airports to allocate traffic to the airports over the longer term for both originating and terminating traffic. The relative attractiveness of OAK is related to the convenience of getting to and from the airport in terms of time and distance, and the availability of flights in terms of non-stop points served and overall seat capacity. Lastly, Inter*VISTAS* incorporated industry intelligence to estimate share of connecting traffic at each airport. This industry intelligence is primarily based on conversations with the airlines, in an effort to understand how the airlines deploy capacity to meet O&D and connecting traffic demand at the various airports as well as an examination of historical statistics that document how connecting traffic is accommodated.

In 2020, passenger traffic was negatively impacted by shelter in place orders designed to create social distancing to decrease the spread of COVID-19 as well as a decline in passenger desire and ability to travel. This negative impact on passenger traffic continued into 2021, albeit at lower levels. As with other exogenous shocks and recoveries, passenger demand is forecast to return to the previous trend four years following the event.

Additionally, Inter*VISTAS* reviewed the actual enplanements at OAK from September 2021 through April 2022 as well as the published capacity from May through September 2022 and based on the same load factors achieved in 2021, Inter*VISTAS* concluded that, OAK could achieve FFY 2022 enplaned passengers of 5,471,720, as seen in Table 6-1. However, actual performance from May through September could be lower than this should airlines reduce scheduled capacity over the period, passenger demand result in lower load factors, or flight cancellation rates for other reasons negatively impact demand. The OAK forecast of 5,113,106 in FFY 2022 is 6.6 percent lower than the 5,471,720 enplaned passengers the airport could achieve to account for these potential negative impacts.

Table 6-1 OAK FFY 2022 Schedule Capacity Analysis

	FFY 2021			FFY 2022[1]		
	Dept Seats	**Enplaned Pax**	**Load Factor**	**Dept Seats**	**Enplaned Pax**	**Load Factor**
October	340,613	184,217	54.1%	552,783	414,522	75.0%
November	361,514	175,493	48.5%	519,943	412,665	79.4%
December	372,236	167,089	44.9%	527,678	414,984	78.6%
January	347,412	131,711	37.9%	521,677	286,376	54.9%
February	309,867	153,963	49.7%	496,263	335,145	67.5%
March	413,935	248,168	60.0%	548,191	419,867	76.6%
April	408,474	298,508	73.1%	592,540	456,713	77.1%
May	455,214	366,449	80.5%	631,847	508,639	80.5%
June	490,494	413,293	84.3%	677,290	570,688	84.3%
July	518,655	448,141	86.4%	712,348	615,500	86.4%
August	529,243	398,160	75.2%	720,203	541,823	75.2%
September	527,780	383,398	72.6%	681,130	494,797	72.6%
Total	**5,075,437**	**3,368,590**	**66.4%**	**7,181,893**	**5,471,720**	**76.2%**
OAK Forecast					***5,113,106***	
Variance					*-6.6%*	

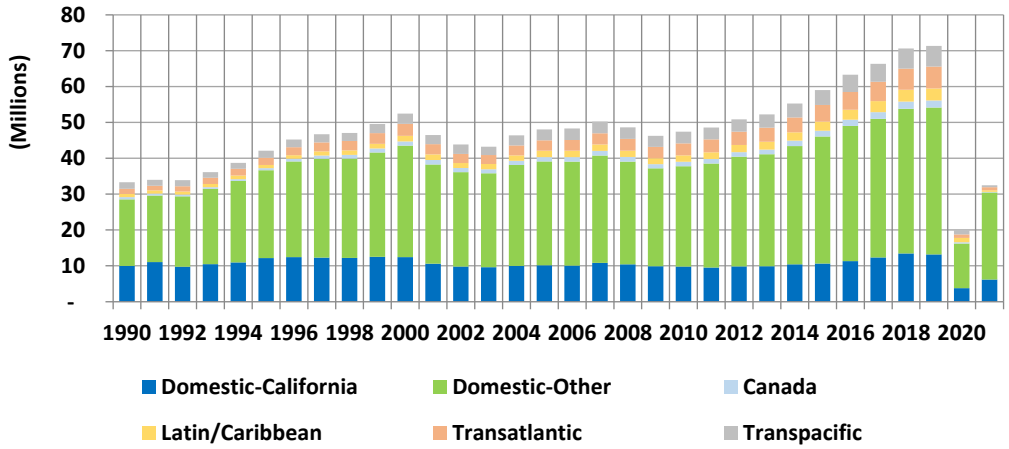
Note: 1/ OAK reported passenger data through April 2022.

Source: Innovata Schedule Data (Schedule data pulled May 31, 2022), OAK Reported Passenger Statistics, InterVISTAS Analysis

6.1.3 Top-Down Forecasts

In order to estimate long term trends for OAK and the Bay Area, Inter*VISTAS* examined the statistical relationship between economic trends and historical traffic volumes. Regression analysis was used to establish the relationships between the independent variables and O&D passenger activity in the Bay Area which was broken out by region: Intra-California, other Domestic, Canada, Latin, Trans-Atlantic, and Trans-Pacific. While California is geographically large and has significant intra-state traffic, historical growth is being driven primarily by domestic traffic to and from points outside of California, as seen in Figure 6-1.

Figure 6-1 Bay Area O&D Passengers (CY 1990-2021)



Source: O&D Survey Data

For each of these market segments, a variety of independent variables were tested against historic O&D passenger traffic data to identify which variables that show the best correlation with historic traffic developments. The independent variables tested included GDP by region, average fare, oil prices, exchange rates, and population. The final models were selected on the basis of statistical fit, parameter robustness and the plausibility of the parameter estimates produced. The most effective models were those based on GDP (as well as dummy variables in some cases in 2001 and 2002 to capture the impacts of the 9/11 terrorist attacks), and average fare or oil prices for the source market. A log-log formula was used meaning the parameters can be interpreted as elasticities:

$$\boldsymbol{Ln}\,(\boldsymbol{Passenger\ Traffic_i}) = \boldsymbol{a_i} + \boldsymbol{b_i}\cdot \boldsymbol{Ln}\,(\boldsymbol{GDP_i}) + \boldsymbol{c_i}\cdot \boldsymbol{Ln}\,(\mathrm{A}\boldsymbol{ir\ Fare_i}) + \boldsymbol{d_i}\cdot(\mathbf{0},\mathbf{1})\,\boldsymbol{Dummy}\,\mathbf{2001} + \boldsymbol{e_i}\cdot(\mathbf{0},\mathbf{1})\,\boldsymbol{Dummy}\,\mathbf{2002}$$

$$(\mathbf{i} = \mathbf{country\ or\ region})$$

For example, Domestic-California was regressed against California GDP, and average fares on intra-California routes, while Domestic-Other was regressed against Bay Area GDP, U.S. Gulf Oil prices, and dummy variables for 9/11.

Table 6-2 presents a summary of the traffic models, including the independent variables and regression output.

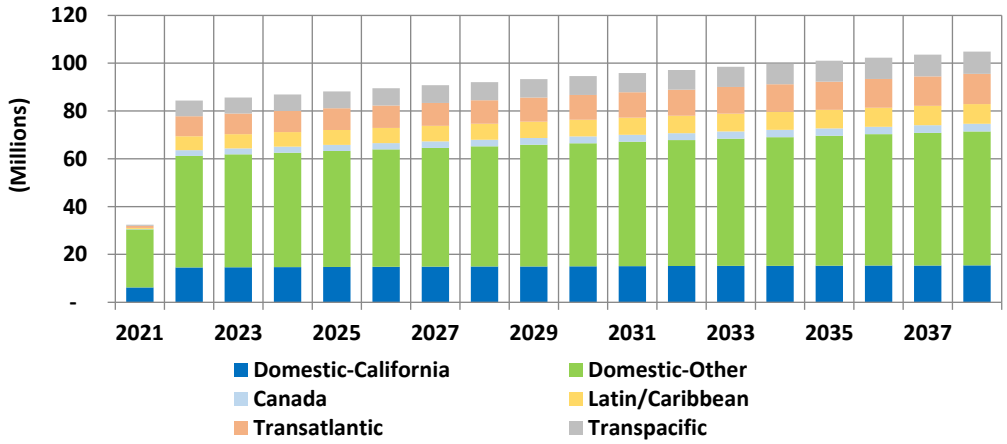
Table 6-2 Regression Results

Market Segment	Independent Variables	Parameter Value	Model Fit (R^2)
Domestic – California	California GDP	0.567	0.882
	California Real Air Fare	-0.482	
Domestic – Other	Bay Area GDP	0.779	0.908
	U.S. Gulf Oil	-0.096	
Canada	Bay Area GDP	1.26	0.955
	Canada Real Air Fare	-0.367	
Latin/Caribbean	Bay Area GDP	1.313	0.972
	Latin/Caribbean Real Air Fare	-0.111	
Transatlantic	U.S. GDP	4.923	0.949
	Transatlantic GDP	-4.598	
Transpacific	Bay Area GDP	1.207	0.966

Source: InterVISTAS analysis

The Bay Area O&D passenger traffic is forecast to increase at 7.1% per year between 2021-2038 as shown on Figure 6-2 and Table 6-3. The FAA 2021-2041 Aerospace Forecast predicts that U.S. carrier domestic traffic will increase 4.9% per annum from 2021-2041. The combined TAF for the Bay Area (SFO, OAK, and SJC) projects enplaned passengers will increase at a compound annual growth rate of 8.0% for the same period. This is higher than the 7.1% annual passenger increases projected for the Bay Area by Inter*VISTAS*, which is explained, in part, by Inter*VISTAS*' more modest assumptions than the FAA's around the levels of connecting passengers at Bay Area airports over time.

Figure 6-2 Forecast of Bay Area O&D Passengers (CY 2021 – 2038)



Source: O&D Survey data; InterVISTAS analysis

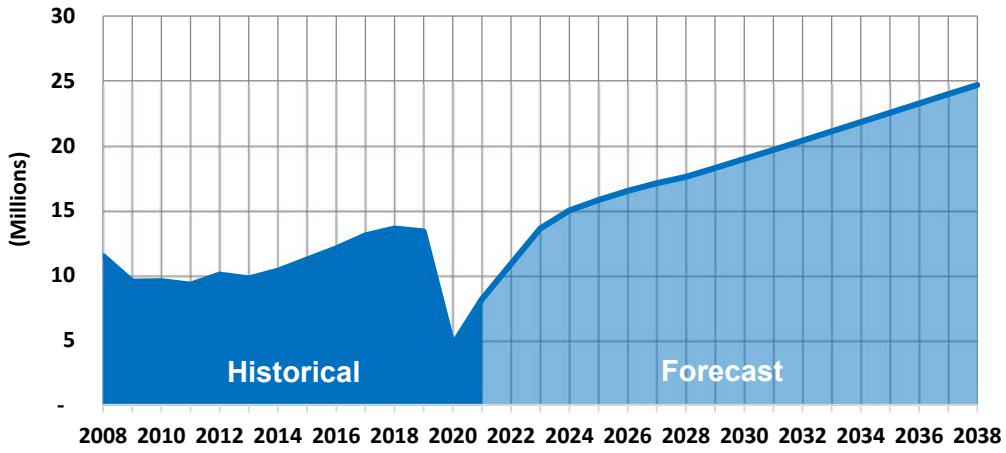
Table 6-3 Compound Annual Growth Rates for the Bay Area O&D Forecast

Market Segment	2021-2028	2021-2038
Domestic – California	13.4%	5.5%
Domestic – Other	11.0%	5.0%
Canada	48.8%	18.9%
Latin/Caribbean	47.9%	18.9%
Transatlantic	41.6%	17.1%
Transpacific	47.1%	18.6%
Total	**16.1%**	**7.1%**

Note: OAK's historical share of passengers prior to the GFC reflected the appeal of the Airport prior to Virgin America operations and the competitive responses thereto, as well as the appeal of OAK in the future.
Source: O&D Survey data; InterVISTAS analysis

As previously mentioned, once O&D passenger demand for the Bay Area is projected, traffic was then allocated to OAK. The forecast anticipates a return to OAK's historical share of Bay Area O&D passengers prior to the Global Financial Crisis. In addition, the share of connecting passenger traffic at OAK is forecast to increase 1.5 percentage points over the forecast horizon. OAK's passenger traffic is forecast to increase at a rate of 29.2% per annum between 2021 and 2023, as which point the growth is forecast to slow to 4.1% per annum through 2038. Overall passenger traffic is projected to increase 3.3% between 2019 and 2038, and 6.7% between 2021 and 2038, reaching 24.7 million passengers in 2038 as seen in Figure 6-3 and Table 6-4.

Figure 6-3 OAK Passenger Forecast (CY 2008-2038)



Source: InterVISTAS analysis

Table 6-4 OAK Passenger Forecast

Year	OAK Passengers
2019	13,378,411
2020	4,622,029
2021	8,142,320
2028	17,585,709
2038	24,685,035
CAGR '19-38	**3.3%**
CAGR '21-38	**6.7%**

Source: InterVISTAS analysis

6.1.4 Passenger Operations

Forecasts of annual commercial passenger aircraft operations are derived from the forecast passenger traffic demand. Passenger aircraft landings depend on the average aircraft size and average load factor (i.e. average passenger per flight), as represented by the formula below:

Passenger Aircraft Operations = (Passenger Forecasts) / (Avg. Aircraft Size x Avg. Load Factor)

where Avg. Aircraft Size x Avg. Load Factor = Avg. Passengers per Aircraft Movement

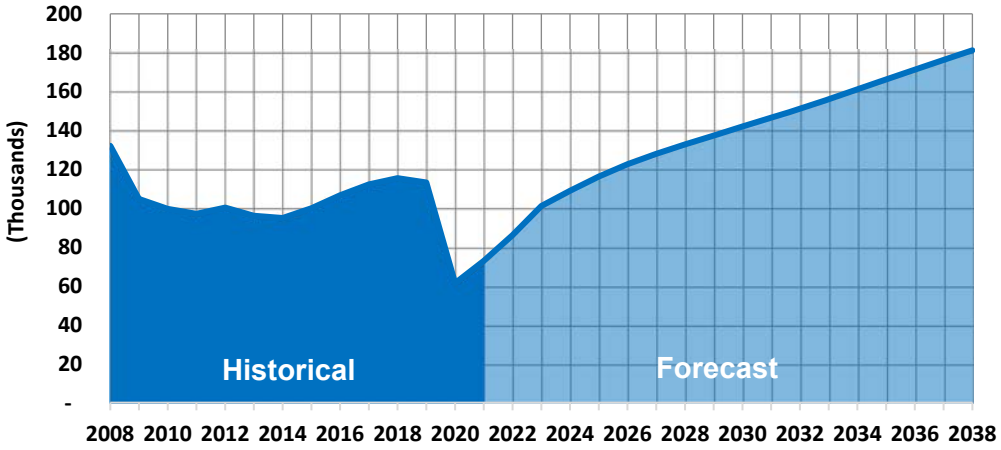
Southwest Airlines is increasing the gauge of aircraft it uses at OAK, as are other airlines serving the Airport. Overall, the average seats per departure increase from 149 and 141 in 2019 and 2021, respectively to 167 in 2038.

The passenger operations forecast includes a near-term impact and recovery with respect to the COVID-19 Pandemic, thus showing the large drop in traffic for 2020 and 2021 with a typical recovery.

Passenger aircraft operations transition seamlessly from the short-term to the long-term forecast methodology because the average aircraft size and load factor assumptions increases modestly over the period. While the short-term forecast focuses on carrier fleet and network planning decisions, and the long-term focuses on the relationship between passenger growth and economic growth, there is no disjunction or step change between the short-term and long-term passenger operations forecasts. This is a result of airline fleet and network planning decisions being a derivative of airline expectations for demand generated by the economy in the short term.

OAK's commercial passenger operations are projected to increase at a rate of 2.5% per annum between 2019 and 2038, and 5.5% per annum between 2021 and 2038, reaching 181,270 operations in 2038.

Figure 6-4 OAK Commercial Passenger Operations Forecast (CY 2008-2038)



Source: InterVISTAS analysis

Table 6-5 OAK Commercial Passenger Operations Forecast

Year	OAK Passengers Operations
2019	113,272
2020	61,544
2021	72,922
2028	132,830
2038	181,270
CAGR '19-38	**2.5%**
CAGR '21-38	**5.5%**

Source: InterVISTAS analysis

6.2 Cargo Forecast

The cargo tonnage forecasts prepared in this study were based largely on historical data correlations through 2017 as part of a very recent forecast update with considerations for 2018 and 2019 data and trend variances, and projected regional economic growth. Stakeholder meetings were held with the major carriers, FedEx and UPS, at OAK, but no detailed growth input expectations were provided. Non-disclosed future flight schedules and operational strategies for FedEx and UPS may not be captured in the forecast details. As with all forecasts, future projections are based on available information and assumptions at the time of development and are vulnerable to dynamic industry and economic conditions that are not anticipated and may notably impact future outcomes.

The cargo tonnage forecasts were prepared for four traditional cargo segments: domestic freighter, international freighter, domestic belly, and international belly. Mail is included with freight as total air cargo in each segment. The belly cargo tonnage forecasts were determined to be linked to the commercial passenger operations forecasts and were developed based on the operations forecast and with applicable utilization rates explained in the belly cargo section. The freighter cargo tonnage forecasts represent the majority of cargo at the airport and were developed by preparing socioeconomic

regression forecasts which considered numerous independent economic variables before selecting the most reasonable and valid correlation. The COVID-19 Pandemic's impact of the cargo industry, including FedEx and UPS operations at OAK, Southwest's belly cargo and international air cargo at OAK were considered and investigated upon finalizing the OAK cargo forecasts. The quick recovery and minimal shifts in air cargo strategy at OAK suggest a limited long-term impact to international and belly cargo while domestic freighter cargo is in-line with previous projections. The summary descriptions of the selected freighter cargo tonnage forecast analyses are presented in the following sections.

6.2.1 Freighter Cargo Methodology and Tonnage Forecast

Methodology

A number of different analysis options were investigated for statistical correlations and meaningful trends to develop models for the demand forecasts. The selected methods considered the observed historical data trends, inputs from the key freighter carriers at OAK, and general industry trends and future developments during the process of determining an appropriate and reasonable model for the domestic and international freighter air cargo segments.

Domestic freighter cargo was ultimately forecast using the following univariate linear socio-econometric model based on U.S. GDP. The GDP based cargo model for domestic freighter tonnage included historical data from 2009 through 2017 and provided very good regression statistics with an adjusted R-squared value of 0.88.

$$\boldsymbol{Domestic\ Freighter\ Cargo\ (tons)} = \mathbf{197,828} + (\mathbf{2.1} * \mathbf{10^{-8}}) * \boldsymbol{GDP_{U.S.}}$$

International freighter cargo was forecast using the following multivariate linear socio-econometric model also based on U.S. GDP, but with the inclusion of a 'dummy' variable for the year 2014 where there was one data anomaly during the historical time period. The GDP based cargo model for international freighter tonnage included historical data from 2008 through 2017 and provided very good regression statistics with an adjusted R-squared value of 0.87.

$$\boldsymbol{International\ Freighter\ Cargo\ (tons)} = \mathbf{-48,524} + (\mathbf{4.8} * \mathbf{10^{-6}}) * \boldsymbol{GDP_{U.S.}} + \mathbf{13,054} * \boldsymbol{Dummy_{2014}}$$

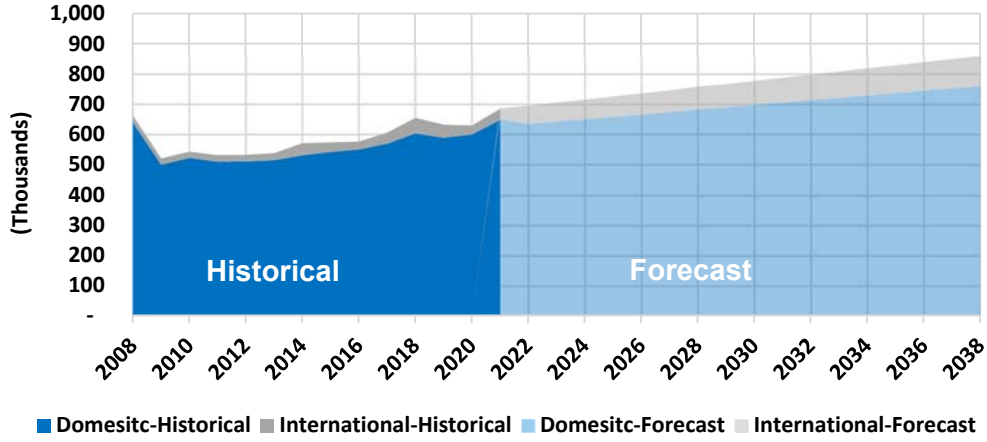
The Woods and Poole Economics CEDDS (Complete Economic and Demographic Data Source) database was used as the source for the U.S. GDP historical and forecast values. The forecast GDP values were applied within the model calculations to determine the calculated year over year growth rates, which were applied to the 2017 cargo tonnages. A dummy variable value of 1.0 was applied to the anomaly year of 2014 with all other years assigned a value of 0, to indicate no abnormality compared to the overall growth trend. The 2018 – 2021 freighter cargo levels were estimated from U.S. DOT Schedule T-100 cargo segment splits and the final total cargo figures published by OAK. CY 2021 data is the most recent full year of data used in the forecast projections.

Tonnage Forecast

The resulting domestic freighter air cargo tonnage level is forecast to increase from 648,694 tons in 2021 to 759,875 tons in 2038, representing an CAGR of 0.9%. The International freighter air cargo tonnage level is forecast to increase from 36,585 tons in 2021 to 99,563 tons in 2038, representing a growth rate of 6.1% per annum. Total freighter air cargo tonnage (domestic + international) is therefore

expected to increase from 685,279 tons in 2021 to 859,437 tons in 2038, representing a growth rate of 1.3% per annum. Figure 6-5 graphically presents the freighter tonnage forecast for OAK.

Figure 6-5 Freighter Cargo Tonnage Forecast



Sources: Airport data, Landrum & Brown analysis

Historical domestic freighter air cargo tonnage and operations through 2019 include some activity that may have been international in true origin or destination. Inbound cargo flights from Asia can typically make the trip to OAK without requiring a tech-stop at ANC and still allowing for efficient utilization of capacity. However, certain outbound flights from OAK to Asia and some inbound heavy flights from Asia may need to refuel in ANC on the trip to Asia depending on the type of freighter aircraft and cargo load. As cargo fleets continue to shift and show improved efficiencies, this refueling need may be eliminated on outbound flights altogether in the future, and OAK records would show more air cargo reported as international instead of domestic. Historical traffic data for 2019 freighter cargo activity were adjusted to account for these reporting variances with a small, calculated shift in domestic to international tonnage and then carried forward in the forecast with an ongoing assumption.

6.2.2 Belly Cargo Tonnage Forecast

As per the commercial passenger forecast, passenger aircraft operations are projected to increase from an estimated 113,272 in 2019 to 181,270 in 2038, representing a growth rate of 2.5% per annum. Commercial passenger operations and average historical belly cargo volumes per operation were considered as a driver of belly cargo growth at OAK. The impact of the Pandemic on commercial passenger traffic resulted in lower than projected operations in 2020 and 2021. The passenger forecast is projected to recover by 2023 and operations are projected to return to previously projected levels from before the Pandemic.

Domestic Belly Cargo

The forecast of domestic passenger aircraft operations was used to project future domestic belly cargo with the general assumption that the average tons per commercial passenger movement will remain stable, increasing slightly from recent historical averages. Domestic belly cargo has represented a small

share of total cargo at OAK. In 2021 domestic belly cargo was just 1.3% of total air cargo tonnage processed at the Airport.

In 2019, the average belly cargo tons were lower at an estimated 0.08 tons transported per commercial passenger aircraft operation compared to a recent average trend of just over 0.11 tons. During the Pandemic, average tons per operation increased to 0.12 tons. It was assumed that tons per aircraft operation would return to the recent trend and then increase 0.5% per annum throughout the forecast period, reaching 0.12 to 0.13 tons per aircraft operation by 2038. Long range target tons per operation were checked against estimated fleet developments and average belly capacities, which are anticipated to have minor change during the forecast.

Domestic belly cargo tonnage is forecast to increase from an estimated 9,014 tons in 2021 to 20,980 tons in 2038, at a rate of 5.1% per annum.

International Belly Cargo

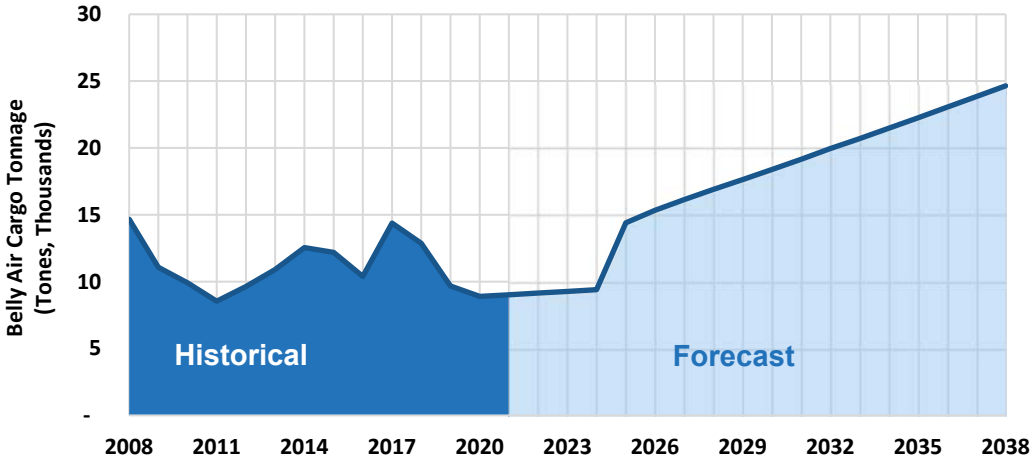
In the same manner as domestic belly cargo, international passenger aircraft operations forecast was used to project international belly cargo demand. In 2017, an estimated 0.51 tons were transported per aircraft operation, but by 2019 with the loss of Norwegian Air Shuttle belly cargo service and the departure of British Airways international service at OAK the average tons per aircraft decreased to about 0.11 tons per operations similar to the domestic segment. During the Pandemic, international travel has decreased or been temporarily eliminated due to health and safety requirements, governmental regulations, and generally low demand. It was assumed in the forecast that 0.3 belly cargo tons per international passenger operation was a reasonable metric when international travel at OAK recovers. During the forecast the tons per aircraft operation metric was estimated to also increase 0.5% per annum and reach 0.32 tons per operation by 2038. Future growth in international belly cargo is dependent on potential new entrants and continued operations and additional growth into Mexico and other Latin American markets by Southwest and other carriers.

International belly cargo tonnage is forecast to increase from an estimated 501 tons in 2019 (just 12 tons in 2021) to 3,670 tons in 2038, representing a growth rate of 11.1% per annum, from a small initial base.

Total Belly Cargo Tonnage Forecast

Total belly air cargo tonnage (domestic and international) is forecast to increase from an estimated 9,678 tons and 9,025 tons in 2019 and 2021, respectively, to 24,650 tons in 2038, representing a growth rate of 5.0% per annum between 2019 and 2038 and 6.1% per annum between 2021 and 2038. The projected forecast of belly cargo tonnage is presented in Figure 6-6.

Figure 6-6 Belly Cargo Tonnage Forecast



Sources: Airport Statistics; Landrum & Brown.

6.2.3 Total Air Cargo Tonnage Forecast

Total air cargo at OAK is projected to increase from 642,405 tons in 2019 and 694,685 tons in 2021 to 884,087 tons by 2038, growing at an annual rate of 1.7% between 2019 and 2038 and 1.4% between 2021 and 2038. The splits in cargo segments are expected to remain fairly similar to the 2019 shares of freighter air cargo and belly air cargo segments with 97.2% freighter air cargo and 2.8% belly air cargo in 2038. Total cargo is expected to shift modestly from 93.2% domestic cargo in 2019 to 88.3% domestic in 2038, yielding a raw increase in the international share of 6.8% to 11.7% by 2038.

Table 6-6 presents the forecast summary of cargo tonnage at OAK.

Table 6-6 OAK Air Cargo Tonnage Forecast

	Freighter (Tons)			Belly (Tons)			Total (Tons)		
Year	**Domestic**	**International**	**Total**	**Domestic**	**International**	**Total**	**Domestic**	**International**	**Total**
2019	589,545	43,182	632,727	9,177	501	9,678	598,722	43,683	642,405
2020	600,695	29,438	630,133	8,890	12	8,902	609,585	29,450	639,035
2021	648,694	36,585	685,279	9,014	12	9,025	658,089	36,596	694,685
2028	682,663	75,323	757,987	14,800	2,105	16,905	697,463	77,428	774,892
2038	759,874	99,563	859,437	20,980	3,670	24,650	780,854	103,233	884,087
CAGR '19-38	**1.3%**	**4.5%**	**1.6%**	**4.4%**	**11.0%**	**5.0%**	**1.4%**	**4.6%**	**1.7%**
CAGR '21-38	**0.9%**	**6.1%**	**1.3%**	**5.1%**	**40.2%**	**6.1%**	**1.0%**	**6.3%**	**1.4%**

Sources: Airport Statistics; Landrum & Brown.

6.3 Freighter Operations Forecast

Freighter operations at the Airport represent activity by all-cargo dedicated aircraft used only to transport goods to and from OAK. These freighter operations may be performed by a range of aircraft from a smaller feeder aircraft that is typically observed as a GA aircraft such as a Cessna 208 Grand

Caravan, or a larger commuter style aircraft such as the ATR42/ATR72, or large dedicated freighters like a Boeing 757, 767, 777 or MD11 aircraft.

Domestic

The domestic freighter air cargo tonnage forecast was used to forecast domestic freighter aircraft operations, assuming an ongoing trend in average tons per freighter aircraft operation. Just before the Pandemic, an estimated 29.4 tons were transported per domestic freighter aircraft operation in 2019. In 2021, 30.0 tons per domestic freighter operation were observed. It was assumed that tons per aircraft operation would increase 0.5% per annum throughout the forecast period. A long-range target of tons/operation was compared to assumed fleet plans of the freighter fleet (primarily for the FedEx and UPS fleets). FedEx plans to add mostly B767 and some B777 freighters to its fleet based on known orders while UPS also plans to add more B767 freighter aircraft. FedEx also plans to retire DC10 aircraft in the next few years.[10] Overall, tons per aircraft operations for domestic freighters is expected to increase to 32.3 tons by 2038.

The domestic freighters operating at OAK are mostly marketed for FedEx (about 75-80%), which comprises large freighters (A300, B757, B767, DC10 and MD11 aircraft), as well as small regional cargo feeder freighters (Beech18, Cessna Caravan and ATR 42/72 aircraft).

The UPS fleet at the Airport entirely comprises large freighters. For both carriers, the B767 and MD11 are the most used aircraft at the Airport with the B767 and B757 being the likely future aircraft of choice for domestic activity.

Domestic freighter operations are forecast to increase from an estimated 21,540 in 2021 to 23,500 in 2038, representing a CAGR of 0.5%.

International

The international freighter air cargo forecast was used to forecast international freighter aircraft operations on a tonnage per operation basis. Pre-Pandemic, OAK international freighters averaged about 66.4 tons per operation. In 2021, a higher than projected 72.9 tons were transported per aircraft operation, and it was assumed that average tons per aircraft operation would also increase at 0.5% per annum throughout the forecast period from the 69.6 tons per operation in 2019. Overall, tons per aircraft operations for international freighters is expected to increase from 69.6 tons to 76.0 tons by 2038. Nearly all of the international freighter activity at OAK is transcontinental with flights to Asia showing a high freighter tonnage capacity from a fleet of all large freighter aircraft.

International freighter operations are therefore forecast to grow at a similar rate compared to international freighter tonnage and increase from 620 operations in 2019 and 502 operations in 2021 to 1,300 in 2038, representing an CAGR of 4.0% per year between 2019 and 2038 and 5.8% per year between 2021 and 2038.

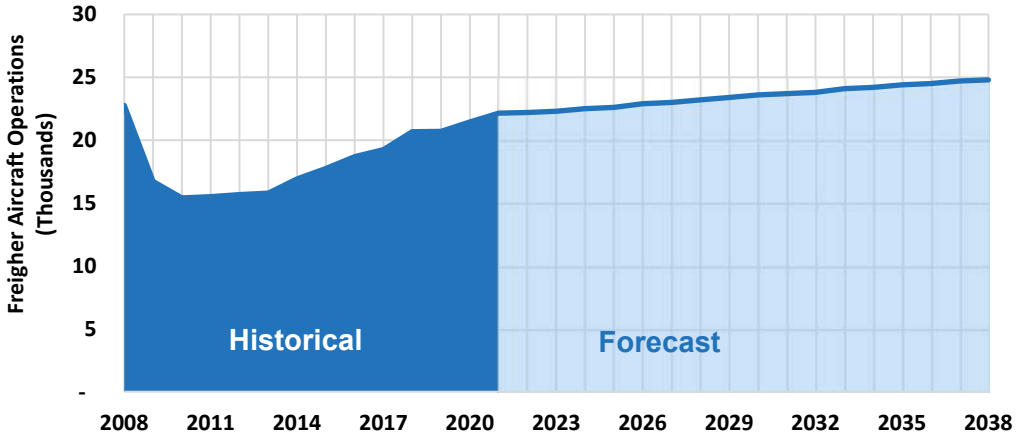
International freighter operations may increase slightly more than currently forecasted if current flights to Asia with a refueling stop in ANC are able to be performed as direct flights on more efficient long-range aircraft.

[10] Review of FedEx 2021 Annual Report and UPS 2021 Annual Report

Figure 6-7 graphically presents total freighter operations (domestic and international), which are forecast to increase from 20,698 operations in 2019 and 22,142 operations in 2021 to 24,800 in 2038, representing a growth rate of 1.0% per annum between 2019 and 2038 and 0.7% per annum between 2021 and 2038.

Table 6-7 lists further details in the freighter operations forecast showing the correlation between tonnage, operations, and tons per operation.

Figure 6-7 OAK Freighter Operations Forecast



Sources: Airport Statistics; Landrum & Brown.

Table 6-7 OAK Freighter Operations Forecast

	Freighter Tonnage (Tons)			Freighter Operations			Average Tons per Operation		
Year	**Domestic**	**International**	**Total**	**Domestic**	**International**	**Total**	**Domestic**	**International**	**Total**
2019	589,545	43,182	632,727	20,078	620	20,698	29.4	69.6	30.6
2020	600,695	29,438	630,133	20,970	474	21444	28.6	62.1	30.9
2021	648,694	36,585	685,279	21,640	502	22,142	30.0	72.9	31.3
2028	682,663	75,323	757,987	22,200	1,000	23.200	30.7	72.8	32.6
2038	759,874	99,563	859,437	23,500	1,300	24,800	32.3	76.0	34.7
CAGR '19-38	**1.3%**	**4.5%**	**1.6%**	**0.8%**	**4.0%**	**1.0%**	**0.5%**	**0.5%**	**0.7%**
CAGR '21-38	**0.9%**	**6.1%**	**1.3%**	**0.5%**	**5.8%**	**0.7%**	**0.4%**	**0.2%**	**0.6%**

Sources: Airport Statistics; U.S. DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown

6.4 General Aviation Methodology and Forecast

Methodology

General aviation aircraft operations represent the non-commercial and non-military segments of air traffic at the Airport. General aviation traffic is therefore any activity not classified as commercial passenger or commercial air cargo in nature, nor specifically military or government. General aviation flight activity was estimated from FAA ATADS annual data, FAA TFMSC annual data, OAK airport annual data, and PASSUR radar flight data. The primary segments identified and forecast in this study are large

business aviation (large aircraft of more than 12,500 pounds), small business aviation (smaller aircraft of 12,500 pounds or less), and small general aviation (small aircraft of 12,500 pounds or less). The large business aviation segment is mainly business jets and can include larger corporate narrow-body aircraft, while the small general aviation segment is mainly piston aircraft which are being operated less and less with a projected long-term reduction in activity by the FAA.

On-demand air taxi operator JSX was expecting to increase flights up to 8 per day from 4 per day at the end of June based on improvements in the COVID-19 Pandemic. However, there have been no further updates in the Diio schedule database for JSX, with the last scheduled flights shown for April 2020.[11] Historical 2019 data did not show a clear presence of JSX Embraer 135/145 jet operations; however, it was assumed that if the scheduled OAG operations are accurate at an average of 1,074 per month and are annualized, they would have an estimated 13,000 annual operations. Data from the Airport for 2021 shows 6,245 operations by JSX. Without a longer historical record or financial analysis, it was assumed that the large business aviation segment for 2019 included the JSX activities and 2020 and thereafter provides no certainties for the success or growth of JSX at OAK.

Operations data for each of the three main segments was reviewed and compared against socioeconomic variables to establish a correlation that would provide a reasonable regression model for predicting future growth. Only outcomes based on statistically reasonable model scenarios with significant statistical results were accepted. General industry trends and FAA aerospace forecast projections for individual segments were considered as well as based aircraft and average usage projections to establish the final forecast methods for each general aviation traffic segments. The resulting approaches and forecasts are presented in the following sections.

Business Aviation

Large Business Aviation (BA) Aircraft (TOW > 12,500 lbs.) operations were forecast using the following univariate linear socio-econometric model:

$$\boldsymbol{Large\ BA\ Operations} = \mathbf{14,852} * \boldsymbol{Population_{MSA}} \text{ -- } \mathbf{49,553}$$

Historical data through 2019 was the basis of the forecast model, with consideration for the impact of the Pandemic and the recovery in 2021 after an unusual down year in 2020. The decision to use the MSA population as a predictor of future growth was made after finding no other statistically sound correlation or better resulting regression model comparing the specific operations to other socioeconomic data variable or combination of variables. Large BA operations are forecast to increase from an estimated 23,765 in 2021 to 33,916 in 2038, representing an CAGR of 2.1%.

Small BA Aircraft (TOW ≤ 12,500 lbs.) operations were forecast using the following univariate linear socio-econometric model:

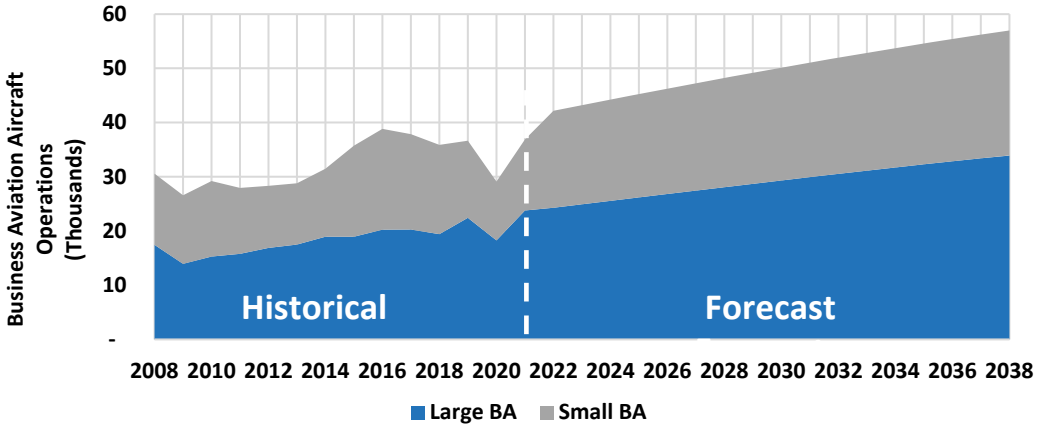
$$\boldsymbol{Small\ BA\ Operations} = \mathbf{44,287} * \boldsymbol{LN(PCPI_{MSA})} \text{ - } \mathbf{480,109}$$

Small BA operations are forecast to increase from an estimated 14,226 in 2019 and 13,111 in 2021 to 23,060 in 2038, representing an CAGR of 2.6% between 2019 and 2038 and 3.4% between 2021 and 2038. Total BA operations are forecast to increase from an estimated 36,654 in 2019 and 36,876 in 2021 to 56,976 in 2038, representing an annual growth rate of 2.3% between 2019 and 2038 and 2.6%

[11] Diio/Cirium reported scheduled flight dynamic report (scheduled activity for JSX at OAK verified as of April 2022)

between 2021 and 2038. The forecast of combined business aviation segment of (large BA + small BA operations) is presented graphically in Figure 6-8.

Figure 6-8 OAK Business Aviation Forecast



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

Small General Aviation

Small GA aircraft operations at OAK were showing continued declines in annual activity following regional and national trends in traditional small general aviation traffic until 2017 where a temporary short-term increase was observed, potentially due to recent success in the local sports franchises. The recent increase or 'surge' is not fully explained in the data, stakeholder interviews, or industry trends and is being treated as temporary in the forecast approach for small GA.

Due to the many years of declining activity, there were no validated correlations between small GA operations and any socioeconomic variables available in the datasets reviewed. It was determined that general growth estimates for small general aviation aircraft from the FAA Aerospace Forecast 2021-2041 should be used to estimate the small GA operations traffic forecast.

Year-over-year negative growth rates for aircraft hours flown obtained from the FAA Aerospace forecast were used to project the small GA operations assuming two segments of the FAA Aerospace forecast Table 29. The Single Engine Piston segment was assumed to be more reasonable for the Itinerant GA operations growth rate which has a stronger declining trend than the local segment. The Total Piston segment found in Table 29 was assumed to be more representative of the local GA segment which also includes some helicopters and may include some light sport aircraft and experimental aircraft.

For Reference, the overall growth rates in aircraft by the 2021 FAA Terminal Area Forecast are shown below, and Table 6-8 presents the projections for based aircraft levels at the Airport through 2038.

- Single-Engine = 1.6%
- Jet = 1.2%
- Multi-Engine = 2.8%
- Helicopter = 0.8%

Table 6-8 OAK Based Aircraft Forecast

	Based Aircraft					
Year	**Single**	**Jet**	**Multi**	**Helo**	**Other**	**Total**
2019	162	71	24	7	0	264
2020	162	71	24	7	0	264
2021	165	71	25	7	0	268
2028	186	77	30	8	0	301
2038	216	87	40	8	0	351

Note: Operations per Based Aircraft factor excludes Jets.
Sources: FAA TAF, 5010 Reports; Landrum & Brown

The FAA Aerospace Forecast 2021-2041 Table 29 projects growth based on projected hours flown by aircraft. The small GA aircraft operations (excludes BA) were projected for both the itinerant and local segments based on the negative growth rates presented in Table 29 as follows:

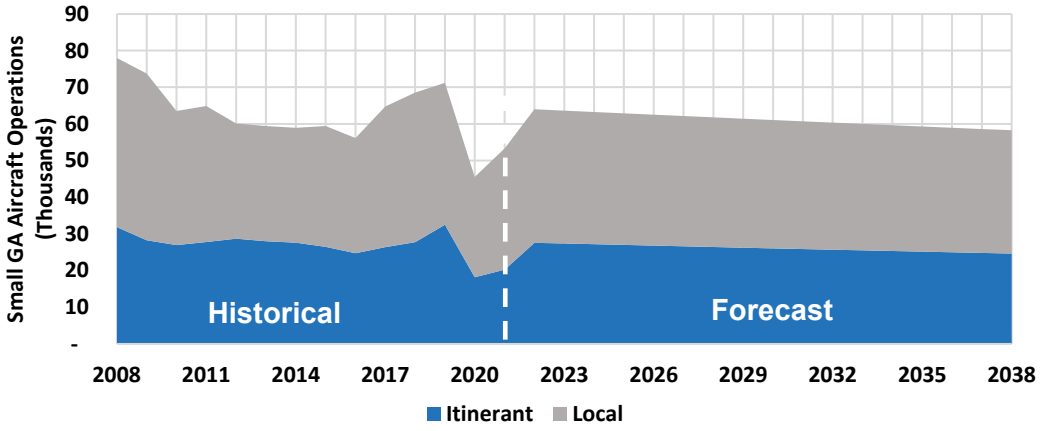
- Itinerant Small GA operations (compared to Piston Single Engine segment) = -0.7% CAGR
- Local Small GA operations (compared to Total Piston segment) = -0.5% CAGR

The forecast assumed that both small GA segments would decline slowly based on the FAA Aerospace forecast's projection for the segments assumed to be most relevant. The 20-year growth rates from Table 29 were applied to the most recent 5-year pre-Pandemic average at OAK for each segment and then a long-term negative growth rates were applied each year to estimate the future small GA operations through 2038.

With the application of the assumed FAA Aerospace negative growth rates, the Itinerant small GA segment is projected to decrease to 24,622 operations 2038, while the local small GA segment is projected to decrease to 33,639 operations in 2038 for a total of 58,261 small GA operations in the final year of the forecast period.

Figure 6-9 graphically presents the forecast for small GA operations at OAK which are projected to show some recovery in the early post-Pandemic years before decreasing to 58,261 operations in 2038 from 71,207 operations in 2019, which represents a -1.1% CAGR.

Figure 6-9 OAK Small General Aviation Operations Forecast



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

Table 6-9 presents the overall traditional general aviation segment forecast for the Airport (including Business Aviation and Small GA), which is projected to grow at an CAGR of 1.5% from the lower 2021 traffic level through 2038.

Table 6-9 Total General Aviation Operations Forecast

	Business Aviation		General Aviation		Total
Year	**Large Aircraft**	**Small Aircraft**	**Itinerant**	**Local**	**Operations**
2019	22,428	14,226	32,499	38,708	107,861
2020	18,254	10,847	18,179	27,351	74,631
2021	23,765	13,111	20,226	33,092	90,194
2028	28,070	20,139	26,414	35,368	109,991
2038	33,916	23,060	24,622	33,639	115,237
CAGR '19-38	**2.2%**	**2.6%**	**-1.5%**	**-0.7%**	**0.3%**
CAGR '21-38	**2.1%**	**3.4%**	**1.2%**	**0.1%**	**1.5%**

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

6.5 OAK Planning Forecasts

There is a level of uncertainty associated with long-range demand forecasting and planning of airport facilities. Planning activity levels inform the future levels of passenger activity, air cargo tonnage, and aircraft operations. The benefit of PALs is to be able to analyze and plan for activity levels that may occur earlier or later than the forecast predicts.

PALs are established by: (1) projecting a near-term increase in activity reasonably expected a few years into the future, (2) projecting an upper bound of activity reasonably expected over the time period being evaluated, and (3) evaluating additional points of activity between these two bounds, as necessary.

In order to quantify future facility requirements within the planning horizon, two PALs were identified for use in planning documents. These PALs correspond to annual levels of passengers and operations.

Design day flight schedules were also developed to quantify the daily and hourly demands for an average day in the peak month of each PAL. More detail can be found in Section 9 of this document.

PAL 1 is defined as 8.8 million annual enplaned passengers or 17.6 MAP and is anticipated to occur by 2028; PAL 2 is defined as 12.3 million annual enplaned passengers or 24.7 MAP and is anticipated to occur by 2038. The forecast used for the PALs are in calendar years. Results of the forecast for the PALs are summarized in Table 6-10.

Table 6-10 PAL Forecast Summary

	OAK Planning Forecast in Calendar Years				
	2019	2020	2021	PAL 1 2028	PAL 2 2038
Passenger Enplanements	**6,689,457**	**2,306,666**	**4,083,962**	**8,792,855**	**12,342,518**
CAGR		*-65.5%*	*-29.1%*	*3.1%*	*3.3%*
Million Annual Passengers ("MAP")	**13.4**	**4.6**	**8.1**	**17.6**	**24.7**
CAGR		*-65.5%*	*-29.1%*	*3.1%*	*3.3%*
Annual Airline Operations	**113,272**	**61,544**	**72,922**	**132,830**	**181,270**
CAGR		*-45.7%*	*-19.8%*	*1.8%*	*2.5%*

	OAK Planning Forecast in Federal Fiscal Years				
	2019	2020	2021	PAL 1 2028	PAL 2 2038
Passenger Enplanements	**6,708,620**	**3,460,280**	**3,368,590**	**8,757,199**	**12,252,702**
CAGR		*-48.4%*	*-29.1%*	*3.0%*	*3.2%*
Million Annual Passengers ("MAP")	**13.4**	**6.9**	**6.7**	**17.5**	**24.5**
CAGR		*-48.4%*	*-29.1%*	*3.0%*	*3.2%*
Annual Airline Operations	**115,752**	**74,475**	**70,077**	**131,614**	**180,022**
CAGR		*-35.7%*	*-22.2%*	*1.4%*	*2.4%*

CAGR = compound annual growth rate
Source: Airport statistics, InterVISTAS analysis

7 Traffic Forecast Results Compared to TAF

OAK produced a range of forecast scenarios to model different shares of the Bay Area passenger market that uses OAK and different airline capacity deployment decisions. The chosen scenario reflects forecasts of economic growth in the Bay Area, OAK's growing catchment share of the Bay Area to historical levels, and a relatively consistent pattern of airline service among the three Bay Area airports. Since Southwest Airlines currently serves approximately 70% of the passengers at OAK, additional input from Southwest Airlines Network Planning and Properties and Facilities departments was incorporated to reflect an evolution of Southwest's strategy at OAK over the period.

- The timing of equipment up-gauging from 143-seat to 175-seat Boeing 737's.
- The inauguration of Hawaii service as well as consequent impact of connecting flights behind OAK.
- Changes to the flight schedule at OAK over the forecast period including longer activity days and banking.
- The Southwest operating day is longer in 2028 and 2038 than it is in 2019. Some flights are projected to arrive into OAK as late at 1:40am and depart as early at 5:35am in 2028. The operating day in 2033 extends to between 5:15am and 1:55am.
- The 2028 and 2038 operations/passenger profiles do not grow uniformly because Southwest provided specific flight schedules for each future year. The Southwest flights, while not tied to specific destinations, were matched. The remain overnight ("RONs") were matched by hand using a last-in, first-out ("LIFO") methodology to minimize gate occupancy.
- Despite increases during other times of the day, one of the largest departure peaks (driven by domestic) continues to be around midday. This allows for other airlines ("OALs") to reach their hubs which are all eastward. This departure bank is preceded by a large arrival bank just before midday.

Future international flights fill in primarily during the afternoon as Trans-Atlantic service grows faster then Trans-Pacific. Trans-Atlantic service at OAK is expected to increase faster than Trans-Pacific service because it has historically been a larger body of demand at the Airport. OAK has had non-stop Trans-Atlantic service for many years to Terceira (which is scheduled to restart seasonally in June 2022) and has attracted other operators including British Airways and European low-cost carriers. Furthermore, as of summer 2022, Trans-Atlantic demand to Europe is experiencing a stronger recovery from COVID-19 than is Trans-Pacific passenger traffic due to travel restrictions and infection rates. Four peak hour departures and four peak hour arrivals are forecast in 2038, with about 800 passengers in the departure peak and 850 in the arrivals peak. Some of these flights may be precleared upon arrival from Canada or Europe depending on flight time and other regulations.

7.1 Enplaned Passenger Forecasts

The enplaned passenger forecast as well as the 2021 TAF, published in March 2022, are presented in Federal Fiscal Years in Figure 7-1. In the OAK forecast developed by Inter*VISTAS*, 2019, 2020, and 2021 enplaned figures were updated to reflect actual reported passenger traffic. The airport saw a slight decrease of -1.0% in the number of enplaned passengers between FY 2018 and FY 2019 largely as a result of the Boeing 737 MAX grounding.

Passenger growth is forecast to increase at a CAGR of 20.3% between FY 2021 and FY 2026, based on the expected air carrier service developments and recovery from COVID-19. Passenger volumes

increases are projected to average 3.4% per year between FY 2026 and FY 2031. The growth rates are then projected to attenuate as the market further matures. The average growth rate over the forecast period is 8.7% per year, reaching 11.5 million enplaned passengers in FY 2036.

The OAK Aviation forecast varies from the passenger enplanements in the TAF by a growing margin over time. This variance is due to several factors, including FAA's likely underestimation of enplaned passengers in FY 2022. Beyond FY 2022, OAK and the FAA have similar growth rates of enplaned passengers.

The variance with FAA's TAF passenger enplanements, as shown in Figure 7-1 and Appendix B, grows larger throughout the forecast because OAK's share of Bay Area traffic gradually increases over the forecast period to recapture market share leaking to other Bay Area Airports and returns to levels seen during the previous peak in 2007. By 2036, the TAF is showing 22.5% fewer passengers than the OAK forecast. This variance is driven by OAK's increasing share based on the following factors: (1) OAK's large catchment area and convenience to many parts of the Bay Area as a preferred airport for locals and tourists, (2) Southwest Airlines commitment to the airport and specific plans for growth at OAK, and (3) OAK's ability to accommodate this growth in traffic specifically available airside capacity, in contrast to other constrained regional airports (e.g., airfield capacity, weather, and nighttime curfews).

Figure 7-1 OAK Enplaned Passenger Forecast vs. 2021 FAA TAF

Note: Data is reflected in Federal Fiscal Year

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

7.2 Commercial Operations Forecast

In addition to passenger aircraft operations, commercial operations also include freighter activity for this comparison with the TAF. The OAK forecast projects operations to grow at a rate of 8.7% per annum from 2021 to 2026, while the TAF assumes a 9.6% growth over the same period. By 2026, the difference in aircraft operations is 4.5% or approximately 7,700 operations. By 2036, there is a difference of roughly 9,600 aircraft operations between the forecasts, or a variance of -4.2%.

Figure 7-2 Commercial Aircraft Operations Forecast vs. 2021 FAA TAF

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

8 Derivative Forecast Fleet Mix

Derivative forecasts based on the future planning horizon were derived from the annual passenger and operations forecast. Annual aircraft operations by aircraft type can be used to support both airfield and apron geometry considerations as well as air quality and noise analyses. Future operations forecasts are based on anticipated changes in passenger, cargo, and general aviation fleets. The Boeing 2021-2040 Current Market Outlook and the Airbus 2021-2040 Global Market Forecast served as guiding documents for the aircraft fleet mix projections along with delivery and retirement announcements provided by the airlines. The market forecasts by the two largest commercial aircraft manufactures highlight a new focus on replacing older, less fuel-efficient aircraft as well as on narrowbody aircraft such as the Airbus 220, Airbus 320 neo, and Boeing 737 MAX where 75% of future passenger jet demand resides. These aircraft manufacturer and order/delivery reports are the result of comprehensive modeling of several factors, and they serve as industry standards for accurately forecasting changes in airplane demand.

8.1 Commercial Fleet Mix

The mix of commercial aircraft operations is based on airline market share as well as up-gauging ability as passenger enplanements increase. New aircraft types such as the Boeing 737 MAX are expected to introduce new market opportunities as well as replacing older, less efficient aircraft. Southwest, the largest airline by market share at OAK, only operates variants of the Boeing 737 in their fleet. As a result, the largest component of the commercial fleet mix is the Boeing 737-700, -800, and MAX 8.

The industry is also experiencing a shift from smaller regional jets to larger regional jets. Smaller aircraft such as the CRJ-200 and ERJ-135 which are equipped with 50 seats or fewer are being replaced by larger aircraft such as the ERJ-175 which can accommodate 76 passengers.

Increases in wide-body aircraft operations are also projected to support growth in international air travel demand. This growth is likely to occur on variants of the fuel-efficient Boeing 787 Dreamliner as these replace older Boeing 767 and 777 aircraft. Table 8-1 presents the projections of commercial aircraft operations at OAK by aircraft segment and specific aircraft type. Due to some unique circumstances experienced in 2019, such as the Boeing 737 MAX grounding, the 2018, 2019, and 2021 fleet mixes were analyzed. In addition, there is currently no replacement aircraft in development to replace these aging 50 seat regional jets.

Table 8-1 Commercial Fleet Mix Historical and Forecast

Aircraft	2018	2019	2021	PAL 1 2028	PAL 2 2038
Wide-Body	**2,993**	**1,290**	**66**	**4,489**	**7,094**
Airbus 330-200	425	95	65	641	1,935
Boeing 767-300	564	0	0	0	0
Boeing 777-200	238	0	0	0	0
Boeing 787-8	586	404	0	0	0
Boeing 787-9	1,180	791	1	3,848	5,159
Narrow-Body	**105,476**	**104,609**	**66,190**	**119,287**	**161,858**
Airbus 220	0	0	753	641	645
Airbus 319	5,389	5,838	1,023	5,131	7,093
Airbus 320	9,368	7,089	3,586	2,181	0
Airbus 320 neo	0	570	3,243	8,722	14,187
Airbus 321	1,767	397	150	0	0
Airbus 321 neo	0	2,124	1,931	2,565	3,224
Boeing 717	360	426	0	0	0
Boeing 737-700	65,956	60,956	29,049	14,109	11,607
Boeing 737-800	17,553	24,045	20,455	31,425	11,607
Boeing 737 MAX 8	1,314	524	5,092	51,306	109,626
Boeing 737-900	2,970	2,640	908	3.207	3,869
McDonnell Douglas MD83	46	0	0	0	0
McDonnell Douglas MD90	753	0	0	0	0
Regional Jet	**5,064**	**6,082**	**6,666**	**8,387**	**11,651**
Bombardier CRJ-200	0	189	13	0	0
Bombardier CRJ-700	110	178	7	0	0
Bombardier CRJ-900	1,048	275	0	641	0
Embraer ERJ-135	671	1,331	942	0	0
Embraer ERJ-145	0	366	1,052	1,333	1,333
Embraer ERJ-175	3,235	3,743	4,652	6,413	10,318
Turboprop	**2,051**	**1,291**	**173**	**667**	**667**
Pilatus PC-12	1,671	1,291	173	667	667
Bombardier Q400	380	0	0	0	0
Commercial Total	**115,433**	**113,272**	**72,922**	**132,830**	**181,270**

Sources: Airport Statistics; FAA Traffic Flow Management System Count (TFSC) Reports; InterVISTAS

8.2 Freighter Fleet Mix

Freighter operations levels at OAK are based on the growth in tons of air cargo transported through the Airport and the increase in the average tons per aircraft operation derived from the assumed future changes in the freighter fleet mix. The freighter fleet is presumed to have relatively few different aircraft that will play a significant role in future operations at OAK. The primary aircraft are presented in Table 8-2 with a shift from one of the current large freighters operating at OAK (the MD-11) being replaced with a new large aircraft (NLA) that may not yet be in production or a new version of one of

today's other larger aircraft. The DC-10 aircraft operated by FedEx is expected to be retired in the next few years according to reports from FedEx relating to early retirement plans following the Pandemic.

Table 8-2 Freighter Fleet Mix Historical and Forecast

Aircraft	2018	2019	2021	PAL 1 2028	PAL 2 2038
Wide-Body	**14,120**	**14,140**	**16,750**	**16,700**	**17,860**
McDonnell Douglas MD-11	5,300	4,900	5,380	3,250	1,700
Boeing 767-300	4,720	4,360	6,460	6,630	7,400
Airbus A300-600	2,290	2,640	2,420	1,710	1,110
McDonnell Douglas DC-10	780	590	720	0	0
Boeing 777-200	1,000	1,580	1,760	2,310	3,650
Other (& NLA)	30	70	10	2,800	4,000
Narrow-Body	**2,710**	**2,710**	**2,850**	**3,020**	**3,220**
Boeing 757-200	2,707	2,710	2,750	3,020	3,220
Other	3	0	100	0	0
Piston	**3,841**	**3,848**	**2,542**	**3,480**	**3,720**
Cessna 208 Caravan	3,728	3,755	2,450	3,330	3,517
Other	113	93	92	150	203
Freighter Total	**20,671**	**20,698**	**22,142**	**23,200**	**24,800**

Sources: Airport Statistics; U.S. DOT Reports Air Carrier Statistics Database (T-100); Passur flight radar data; Landrum & Brown

8.3 General Aviation Fleet Mix

The total general aviation fleet mix for the Airport is based on the forecast of total GA operations at the Airport with the segment and specific aircraft type shares increasing or decreasing with the impact of current trends and predicted industry shifts in trends based on popularity, preference and demand. In general, the demand for small piston aircraft has been declining for decades at U.S. airports and this is generally true at OAK as well. At most airports, the business jet market has shown the biggest growth, and this is expected to be true at OAK for future fleet projections. Table 8-3 presents the projections of general aviation operations at OAK by aircraft segment and specific aircraft type. The predicted fleet mix is a general prediction of future operations based on the most common aircraft types currently in operation at the Airport, with many similar types and models combined or summed in an 'other' category due to the numerous models and variants in use.

Table 8-3 General Aviation Fleet Mix Historical and Forecast

Aircraft	2018	2019	2021	PAL 1 2028	PAL 2 2038
Large Aircraft (TOW > 12,500 lbs)	**19,404**	**22,428**	**23,765**	**28,070**	**33,916**
Gulfstream III/IV/V/VI	3,309	3,824	4,052	4,786	5,783
Bombardier Challenger 300/600	3,223	3,726	3,948	4,663	5,634
Cessna 560/560XL	2,164	2,501	2,650	3,130	3,782
Dassault Falcon	2,032	2,348	2,488	2,939	3,551
BAe HS 125/700-800/Hawker 800	1,036	1,198	1,269	1,499	1,812
Cessna Citation X	996	1,151	1,220	1,441	1,741
Cessna Citation Sovereign	813	940	996	1,176	1,421
Cessna Citation Jet 525	704	814	862	1,018	1,231
Other (inc. Embraer 135/145)	5,127	5,926	6,280	7,418	8,961
Small Aircraft (TOW < = 12,500lbs)	**16,458**	**14,226**	**13,111**	**20,139**	**23,060**
Pilatus PC-12	4,968	4,294	3,958	6,079	6,961
Cessna 208 Caravan	3,964	3,427	3,158	4,851	5,554
Beech Super King Air 350	1,283	1,109	1,022	1,570	1,798
Embraer Phenom 100	858	741	683	1,050	1,202
Embraer Phenom 300	849	734	677	1,039	1,190
Beech 200 Super King	770	665	613	942	1,079
Other	3,766	3,256	3,000	4,608	5,276
Business Aviation Total	**35,862**	**36,654**	**36,876**	**48,209**	**56,976**
Cessna 172 Skyhawk	21,704	22,549	16,884	19,565	18,450
Piper PA-28 Cherokee	12,361	12,843	9,617	11,143	10,508
Cessna 182 Skylane	7,056	7,331	5,489	6,360	5,998
Cessna 152	3,791	3,939	2,949	3,418	3,223
Cirrus SR22	3,646	3,788	2,836	3,286	3,099
Cessna 210	1,810	1,881	1,408	1,632	1,539
Other	18,169	18,876	14,135	16,378	15,444
General Aviation Total	**68,537**	**71,207**	**53,318**	**61,782**	**58,261**

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

9 Design Day Flight Schedules

Design day flight schedules ("DDFS") are beneficial for establishing peak period demands used to calculate facility requirements and test facility sizing. To support both the terminal facility planning and airfield facility planning, two design day flight schedules were developed. One flight schedule focuses on commercial passenger activity to drive terminal requirements and the other focuses on freighter, general aviation, and military flight operations to support airfield and airspace simulations and cargo facility requirements.

9.1 Design Day Flight Schedules Methodology

The methodologies for developing the DDFS for each component of traffic are similar but rely on different peaking characteristics. The approaches for baselining and developing each set of schedules is described below.

9.1.1 Commercial Passenger Activity

To serve as a basis for calculating terminal requirements, average day peak month ("ADPM") enplanements and deplanements were calculated. The peak month in terms of passenger enplanements and operations is July, representing between 9.2% and 9.4% of total annual passengers in the years prior to the COVID pandemic. The design day schedule is based on an average day in July (i.e., the total number of departing seats for the month divided by 31).

A weekday from published airline schedules closest to the theoretical average day was selected as the basis for the development of future flight schedules (July 12, 2018). Accordingly, airline schedule data was collected to determine arrival and departure times, as well as aircraft types and seat capacities. This schedule data was then supplemented with load factor, origin-destination, and connecting passenger information from U.S. Department of Transportation T-100 and origin-destination traffic reports to determine passenger enplanements and deplanements. The 2018 schedule was re-baselined to reflect July 2019 changes. The DDFS was re-baselined again with a July 2021 schedule (July 26, 2021) to account for post-pandemic recovery and the deployment of new fuel-efficient aircraft such as the Boeing 737 MAX. Future flight schedules were grown based on forecast passengers and operations, as well as interviews conducted with select airlines serving the Airport.

Design day flight schedule factors were established to define the relationship to peak hour, peak day, and peak month. Those factors can be seen in Table 9-1 below. While there is some seasonality in the flight schedule patterns at OAK, there has been little historical change in the peak month factors, so the peak month is assumed to stay constant throughout the planning period. The average day is held constant as well given the historical trends surrounding day-to-day schedule variations during the peak month. The peak hour as a percent of annual was allowed to vary throughout the planning period so as not to constrain organic schedule growth or force hub carriers to schedule flights that do not align with their hubbing strategies.

Table 9-1 Design Day Flight Schedule Factors

	Operations	Passengers
Peak month as a percent of annual	held constant for both domestic (9.05%) and international (10.16%) in order to maintain historical peak month trends	held constant for both domestic (9.43%) and international (11.61%) in order to maintain historical peak month trends
Average day as a percent of annual	held constant throughout planning period to maintain historical average day peak month (ADPM) trends for domestic (0.29%) and international (0.42%)	held constant throughout planning period to maintain historical ADPM trends for domestic (0.30%) and international (0.48%)
Peak hour as a percent of annual	varied throughout the planning period to accommodate arrivals and departures associated with new routes	varied throughout the planning period to accommodate arrivals and departures associated with new routes

Source: InterVISTAS analysis

Passenger growth is derived from one of two sources: (1) adding new flights (operations), and (2) up-gauging existing flights to larger aircraft. When looking at underserved markets for which to expand airline service, it is important to note that OAK has historically had nonstop service to 21 of the 30 largest airports. Service to airports east of the Mississippi River, however, is underrepresented. Many of these underserved markets are accommodated in the PAL 1 and PAL 2 design day flight schedule development, as the shift in the share of passengers using OAK over other Bay Area airports grows.

As the anchor tenant, Southwest operates a relatively mature schedule at OAK, with existing service to 35 airports in July 2019 and 30 in July 2021. Given its current exclusive Boeing 737 fleet mix (aircraft with either 143 or 175 seats), however, Southwest has a limited ability to up-gauge to larger aircraft. As a result, growth for Southwest is expected to occur through additional frequencies to existing destinations as well as new frequencies to unserved markets in their North and Central American network which were previously reached via connection.

For OALs serving OAK as a spoke market, the airline hubs dictate most arrival and departure times. Because of this, some additional passenger and operations growth is expected in the morning departure peak, as not all hub destinations are presently served. More aircraft up-gauging is anticipated for OALs as these airlines have more diverse fleets and the hubs that they serve are considerably more congested from a gate and apron perspective.

9.1.2 Freighter, General Aviation, and Military Activity

In order to evaluate the peaking patterns at OAK, the flight by flight details for 2016 and 2017 from PASSUR radar data (arrivals and departures) were analyzed and used to segment annual cargo, general aviation and military aircraft operations forecasts into monthly, daily, and hourly equivalents. According to the radar data, August was found to be the peak month for general activity while December was the peak month for cargo activity.

For support of potential cargo facility planning activities, the freighter operations peak period demand is shown in two scenarios: (peak general month of August, and peak cargo month of December) so that the larger demand of the holiday season in the U.S. is represented as the true cargo peak in comparison to the passenger peak in August.

It is estimated that the month of August represents a 9.0% share of total annual freighter operations, 9.4% of annual general aviation operations and 9.9% of the total annual military operations. Military

operations peaked in January 2017 while cargo operations peaked in December. A typical day during the peak month accounts for about 3.2% of the monthly operations, with 3.3% used for general aviation, 5.3% for cargo and 5.4% for military due to more activity during specific weekdays. It was assumed that the percentage factors of peak month, design day, and peak hour would remain constant from 2019 to 2038, with allowance for a small increase in total peak hour cargo operations due to the need to accommodate large banks of traffic for the main daily sorting operation.

9.2 Design Day Flight Schedule Results – Commercial Passenger Activity

A summary of the design day passengers and operations for each of the planning activity levels as well as historical baseline from either side of the pandemic is provided in Table 9-2.

Table 9-2 Design Day Flight Schedule Results

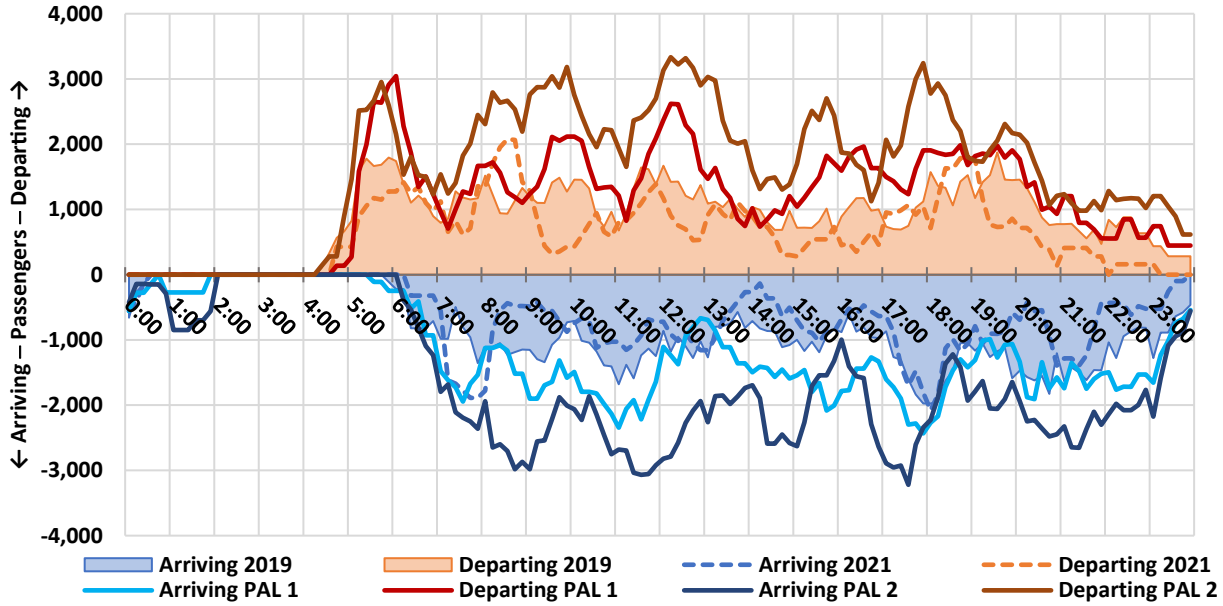
	2018	2019	2021	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	8,142,320	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	72,922	132,830	181,270
Daily					
Deplaned Passengers	21,361	20,658	15,114	27,451	38,630
Domestic Passengers	19,876	19,640	14,497	24,219	33,286
International Passengers	1,485	1,018	618	3,232	5,344
Enplaned Passengers	21,302	20,600	15,114	27,491	38,689
Domestic Passengers	19.818	19,587	14,497	24,216	33,270
International Passengers	1,484	1,013	618	3,275	5,420
Operations	356	346	232	414	562
Arriving Operations	178	173	116	207	281
Departing Operations	178	173	116	207	281
Schedule Parameters					
Load Factors	78.7%	78.6%	85.7%	79.0%	80.9%
Domestic Load Factor	78.6%	78.5%	85.6%	78.8%	80.6%
International Load Factor	80.7%	80.0%	88.7%	81.2%	82.5%
Seats per Operation	152.2	151.8	152.1	167.9	170.1
Domestic	148.5	149.6	151.3	161.9	163.1
International	229.1	211.5	174.0	235.8	233.3

Source: InterVISTAS analysis

The morning "head-start" departure peak between 5:00am and 7:00am increases in PAL 1 and PAL 2, but there is not a pronounced increase in late evening arrivals. As a west coast market, there is often a peaked morning departure bank to serve eastern hubs, but the time zone patterns can meter those arrivals back to OAK in the evening. Additionally, it is not uncommon to see some ultra-low cost carriers ("ULCCs") schedule RON arrivals to align with crew rest periods.

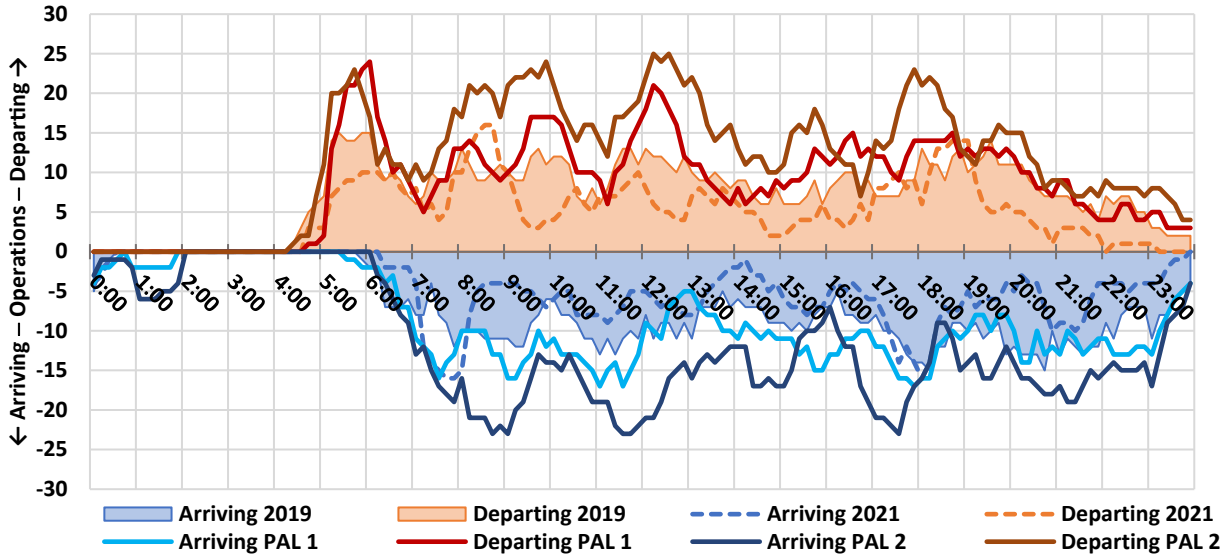
Despite increases during other times of the day, one of the largest departure peaks (driven by domestic) continues to be around midday. This allows OALs an additional frequency to reach their hubs which are almost entirely located east of OAK. This departure bank is preceded by a large arrival bank just before midday. These departure and arrival banks for PAL 1 and PAL 2 can be seen in Figure 9-1 for passengers and Figure 9-2 for operations.

Figure 9-1 Rolling Departure and Arriving Passengers in PAL 1 and PAL 2



Source: InterVISTAS analysis

Figure 9-2 Rolling Departure and Arriving Operations in PAL 1 and PAL 2



Source: InterVISTAS analysis

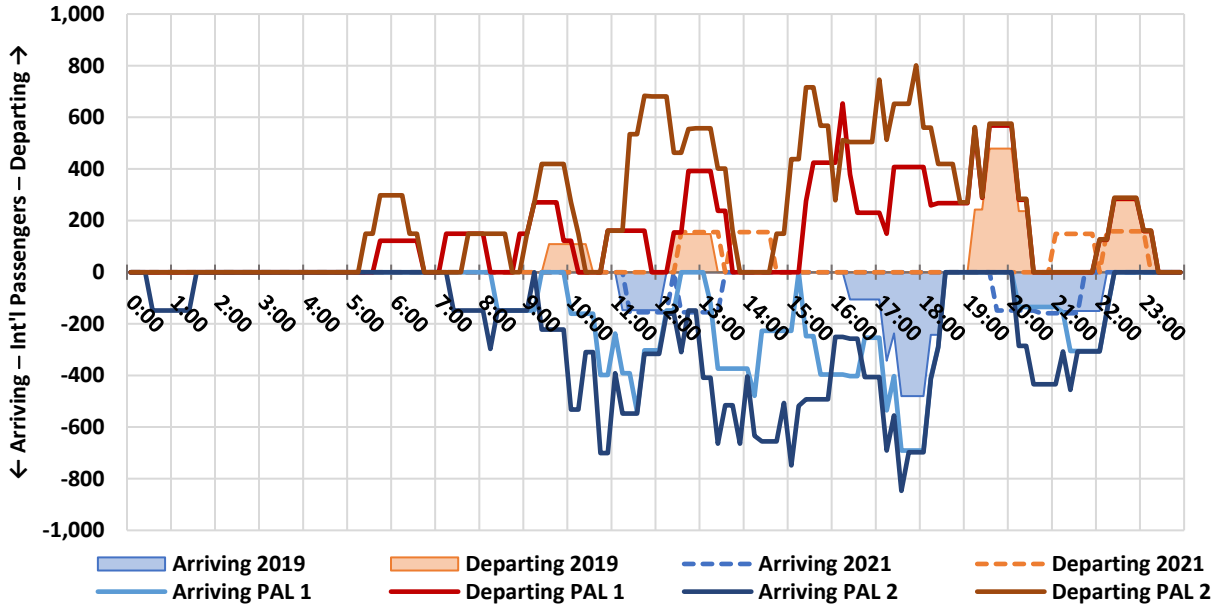
The Southwest operating day is longer in the PAL 1 and PAL 2 flight schedules than it is in the baseline schedules, especially during the late evening. Some flights are projected to arrive into OAK as late at 1:40am and depart as early at 5:35am in PAL 1. The operating day in PAL 2 extends to between 5:15am and 1:55am. This longer operating day allows for additional destinations to be served and for passengers to access additional connecting banks across their network.

The PAL 1 and PAL 2 passenger and operation daily profiles do not grow uniformly because Southwest provided flight schedule inputs for each of these future years. The Southwest flights, while not tied to

specific destinations, were matched to create arrival and departure turns assuming similar ground times to match Southwest's current operation. The RONs were matched by hand using a LIFO methodology to minimize gate occupancy and simplify towing operations.

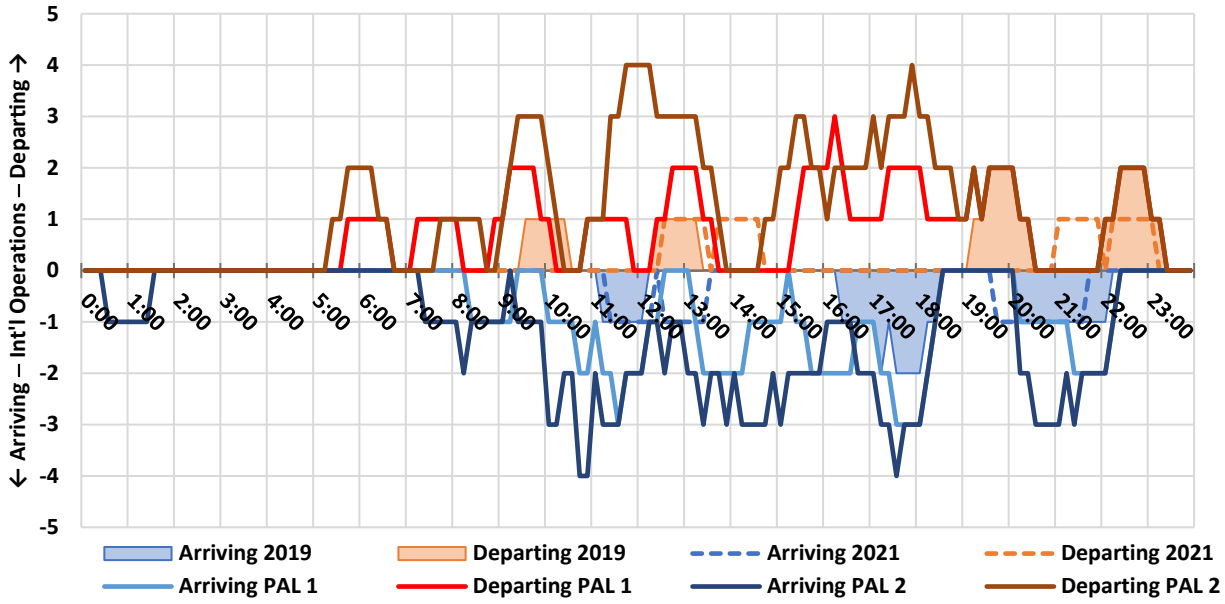
Future international flights fill-in primarily in during the afternoon as Trans-Atlantic service grows faster than Trans-Pacific. Given time zone and travel block times, Trans-Atlantic operations generally turn at west coast cities during the afternoon and evening while Trans-Pacific operations generally turn in the late-morning or late-evening. Four peak hour international departures and four peak hour international arrivals are forecast in PAL 2, with about 800 passengers in the departure peak and 850 in the arrivals peak. Some of these flights may be precleared upon arrival from Canada or Europe depending on departure time at origin and other regulations/international agreements concerning US Preclearance. The international passenger and operations profiles for PAL 1 and PAL 2 can be seen in Figure 9-3 and Figure 9-4, respectively.

Figure 9-3 Rolling International Departing and Arriving Passengers in PAL 1 and PAL 2



Source: InterVISTAS analysis

Figure 9-4 Rolling International Departing and Arriving Operations in PAL 1 and PAL 2



Source: InterVISTAS analysis

A summary of the peak hour passenger and operation characteristics for the planning levels is provided in Table 9-3.

Table 9-3 Peak Hour Design Day Flight Schedule Results

	2018	2019	2021	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	8,142,320	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	72,922	132,830	181,270
Peak Rolling Hour					
Deplaned Passengers	2,107	1,973	2,079	2,431	3,218
Domestic Passengers	2,107	1,704	2,079	2,107	2,835
International Passengers	596	480	159	691	847
Enplaned Passengers	2,167	1,874	2,077	3,045	3,334
Domestic Passengers	1,830	1,795	2,077	2,923	2,856
International Passengers	479	479	159	654	801
Operations	27	27	26	31	46
Arriving Operations	17	15	16	17	23
Departing Operations	17	15	16	24	25

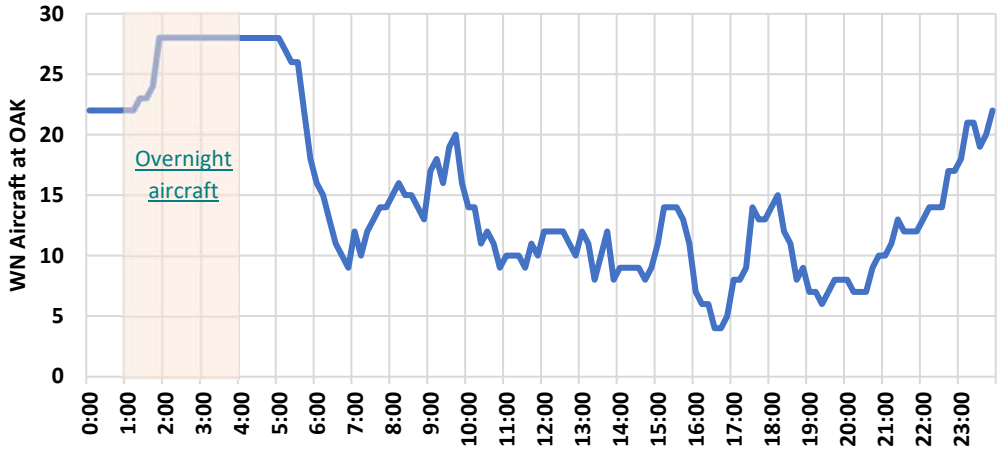
Note: Peak period activity is the same for FFY and CY because it occurs in the summer.
Source: InterVISTAS analysis

9.2.1 Overnight Commercial Passenger Aircraft Demand

There are 46 aircraft that remain overnight in the PAL 2 ADPM flight schedule, of which 28 are operated by Southwest. The Southwest "head start" bank includes 19 departures and occurs between 5:00am and 7:00am before the first arrival occurs, allowing for gates to accommodate one or two departure-only

operations before the first arrival. Southwest's projected aircraft on the ground profile is shown in Figure 9-5.

Figure 9-5 Southwest Overnight Aircraft Demand



Source: InterVISTAS analysis

9.3 Design Day Flight Schedule Results – Freighter, General Aviation, and Military Activity

Table 9-4, Table 9-5, Table 9-6, and Table 9-7 provide the forecasts of estimated peak period operations at OAK for freighter, general aviation, and military through the forecast period of 2019 to 2038.

Table 9-4 Freighter Peak Period Operations Forecast (Peak General Month)

Freighter	**2018**	**2019**	**2021**	**PAL 1 2028**	**PAL 2 2038**
Annual	20,671	20,698	22,142	23,200	24,800
DDFS Month (August)	1,867	1,869	1,810	2,095	2,240
% of annual	*9.0%*	*9.0%*	*8.4%*	*9.0%*	*9.0%*
Average Day	99	99	96	111	119
% of DDFS month	*5.3%*	*5.3%*	*5.3%*	*5.3%*	*5.3%*
Peak Hour Arrivals	9	9	9	11	11
% of avg day	*9.5%*	*9.5%*	*9.5%*	*9.5%*	*9.5%*
Peak Hour Departures	11	11	11	13	14
% of avg day	*11.6%*	*11.6%*	*11.6%*	*11.6%*	*11.6%*
Peak Hour Total Ops	11	11	11	13	14
% of avg day	*11.6%*	*11.6%*	*11.6%*	*11.8%*	*11.9%*

Sources: Airport Statistics; Landrum & Brown

Table 9-5 Freighter Peak Period Operations Forecast (for Cargo Facility Planning)

Freighter	2018	2019	2021	PAL 1 2028	PAL 2 2038
Annual	20,671	20,698	22,142	23,200	24,800
Peak Month (December)	2,418	2,421	2,674	2,713	2,900
% of annual	*11.7%*	*11.7%*	*12.1%*	*11.7%*	*11.7%*
Average Day	127	127	139	142	152
% of peak month	*5.2%*	*5.2%*	*5.2%*	*5.2%*	*5.2%*
Peak Hour Arrivals	10	10	11	12	12
% of avg day	*8.2%*	*8.2%*	*8.2%*	*8.2%*	*8.2%*
Peak Hour Departures	12	12	13	14	15
% of avg day	*9.7%*	*9.7%*	*9.7%*	*9.7%*	*9.7%*
Peak Hour Total Ops	14	14	16	16	17
% of avg day	*11.2%*	*11.2%*	*11.2%*	*11.2%*	*11.2%*

Sources: Airport Statistics; Landrum & Brown

Table 9-6 General Aviation Peak Period Operations Forecast

General Aviation	2018	2019	2021	PAL 1 2028	PAL 2 2038
Annual	104,399	107,861	90,194	*109,991*	*115,237*
Peak Month	9,776	10,100	8,709	10,339	10,832
% of annual	*9.4%*	*9.4%*	*9.7%*	*9.4%*	*9.4%*
Average Day	327	337	284	341	357
% of peak month	*3.3%*	*3.3%*	*3.3%*	*3.3%*	*3.3%*
Peak Hour Arrivals	31	32	27	32	34
% of avg day	*9.4%*	*9.4%*	*9.4%*	*9.4%*	*9.4%*
Peak Hour Departures	27	28	24	29	30
% of avg day	*8.4%*	*8.4%*	*8.4%*	*8.4%*	*8.4%*
Peak Hour Total Ops	46	47	40	48	50
% of avg day	*14.0%*	*14.0%*	*14.0%*	*14.0%*	*14.0%*

Sources: Airport Statistics; Landrum & Brown

Table 9-7 Military Peak Period Operations Forecast

Military	2018	2019	2021	PAL 1 2028	PAL 2 2038
Annual	1,230	926	837	1,000	1,000
DDFS Month (August)	121	91	83	99	99
% of annual	*9.9%*	*9.9%*	*9.9%*	*9.9%*	*9.9%*
Average Day	6	6	6	6	6
% of DDFS month	*5.0%*	*5.4%*	*7.2%*	*5.4%*	*5.4%*
Peak Hour Arrivals	2	2	2	2	2
% of avg day	*27.9%*	*27.9%*	*27.9%*	*27.9%*	*27.9%*
Peak Hour Departures	2	2	2	2	2
% of avg day	*33.3%*	*33.3%*	*33.3%*	*33.3%*	*33.3%*
Peak Hour Total Ops	2	2	2	2	2
% of avg day	*33.3%*	*33.3%*	*33.3%*	*33.3%*	*33.3%*

Sources: Airport Statistics; Landrum & Brown

Note: Peak Hour Military operations were rounded up

10 Appendix

Appendix A Summary of Oakland International Airport Forecast – FAA Standard Template

	Forecast							Compound Annual Growth Rates			
	2019	2020	Base Year 2021	Base Year+1 2022	Base Year+5 2026	Base Year+10 2031	Base Year+15 2036	Base Year+1 2022	Base Year+5 2026	Base Year+10 2031	Base Year+15 2036
Passenger Enplanements											
Air Carrier	6,569,964	3,323,325	3,203,202	4,955,681	8,096,989	9,563,927	11,334,299	54.7%	20.4%	11.6%	8.8%
Commuter/Air Taxi	138,656	136,955	165,388	157,424	164,656	182,188	198,419	-4.8%	-0.1%	1.0%	1.2%
Total Enplanements	**6,708,620**	**3,460,280**	**3,368,590**	**5,113,106**	**8,261,645**	**9,746,116**	**11,532,719**	**51.8%**	**19.7%**	**11.2%**	**8.6%**
Aircraft Operations											
Itinerant											
Air Carrier	131,544	94,914	86,716	103,132	141,848	167,112	192,458	18.9%	10.3%	6.8%	5.5%
Commuter/Air Taxi	31,622	26,123	25,876	26,579	28,650	31,789	34,695	2.7%	2.1%	2.1%	2.0%
Total Commercial Operations	*163,166*	*121,037*	*112,592*	*129,711*	*170,498*	*198,901*	*227,153*	*15.2%*	*8.7%*	*5.9%*	*4.8%*
General Aviation	39,390	27,043	30,690	41,839	46,160	46,949	47,496	36.3%	8.5%	4.3%	3.0%
Military	534	449	402	530	550	550	550	31.8%	6.5%	3.2%	2.1%
Local											
General Aviation	40,883	26,964	32,930	35,609	35,769	34,884	34,020	8.1%	1.7%	0.6%	0.2%
Military	468	362	288	429	450	450	450	49.0%	9.3%	4.6%	3.0%
Total Operations	**244,441**	**175,855**	**176,902**	**208,159**	**253,427**	**281,734**	**309,670**	**17.7%**	**7.5%**	**4.8%**	**3.8%**
Peak Hour Operations	**76**	**65**	**65**	**71**	**84**	**89**	**96**	**9.2%**	**5.3%**	**3.2%**	**2.6%**
Cargo/Mail											
Enplaned and Deplaned Tons	655,441	639,878	680,488	701,602	747,638	803,373	859,070	3.1%	1.9%	1.7%	1.6%
Based Aircraft											
Single Engine (Nonjet)	162	161	165	168	180	195	210	1.8%	1.8%	1.7%	1.6%
Multi Engine (Nonjet)	24	24	25	25	28	33	38	0.0%	2.3%	2.8%	2.8%
Jet Engine	72	73	71	72	75	80	83	1.4%	1.1%	1.2%	1.2%
Helicopter	7	7	7	8	8	8	8	14.3%	2.7%	1.3%	0.9%
Other	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Total Based Aircraft	**265**	**265**	**268**	**273**	**291**	**316**	**341**	**1.9%**	**1.7%**	**1.7%**	**1.6%**

Note: Data is reflected in Federal Fiscal Years

			Forecast					Compound Annual Growth Rates			
	2019	2020	Base Year 2021	Base Year+1 2022	Base Year+5 2026	Base Year+10 2031	Base Year+15 2036	Base Year+1 2022	Base Year+5 2026	Base Year+10 2031	Base Year+15 2036
Operational Factors											
Average Aircraft Size (seats)											
Air Carrier – Passenger	149	151	152	157	162	165	167	3.3%	1.3%	0.8%	0.6%
Average Enplaning Load Factor											
Air Carrier - Passenger	79.3%	49.2%	72.3%	79.5%	80.2%	80.3%	80.8%	10.0%	2.1%	1.1%	0.7%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

Appendix B Comparison of OAK and TAF Forecasts – FAA Standard Template

	Year	OAK Forecast	FAA TAF	OAK vs. TAF % Difference
Passenger Enplanements				
	2019	6,708,620	6,584,891	1.9%
	2020	3,460,280	3,438,417	0.6%
Base Year	2021	3,368,590	3,410,189	-1.2%
Base Year + 5 yrs.	2026	8,261,645	7,271,654	13.6%
Base Year + 10 yrs.	2031	9,746,116	8,337,986	16.9%
Base Year + 15 yrs.	2036	11,532,719	9,414,399	22.5%
Commercial Operations				
	2019	163,166	163,166	0.0%
	2020	121,037	121,037	0.0%
Base Year	2021	112,592	112,592	0.0%
Base Year + 5 yrs.	2026	170,498	178,241	-4.3%
Base Year + 10 yrs.	2031	198,901	197,351	0.8%
Base Year + 15 yrs.	2036	227,153	217,501	4.4%
Total Operations				
	2019	244,441	244,441	0.0%
	2020	175,855	175,855	0.0%
Base Year	2021	176,902	176,902	0.0%
Base Year + 5 yrs.	2026	253,427	261,030	-2.9%
Base Year + 10 yrs.	2031	281,734	280,449	0.5%
Base Year + 15 yrs.	2036	309,670	300,910	2.9%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

OAK

Oakland International Airport Comprehensive Aviation Activity Forecast Report (2019-2038)

JULY 28, 2020, UPDATED JUNE 2021

Table of Contents

1 Executive Summary

This document presents comprehensive aviation activity forecasts including passenger and operations activity for commercial airline, general aviation, and military operations at Oakland International Airport ("OAK" or the "Airport") for use in the Airport's planning efforts. As a Medium Hub Airport, the Airport plays a critical role in the system of three commercial service airports serving the San Francisco Bay Area ("Bay Area"). The Bay Area is the 4th largest metropolitan population base in the country. OAK also serves as a connecting point on Southwest Airlines' network.

Annual and peak hour forecasts were prepared through 2038 with a base year of 2019. Forecasted enplaned passengers include both domestic and international traffic. Aircraft operations include Air Carrier, Commuter Air Taxi, General Aviation ("GA"), Military, and Cargo activity. Two consulting firms assisted OAK with this effort; Inter*VISTAS* Consulting, Inc. prepared the Passenger-related activity forecasts, while Landrum & Brown prepared the Cargo, GA, and Military activity forecasts.

The forecasts have been prepared using a combination of traditional top-down econometric modeling and bottom-up analysis of carrier networks. The bottom-up approach is used in the short term forecast as estimates of economic activity in the near term tend to diverge, and the published capacity of the airline is more reliable. Over the long term, the relationship between the economic and demographic drivers is more reliable.

Beginning in March 2020, the COVID-19 Pandemic negatively impacted passenger demand. Public health directives advised the public to restrict all non-essential travel, virtually eliminating business travel, and significantly reducing leisure travel including visiting friends and relatives. Passenger airlines responded by sharply reducing flight schedules to better match seat capacity with passenger demand, which also had an impact on the availability of belly space for air cargo. Demand for air cargo has remained resilient throughout, and additional freighter activity has backfilled the temporary loss in belly capacity.

The forecasts presented in this report are long-term forecasts. The impacts of the COVID-19 Pandemic are not expected to alter passenger or cargo demand at OAK over the horizon of planning forecasts. As with other exogenous shocks to passenger demand in the past, passengers are forecast to recover to pre-pandemic levels in 2023. Passenger operations are forecast to recover to pre-pandemic levels in 2025. Passenger operations recovery is expected to lag total passengers due to higher load factors and up-gauged aircraft. Air cargo and general aviation demand was not negatively impacted by the COVID-19 pandemic, so those forecasts have not been changed.

This update to OAK's Comprehensive Forecast Report, conducted in Spring of 2021, includes a shift of the years associated with the planning activity levels ("PAL") by three years. PAL 1 has shifted from 2025 to 2028, and PAL 2 has shifted from 2035 to 2038. Because planning activity levels are based on demand rather than specific years, the shift of associated years demonstrates the ability of the planning activity level to be responsive to changes in aviation demand, in this case caused by the COVID-19 Pandemic.

As more people have been vaccinated in the United States, public health restrictions have been relaxed, and people have resumed leisure travel and some business travel. In response to strong demand, Southwest Airlines is planning to operate 90% of their pre-pandemic systemwide capacity during summer 2021, and other U.S. airlines are planning to operate 70% to 90% of pre-pandemic capacity. The surge in demand and the airlines' capacity deployment is a testament to the recovery underway.

OAK Planning Forecasts

In order to quantify future facility requirements for the planning horizon, two planning activity levels were identified for use in planning documents. This report, updated in June 2021, reflects the impacts of the pandemic on aviation traffic, including a shift in the years that the PALs are forecasted to occur. PAL 1 is defined as 8.8 million annual enplaned passengers or 17.6 Million Annual Passengers ("MAP"); PAL 2 is defined as 12.3 million annual enplaned passengers or 24.7 MAP. Total air cargo tonnage is forecast to increase from 642,405 U.S. tons in 2019 to 884,087 U.S. tons by 2038 for an annual growth rate of 1.7%. Total aircraft operations are forecast to increase from 242,757 operations in 2019 to 323,501 operations by 2038 for an annual growth rate of 1.5%. The cargo forecast is in U.S. short tons ("tons"). Results of the forecast for the PALs are summarized in Table 1-1.

Table 1-1 PAL Forecast Summary

	Forecast in Calendar Years			Forecast in Federal Fiscal Years		
	Base Year 2019	**PAL 1 2028**	**PAL 2 2038**	**Base Year 2019**	**PAL 1 2028**	**PAL 2 2038**
Passenger Activity						
Passenger Enplanements	6,689,457	8,792,855	12,342,518	6,708,620	8,757,199	12,252,702
CAGR (%) (a)		*3.1%*	*3.3%*		*3.0%*	*3.2%*
Million Annual Passengers ("MAP")	13.4	17.6	24.7	13.4	17.5	24.5
CAGR (%) (a)		*3.1%*	*3.3%*		*3.0%*	*3.2%*
Freighter Cargo Tonnage						
Belly Cargo (U.S. Tons)	9,678	16,905	24,650	10,478	16,715	24,450
Freighter Cargo (U.S. Tons)	632,727	757,987	859,437	638,909	755,396	856,857
Total Air Cargo Tonnage (U.S. Tons)	*642,405*	*774,892*	*884,087*	*649,387*	*772,111*	*881,307*
CAGR (%) (a)		*2.1%*	*1.7%*		*1.9%*	*1.6%*
Aircraft Operations						
Passenger Airline Operations	113,272	132,830	181,270	115,752	131,614	180,022
Freighter Operations	20,698	23,200	24,800	20,691	23,150	24,767
Business/General Aviation	107,861	110,758	116,431	106,996	110,611	116,291
Military	926	1,000	1,000	1,002	1,000	1,000
Total Aircraft Operations	*242,757*	*267,788*	*323,501*	*244,441*	*266,375*	*322,080*
CAGR (%) (a)		*1.1%*	*1.5%*		*1.0%*	*1.5%*

(a) CAGR: Compound annual growth rate. CAGRs shown are for 2019-2028 and 2019-2038.
Source: Airport statistics; InterVISTAS analysis

FAA Terminal Area Forecast

The Federal Aviation Administration's ("FAA") 2019 Terminal Area Forecast ("TAF") provides an unconstrained forecast of airport activity at OAK that reflects continued growth. This document presents OAK's independent forecast of activity and compares its results to those of the FAA's TAF and discusses various factors that could influence deviations from the TAF and explain the differences between the two forecasts results. These factors include:

- Differences in actual activity performance in the early years of the forecast;
- The impact of the Boeing 737 MAX grounding on activity in 2019 and a portion of 2020;
- An understanding of economic development in the San Francisco Bay Area over the forecast period and how that will impact OAK vis-à-vis the region's other airports;
- The influence of Southwest Airlines' fleet and network plans over the forecast period as the largest airline at OAK by capacity, as well as the impact of other passenger airline fleet and network plans;
- The influence of cargo airlines' fleet and network plans including those of FedEx and UPS and;
- The impact of general aviation activity including new business models such as JSX (formerly JetSuiteX).

As discussed herein, OAK's forecasts were developed using techniques that are similar to those used to develop the TAF, with additional airport-specific input. The primary differences between the TAF results and the OAK results are based on OAK's analysis:

- That OAK will have higher activity growth when compared to other airports serving the San Francisco Bay Area because of the comparative convenience of OAK to the most rapidly growing areas in the region;
- The fleet and network plans of the airlines serving and likely to serve OAK.

The results of the forecasts for the Base Year and forecast years in five-year increments are presented in Table 1-2.

Table 1-2 Summary of Oakland International Airport Forecast

	Forecast in Federal Fiscal Years				Compound Annual Growth Rates		
	Base Year 2019	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034
Passenger Enplanements							
Air Carrier	6,569,964	7,189,320	8,874,856	10,621,100	1.8%	3.1%	3.3%
Commuter/ Air Taxi	138,656	157,605	175,222	192,122	2.6%	2.4%	2.2%
Total	**6,708,620**	**7,346,925**	**9,050,078**	**10,813,222**	**1.8%**	**3.0%**	**3.2%**
Aircraft Operations							
Air Carrier	131,544	127,438	157,566	182,040	-0.6%	1.8%	2.2%
Commuter/ Air Taxi	31,622	27,388	30,542	33,568	-2.8%	-0.3%	0.4%
Subtotal	*163,166*	*154,826*	*188,108*	*215,608*	*-1.0%*	*1.4%*	*1.9%*
General Aviation	80,273	82,832	82,663	82,479	0.6%	0.3%	0.2%
Military	1,002	1,000	1,000	1,000	0.0%	0.0%	0.0%
Total	**244,441**	**238,657**	**271,771**	**299,087**	**-0.5%**	**1.1%**	**1.4%**
Cargo/Mail							
Enplaned and Deplaned Tons	655,441	725,134	781,559	836,829	2.0%	1.8%	1.6%
Operational Factors							
Average Aircraft Size (seats)							
Air Carrier – Passenger	149	162	165	167	1.7%	1.0%	0.8%
Average Enplaning Load Factor							
Air Carrier - Passenger	79.3%	79.7%	80.1%	80.6%	0.1%	0.1%	0.1%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.

Design Day Flight Schedules

Design day flight schedules (DDFS) are beneficial for establishing peak period demands used to calculate facility requirements and test facility sizing. To support both terminal facility planning and airfield facility planning, two design day flight schedules were developed that correspond to PAL 1, anticipated to occur by 2028, and to PAL 2, anticipated to occur by 2038. Each DDFS was developed using 2018 and 2019 actual activity as a base with forecasts informed by (1) annual increases in the relevant activity, (2) trend analysis of how activity during the peak periods tends to increase vis-à-vis annual increases, and (3) consultations with the relevant Airport users. Due to some unique circumstances experienced in 2019, such as the Boeing 737 MAX grounding, both 2018 and 2019 schedule patterns were analyzed. One flight schedule focuses on commercial passenger activity to drive terminal requirements and the other focuses on freighter, general aviation, and military flight operations to support airfield and airspace simulations and cargo facility requirements.

A summary of the design day passengers and operations for each of the planning levels is provided in Table 1-3.

Table 1-3 Peak Period Commercial Passenger Activity Results

	2018	2019	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	132,830	181,270
Daily				
Deplaned Passengers	21,361	20,658	27,451	38,630
Domestic Passengers	19,876	19,640	24,219	33,286
International Passengers	1,485	1,018	3,232	5,344
Enplaned Passengers	21,302	20,600	27,491	38,689
Domestic Passengers	19.818	19,587	24,216	33,270
International Passengers	1,484	1,013	3,275	5,420
Operations	356	346	414	562
Arriving Operations	178	173	207	281
Departing Operations	178	173	207	281
Peak Rolling Hour				
Deplaned Passengers	2,107	1,973	2,431	3,218
Domestic Passengers	2,107	1,704	2,107	2,835
International Passengers	596	480	691	847
Enplaned Passengers	2,167	1,874	3,045	3,334
Domestic Passengers	1,830	1,795	2,923	2,856
International Passengers	479	479	654	801
Operations	27	27	31	46
Arriving Operations	17	15	17	23
Departing Operations	17	15	24	25

Source: InterVISTAS analysis

Table 1-4 provides the forecasts of estimated peak period operations at OAK for freighter, general aviation, and military through the forecast period of 2019 to 2038.

Table 1-4 Freighter Peak Period Operations Forecast (Peak General Month)

	2018	2019	PAL 1 2028	PAL 2 2038
Freighter (for Commercial Passenger Design Day)				
Annual	20,671	20,698	23,200	24,800
Average Day	99	99	111	119
Peak Hour Arrivals	9	9	11	11
Peak Hour Departures	11	11	13	14
Peak Hour Total Ops	11	11	13	14
Freighter (for Cargo Facility Planning)				
Annual	20,671	20,698	23,200	24,800
Average Day	127	127	142	152
Peak Hour Arrivals	10	10	12	12
Peak Hour Departures	12	12	14	15
Peak Hour Total Ops	14	14	16	17
General Aviation				
Annual	104,399	107,861	110,758	116,431
Average Day	327	337	346	364
Peak Hour Arrivals	31	32	32	34
Peak Hour Departures	27	28	29	31
Peak Hour Total Ops	46	47	49	51
Military				
Annual	1,230	926	1,000	1,000
Average Day	6	6	6	6
Peak Hour Arrivals	2	2	2	2
Peak Hour Departures	2	2	2	2
Peak Hour Total Ops	2	2	2	2

Sources: Airport Statistics; Landrum & Brown

Note: Peak Hour Military operations were rounded up

2 Introduction

This report was prepared for the Port of Oakland to present the analysis of the historical traffic at OAK, as well as the methodology and results of the planning activity forecast. The most recent calendar year of data available at the time of this analysis was 2019; therefore 2019 was selected as the base year. In addition to showing the results of the forecast, this report also compares the Port's forecast to the FAA TAF.

The forecasts presented herein are "unconstrained" and as such do not take facility constraints or other outside limiting factors into consideration. In other words, for the purposes of estimating future demand, the forecast assumes facilities can accommodate the projected demand. Prior to finalizing the forecast report, the Coronavirus (COVID-19) pandemic began, which has had an immediate impact of aviation traffic at the Airport.

Beginning in March 2020, the COVID-19 Pandemic negatively impacted passenger demand. Public health directives advised the public to restrict all non-essential travel, virtually eliminating business travel, and significantly reducing leisure travel including visiting friends and relatives. Passenger airlines responded by sharply reducing flight schedules to better match seat capacity with passenger demand, which also had an impact on the availability of belly space for air cargo. Demand for air cargo has remained resilient throughout, and additional freighter activity has backfilled the temporary loss in belly capacity.

The forecasts presented in this report are long-term forecasts. The impacts of the COVID-19 Pandemic are not expected to alter passenger or cargo demand at OAK over the horizon of planning forecasts. As with other exogenous shocks to passenger demand in the past, passengers are forecast to recover to pre-pandemic levels in 2023. Passenger operations will recover to pre-pandemic levels in 2025. Passenger operations recovery is expected to lag total passengers due to higher load factors and upguaged aircraft. Air cargo and general aviation demand was not negatively impacted by the COVID-19 pandemic, so those forecasts have not been changed.

This update to OAK's Comprehensive Forecast Report, conducted in Spring of 2021, includes a shift of the years associated with the planning activity levels ("PAL") by three years. PAL 1 has shifted from 2025 to 2028, and PAL 2 has shifted from 2035 to 2038. Because planning activity levels are based on demand rather than specific years, the shift of associated years demonstrates the ability of the planning activity level to be responsive to changes in aviation demand, in this case caused by the COVID-19 Pandemic.

As more people have been vaccinated in the United States, public health restrictions have been relaxed, and people have resumed leisure travel and some business travel. In response to strong demand, Southwest Airlines is planning to operate 90% of their pre-pandemic systemwide capacity during summer 2021, and other U.S. airlines are planning to operate 70% to 90% of pre-pandemic capacity. The surge in demand and the airlines' capacity deployment is a testament to the recovery underway.

3 Overview of the Catchment Area

Demand for aviation activity is derived demand related to economic and demographic development of the airport's catchment area, as well as economic and demographic conditions in source markets of destination traffic. This chapter addresses OAK's catchment area.

3.1 Commercial Activity Catchment Area

OAK is located on the, "East Bay," side of the highly competitive Bay Area region. The Bay Area includes the cities of San Francisco, Oakland, and San Jose, as well as the surrounding suburbs. In the Bay Area, there are three commercial airports: two medium hubs, OAK and Norman Y. Mineta San Jose International Airport ("SJC") and one large hub airport, San Francisco International Airport ("SFO") as shown on Figure 3-1. OAK is located approximately 10 miles south of Downtown Oakland, 20 miles east of San Francisco, and approximately 30 miles northeast of San Francisco International Airport. In Calendar Year ("CY") 2019 SFO served 28.7 million enplaned passengers, while OAK and SJC served 6.7 million and 7.8 million enplaned passengers, respectively.

Figure 3-1 Bay Area Airports

The Bay Area is comprised of four regions, Wine Country, the East Bay, the South Bay, and the counties of Marin, San Francisco, and San Mateo. As illustrated in Figure 3-2, OAK is the most convenient airport in terms of time and distance to the East Bay and Wine Country regions. These regions have a population base of 4.2 million inhabitants. The East Bay is largely comprised of Alameda and Contra Costa counties, while the Wine Country includes Napa, Sonoma, and Solano counties. The South Bay, which has a population of 1.9 million, includes Santa Clara County, where SJC is the most convenient airport. Lastly, Marin, San Francisco, and San Mateo counties have easiest access to SFO. The combined population of Marin, San Francisco, and San Mateo Counties is 1.9 million.

Figure 3-2 OAK Commercial Operations Catchment Area

A consumer's choice of airport in the Bay Area is also defined by the availability and convenience of air service at the region's airports. Table 3-1 presents air service available at the Bay Area's three primary airports as well as smaller airports located within approximately 100 road miles of OAK. Historically, air service at OAK has been primarily domestic with a broad portfolio of non-stop routes and airlines serving U.S. markets. Of the competitive airports, it is most similar in size and air service to Sacramento Metropolitan Airport ("SMF") and SJC. While SJC is located in the Bay Area, SMF's service area is primarily the City of Sacramento. SFO is a larger airport with significantly more international air service as well as service to a variety of smaller domestic markets that are available as a result of United Airlines' hub operation there. Charles M. Schulz Sonoma County, Modesto City-County, and Monterey Regional airports are located on the periphery of the Bay Area and have significantly more limited air service.

Table 3-1 Commercial Air Service at Airports in and around the Bay Area CY 2019

Airport	Code	Road Miles from OAK (a)	Typical Drive Time from OAK (a)	Number of Airlines (b)	Non-stop Domestic Destinations (b)	Non-stop International Destinations (b)	Average Daily Departure Seats (b)
Oakland International	OAK	--	--	16	56	14	23,483
San Francisco International	SFO	31	35m	54	91	53	93,846
Norman Y. Mineta San Jose	SJC	34	45m	15	46	10	27,838
Charles M. Schulz Sonoma County	STS	76	1h 22m	4	11	--	858
Modesto City-County	MOD	78	1h 35m	--	--	--	--
Sacramento Metropolitan	SMF	96	1h 36m	15	41	4	22,157
Monterey Regional	MRY	106	1h 50m	4	7	--	871

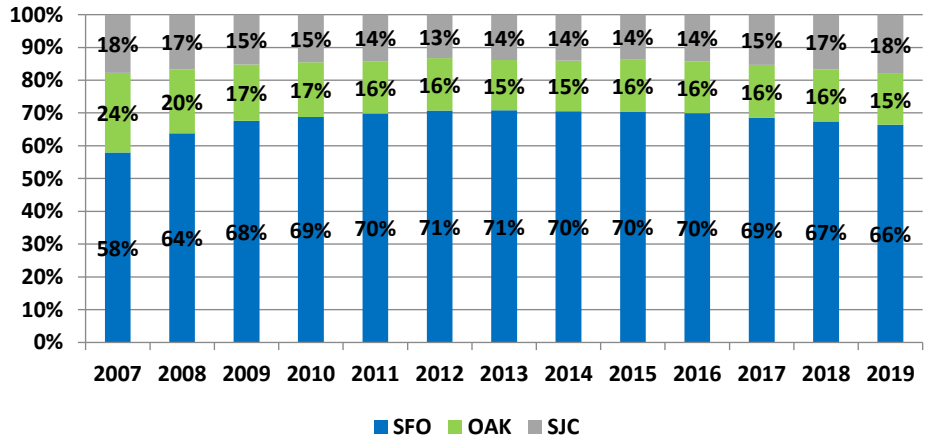
Source: (a) Mapquest.com, (b) Innovata Schedule Data

3.2 OAK's Share of Bay Area Passengers

In CY 2019, OAK accommodated 15% of the Bay Area's passenger traffic. The proximity of alternative airports in the Bay Area results in passengers having three airports from which to choose as discussed in the previous section. Typically, passengers select airports based on proximity to home, work, or their destination; ease and speed of ground access; and availability of convenient and competitively priced flights.

At its peak in 2007, OAK's share of the total Bay Area passenger traffic was 24%, as shown in Figure 3-3, however, OAK's share of passenger traffic has since remained below 2007 levels. Inversely, from 2007 to 2019, SFO has increased its share of Bay Area traffic by 8 percentage points, however, SFO's share of the Bay Area passengers is down from its peak in 2012 and 2013 of 71%.

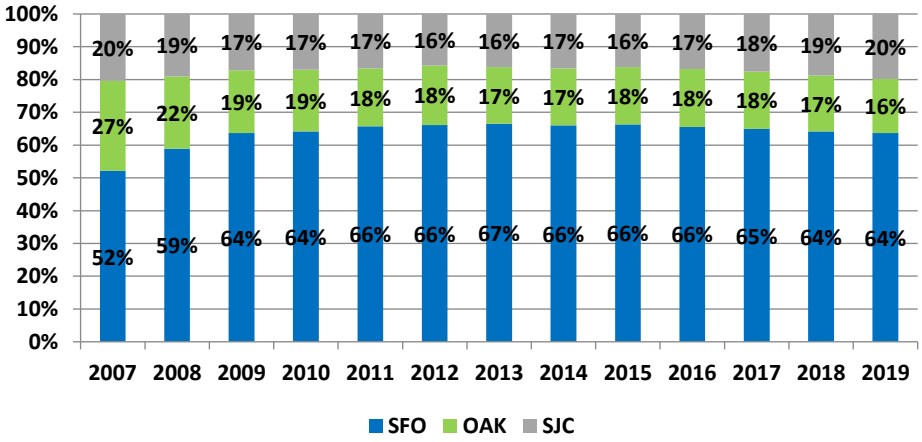
Figure 3-3 Share of Bay Area Passenger Total Traffic, CY 2007 – 2019



Source: Airport Statistics Data; US DOT T100

Compared to total passenger traffic, both OAK and SJC have historically had larger shares of the Bay Area's Origin and Destination ("O&D") passengers. This is because SFO accommodates a larger share of connecting passengers among Bay Area airports as it is a United Airlines hub and the Bay Area's primary International gateway. As shown in Figure 3-4, OAK had a 16% share of O&D passengers in 2019, down 11 percentage points from its 2007 peak of 27%. OAK's share of O&D has remained below 20% since the Global Financial Crisis of 2008-2009.

Figure 3-4 Share of Bay Area O&D Traffic, CY 2007 – 2019



Source: US DOT O&D Survey and Sabre MIDT

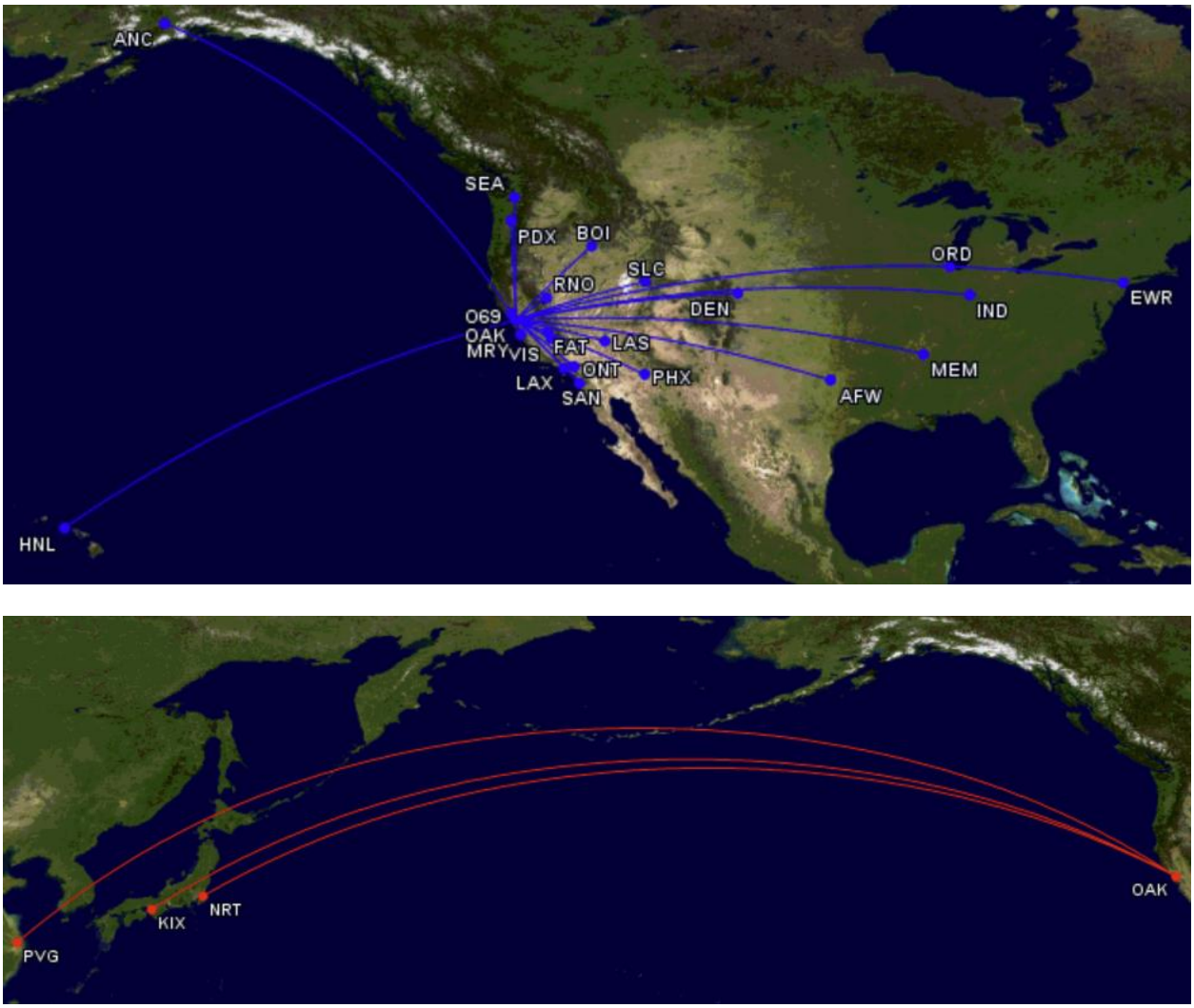
During the Global Financial Crisis of 2008-2009, SFO's share of O&D passengers increased from 52% in 2007 to 64% in 2009. During this period, new entrant Virgin America began service at SFO and JetBlue Airways and Southwest Airlines shifted flights from OAK to SFO as a competitive response to Virgin America. SFO hub carrier United Airlines also added service to compete with Virgin America. These capacity decisions caused Bay Area O&D passenger share at SFO to increase to a peak in 2013 of 67%. Since 2013, SFO's share has decreased by 3 percentage points to 64% in 2019.

SJC's share of the region's O&D passenger was 20% in 2019, back to their pre-recession levels. In 2019, OAK's share of Bay Area O&D passengers has been negatively impacted by the grounding of the Boeing 737 MAX aircraft that caused Southwest Airlines and American Airlines to reduce planned capacity throughout their US network including at OAK.

3.3 OAK Cargo Demand

Demand for origin and destination of commercial cargo traffic is based on the specific needs of the local base of shippers, businesses, and pilots. In addition, there may be significant influences of external regions and carrier strategies driving air cargo demand at an airport. FedEx is the largest freight airline at OAK, where it operates its west coast regional hub as shown on Figure 3-5. The FedEx operation is dependent on local demand of origin and destination freight, as well as influenced by the broader FedEx network demand and system strategies. Figure 3-5 represents the route system of FedEx airport markets connected to the OAK regional hub. UPS is the second largest freight airline at OAK, but its operation is focused on serving the local demand with its regional hub located at Ontario International Airport in the Los Angeles basin. Note that both FedEx and UPS have sortation facilities at Anchorage International Airport ("ANC"). They also strategically use ANC, as needed, as a technical stop for fuel between North America and Asia.

Figure 3-5 OAK FedEx West Coast Regional Hub Catchment Area



Sources: U.S. DOT Schedule T-100 data; Landrum & Brown analysis; Great Circle Mapper

In 2019, 642,405 tons of cargo was handled at OAK. Of the total freighter cargo, FedEx handled about 79%, and UPS handled 21%. Approximately 89% of cargo handled at OAK was domestic, while approximately 11% was international. Approximately 98% of cargo at OAK was accommodated on freighter aircraft, while approximately 2% was accommodated in the belly compartment of passenger aircraft.

In contrast to OAK, FedEx and UPS service to SFO and SJC pursue distinct strategies that make them both competitive and complementary to OAK. UPS does not serve SFO at all, and FedEx operates only a direct service from SFO to its hub at Memphis. FedEx handles a significant amount of international cargo transferred at SFO from other airlines' as belly cargo. SFO reported 601,862 ton of cargo and mail in 2019, of which 72% was belly cargo and 65% was international cargo. United Airlines is by far the largest cargo carrier at SFO.

SJC has limited cargo services by FedEx and UPS focused on O&D cargo. SJC handled approximately 53,000 tons of cargo in 2019, of which 76% was domestic and 68% was handled on freighter aircraft. FedEx handled 40% and UPS handled 28% of the 2019 cargo tonnage at SJC.

3.4 General Aviation Catchment Area

The catchment area for OAK's general aviation ("GA") activity represents the local population and economy that is assumed to support the Airport as the main source driving demand for these segments of aviation activity.

The Airport's GA catchment area is more limited by the numerous competing nearby airports shown on Table 3-2 that accommodate civil aviation demand, whereas the catchment area for the commercial forecasts is larger and affected by several other factors including: fewer competing airports, airline mix, airfares, market frequency, and the number of passenger markets served. GA operations are often split into two categories, "Heavy GA," operations that typically includes business aviation operations on larger aircraft including jets, and light GA operations that includes smaller aircraft favored by owner-operators and flight schools. Passengers flying via large business aviation are time sensitive and price inelastic and tend to choose an airport based on proximity or convenience, while smaller GA operators are typically more price sensitive and select an airport based on price of landing fees, fuel flowage fees, and facilities rentals. As shown on Table 3-2, OAK ranks seventh in GA activity among the twelve airports in the Bay Area. As such, OAK's catchment area for GA activity is more limited than the catchment area for commercial air service.

Table 3-2 General Aviation Airports in and around the Bay Area

Airport	Code	Road Miles from OAK (a)	Typical Drive Time from OAK (a)	FFY 2019 GA Operations (b)
Oakland International	OAK	--	--	80,273
San Francisco International	SFO	30	31m	11,135
Norman Y. Mineta San Jose International	SJC	33	38m	36,248
Hayward Executive Airport	HWD	10	18m	109,865
Livermore Municipal Airport	LVK	24	27m	151,371
San Carlos Airport	SQL	26	30m	70,281
Buchanan Field Airport	CCR	30	31m	92,589
Palo Alto Airport	PAO	29	35m	154,225
Reid-Hillview Airport	RHV	39	42m	196,632
Napa County Airport	APC	46	53m	40,066
Byron Airport	C83	49	1h 3m	83,000
Sonoma County Airport	STS	74	1h 15m	69,822

Sources: (a) Google Maps; (b) FAA TAF

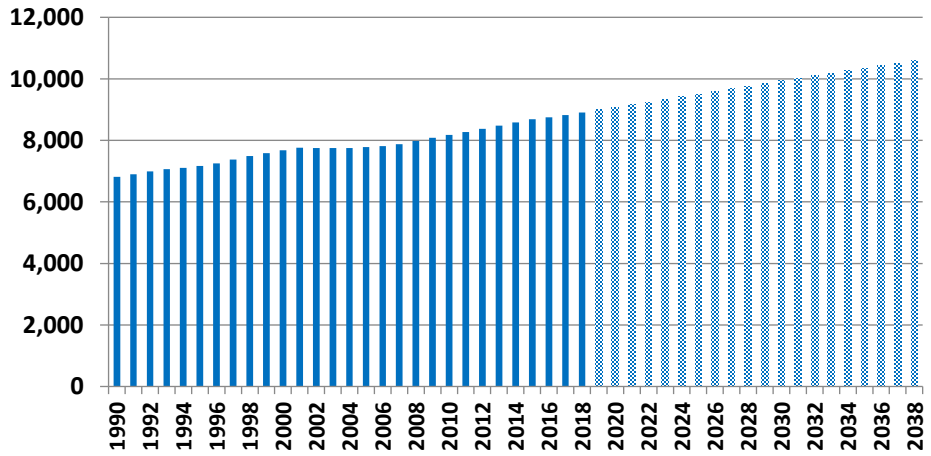
4 Catchment Area Demographics and Economy

The data presented in this section reflects the historical changes in socioeconomic variables that may impact demand for aviation activity at OAK and the historical aviation data from the Airport. This data provides the context for understanding historical trends and potential correlations between aviation traffic and the variables discussed for passenger activity, air cargo and GA.

4.1 Population

As of 2018, the Bay Area's total population reached 8.9 million residents, achieving a 1.0% growth per annum since 1990 as shown on Figure 4-1. For the past decade however, the region's population increased at a slightly higher rate of 1.1% annually. Population projections for the Bay Area estimate the region will increase by 1.7 million residents by 2038 to 10.6 million people, or at an average annual rate of 0.9% per annum. A growing population drives the potential pool of travelers and is an indicator for future demand level.

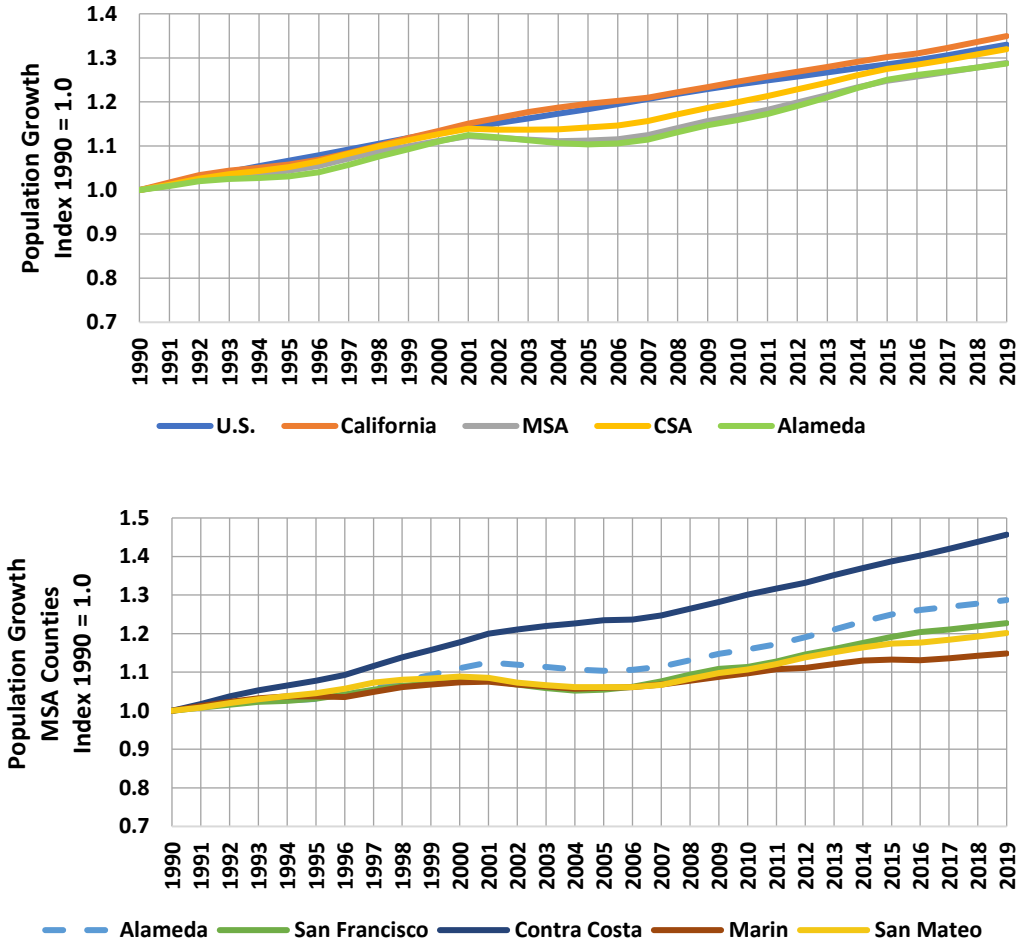
Figure 4-1 Bay Area Population (CY 1990-2038, thousands)



Source: Woods + Poole 2019

Since 2009, the population of the San Francisco-Oakland-Berkeley increased at an average growth rate of 1.1% reaching an estimated 4.8 million people in 2019. The MSA population is forecast to increase to an estimated 5.3 million in 2038, representing an average growth rate of 0.6% during the forecast period. The following index charts in Figure 4-2 show a comparison to broader and narrower population bases, with the MSA population growing at a very similar pace to the U.S., California, the San Jose-San Francisco-Oakland, CA combined statistical area (CSA) and Alameda County.

Figure 4-2 Population Comparisons, CY 1990 – 2019

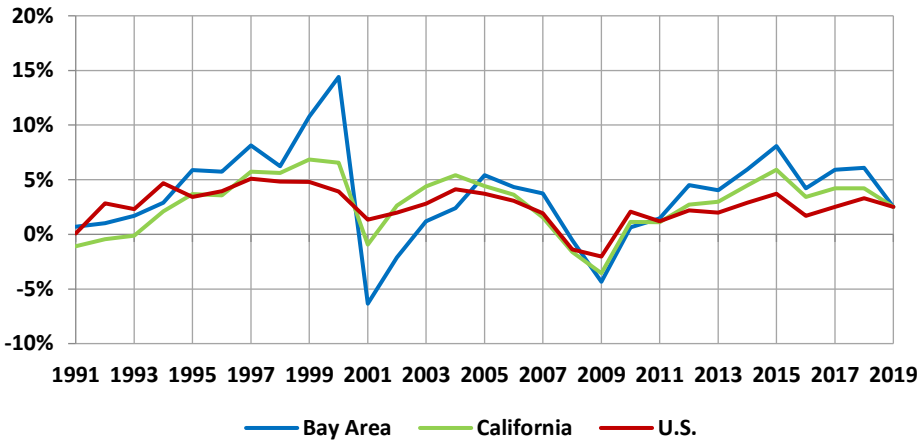


Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2019; Landrum & Brown

4.2 Economy

The San Francisco Bay Area is a hub of economic activity, and home to a diverse range of industries. San Francisco is the center of the region's financial and tourism industry; the East Bay (including Oakland) enjoys a diversified economic base discussed further below; San Jose is the heart of Silicon Valley and technology industry; and lastly the North Bay is a major player in agriculture and wine industry. Given these diverse economic sectors, the Bay Area has experienced ten years of increases in Gross Regional Product between 0.7% and 8.1% since 2009. Following the 2008-2009 Economic Recession, the Bay Area's economy rebounded at a faster rate than both the U.S. and the California economies, as shown in Figure 4-3.

Figure 4-3 Year-Over-Year Change in GRP (CY 1990-2019)



Source: Woods + Poole 2019

As previously mentioned, the Bay Area has a diversified economy where no sector accounts for more than 12.1% of employment as shown in Table 4-1. The economy of the East Bay is among the most diverse of the Bay Area's economies having broad base of employers from the Technology, Health Care, and Services sectors. Oakland's catchment area is home to two national labs, the University of California at Berkeley, Safeway, Kaiser Permanente and the Tesla automobile manufacturing plant, which is the largest manufacturing plant West of the Mississippi.

Table 4-1 Bay Area Employment by Sector

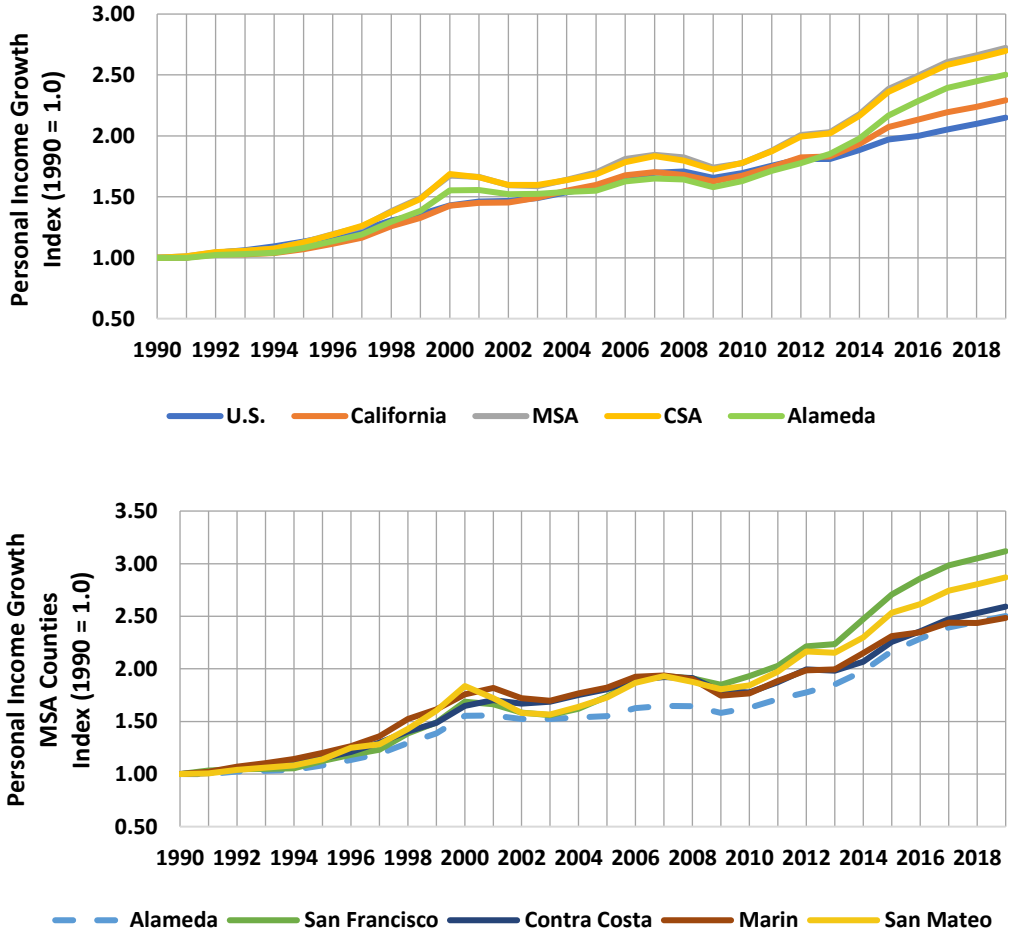
Employment Sector	Share
Professional & Technical Services	12.1%
Health Care & Social Assistance	10.9%
Retail Trade	8.4%
State & Local Government	8.3%
Accommodation & Food Services	7.6%
Manufacturing	6.9%
Administration & Waste Services	5.9%
Other Services Except Public Admin	5.3%
Construction	5.0%
Real Estate	4.9%
Finance & Insurance	4.7%
Transportation & Warehousing	3.5%
Information	3.5%
Wholesale Trade	3.3%
Educational Services	3.1%
Arts, Entertainment & Recreation	2.5%
Other	4.1%
Total	**100.0%**

Source: Woods + Poole 2019

Demand for air travel and for goods movement by air is very dependent upon financial ability of businesses and individuals. Increased economic output, wages, and disposable income generally lead to greater opportunity to choose air travel over traveling or transporting goods by ground. Since 2009,

personal income in the MSA has increased at an average growth rate of 4.6% per annum, reaching almost $426 billion (2012 USD) in 2019. The higher growth rate in personal income compared to employment indicates potential for higher levels of disposable income if inflation is stable. Personal income growth is forecast to continue to outpace employment growth at a rate of 1.8% per year through 2038, reaching nearly $595 billion (2012 USD). The following growth index charts suggest that the MSA personal income levels have been growing slightly faster than those of California and the United States. Alameda County, however, has been experiencing growth in personal income at a slightly slower pace than most of the counties in the MSA.

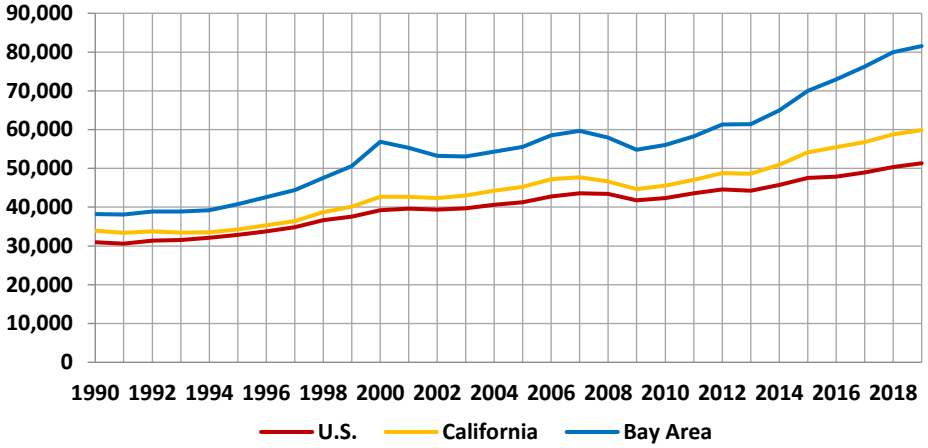
Figure 4-4 Personal Income Comparisons



Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2019; Landrum & Brown

The San Francisco Bay Area is an affluent community in which per capita personal income ("PCPI") is higher than that of both California and the United States average as shown on Figure 4-5. Per capita personal income corresponds to the average income per inhabitant and is calculated by dividing total income by total population. In 2019, the regions personal income per capita was 59% and 36% higher than the United States and California, respectively.

Figure 4-5 Total Personal Income Per Capita (2012 $, CY 1990-2019)

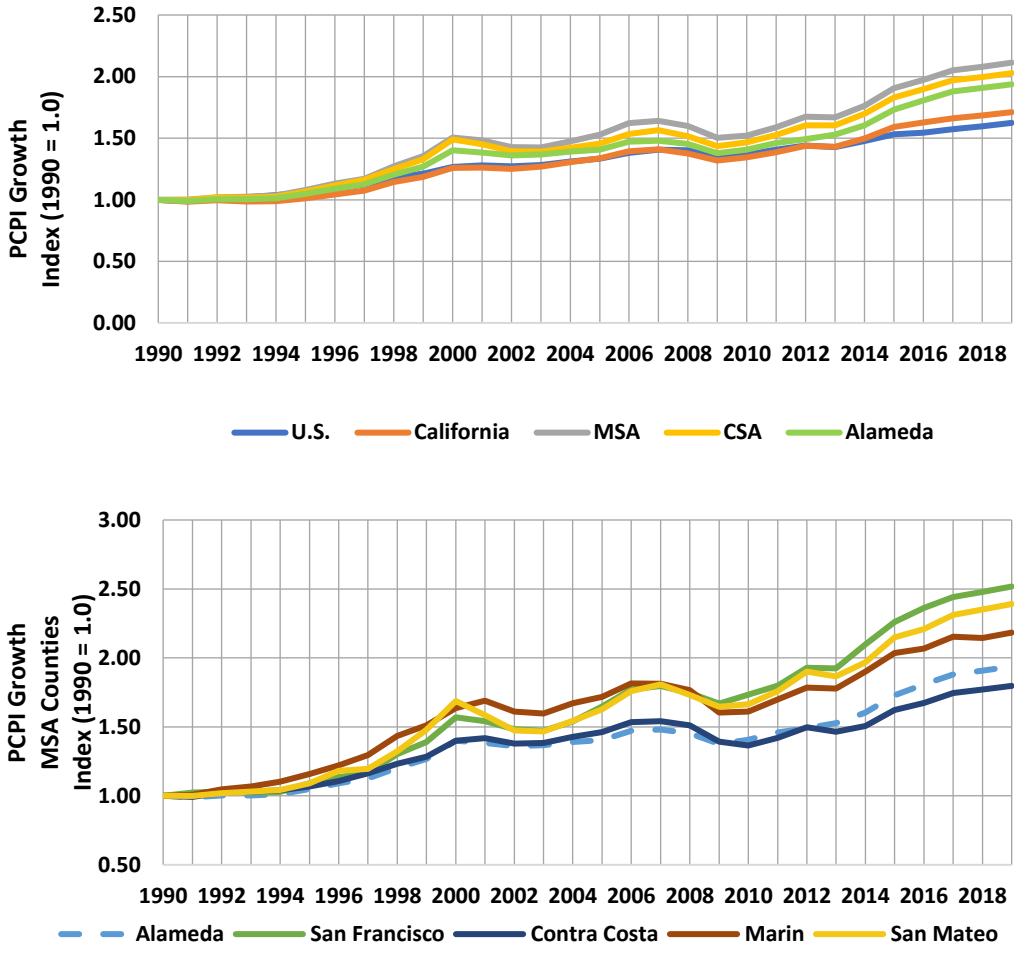


Source: Woods + Poole 2019

Income in the Bay Area has also increased at a faster rate from 1990 to 2019 at 2.6% per annum compared to 1.7% and 1.8% for the United States and California, respectively. While the Bay Area experienced higher cyclicality during the dot-com bubble burst in 2000-2001, and the Global Financial Crisis of 2008-2009, the diversification of the economy in recent years is expected to result in less cyclicality in the future.

Since 2009, PCPI in the MSA has increased at an average rate of 3.5% per annum. PCPI is forecast to increase from an estimated $88,798 (2012 USD) in 2019 to $111,393 in 2038, representing a modest growth rate of 1.2% annually. The following growth index charts show the MSA leading the broader regional groups with Alameda County near the median point, still growing slightly faster than California and the U.S. At the county level in the MSA, Alameda and Contra Costa counties are trailing the other counties in PCPI growth.

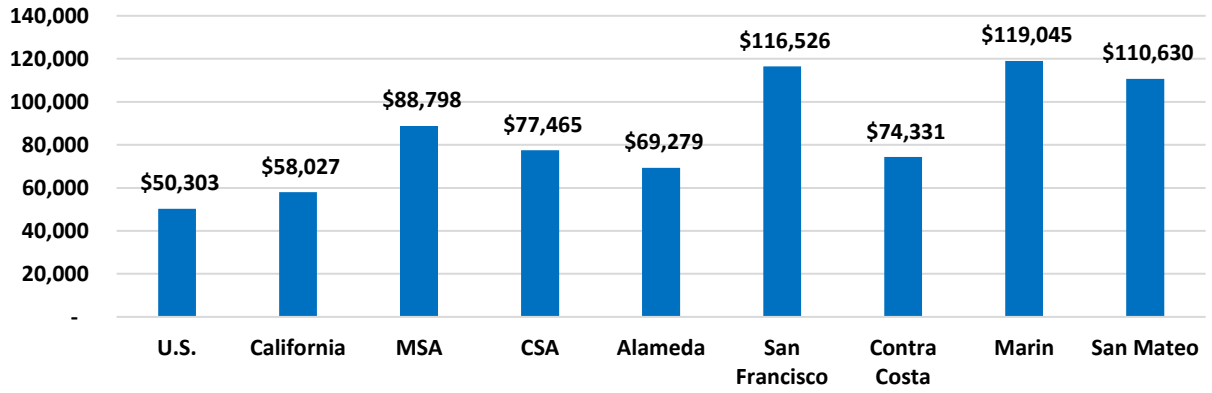
Figure 4-6 Personal Income per Capita Comparisons, CY 1990-2019



Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2019; Landrum & Brown

As a further comparison of PCPI in counties within the MSA, Figure 4-7 shows the MSA to have a higher average PCPI than Alameda County where the Airport is located, and Contra Costa County, but notably lower than the three other counties in the MSA.

Figure 4-7 2019 Estimated Average PCPI (in 2012 USD)



Sources: Woods & Poole, The Complete Economic and Demographic Data Source (CEDDS) 2019; Landrum & Brown

4.3 Fuel Prices

All the listed socioeconomic variables or demand drivers project some growth. Fuel prices are generally expected to keep pace with growth in U.S. Gross Domestic Product ("GDP") and inflation, not causing any significant deterrent to GA traffic growth. Spikes or unexpected significant increases to jet fuel or Avgas could certainly decrease the probability of growth as predicted in these forecasts. Other than higher fuel prices, increases to airport usage fees, taxes, and aircraft maintenance and purchase prices could also limit growth at OAK, especially in the general aviation segment.

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% 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 per barrel.

Around July 2014, the price of crude oil began to drop significantly, and during 2015-2016 the U.S. dollar gained strength and oil prices reached a bottom of nearly $36 per barrel in April 2016. In January 2019, Energy Information Administration ("EIA") released their long-term energy outlook, which projected the price of oil, adjusted for inflation, to reach $98 per barrel by the end of 2039 (in 2018 U.S. Dollars). In the 2018 outlook, the EIA had estimated the 20-year projection slightly higher, at about $101 per barrel for 2038 (in 2017 U.S. Dollars). In 2020 from February through May, the cost of fuel fluctuated with the COVID-19 pandemic and looks to have smaller influences on aircraft operating costs in the near term, with significant changes in supply and demand due to the pandemic. Future costs are expected to increase slower than previous forecasts influenced by increased oil production levels globally. The 2020 EIA long-term energy outlook now estimates $86 per barrel by 2040 (in 2019 U.S. Dollars) up from $36 per barrel observed at the end of May 2020.

5 OAK Facilities and Historical Activity

5.1 OAK Historical Passenger Activity and Airline Service

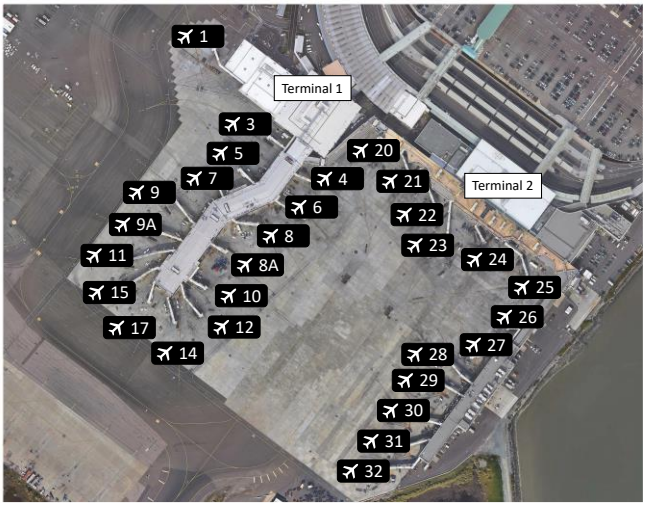
Owned and operated by the Port of Oakland, OAK is the fifth largest airport in California. The Airport, which is located roughly 10 miles south of Downtown Oakland, covers 2,600 acres and has four runways as shown on Figure 5-1. The Airport can be divided into the South Field, shown at the left of the image below, which has one 10,000 feet runway along with the commercial passenger and cargo facilities, and the North Field at the right of the image below, which has three runways (6,212; 5,458; and 3,376 feet) along with the Airport's GA facilities. The South Field primarily serves commercial aviation operations, while the North Field primarily serves GA operations.

Figure 5-1 Aerial View of Oakland International Airport

Sources: Google

OAK has two passenger terminals, Terminal 1 and Terminal 2, that each have unique check-in and baggage claim facilities, but are connected post security as seen in Figure 5-2. In total, there are 29 gates at OAK. Southwest Airlines operates from Terminal 2 and utilizes gates in Terminal 1 while all other airlines operate from Terminal 1. Federal Inspections Services are available in Terminal 1.

Figure 5-2 OAK Terminal Map



Source: Google Earth, Oakland Airport

5.1.1 Airline Service

Airlines that serve OAK provide passenger services to cities in the United States, Mexico, and the Azores, Portugal. As of CY 2019, OAK had service to 62 markets, of which, 55 are domestic points and 7 are international. Additionally, OAK had nonstop service to 21 of the 30 large hub airports in the United States including 26 of the 50 states. OAK's non-stop service is largely focused West of the Mississippi River, resulting in underrepresentation in eastern markets. In 2019, OAK had service to seven markets in Mexico including one business market (Mexico City), three visiting friends and relatives (Guadalajara, Leon/Guanajuato, and Morelia) and two leisure markets (Puerto Vallarta and Los Cabos) as seen in Figure 5-3.

Figure 5-3 Oakland International Airport Service Map

Source: Innovata Schedule Data, CY 2019

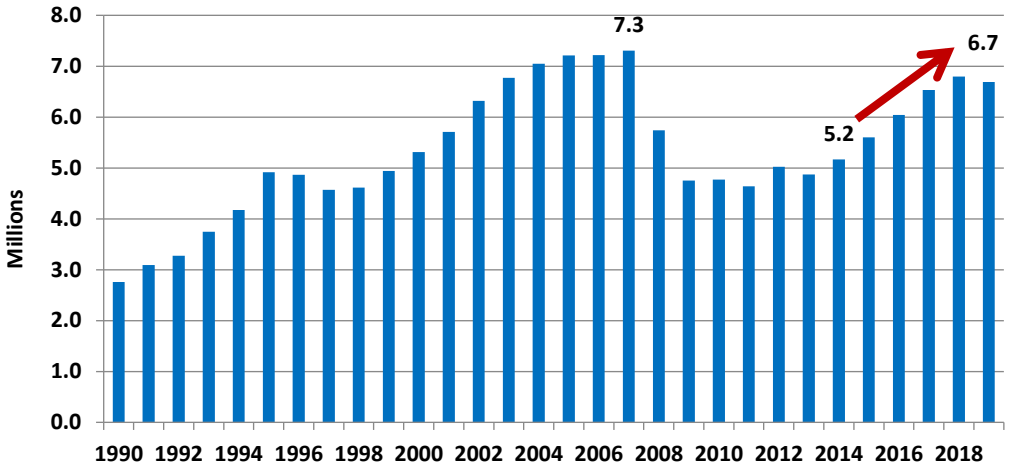
5.1.2 Passenger Development

In 2019, OAK served 6.7 million enplaned passengers as shown on Figure 5-4. While this remains below the record levels of 2007, enplanements have increased 30% since 2014. After experiencing relatively steady passenger growth between 1990 and 2007, Oakland was impacted by the Global Financial Crisis, during which the airport saw enplanements decrease by 21.5% and 17.2% in 2008 and 2009, respectively. While all Medium Hub airports were negatively impacted by the economic recession, OAK experienced one of the most significant declines because there was a shift in capacity from OAK to SFO by Southwest and JetBlue.

While OAK's traffic recovery following the Global Financial Crisis was muted by airline network planning decisions, the Airport's passenger performance following September 11, 2001 was considerably more robust. OAK's traffic never decreased following September 11, 2001, and continued to increase for the succeeding six years, unlike what was experienced at most airports, which experienced a multi-year recovery. Much of OAK's growth during this time was due to Southwest, which continued to add capacity while other airlines were shrinking.

Between 2010 and 2013, traffic at the Airport stabilized, and from 2014 through 2018, passenger traffic at the Airport experienced a period of continued growth. In 2019, passenger traffic at OAK decreased slightly largely as a result of the Boeing 737 MAX grounding. From 2014 through 2019 passenger traffic increased an average of 5.3% per annum, and from 1990 through 2019, OAK's enplaned passenger traffic increased an average of 3.1% annually.

Figure 5-4 Historic OAK Annual Enplaned Passengers (CY 1990-2019)



Source: Airport website

5.1.3 Seat Capacity

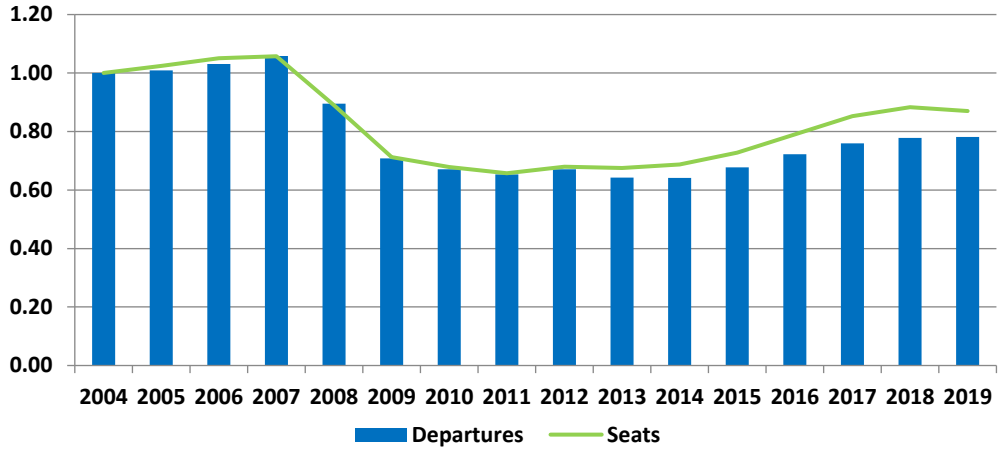
Similar to passenger traffic, departures and seat capacity at OAK also peaked in 2007 as shown on Figure 5-5. While departures and seats decreased from 2007 to 2008, they did so at a slower rate than passenger traffic, shrinking by 15% and 16%, respectively, compared to enplaned passengers which declined by 21.5%. Following the Global Financial Crisis and higher fuel prices, the U.S. carriers entered into a period of capacity discipline. Southwest accounted for 28% of the decrease in seat departures between 2007 and 2008. This was related to both the economic recession and a shift in Southwest's Bay

Area strategy by adding capacity at SFO in addition to OAK and SJC. Additionally, JetBlue moved capacity to SFO from OAK between 2007 to 2008.

Since 2014, departing seat capacity has increased 4.8% per annum. Seats increased faster than flight departures due to the use of larger aircraft as Southwest Airlines and other airlines increased the gauge of aircraft serving OAK. Additionally, airlines serving OAK have more than doubled the number of non-stop destinations served from 2011-2019.

In 2019, passenger traffic at OAK was negatively impacted by the Boeing 737 MAX grounding. Several airlines, including Southwest Airlines and American Airlines, were the most affected by the global grounding as they have the largest numbers of these models in their fleets. As a result, American Airlines delayed the expansion of service from OAK to Dallas/Fort Worth International Airport, and Southwest Airlines paused its planned expansion of capacity at OAK. The impact of the Boeing 737 MAX grounding on passenger traffic at OAK in 2018 is estimated to be 400,000 annual passengers, inclusive of enplaned and deplaned passengers. The Port expects this capacity and traffic to be recovered rapidly following the recertification of the Boeing 737 MAX.

Figure 5-5 Index of Historic Schedule Data at OAK (CY 2004-2019)

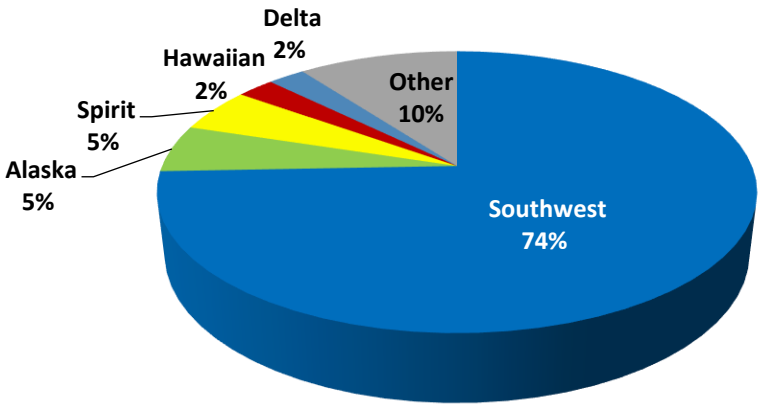


Source: Innovata Schedules, Calendar Year; Indexed to 2004

5.1.4 Airline Market Share

OAK is served by 16 carriers, the largest of which is Southwest Airlines with a 74% share of seat capacity as shown in Figure 5-6. As the dominant carrier, Southwest offered an average of 115 daily departures in 2019, with a majority of its service to other points in the western United States. During the airport's 2007 peak, Southwest had an average of 138 daily departures. Alaska Airlines is OAK's second largest carrier with a 5% share, primarily serving the Pacific Northwest and Hawaii. Spirit Airlines, which also accounts for 5% of the airports seat capacity and has been growing rapidly at OAK since they entered the market in 2011. The carrier now serves 5 markets. Lastly, Delta and Hawaiian each have a 2% share of OAK's seat capacity, collectively serving 3 markets each.

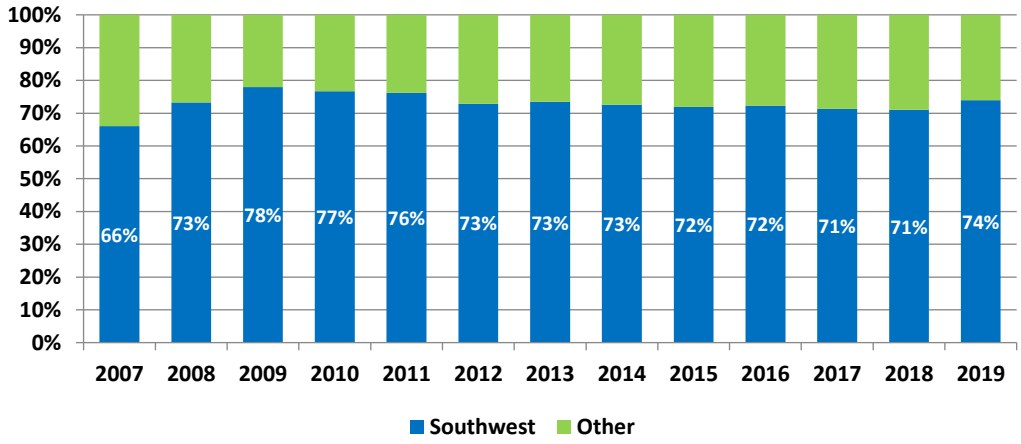
Figure 5-6 Carrier's Share of OAK's Seat Departures (CY 2019)



Source: Innovata Schedule Data

Southwest has historically made up a majority of OAK's departing seat capacity, peaking in 2009 with 78% as seen in Figure 5-7. While the carrier's share has been consistently in the low 70's since 2012, Southwest's share of capacity reached a seven-year high of 74% in 2019. Although this remains below its peak in 2009, Southwest's absolute number of seats at OAK has increased from 5.5 million in 2009 to 6.4 million in 2019, or at an average annual rate of 16.2%.

Figure 5-7 Southwest's Share of Seat Departures (CY 2007-2019)



Note: 2019 is based on published schedules throughout the end of the year. Data was pulled on August 26, 2019.
Source: Innovata Schedule Data

Southwest's dominance and importance at OAK is evident by the fact that the carrier serves 35 of the 55 non-stop, domestic markets from OAK. Additionally, OAK is an important part of Southwest network; the airport is currently one of the carrier's first two gateways to Hawaii. Furthermore, in 2017, Southwest introduced international service to two Mexican destinations, making OAK one of 21 airports on Southwest's system that has international service.

5.1.5 O&D Passenger Markets

The Bay Area generates a large demand for O&D passengers, passengers who begin or end their trip in the Bay Area, and the region's growing economy provides strong potential for continued growth. Los Angeles is currently OAK's largest O&D market, making up over 27% of the airport's total O&D passengers. While Los Angeles is also served nonstop from SFO and SJC, local passengers typically choose to use the most convenient airport as opposed to the largest. OAK's largest O&D markets, as seen in Table 5-1 reflect airline service at the airport as all 20 markets are served non-stop.

Table 5-1 OAK's Top 20 Domestic O&D Markets (CY 2019)

Rank	Market[1]	Code	Nonstop Miles	O&D Passengers	Average Fare	Share of Total
1	Los Angeles	LAX	336	2,994,350	$98	27.4%
2	Las Vegas	LAS	406	927,888	$74	8.5%
3	San Diego	SAN	447	779,624	$99	7.1%
4	Seattle	SEA	671	615,137	$114	5.6%
5	Phoenix	PHX	644	515,632	$121	4.7%
6	Portland	PDX	543	455,598	$106	4.2%
7	Salt Lake City	SLC	587	311,989	$121	2.9%
8	Honolulu, Oahu	HNL	2,406	303,907	$193	2.8%
9	Denver	DEN	955	300,821	$144	2.8%
10	Kahului, Maui	OGG	2,346	275,408	$189	2.5%
11	Houston	HOU	1,638	251,385	$152	2.3%
12	Chicago	CHI	1,831	240,989	$165	2.2%
13	Washington, D.C.	WAS	2,402	181,727	$205	1.7%
14	Lihue, Kauai	LIH	2,453	165,349	$234	1.5%
15	Dallas-Fort Worth	DFW	1,452	160,373	$157	1.5%
16	Albuquerque	ABQ	886	157,361	$141	1.4%
17	New York	NYC	2,568	133,307	$181	1.2%
18	Atlanta	ATL	2,124	131,489	$198	1.2%
19	New Orleans	MSY	1,899	115,133	$181	1.1%
20	Kona, Hawaii	KOA	2,376	106,830	$206	1.0%
	Other			1,805,333	$171	16.5%
	Total			**10,929,631**	**$130**	**100.0%**

Note: 1/ O&D markets are on a city-to-city basis and the following cities include multiple airports: Los Angeles (BUR, LAX, LGB, ONT, SNA), Phoenix (AZA, PHX), Houston (HOU, IAH), Chicago (MDW, ORD), Washington, D.C. (BWI, DCA, IAD), Dallas-Fort Worth (DAL, DFW), New York (EWR, JFK, LGA, SWF),
Source: US DOT O&D Survey

Overall, OAK has a strong market that has been exhibiting significant increases since 2013 and will continue into the forecast period. Economic and demographic trends in the Bay Area are driving demand for passenger activity. The population and economy of the region are expanding and diversifying making the increases in economic activity and passenger activity sustainable over the forecast period.

- The location of OAK is closest to the most rapidly expanding parts of the Bay Area including the East Bay and Wine Country, and these circumstances are forecast to continue in the future.
- Since 2014, OAK's passenger traffic has increased 30%. In 2019, OAK accommodated 13.4 million passengers, which was 1.6% lower than 2018.
- Similarly, departure seat capacity has increased 27% since 2014. OAK has service to 70 markets, including 14 international markets.

- Southwest is the largest airline at OAK and is invested in growing the airport. Currently, OAK has service to Mexico and Hawaii on Southwest, both of which are new regions to the airline served non-stop from a limited number of markets. This demonstrates the importance of OAK to the Southwest Airlines network.

This underpinning of the OAK market is key to the activity forecast. Current market dynamics inform the short-term forecast and enhance the long-term forecast by providing insight into carrier strategy and long-terms trends among Bay Area airports.

5.2 OAK Historical Cargo and Freighter Operations

Air cargo traffic at OAK exhibited a 5.7% increase in 2017 reaching 620,832 tons and 7.1% increase in 2018 reaching 670,333 tons, but demand pulled back some in 2019 with a decrease of 4.2% to 642,405 tons. Freighter activity increased by 3.0% in 2017 reaching 19,246 operations, with a larger increase of 7.4% in 2018 with 20,671 operations and no real change in 2019 with 20,698 operations.

Air cargo activities at the Airport are consolidated mainly in the north end of the central terminal core consisting primarily of the 75-acre FedEx west coast regional hub, a UPS origin & destination gateway facility, the belly cargo building with adjacent apron parking, shared remote hardstands near the Oakland Maintenance Center (OMC). Figure 5-8 presents the general areas and major operators at OAK for cargo activities in December 2019.

Figure 5-8 OAK Cargo Areas

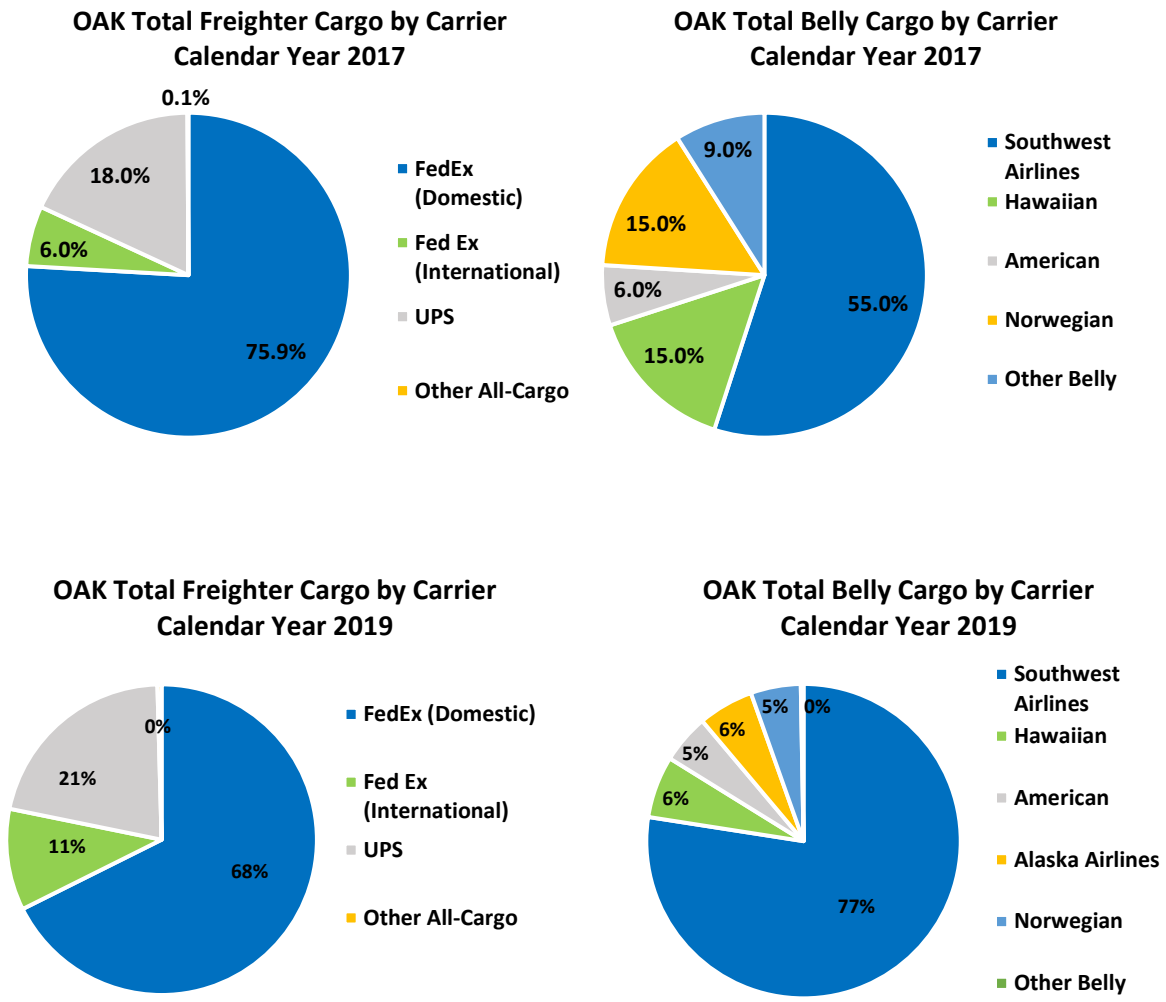
Sources: Google Earth imagery; Landrum & Brown

5.2.1 Historical Cargo Tonnage

Air cargo tonnage at the Airport is predominantly driven by all-cargo (freighter) operations, which transport only air cargo (freight and mail) and represented nearly 98% of total air cargo tonnage in 2019,

up from 97% in 2017. Belly air cargo at OAK, which transports air cargo (freight and mail) in the belly hold of commercial passenger aircraft, makes up the remaining share as seen in Figure 5-9.

Figure 5-9 2017 vs. 2019 Cargo Activity Splits



Sources: Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown

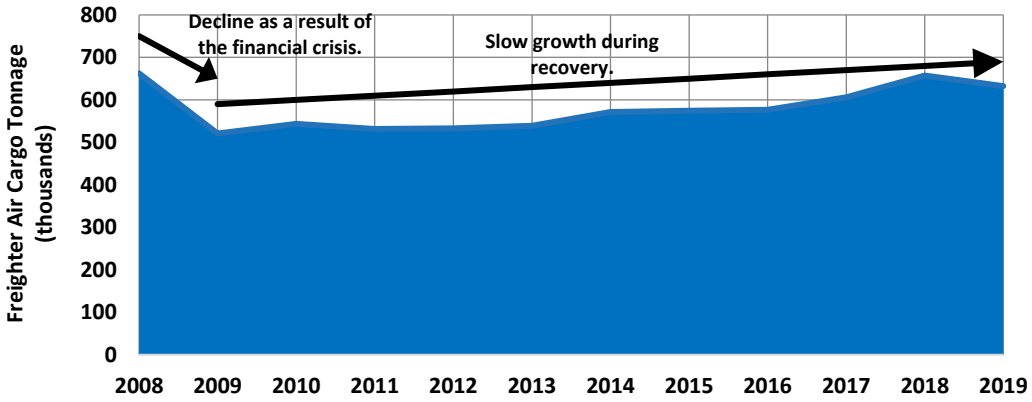
Freighter traffic at the Airport from 2017 to 2019 was mostly comprised of FedEx and UPS services with FedEx accounting for nearly 82% of the freighter operations and freighter cargo tonnages (loaded and unloaded) in 2017 but decreasing to 78% in 2019 with UPS exhibiting the most growth among all carriers at the Airport. Freighter cargo volumes at OAK decreased by 21.4% in 2009 following the global financial crisis, but since 2009, freighter air cargo volumes have increased at a compound annual growth rate ("CAGR") of 2.0%, reaching 632,727 tons in 2019.

Freighter cargo at OAK is mainly domestic with nearly 89% transported to or from domestic markets in 2019. International freighter air cargo has been increasing faster than domestic cargo, growing at an average rate of 7.4% per annum, as compared to its domestic counterpart at 1.7% per annum from 2009

to 2017. The international air cargo base is significantly smaller, which contributes heavily to the difference in growth rates.

Figure 5-10 presents a graphical history of freighter cargo tonnages at OAK up to 2019.

Figure 5-10 Freighter Cargo Tonnage History

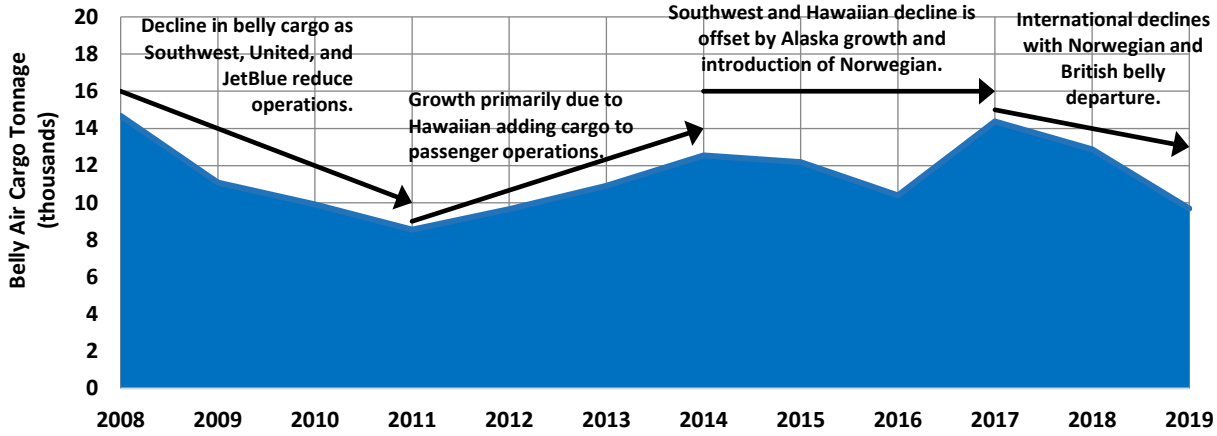


Sources: Airport Statistics; Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown.

Belly cargo declined at a rate of -16.5% per annum from 2008 through 2011 as Southwest Airlines, United Airlines, and JetBlue Airways decreased operations at the Airport. In 2012, Hawaiian Airlines began handling air cargo at the Airport, which helped to reverse the trend of losses in belly cargo. Hawaiian and Southwest airlines had reduced air cargo levels in 2015 and 2016, respectively, which were somewhat offset by Alaska and Norwegian cargo growth. Both Southwest and Hawaiian airlines showed increases in 2017 and total belly cargo was higher again in 2017 reaching 14,377 tons and nearly matching the tonnage from 2008. Among the commercial passenger airlines, most airlines are operating at levels below their 2008 activities, with only Southwest, Spirit, JetBlue, and Norwegian Air Shuttle that exhibited notable growth in scheduled operations at OAK from 2016 to 2018. In 2019, belly cargo retracted with the loss of Norwegian belly cargo services and the departure of British Airways.

Figure 5-11 presents a graphical history of belly cargo tonnages at OAK up to 2019.

Figure 5-11 Belly Cargo Tonnage History

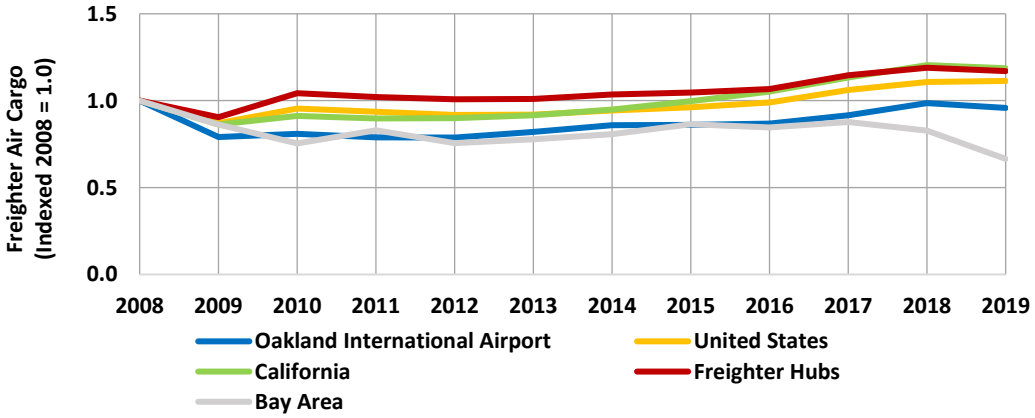


Sources: Airport Statistics; Diio, US DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown.

5.2.2 Freighter Air Cargo Benchmarks

Freighter air cargo market growth and magnitude of cargo volumes are dependent upon a number of factors that are partially related to the base demand of the region, and some that are more strategic in nature and linked to the geographic position and carrier route networks. OAK is a western U.S. regional cargo hub for FedEx; and therefore, processes large volumes of packages that connect to the rest of the U.S. and some international regions (mainly Asia). Freighter air cargo at OAK declined sharply in 2009, as did air cargo at most airports around the world due to the recession and world financial crisis. Despite the recession ending nearly ten years ago, freighter air cargo remains just below pre-recession levels at the Airport. This is consistent with the other Bay Area airports. Figure 5-12 compares freighter air cargo tonnages at OAK to other regions and categories to emphasize general growth or recovery potential.

Figure 5-12 Freighter Tonnage Comparison; Indexed: 2008=1.0

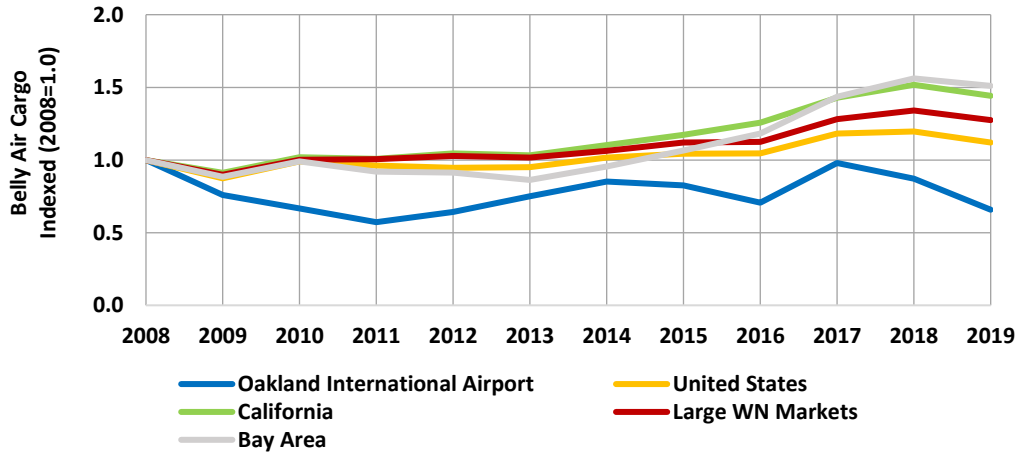


Note: Freighter Hub Benchmark Airports include the top 9 U.S. airports from 2019 (based on total air cargo) –MEM, ANC, SDF, LAX, MIA, ORD, JFK, IND, CVG; Bay Area – SFO, SJC
Source: Diio, U.S. DOT Reports Air Carrier Statistics Database (T-100).

5.2.3 Belly Air Cargo Benchmarks

Belly air cargo is linked to commercial passenger operations and the focus of the operating airlines on marketing cargo transport and utilization of belly hold capacity. Belly cargo at OAK declined sharply until 2011, before recovering to near 2008 levels later in 2017. Due to a decline in international belly cargo at the Airport, total belly cargo in 2019 was back down to the levels seen in 2010 to 2012. Belly cargo had been increasing at an average rate of 9.4% per annum from 2011 to 2017 and is still is trailing the growth at some other benchmarking airports. See Figure 5-13.

Figure 5-13 Belly Tonnage Comparison; Indexed: 2008=1.0



Note: Belly cargo benchmark airports "Large WN Markets" include the top 30 Southwest Airlines (WN) airports
Source: Diio, US DOT Reports Air Carrier Statistics Database (T-100).

5.2.4 Historical Freighter Operations

Dedicated freighter aircraft operations at OAK decreased by 26.6% in 2009 following general industry reductions after the global financial crisis. The freighter operations decrease was somewhat greater than the decrease in freighter cargo tonnage after 2009 as smaller increases in available capacity led to increased utilization and higher efficiencies among the remaining aircraft operations. Since 2009, freighter air cargo operations have increased at an average annual rate of 2.2%. The rate of growth for freighter aircraft operations is a little lower than the 2.0% rate of growth for freighter air cargo tonnage, supporting the assumptions of slightly higher load factors with larger aircraft. Freighter operations have historically been mainly domestic with 93% of total freighter traffic in 2019. Table 5-2 and Figure 5-14 provide a history of freighter cargo traffic at OAK from 2008 to 2019.

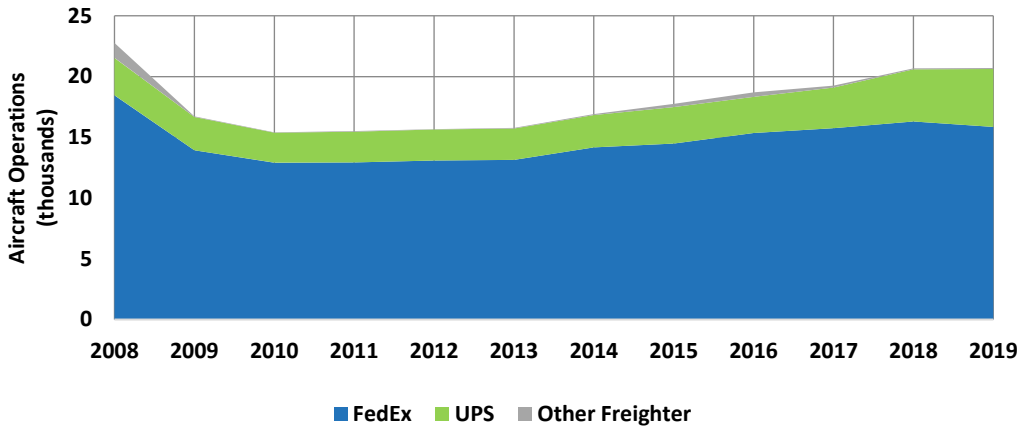
Table 5-2 Freighter Utilization History

	Freighter Tonnage (tons)			Freighter Operations			Average Tons per Operation		
Year	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total
2008	639,576	22,811	662,387	21,446	1,318	22,764	29.8	17.3	29.1
2009	499,740	21,147	520,887	16,280	432	16,712	30.7	49.0	31.2
2010	522,602	20,622	543,224	15,078	327	15,405	34.7	63.1	35.3
2011	509,982	21,519	531,501	15,140	360	15,500	33.7	59.8	34.3
2012	511,089	21,930	533,019	15,313	361	15,674	33.4	60.7	34.0
2013	515,171	23,540	538,711	15,357	428	15,785	33.5	55.0	34.1
2014	531,367	40,064	571,431	16,318	595	16,913	32.6	67.3	33.8

2015	542,399	31,740	574,139	17,293	455	17,748	31.4	69.8	32.3
2016	550,614	26,348	576,962	18,247	443	18,690	30.2	59.5	30.9
2017	569,697	36,758	606,455	18,685	561	19,246	30.5	65.5	31.5
2018	607,313	50,143	657,456	19,979	692	20,671	30.4	72.5	31.8
2019	589,545	43,182	632,727	20,078	620	20,698	29.4	69.6	30.6

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC).

Figure 5-14 Freighter Operations History



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC).

There are currently two flights per week flying to OAK by way of ANC from Asia. About one third of all FedEx outbound flights to Asia have a scheduled stop-over at ANC due to weight and range limitations of the aircraft. New and improved aircraft being used in the freighter fleet are reducing that need to stop over in ANC, so there will likely be increases in international air cargo freight due to the progression of more direct flights between Asia and OAK. Currently, flights to and from Asia by way of a stop-over in ANC are reported as domestic flights and domestic cargo tonnages. If this fully shifts in the future, there will be a small impact to the segment shares of domestic and international cargo.

5.3 OAK General Aviation Historical Operations

Typical GA activity includes recreational and flight training activities, business travel, news reporting, traffic observation, environmental surveys, local 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 Heavy GA aircraft, such as large turboprop aircraft and an array of corporate jets. Heavy GA activity for OAK in this forecast is segmented into two groups: Business Aviation (BA) and GA, and three major classifications: large jet business aviation, small jet business aviation and small general aviation. Military and government aircraft use of small aircraft similar to typical GA aircraft are included in the Military operations segment.

GA traffic at the Airport exhibited an 8.0% increase in 2017 driven by local GA activity reaching 102,578 operations. In 2018 and 2019 GA operations increased 5.1% and 2.9%, respectively, with continued growth in business aviation and itinerant GA operations. GA activities at the Airport are consolidated on

the North airfield along the northeast side of Runways 10L/28R and 15/33. Figure 5-15 presents the general areas and major operators at OAK for GA activities in December 2019.

Figure 5-15 OAK General Aviation Area

Sources: Google Earth imagery; Landrum & Brown

Key components of GA include two fixed-based-operators (FBOs), numerous corporate flight groups, two flying clubs, other aircraft maintenance and storage related groups, and a new 'on demand' Air Taxi service, JSX.

JSX (formerly JetSuiteX) is an on-demand air taxi service operating used/recently retired 30 seat Embraer 135/145 jet aircraft to provide "hop-on jet service" from OAK to popular markets on the West Coast and popular leisure markets of Las Vegas and Phoenix. The JSX business model is dependent upon demand from cost conscience consumers who want to skip the lines and congestions of the typical passenger terminal while still getting most of the typical commercial air service benefits. JSX was planning on adding two new aircraft per month into the near future before COVID-19. Due to the Part 135 operating status, JSX was not reporting operations or passenger traffic counts to U.S. DOT and had not started reporting traffic to the Port of Oakland. Service from OAK began in November 2017 with flights to Burbank and later expanded to Orange County, Las Vegas, and other cities. Discussions with JSX suggest early success on most flights with load factors between 67-83% but a clear observation of actual traffic levels is not yet available. If a route underperforms, JSX has been known to make changes mere months after initiating a service. Target starting fares were initially at $89 each way but no financial information was available to analyze and understand break even operating levels.

5.3.1 Historical National GA Activity

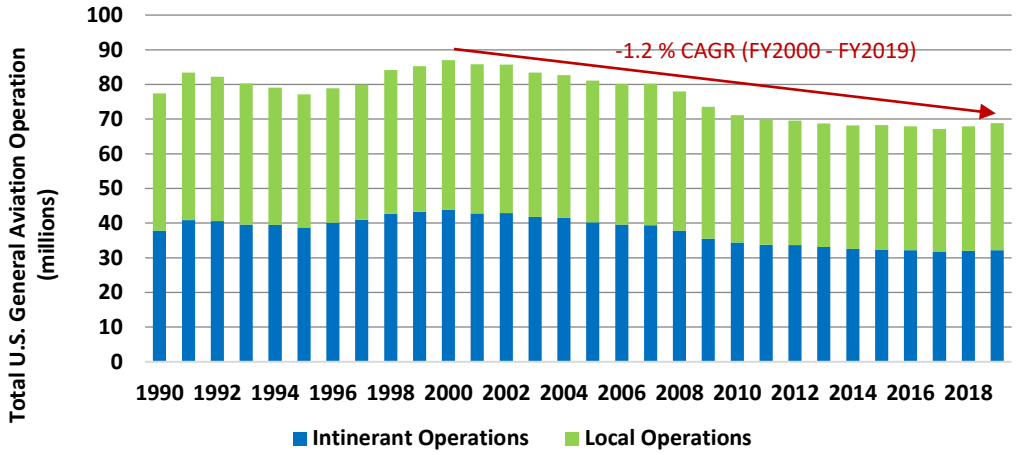
The civil aviation industry in the U.S. has experienced major changes over the past several decades. GA activity levels were at their highest in the late 1970s through 1981. GA activity levels and new aircraft production reached all-time lows in the early 1990s due to a number of factors including increased fuel

prices, increased product liability stemming from litigation concerns, and increased cost of new aircraft. The passage of the 1994 General Aviation Revitalization Act (GARA)[1] 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.[2]

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 in the U.S. with air traffic control service increased in FY2007, but just slightly at 0.2% over FY2006. However, GA operations declined by 4.7% at airports with air traffic control service the following year. The decline in GA traffic continued due to the economic downturn and world financial crisis in 2008 and increased in fuel prices. GA operations decreased by 11.3% in FY2009, 5.1% in FY2010, and 2.3% in FY2011. In FY2012, GA operations increased 0.6%, but subsequently decreased each of the following years.

Figure 5-16 shows the number of GA operations at U.S. airports since FY1990. Since 2000, total GA operations in the U.S. decreased at a rate of -1.2% per annum, and activity levels have been flat since 2014.

Figure 5-16 U.S. General Aviation Operations History



Sources: FAA Terminal Area Forecast; Landrum & Brown

5.3.2 Business Aviation and Small GA

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

[1] GARA imposes an 18-year statute of repose on product liability lawsuits for GA aircraft. FY is a federal fiscal year of Oct 1st to September 31st.
[2] Based on information from the General Aviation Manufacturers Association (GAMA).

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.

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 en-route productivity
- Minimized time away from home
- Enhanced industrial security
- Enhanced personal safety
- Management control over scheduling

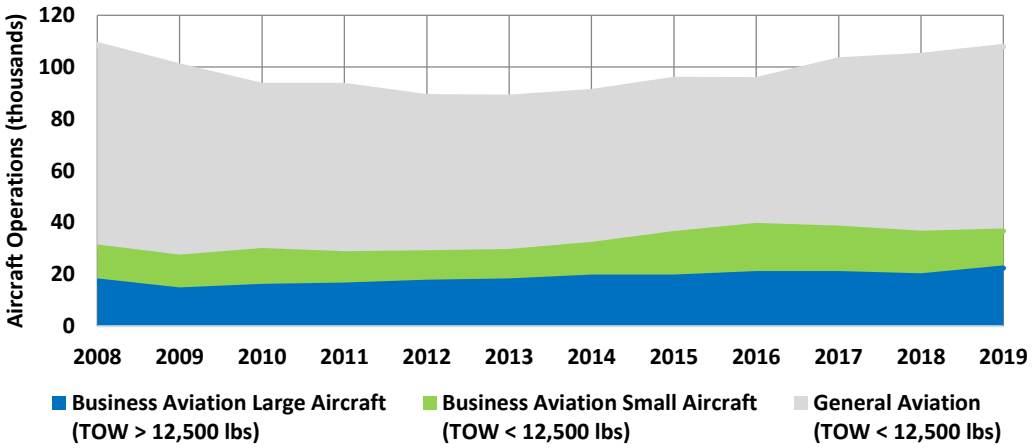
Business use of GA aircraft ranges from small, single-engine aircraft rentals to multiple aircraft corporate fleets supported by dedicated flight crews and mechanics. GA aircraft use allows employers to transport personnel and air cargo efficiently. Businesses often use GA aircraft to link multiple office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

After growing rapidly for most of the past decade, the demand for business jet aircraft 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 recent years leading up to 2016 had seen a dramatic impact of the recession on the business jet market. Issues such as reduced corporate profits, bankruptcies, mergers, and an intense scrutiny on GA as a result of corporate collapses resulted in reductions in corporate GA activity, especially in the business jet sector. Since 2016, there have been some renewed growth in corporate aviation and fractional or shared jet ownership, which has lowered the financial burden and reduced the risk of business jet ownership while still providing the benefits of convenience. New to OAK in late 2019 was on-demand air taxi service using small regional passenger jets, which are considered large business jets in this forecast.

Figure 5-17 shows a graphical history of all general aviation operations at OAK. Overall, total combined business and small GA aircraft operations at OAK declined from 108,554 operations in 2008 to 88,218 operations in 2013, and then increased back to near 2008 levels in 2019 with 107,861 operations. Small GA aircraft operations declined from 78,006 in 2008 to 71,207 in 2019, representing a decrease of -0.8% per annum. Large business aviation aircraft operations increased from 17,422 in 2008 to 22,428 in 2019, representing a growth rate of 2.3% per annum. Small business aviation aircraft operations increased from 13,126 in 2008 to 14,226 in 2019, representing an average growth rate of 0.7% per annum. The low point in recent historical traffic occurred in 2013, and total general aviation operations at OAK has shown a recovery from 2013 to 2019, with an increase of 5.2% per annum. There was a slight shift in trends in 2017 where records show a drop in the number of business aviation operations and an

increase in small GA operations. This recent shift is expected to be temporary with longer historical trends returning to general aviation traffic levels at the Airport.

Figure 5-17 OAK General Aviation Operations History

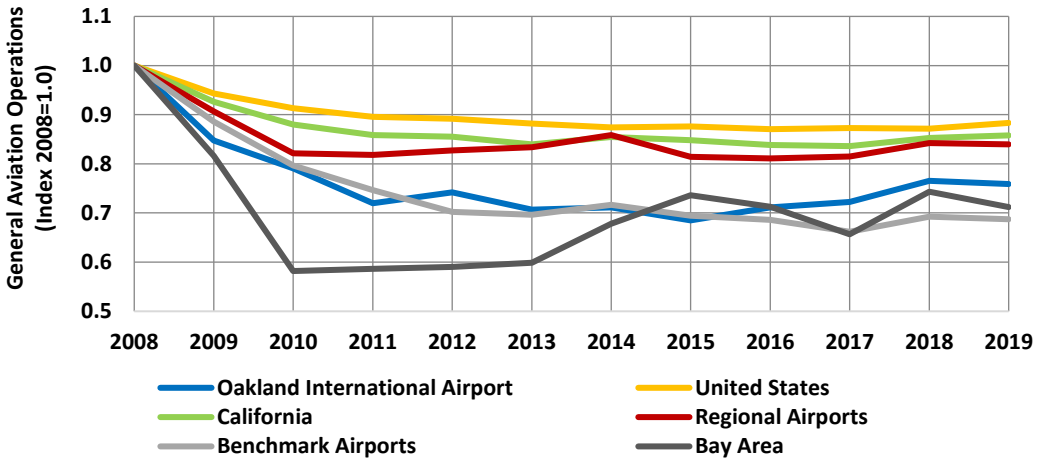


Sources: Airport Statistics; Diio, U.S. DOT Reports Air Carrier Statistics Database (T-100); FAA, Traffic Flow Management System Counts (TFMSC).

5.3.3 General Aviation Benchmarks

Itinerant and local GA aircraft operations, as reported in the FAA Terminal Area Forecast (includes some business aviation but no Air Taxi), have decreased significantly at almost every airport in the U.S. since FY2008. However, the GA benchmark airports in California with emphasis in business aviation, including OAK and the Bay Area airports, have decreased at a faster rate during that time. The faster decline may be partly due to the average price of fuel in California and the Bay Area already being higher than the U.S. national average. See Figure 5-18.

Figure 5-18 General Aviation Operations Comparison; indexed 2008=1.0



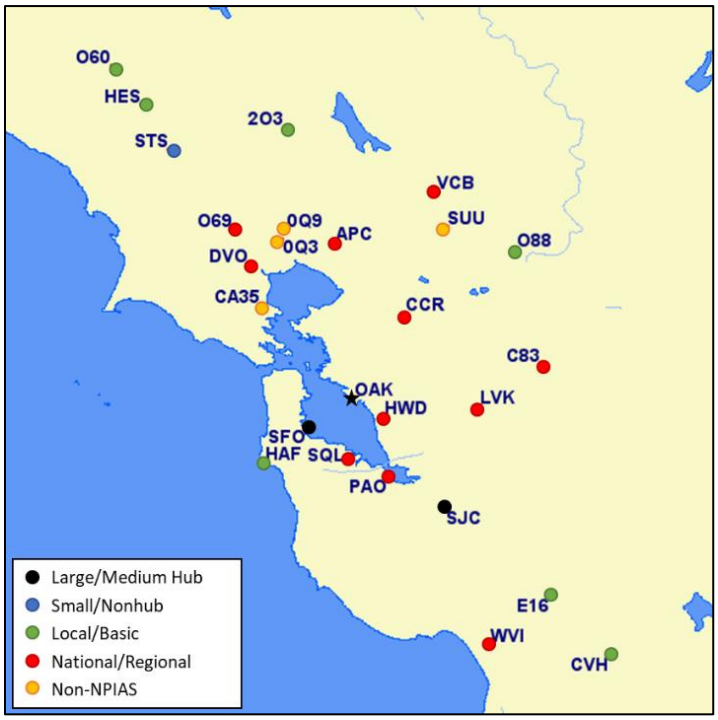
Note: General Aviation Benchmark Airports include nine California airports selected for business aviation and market size (HWD, SJC, SAC, FAT, CRQ, LAX, SMO, LGB and VNY).
Sources: FAA, Terminal Area Forecast (TAF) historical FY data; Landrum & Brown analysis

5.3.4 Regional Airport Benchmarks

Regional airports were selected for a benchmark comparison and include 23 National Plan of Integrated Airport Systems (NPIAS) airports within approximately 70 nautical miles from OAK to the Northwest and Southeast of the Airport; excluding the Sacramento, Stockton, and Monterey regions. There are additionally four airports not listed in the FAA NPIAS registry that are within the OAK general aviation benchmark region, but operations activity for these airports was not available to include in the dataset.

Figure 5-19 shows a map of the regional benchmark airports evaluated in the comparison.

Figure 5-19 OAK Benchmark Airports Map

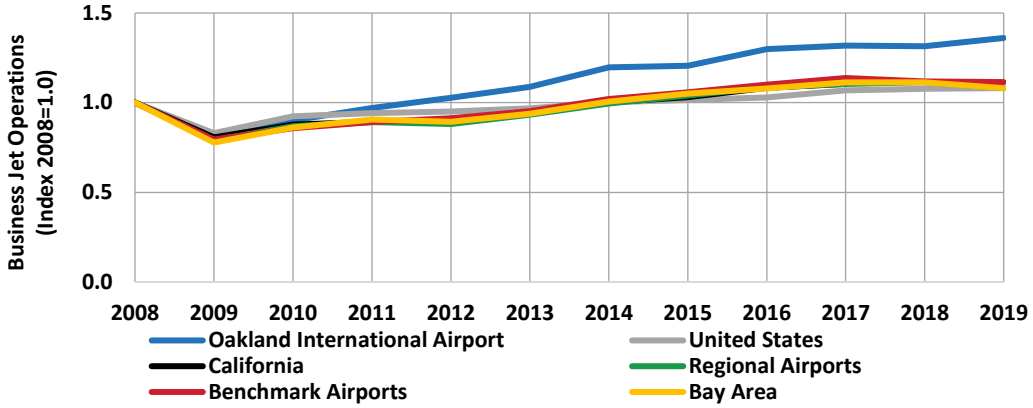


Sources: Landrum & Brown analysis, gcmap.com maps

5.3.5 Business Jet Operations Benchmarks

Business Jet activity, as reported by the FAA Traffic Flow Management System Counts ("TFMSC"), includes certain types of business/corporate aircraft that are not used for scheduled operations. While small GA traffic at OAK has decreased since 2008, business jet traffic at OAK increased at a faster rate than all of the selected benchmarks, including the other Bay Area airports. Bay Area Gross Regional Product ("GRP") has been recently growing faster than the U.S. average by nearly two times due to healthy business development and the Bay Area's position as the second largest patent developing region after Silicon Valley. Further supporting potential growth in business jet activity is the lower cost of doing business in Oakland and a highly ranked business environment. See Figure 5-20.

Figure 5-20 Business Jet Segment – Operations Comparison; indexed 2008=1.0



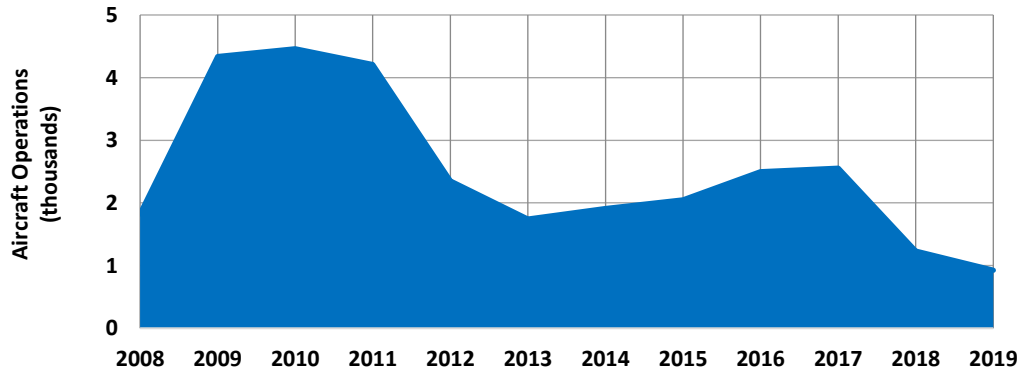
Sources: FAA, Traffic Flow Management System Counts (TFMSC) historical data; Landrum & Brown analysis

5.4 Military

Military operations are generally unpredictable and have high priority on runway utilization ranging from true emergency conditions to training operations and basic government transports. Military activity is located at the North airfield with based activity from the Sheriff's Office and Civil Air Patrol, as well as other government transport needs. From 2008 to 2009, Military aircraft operations at OAK increased by 137.7% to more than 4,000 annual operations, but by 2013, military aircraft operations were reduced back to near 2008 levels. From 2013 to 2017, military aircraft operations increased at a rate of 10.0% per annum, before showing decreases again in 2018 and 2019 to just 926 total military operations. See Figure 5-21.

The majority of military operations appear to be largely government activity from the Police, Civil Air Patrol ("CAP"), FAA, and other U.S. Government traffic. Although military operations are distinct and separate from cargo and general aviation operations, they are included in the general operations forecasting efforts of this study and included in the total operations comparison to the FAA TAF predictions for OAK and other potential analyses supporting planning efforts by the Port of Oakland.

Figure 5-21 OAK Military Operations History



Sources: Airport Statistics; FAA, OPSNET traffic counts

6 Forecast Methodology, Assumptions and Results

6.1 Passenger Forecast

The forecasts of aviation activity at OAK were prepared using a combination of methodologies including a review of recent industry trends and expectations of future airline service and schedule data to inform near-term forecasts, and statistical analyses of the relationship between historical demand and local and national economic conditions to inform the longer-term forecasts. This is similar to the to the methodology used by the FAA to develop the TAF. The FAA notes the TAF assumes a demand driven forecast for aviation services based upon local and national economic conditions, as well as conditions within the aviation industry and is developed independent of the ability of the airport and air traffic control system to furnish the capacity required to meet demand.

6.1.1 Overview of Methodology

Inter*VISTAS* developed annual forecasts of passenger and aircraft activity at OAK. The OAK forecast was developed using a combination of both a bottom-up (short term) microeconomic methodology and a top-down macro-economic methodology to produce unconstrained forecasts. However, given OAK's position in a multiple airport market, predicting future traffic levels at individual airports cannot be done in isolation and one must consider the trends and dynamics occurring at other airports in the region. That said, several key factors were analyzed as drivers for OAK unconstrained demand forecast, including:

- The growing Bay Area Catchment Area
- The shift in share toward Oakland as a result of the convenience of the airport to the fastest growing parts of the Bay Area
- Southwest's anchor tenant position and network growth plans at OAK
- Connecting passenger traffic was forecast to increase by 1.5 percentage points over the life of the forecast

As a result, the forecast was developed using a two-step process:

- A forecast of the O&D passenger activity in the Bay Area was developed based on historical relationships with macro-economic variables and airline market plans from the base year 2019 through 2034; and
- The demand was allocated to OAK based on its historic relationship to the region and the short-term forecast.

6.1.2 Bottom-Up Forecasts

The bottom-up forecast developed for OAK was based on the short-term network and fleet planning decisions by airlines currently serving and likely to serve the airport, most notably Southwest Airlines (WN). As the largest carrier at OAK, Southwest's continued growth is vital to the airport's overall growth. Between 2018 and 2019, WN increased capacity by 3.4%, and following review of the published schedule data as well as additional discussions with the airline, Southwest confirmed their commitment to OAK. While the short-term forecast projects growth for WN, growth for other airlines at the airports are projected to slow based on published schedule data.

This short-term approach models the relative attractiveness of the catchment areas of each of the Bay Area's airports to allocate traffic to the airports over the longer term for both originating and

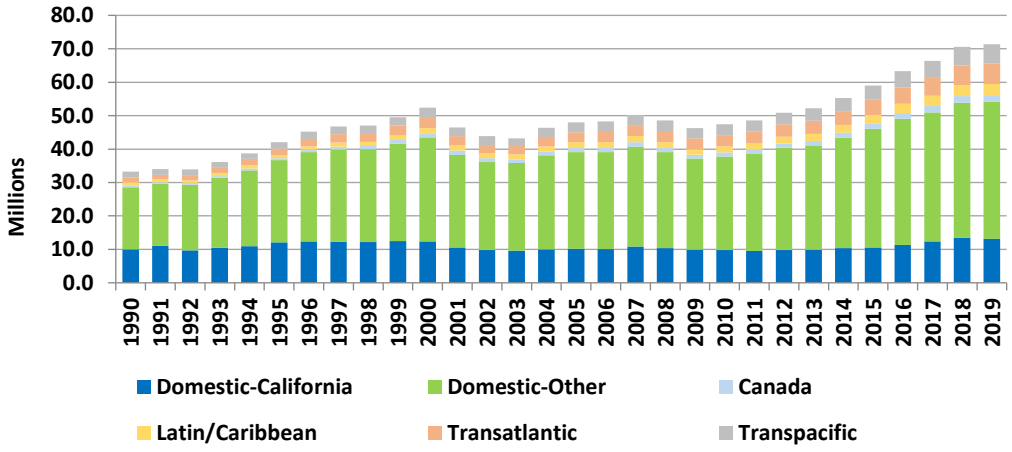
terminating traffic. Lastly, Inter*VISTAS* incorporated industry intelligence to estimate share of connecting traffic at each airport.

In 2020, passenger traffic was negatively impacted by shelter in place orders designed to create social distancing to decrease the spread of COVID-19. As with other exogenous shocks and recoveries, passenger demand is forecast to return to the previous trend four years following the event.

6.1.3 Top-Down Forecasts

In order to estimate long term trends for OAK and the Bay Area, Inter*VISTAS* examined the statistical relationship between economic trends and historical traffic volumes. Regression analysis was used to establish the relationships between the independent variables and O&D passenger activity in the Bay Area which was broken out by region: Intra-California, other Domestic, Canada, Latin, Trans-Atlantic, and Trans-Pacific. While California is geographically large and has significant intra-state traffic, historical growth is being driven primarily by domestic traffic to and from points outside of California, as seen in Figure 6-1.

Figure 6-1 Bay Area O&D Passengers (CY 1990-2019)



Source: O&D Survey Data

For each of these market segments, a variety of independent variables were tested against historic O&D passenger traffic data to identify which variables that show the best correlation with historic traffic developments. The independent variables tested included GDP by region, average fare, oil prices, exchange rates, and population. The final models were selected on the basis of statistical fit, parameter robustness and the plausibility of the parameter estimates produced. The most effective models were those based on GDP (as well as dummy variables in some cases in 2001 and 2002 to capture the impacts of the 9/11 terrorist attacks), and average fare or oil prices for the source market. A log-log formula was used meaning the parameters can be interpreted as elasticities:

$$\boldsymbol{Ln}\left(\boldsymbol{Passenger\ Traffic_i}\right) = \boldsymbol{a_i} + \boldsymbol{b_i} \cdot \boldsymbol{Ln}\left(\boldsymbol{GDP_i}\right) + \boldsymbol{c_i} \cdot \boldsymbol{Ln}\left(\boldsymbol{Air\ Fare_i}\right) + \boldsymbol{d_i} \cdot (\mathbf{0},\mathbf{1})\ \boldsymbol{Dummy\ 2001} + \boldsymbol{e_i} \cdot (\mathbf{0},\mathbf{1})\ \boldsymbol{Dummy\ 2002}$$

$$(\mathbf{i} = \textbf{country or region})$$

For example, Domestic-California was regressed against California GDP, and average fares on intra-California routes, while Domestic-Other was regressed against Bay Area GDP, U.S. Gulf Oil prices, and dummy variables for 9/11.

Figure 6-1 presents a summary of the traffic models, including the independent variables and regression output.

Table 6-1 Regression Results

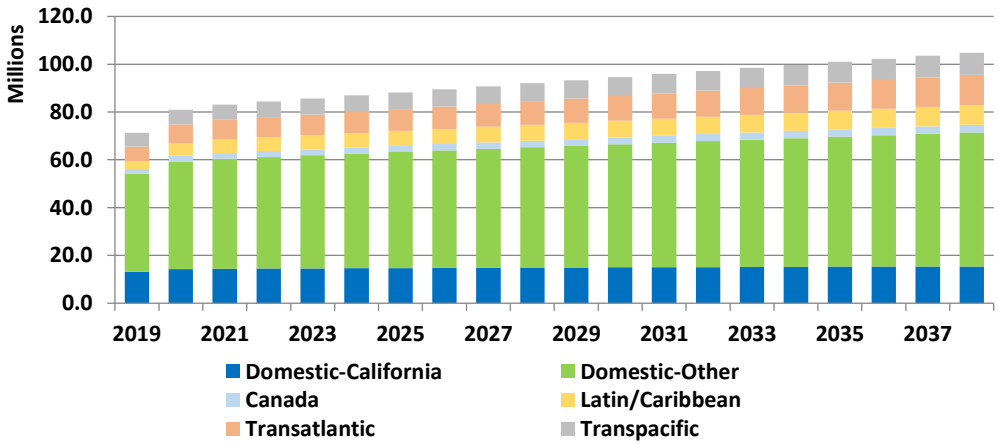
Market Segment	Independent Variables	Parameter Value	Model Fit (R^2)
Domestic – California	California GDP	0.567	0.882
	California Real Air Fare	-0.482	
Domestic – Other	Bay Area GDP	0.779	0.908
	U.S. Gulf Oil	-0.096	
Canada	Bay Area GDP	1.26	0.955
	Canada Real Air Fare	-0.367	
Latin/Caribbean	Bay Area GDP	1.313	0.972
	Latin/Caribbean Real Air Fare	-0.111	
Transatlantic	U.S. GDP	4.923	0.949
	Transatlantic GDP	-4.598	
Transpacific	Bay Area GDP	1.207	0.966

Source: InterVISTAS analysis

The Bay Area O&D passenger traffic is forecast to increase at 1.4% over the 2019-2038 as shown on

Figure 6-2 and Table 6-2. Similarly, the FAA 2019 Aerospace Forecast predicts that U.S. traffic will increase 1.8% per annum from 2019-2039. The combined TAF for the Bay Area (SFO, OAK, and SJC) projects enplaned passengers will increase at a compound annual growth rate of 2.4% for the same period. This is higher than the 1.4% annual passenger increases projected for the Bay Area by Inter*VISTAS*, which is explained, in part, by Inter*VISTAS*' more modest assumptions than the FAA's around the levels of connecting passengers at Bay Area airports over time.

Figure 6-2 Forecast of Bay Area O&D Passengers (CY 2019 – 2038)



Source: O&D Survey data; InterVISTAS analysis

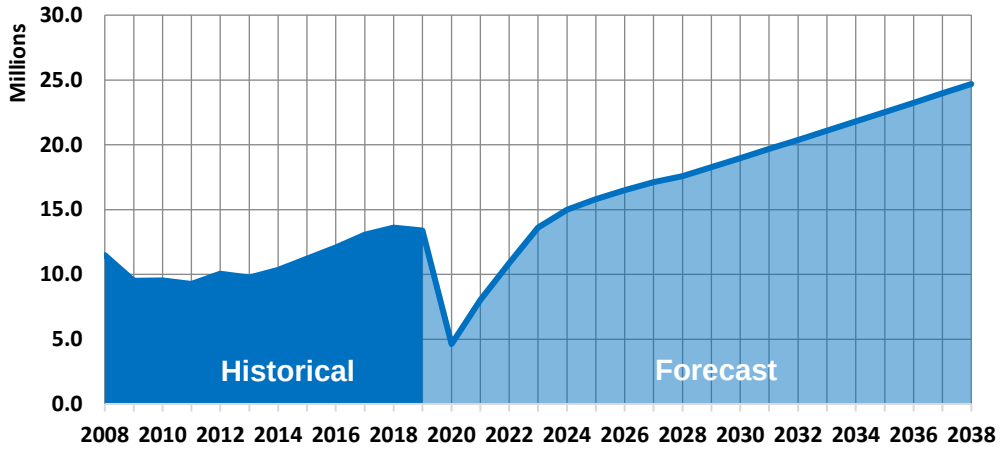
Table 6-2 Compound Annual Growth Rates for the Bay Area O&D Forecast

Market Segment	2019-2028	2019-2038
Domestic – California	0.4%	0.4%
Domestic – Other	1.4%	1.2%
Canada	1.9%	1.8%
Latin/Caribbean	3.5%	2.8%
Transatlantic	3.1%	2.8%
Transpacific	2.1%	2.1%
Total	**1.6%**	**1.4%**

Source: O&D Survey data; InterVISTAS analysis

As previously mentioned, once O&D passenger demand for the Bay Area is projected, traffic was then allocated to OAK. The forecast anticipates a return to OAK's historical share of Bay Area O&D passengers prior to the Global Financial Crisis. In addition, the share of connecting passenger traffic at OAK is forecast to increase 1.5 percentage points over the forecast horizon. In total, OAK's passenger traffic is forecast to increase at a rate of 3.3% per annum between 2019 and 2038, reaching 24.7 million passengers in 2038 as seen in Figure 6-3 and Table 6-3.

Figure 6-3 OAK Passenger Forecast (CY 2008-2038)



Source: InterVISTAS analysis

Table 6-3 OAK Passenger Forecast

Year	OAK Passengers
2019	13,378,411
2028	17,585,709
2038	24,685,035
CAGR '19-38	**3.3%**

Source: InterVISTAS analysis

6.1.4 Passenger Operations

Forecasts of annual commercial passenger aircraft operations are based on forecast passenger traffic demand. Passenger aircraft landings depend on the average aircraft size and average load factor (i.e. average passenger per flight), as represented by the formula below:

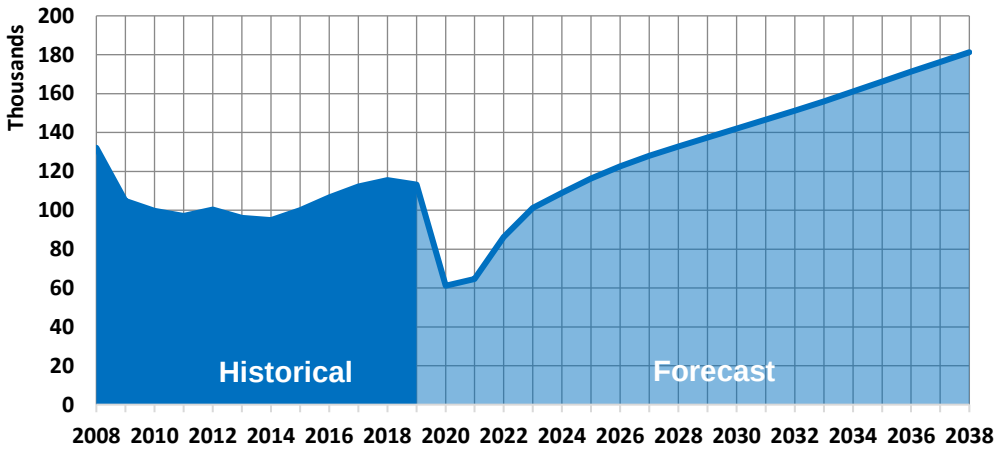
Passenger Aircraft Operations = (Passenger Forecasts) / (Avg. Aircraft Size x Avg. Load Factor)

where Avg. Aircraft Size x Avg. Load Factor = Avg. Passengers per Aircraft Movement

Southwest Airlines is increasing the gauge of aircraft it uses at OAK, as are other airlines serving the Airport. Overall, the average seats per departure increase from 149 in 2019 year to 167 in 2038.
The passenger operations forecast includes a near-term impact and recovery with respect to the COVID - 19 pandemic, thus showing the large drop in traffic for 2020 with a typical recovery.

OAK's commercial passenger operations are projected to increase at a rate of 2.5% per annum between 2019 and 2038, reaching 181,270 operations in 2038.

Figure 6-4 OAK Commercial Passenger Operations Forecast (CY 2008-2038)



Source: InterVISTAS analysis

Table 6-4 OAK Commercial Passenger Operations Forecast

Year	OAK Passengers Operations
2019	113,272
2028	132,830
2038	181,270
CAGR '19-38	**2.5%**

Source: InterVISTAS analysis

6.2 Cargo Forecast

The cargo tonnage forecasts prepared in this study were based largely on historical data correlations through 2017 as part of a very recent forecast update with considerations for 2018 and 2019 data and trend variances, and projected regional economic growth. Stakeholder meetings were held with the major carriers, FedEx and UPS, at OAK, but no detailed growth input expectations were provided. Non-disclosed future flight schedules and operational strategies for FedEx and UPS may not be captured in the forecast details. As with all forecasts, future projections are based on available information and assumptions at the time of development and are vulnerable to dynamic industry and economic conditions that are not anticipated and may notably impact future outcomes.

The cargo tonnage forecasts were prepared for four traditional cargo segments: domestic freighter, international freighter, domestic belly, and international belly. Mail is included with freight as total air cargo in each segment. The belly cargo tonnage forecasts were determined to be linked to the commercial passenger operations forecasts and were developed based on the operations forecast and with applicable utilization rates explained in the belly cargo section. The freighter cargo tonnage forecasts represent the majority of cargo at the airport and were developed by preparing socioeconomic regression forecasts which considered numerous independent economic variables before selecting the most reasonable and valid correlation. The summary descriptions of the selected freighter cargo tonnage forecast analyses are presented in the following sections.

6.2.1 Freighter Cargo Methodology and Tonnage Forecast

Methodology

A number of different analysis options were investigated for statistical correlations and meaningful trends to develop models for the demand forecasts. The selected methods considered the observed historical data trends, inputs from the key freighter carriers at OAK, and general industry trends and future developments during the process of determining an appropriate and reasonable model for the domestic and international freighter air cargo segments.

Domestic freighter cargo was ultimately forecast using the following univariate linear socio-econometric model based on U.S. GDP. The GDP based cargo model for domestic freighter tonnage included historical data from 2009 through 2017 and provided very good regression statistics with an adjusted R-squared value of 0.88.

$$\boldsymbol{Domestic\ Freighter\ Cargo\ (tons)} = \mathbf{197,828} + (\mathbf{2.1} * \mathbf{10^{-8}}) * \boldsymbol{GDP_{U.S.}}$$

International freighter cargo was forecast using the following multivariate linear socio-econometric model also based on U.S. GDP, but with the inclusion of a 'dummy' variable for the year 2014 where there was one data anomaly during the historical time period. The GDP based cargo model for international freighter tonnage included historical data from 2008 through 2017 and provided very good regression statistics with an adjusted R-squared value of 0.87.

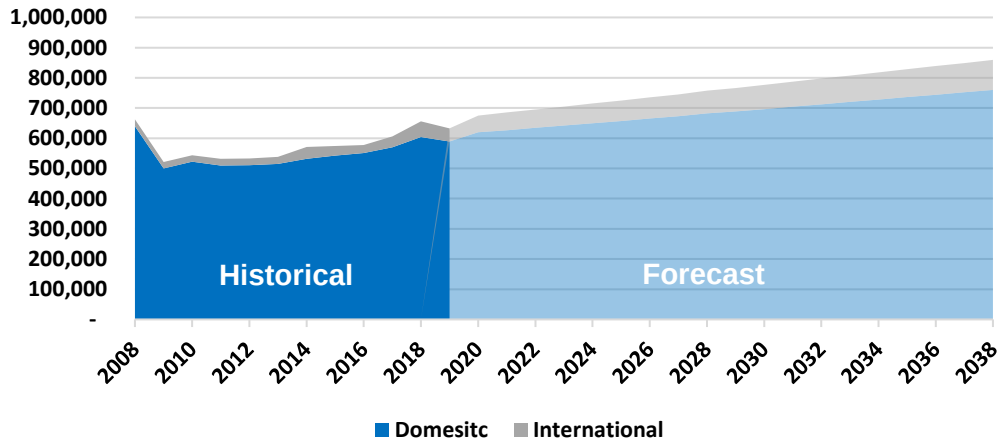
$$\boldsymbol{International\ Freighter\ Cargo\ (tons)} = -\mathbf{48,524} + (\mathbf{4.8} * \mathbf{10^{-6}}) * \boldsymbol{GDP_{U.S.}} + \mathbf{13,054} * \boldsymbol{Dummy_{2014}}$$

The 2019 Woods and Poole Economics CEDDS (Complete Economic and Demographic Data Source) database was used as the source for the U.S. GDP historical and forecast values. The forecast GDP values were applied within the model calculations to determine the calculated year over year growth rates, which were applied to the 2017 cargo tonnages. A dummy variable value of 1.0 was applied to the anomaly year of 2014 with all other years assigned a value of 0, to indicate no abnormality compared to the overall growth trend. Historical freighter cargo levels were estimated from U.S. DOT Schedule T-100 cargo segment splits and the final total cargo figures published by OAK. 2019 data serves as the base year in the forecast projections.

Tonnage Forecast

The resulting domestic freighter air cargo tonnage level is forecast to increase from 589,545 tons in 2019 to 759,875 tons in 2038, representing an CAGR of 1.3%. The International freighter air cargo tonnage level is forecast to increase from 43,182 tons in 2019 to 99,563 tons in 2038, representing a growth rate of 4.5% per annum. Total freighter air cargo tonnage (domestic + international) is therefore expected to increase from 632,727 tons in 2019 to 859,437 tons in 2038, representing a growth rate of 1.6% per annum. Figure 6-5 graphically presents the freighter tonnage forecast for OAK.

Figure 6-5 Freighter Cargo Tonnage Forecast



Sources: Airport data, Landrum & Brown analysis

Historical domestic freighter air cargo tonnage and operations through 2019 include some activity that may have been international in true origin or destination. Inbound cargo flights from Asia can typically make the trip to OAK without requiring a tech-stop at ANC and still allowing for efficient utilization of capacity. However, certain outbound flights from OAK to Asia and some inbound heavy flights from Asia may need to refuel in ANC on the trip to Asia depending on the type of freighter aircraft and cargo load. As cargo fleets continue to shift and show improved efficiencies, this refueling need may be eliminated on outbound flights altogether in the future, and OAK records would show more air cargo reported as international instead of domestic. The base year 2019 figures for freighter cargo activity were adjusted to account for these reporting variances with a small calculated shift in domestic to international tonnage and then carried forward in the forecast with an ongoing assumption.

6.2.2 Belly Cargo Tonnage Forecast

As per the commercial passenger forecast, passenger aircraft operations are projected to increase from an estimated 113,272 in 2019 to 181,270 in 2038, representing a growth rate of 2.5% per annum. Commercial passenger operations and average historical belly cargo volumes per operation were considered as a driver of belly cargo growth at OAK.

Domestic Belly Cargo

The forecast of domestic passenger aircraft operations was used to project future domestic belly cargo with the general assumption that the average tons per commercial passenger movement will remain stable, increasing slightly from recent historical averages. Domestic belly cargo has represented a small share of total cargo at OAK. In 2019 domestic belly cargo was just 1.4% of total air cargo tonnage processed at the Airport.

In 2019, the average belly cargo tons were lower at an estimated 0.08 tons transported per commercial passenger aircraft operation compared to a recent average trend of just over 0.11 tons. It was assumed that tons per aircraft operation would return to the recent trend and then increase 0.5% per annum throughout the forecast period, reaching 0.12 to 0.13 tons per aircraft operation by 2038. Long range target tons per operation were checked against estimated fleet developments and average belly capacities, which are anticipated to have minor change during the forecast.

Domestic belly cargo tonnage is forecast to increase from an estimated 9,177 tons in 2019 to 20,980 tons in 2038, at a rate of 4.4% per annum.

International Belly Cargo

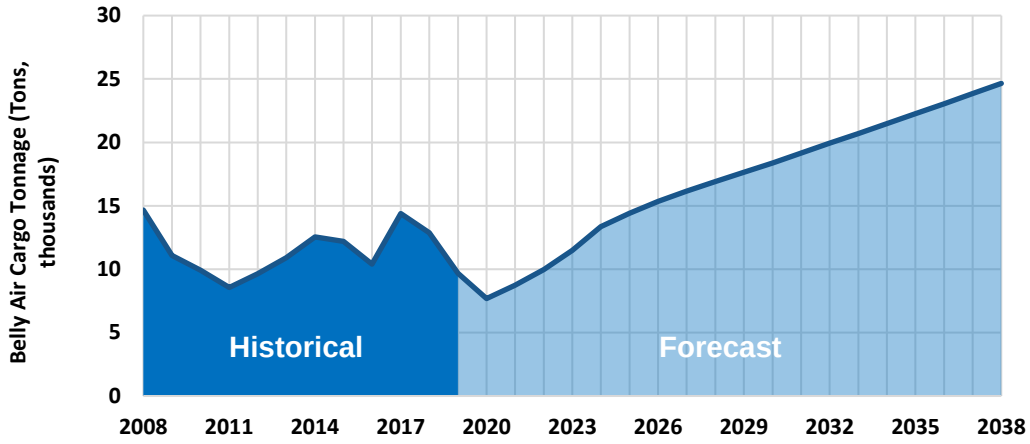
In the same manner as domestic belly cargo, international passenger aircraft operations forecast was used to project international belly cargo demand. In 2017, an estimated 0.51 tons were transported per aircraft operation, but by 2019 with the loss of Norwegian Air Shuttle belly cargo service and the departure of British Airways international service at OAK the average tons per aircraft decreased to about 0.11 tons per operations similar to the domestic segment. It was assumed in the forecast that 0.3 belly cargo tons per international passenger operation was a reasonable metric. During the forecast the tons per aircraft operation metric was estimated to also increase 0.5% per annum and reach 0.32 tons per operation by 2038. Future growth in international belly cargo is dependent on potential new entrants and continued operations and additional growth into Mexico and other Latin American markets by Southwest and other carriers.

International belly cargo tonnage is forecast to increase from an estimated 501 tons in 2019 to 3,670 tons in 2038, representing a growth rate of 11.1% per annum, from a small initial base.

Total Belly Cargo Tonnage Forecast

Total belly air cargo tonnage (domestic and international) is forecast to increase from an estimated 9,678 tons in 2019 to 24,650 tons in 2038, representing a growth rate of 5.0% per annum. The projected forecast of belly cargo tonnage is presented in Figure 6-6.

Figure 6-6 Belly Cargo Tonnage Forecast



Sources: Airport Statistics; Landrum & Brown.

6.2.3 Total Air Cargo Tonnage Forecast

Total air cargo at OAK is projected to increase from 642,405 tons in 2019 to 884,087 tons by 2038, at an annual rate of 1.7%. The splits in cargo segments are expected to remain fairly similar to the existing shares of freighter air cargo and belly air cargo segments with 97.2% freighter air cargo and 2.8% belly air cargo in 2038. Total cargo is expected to shift modestly from 93.2% domestic cargo in 2019 to 88.3% domestic in 2038, yielding a raw increase in the international share of 6.8% to 11.7% by 2038.

Table 6-5 presents the forecast summary of cargo tonnage at OAK.

Table 6-5 OAK Air Cargo Tonnage Forecast

	Freighter (Tons)			Belly (Tons)			Total (Tons)		
Year	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total
2019	589,545	43,182	632,727	9,177	501	9,678	598,722	43,683	642,405
2028	682,663	75,323	757,987	14,800	2,105	16,905	697,463	77,428	774,892
2038	759,874	99,563	859,437	20,980	3,670	24,650	780,854	103,233	884,087
CAGR '19-38	**1.3%**	**4.5%**	**1.6%**	**4.4%**	**11.1%**	**5.0%**	**1.4%**	**4.6%**	**1.7%**

Sources: Airport Statistics; Landrum & Brown.

6.3 Freighter Operations Forecast

Freighter operations at the Airport represent activity by all-cargo dedicated aircraft used only to transport goods to and from OAK. These freighter operations may be performed by a range of aircraft from a smaller feeder aircraft that is typically observed as a GA aircraft such as a Cessna 208 Grand Caravan, or a larger commuter style aircraft such as the ATR42/ATR72, or large dedicated freighters like a Boeing 757, 767, 777 or MD11 aircraft.

Domestic

The domestic freighter air cargo tonnage forecast was used to forecast domestic freighter aircraft operations, assuming an ongoing trend in average tons per freighter aircraft operation. In 2019, an estimated 29.4 tons were transported per aircraft operation. It was assumed that tons per aircraft operation would increase 0.5% per annum throughout the forecast period. A long-range target of tons/operation was compared to assumed fleet plans of the freighter fleet (primarily for the FedEx and UPS fleets). Overall, tons per aircraft operations for domestic freighters is expected to increase from 29.4 tons to 32.3 tons by 2038.

The domestic freighters operating at OAK are mostly marketed for FedEx (about 76%), which comprises large freighters (A300, B757, B767, DC10 and MD11 aircraft), as well as small regional cargo feeder freighters (Beech18, Cessna Caravan and ATR 42/72 aircraft).

The UPS fleet at the Airport entirely comprises large freighters. For both carriers, the B767 and MD11 are the most used aircraft at the Airport with the B767 and B757 being the likely future aircraft of choice for domestic activity.

Domestic freighter operations are forecast to increase from an estimated 20,078 in 2019 to 23,500 in 2038, representing an CAGR of 0.8%.

International

The international freighter air cargo forecast was used to forecast international freighter aircraft operations on a tonnage per operation basis. In 2019, an estimated 69.6 tons were transported per aircraft operation, and it was assumed that average tons per aircraft operation would also increase at 0.5% per annum throughout the forecast period. Overall, tons per aircraft operations for international freighters is expected to increase from 69.6 tons to 76.0 tons by 2038. Nearly all of the international freighter activity at OAK is transcontinental with flights to Asia showing a high freighter tonnage capacity from a fleet of all large freighter aircraft.

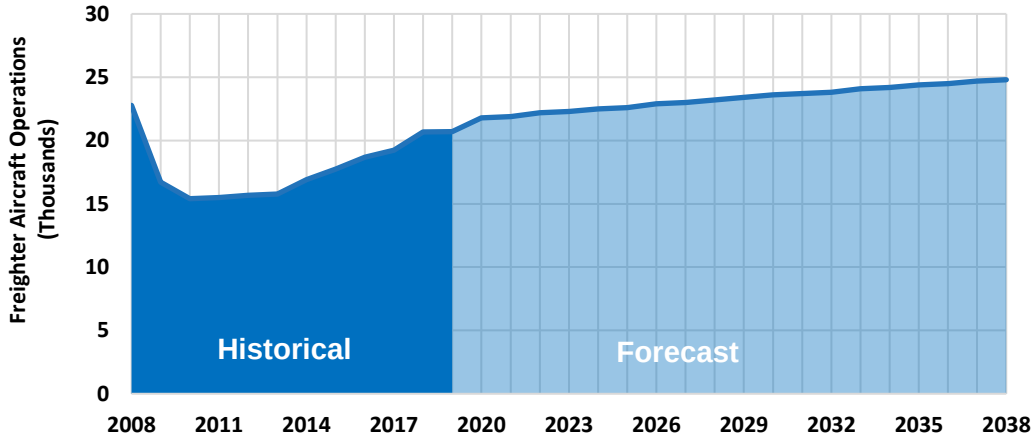
International freighter operations are therefore forecast to grow at a similar rate compared to international freighter tonnage and increase from about 620 operations in 2019 to 1,300 in 2038, representing an CAGR of 4.0%.

International freighter operations may increase slightly more than currently forecasted if current flights to Asia with a refueling stop in ANC are able to be performed as direct flights on more efficient long-range aircraft.

Figure 6-7 graphically presents total freighter operations (domestic and international), which are forecast to increase from 20,698 operations in 2019 to 24,800 in 2038, representing a growth rate of 1.0% per annum.

Table 6-6 lists further details in the freighter operations forecast showing the correlation between tonnage, operations, and tons per operation.

Figure 6-7 OAK Freighter Operations Forecast



Sources: Airport Statistics; Landrum & Brown.

Table 6-6 OAK Freighter Operations Forecast

	Freighter Tonnage (Tons)			Freighter Operations			Average Tons per Operation		
Year	Domestic	International	Total	Domestic	International	Total	Domestic	International	Total
2019	589,545	43,182	632,727	20,078	620	20,698	29.4	69.6	30.6
2028	682,663	75,323	757,987	22,200	1,000	23.200	30.7	72.8	32.6
2038	759,874	99,563	859,437	23,500	1,300	24,800	32.3	76.0	34.7

Sources: Airport Statistics; U.S. DOT Reports Air Carrier Statistics Database (T-100); Landrum & Brown

6.4 General Aviation Methodology and Forecast

Methodology

General aviation aircraft operations represent the non-commercial and non-military segments of air traffic at the Airport. General aviation traffic is therefore any activity not classified as commercial passenger or commercial air cargo in nature, nor specifically military or government. General aviation flight activity was estimated from FAA ATADS annual data, FAA TFMSC annual data, OAK airport annual data, and PASSUR radar flight data. The primary segments identified and forecast in this study are large business aviation (large aircraft of more than 12,500 pounds), small business aviation (smaller aircraft of 12,500 pounds or less), and small general aviation (small aircraft of 12,500 pounds or less). The large business aviation segment is mainly business jets and can include larger corporate narrow-body aircraft, while the small general aviation segment is mainly piston aircraft which are being operated less and less with a projected long-term reduction in activity by the FAA.

On-demand air taxi operator JSX was expecting to increase flights up to 8 per day from 4 per day at the end of June based on improvements in the COVID-19 pandemic. However, there have been no further updates in the OAG schedule for JSX as of July 6, 2020. Historical 2019 data did not show a clear presence of JSX Embraer 135/145 jet operations; however, it was assumed that if the scheduled OAG operations are accurate at an average of 1,074 and are annualized, they would have an estimated 13,000 annual operations. Without a longer historical record or financial analysis, it was assumed that

the large business aviation segment for 2019 included the JSX activities and 2020 and thereafter provides no certainties for the success or growth of JSX at OAK.

Operations data for each of the three main segments was reviewed and compared against socioeconomic variables to establish a correlation that would provide a reasonable regression model for predicting future growth. Only outcomes based on statistically reasonable model scenarios with significant statistical results were accepted. General industry trends and FAA aerospace forecast projections for individual segments were considered as well as based aircraft and average usage projections to establish the final forecast methods for each general aviation traffic segments. The resulting approaches and forecasts are presented in the following sections.

Business Aviation

Large Business Aviation (BA) Aircraft (TOW > 12,500 lbs.) operations were forecast using the following univariate linear socio-econometric model:

$$\boldsymbol{Large\ BA\ Operations = 14,852 * Population_{MSA} - 49,553}$$

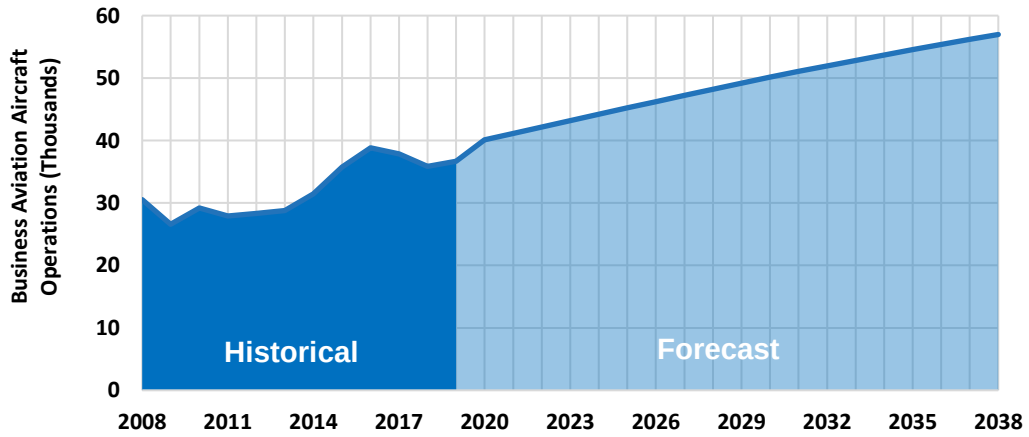
The decision to use the MSA population as a predictor of future growth was made after finding no other statistically sound correlation or better resulting regression model comparing the specific operations to other socioeconomic data variable or combination of variables. Large BA operations are forecast to increase from an estimated 22,428 in 2019 to 33,916 in 2038, representing an CAGR of 2.2%.

Small BA Aircraft (TOW ≤ 12,500 lbs.) operations were forecast using the following univariate linear socio-econometric model:

$$\boldsymbol{Small\ BA\ Operations = 44,287 * LN(PCPI_{MSA}) - 480,109}$$

Small BA operations are forecast to increase from an estimated 14,226 in 2019 to 23,060 in 2038, representing an CAGR of 2.6%. Total BA operations are forecast to increase from an estimated 36,654 in 2019 to 56,976 in 2038, representing an annual growth rate of 2.3%. The forecast of combined business aviation segment of (large BA + small BA operations) is presented graphically in Figure 6-8.

Figure 6-8 OAK Business Aviation Forecast



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

Small General Aviation

Small GA aircraft operations at OAK were showing continued declines in annual activity following regional and national trends in traditional small general aviation traffic until 2017 where a temporary short-term increase was observed, potentially due to recent success in the local sports franchises. The recent increase or 'surge' is not fully explained in the data, stakeholder interviews, or industry trends and is being treated as temporary in the forecast approach for small GA.

Due to the many years of declining activity, there were no validated correlations between small GA operations and any socioeconomic variables available in the datasets reviewed. It was determined that a based-aircraft and average metric of operations per based aircraft should be used to estimate the small GA operations traffic forecast.

The based aircraft data used in this study was derived in accordance with the FAA Airport Master Record Forms (5010-1 & 5010-2). The based aircraft data is derived from the FAA's Aeronautical Information Services based on the most recent Airport Facilities Directory (AFD).

Year-over-year growth rates for active aircraft obtained from the FAA Aerospace forecast were used to project the based aircraft at the Airport beginning with the 2017 based aircraft segments provided in the 5010 report. Jet aircraft growth was projected in the based aircraft forecast but not included in the estimation of small GA aircraft growth and forecasted future operations.

Table 6-7 presents the projections for based aircraft levels at the Airport through 2038. It is noted below that the Single-Engine rate of reduction was cut in half from the overall FAA Aerospace Forecast value in an effort to adjust for potential risk in the assumption that the recent unexpected increase in small GA operations is truly temporary.

- Single-Engine[3] = -0.4%
- Jet = 1.1%
- Multi-Engine = 0.5%
- Helicopter = 1.8%

Table 6-7 OAK Based Aircraft Forecast

	Based Aircraft						Operations per Based Aircraft*
Year	Single	Jet	Multi	Heli	Other	Total	
2019	162	71	24	7	0	264	345
2028	155	81	24	9	0	268	334
2038	147	89	27	10	0	273	323

Note: Operations per Based Aircraft factor excludes Jets.
Sources: FAA TAF, 5010 Reports; Landrum & Brown

The small GA aircraft operations (excluding BA) for 2019 were divided by the based aircraft (excluding jets) for 2019 to determine an initial value for operations per based aircraft ("OPBA"). In 2016 and 2017, the OPBA increased from around 270 in 2015 to 346 operations in 2018. The forecast assumed that the

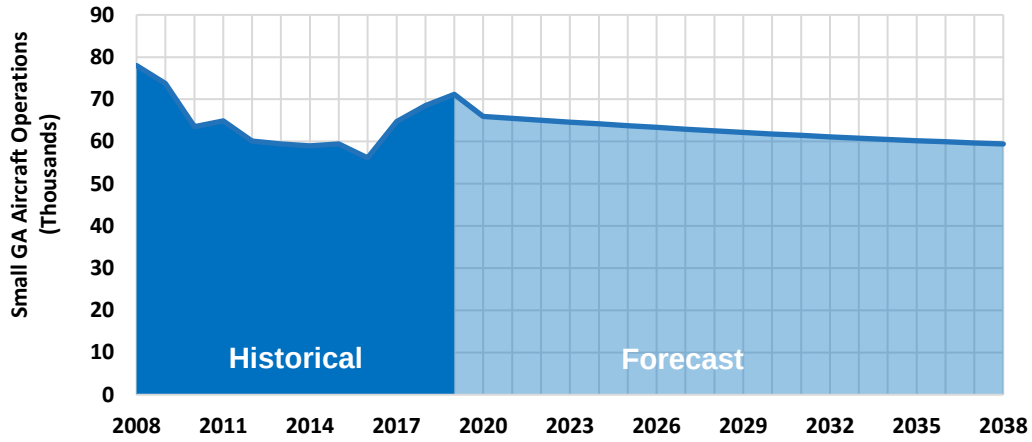
[3] Single-engine rate is half the decline indicated in the 2018-2038 FAA Aerospace Forecast.

OPBA would decline some and trend down toward an average of 310 as a long-term target and was estimated to reach 323 by 2038.

The based aircraft forecast was multiplied by the OPBA forecast to determine future activity of small GA after first excluding jet activity in the based aircraft inventory. The split between local and itinerant operations for small GA was assumed to remain constant during the forecast at approximately 60% local. Based aircraft (including business jets) are assumed to generally follow the TAF projections and are forecast to increase from 264 in 2019 to 273 in 2038, representing an CAGR of 0.2%.

Itinerant GA operations are forecast to decrease from a recent and unexpected high estimate of 32,499 in 2019 to 23,378 in 2038, representing an annual growth rate of -1.7%. Local GA operations are also forecast to decrease from an estimated 38,708 in 2019 to 36,077 in 2038, representing an CAGR of -0.4%. The projected decreases in small general aviation activity follow the national trend and FAA assumptions of lower activity levels in this segment of aviation. Figure 6-9 graphically presents the forecast for small GA operations at OAK which are projected to decrease from 71,207 operations in 2019 to 59,455 operations in 2038, representing a growth rate of -0.9% per annum.

Figure 6-9 OAK Small General Aviation Operations Forecast



Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

Table 6-8 presents the overall traditional general aviation segment forecast for the Airport (including Business Aviation and Small GA), which is projected to grow at an CAGR of 0.4% through 2038.

Table 6-8 Total General Aviation Operations Forecast

	Business Aviation		General Aviation		Total
Year	**Large Aircraft**	**Small Aircraft**	**Itinerant**	**Local**	**Operations**
2019	22,428	14,226	32,499	38,708	107,861
2028	28,070	20,139	24,595	37,955	110,758
2038	33,916	23,060	23,378	36,077	116,431
CAGR '19-38	**2.2%**	**2.6%**	**-1.7%**	**-0.4%**	**0.4%**

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

6.5 OAK Planning Forecasts

There is a level of uncertainty associated with long-range demand forecasting and planning of airport facilities. Planning activity levels inform the future levels of passenger activity, air cargo tonnage, and aircraft operations at which facilities may trigger the need for additional capacity or other development, and may be used for analyzing the benefits of proposed development alternatives. The benefit of PALs is to disassociate projects from specific years as realized activity levels may occur earlier or later than the forecast predicts.

With PALs, airport management can accelerate or decelerate projects in the capital improvement program based on how demand occurs in the future. PALs are established by: (1) projecting a near-term increase in activity reasonably expected a few years into the future, (2) projecting an upper bound of activity reasonably expected over the time period being evaluated, and (3) evaluating additional points of activity between these two bounds, as necessary.

In order to quantify future facility requirements within the planning horizon, two PALs were identified for use in planning documents. These PALs correspond to annual levels of passengers and operations that can be used to test the ability of the existing facilities to accommodate those levels of demand at acceptable levels of service to the airlines and users of the Airport. Design day flight schedules were also developed to quantify the daily and hourly demands that would be placed on the airport facilities, for an average day in the peak month of each PAL. More detail can be found in Section 9 of this document.

PAL 1 is defined as 8.8 million annual enplaned passengers or 17.6 MAP and is anticipated to occur by 2028; PAL 2 is defined as 12.3 million annual enplaned passengers or 24.7 MAP and is anticipated to occur by 2038. The forecast used for the PALs are in calendar years. Results of the forecast for the PALs are summarized in Table 6-9.

Table 6-9 PAL Forecast Summary

	OAK Planning Forecast in Calendar Years			OAK Planning Forecast in Federal Fiscal Years		
	Base Year 2019	PAL 1 2028	PAL 2 2038	Base Year 2019	PAL 1 2028	PAL 2 2038
Passenger Enplanements	**6,689,457**	**8,792,855**	**12,342,518**	**6,708,620**	**8,757,199**	**12,252,702**
CAGR		*3.1%*	*3.3%*		*2.9%*	*3.2%*
Million Annual Passengers ("MAP")	**13.4**	**17.6**	**24.7**	**13.4**	**17.5**	**24.5**
CAGR		*4.1%*	*3.3%*		*2.9%*	*3.2%*
Annual Airline Operations	**113,272**	**132,830**	**181,270**	**115,752**	**131,614**	**180,022**
CAGR		*1.7%*	*2.5%*		*1.4%*	*2.4%*

CAGR = compound annual growth rate

Source: Airport statistics, InterVISTAS analysis

7 Traffic Forecast Results Compared to TAF

OAK produced a range of forecast scenarios to model different shares of the Bay Area passenger market that uses OAK and different airline capacity deployment decisions. The chosen scenario reflects forecasts of economic growth in the Bay Area, OAK's growing catchment share of the Bay Area to historical levels, and a relatively consistent pattern of airline service among the three Bay Area airports. Since Southwest Airlines currently serves approximately 70% of the passengers at OAK, additional input from Southwest Airlines Network Planning and Properties and Facilities departments was incorporated to reflect an evolution of Southwest's strategy at OAK over the period.

- The timing of equipment up-gauging from 143-seat to 175-seat Boeing 737's.
- The inauguration of Hawaii service as well as consequent impact of connecting flights behind OAK.
- Changes to the flight schedule at OAK over the forecast period including longer activity days and banking.
- The Southwest operating day is longer in 2028 and 2038 than it is in 2019. Some flights are projected to arrive into OAK as late at 1:40am and depart as early at 5:35am in 2028. The operating day in 2033 extends to between 5:15am and 1:55am.
- The 2028 and 2038 operations/passenger profiles do not grow uniformly because Southwest provided specific flight schedules for each future year. The Southwest flights, while not tied to specific destinations, were matched. The remain overnight (RONs) were matched by hand using a last-in, first-out (LIFO) methodology to minimize gate occupancy.
- Despite increases during other times of the day, one of the largest departure peaks (driven by domestic) continues to be around midday. This allows for other airlines ("OALs") to reach their hubs which are all eastward. This departure bank is preceded by a large arrival bank just before midday.

Future international flights fill in primarily during the afternoon as Trans-Atlantic service grows faster than Trans-Pacific. Four peak hour departures and four peak hour arrivals are forecast in 2038, with about 800 passengers in the departure peak and 850 in the arrivals peak. Some of these flights may be precleared upon arrival from Canada or Europe depending on flight time and other regulations.

7.1 Enplaned Passenger Forecasts

The enplaned passenger forecast as well as the 2019 TAF are presented in Federal Fiscal Years in Figure 7-1. In the OAK forecast developed by Inter*VISTAS*, 2019 and 2020 enplaned figures were updated to reflect actual reported passenger traffic. The airport saw a slight decrease of -1.0% in the number of enplaned passengers between FY 2018 and FY 2019 largely as a result of the Boeing 737 MAX grounding.

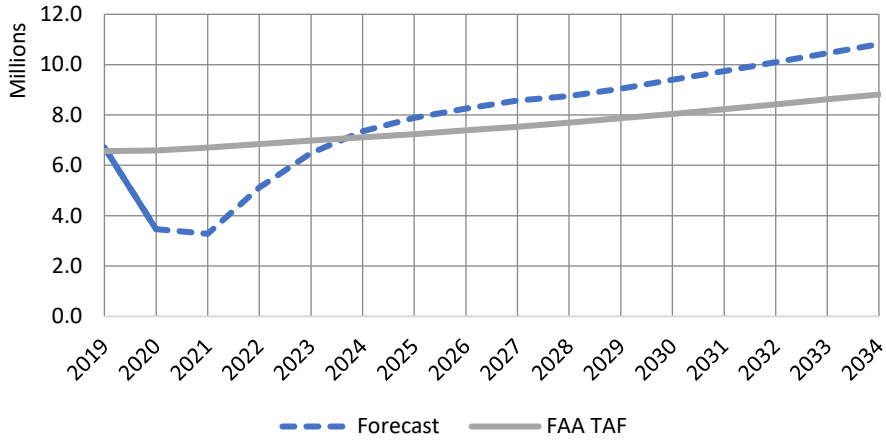
Passenger growth is forecast to increase at a CAGR of 1.8% between FY 2019 and FY 2024, based on the expected air carrier service developments. Passenger volumes increases are projected to average 4.3% per year between FY 2024 and FY 2029. The growth rates are then projected to attenuate as the market further matures. The average growth rate over the forecast period is 3.2% per year, reaching 10.8 million enplaned passengers in FY 2034.

The OAK Aviation forecast varies from the passenger enplanements in the TAF by a growing margin over

time. This variance is due to several factors, including FAA's underestimation of the base year (2019), which accounts for 2.2% of the variance and that carries through the horizon of the forecast. Additionally, the FAA TAF does not include the impact of the global pandemic experienced in 2020.

The variance with FAA's TAF passenger enplanements grows larger throughout the forecast because OAK's share of Bay Area traffic gradually increases over the forecast period to recapture market share leaking to other Bay Area Airports and returns to levels seen during the previous peak in 2007. By 2034, the TAF is showing 23% fewer passengers than the OAK forecast. This variance is driven by OAK's increasing share based on the following factors: (1) OAK's large catchment area and convenience to many parts of the Bay Area as a preferred airport for locals and tourists, (2) Southwest Airlines commitment to the airport and specific plans for growth at OAK, and (3) OAK's ability to accommodate this growth in traffic specifically available airside capacity, in contrast to other constrained regional airports.

Figure 7-1 OAK Enplaned Passenger Forecast vs. 2019 FAA TAF



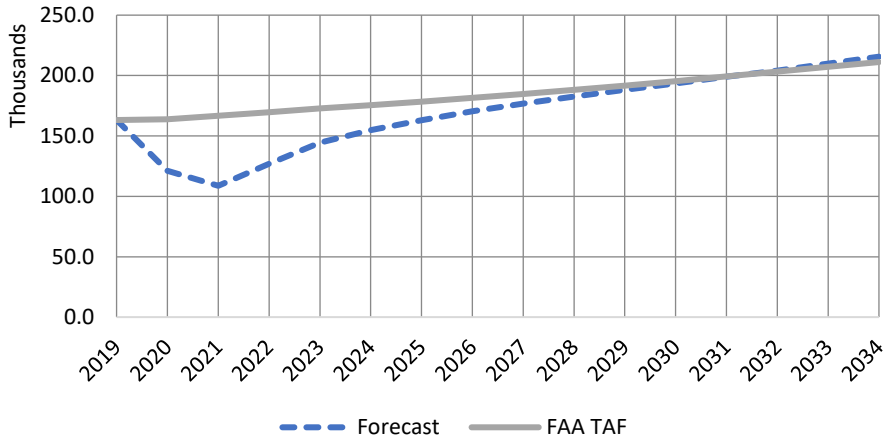
Note: Data is reflected in Federal Fiscal Year

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts. FAA TAF: https://www.faa.gov/data_research/aviation/taf/

7.2 Commercial Operations Forecast

In addition to passenger aircraft operations, commercial operations also include freighter activity for this comparison with the TAF. The OAK forecast projects operations to grow at a rate of -1.0% per annum from 2019 to 2024, while the TAF assumes a 1.5% growth over the same period. By 2024, the difference in aircraft operations is 13.4% or approximately 20,700 operations. By 2034, there is a difference of roughly 4,500 aircraft operations between the forecasts, or a variance of 2.1%.

Figure 7-2 Commercial Aircraft Operations Forecast vs. 2019 FAA TAF



Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

8 Derivative Forecast Fleet Mix

Derivative forecasts based on the future planning horizon were derived from the annual passenger and operations forecast. Annual aircraft operations by aircraft type can be used to support both airfield and apron geometry considerations as well as air quality and noise analyses. Future operations forecasts are based on anticipated changes in passenger, cargo, and general aviation fleets. The 2018 Boeing Current Market Outlook and the 2018 Airbus Global Market Forecast served as guiding documents for the aircraft fleet mix projections along with delivery and retirement announcements provided by the airlines. These aircraft manufacturer and order/delivery reports are the result of comprehensive modeling of several factors, and they serve as industry standards for accurately forecasting changes in airplane demand.

8.1 Commercial Fleet Mix

The mix of commercial aircraft operations is based on airline market share as well as up-gauging ability as passenger enplanements increase. New aircraft types such as the Boeing 737 MAX are expected to introduce new market opportunities as well as replacing older, less efficient aircraft. Southwest, the largest airline by market share at OAK, only operates variants of the Boeing 737 in their fleet. As a result, the largest component of the commercial fleet mix is the Boeing 737-700, -800, and MAX 8.

The industry is also experiencing a shift from smaller regional jets to larger regional jets. Smaller aircraft such as the CRJ-200 and ERJ-135 which are equipped with 50 seats or fewer are being replaced by larger aircraft such as the EMB-175 which can accommodate 76 passengers.

Increases in wide-body aircraft operations are also projected to support growth in international air travel demand. This growth is likely to occur on variants of the fuel-efficient Boeing 787 Dreamliner as these replace older Boeing 767 and 777 aircraft. Table 8-1 presents the projections of commercial aircraft operations at OAK by aircraft segment and specific aircraft type. Due to some unique circumstances experienced in 2019, such as the Boeing 737 MAX grounding, both 2018 and 2019 fleet mixes were analyzed. In addition, there is currently no replacement aircraft in development to replace these aging 50 seat regional jets.

Table 8-1 Commercial Fleet Mix Historical and Forecast

Aircraft	2018	2019	PAL 1 2028	PAL 2 2038
Wide-Body	**2,993**	**1,290**	**4,489**	**7,094**
Airbus 330-200	425	95	641	1,935
Boeing 767-300	564	0	0	0
Boeing 777-200	238	0	0	0
Boeing 787-8	586	404	0	0
Boeing 787-9	1,180	791	3,848	5,159
Narrow-Body	**105,476**	**104,609**	**119,287**	**161,858**
Airbus 319	5,389	5,838	5,131	7,093
Airbus 320	9,368	7,659	10,903	14,187
Airbus 321	1,767	2,521	2,565	3,224
Boeing 717	360	426	641	645

Boeing 737-700	65,956	60,956	14,109	11,607
Boeing 737-800	17,553	24,045	31,425	11,607
Boeing 737 MAX 8	1,314	524	51,306	109,626
Boeing 737-900	2,970	2,640	3.207	3,869
McDonnell Douglas MD83	46	0	0	0
McDonnell Douglas MD90	753	0	0	0
Regional Jet	**5,064**	**6,082**	**8,387**	**11,651**
Bombardier CRJ-200	0	189	0	0
Bombardier CRJ-700	110	178	0	0
Bombardier CRJ-900	1,048	275	641	0
Embraer ERJ-135	671	1,331	0	0
Embraer ERJ-145	0	366	1,333	1,333
Embraer ERJ-175	3,235	3,743	6,413	10,318
Turboprop	**2,051**	**1,291**	**667**	**667**
Pilatus PC-12	1,671	1,291	667	667
Bombardier Q400	380	0	0	0
Commercial Total	**115,433**	**113,272**	**132,830**	**181,270**

Sources: Airport Statistics; FAA Traffic Flow Management System Count (TFSC) Reports; InterVISTAS

8.2 Freighter Fleet Mix

Freighter operations levels at OAK are based on the growth in tons of air cargo transported through the Airport and the increased in the average tons per aircraft operation derived from the assumed future changes in the freighter fleet mix. The freighter fleet is presumed to have relatively few different aircraft that will play a significant role in future operations at OAK. The primary aircraft are presented in Table 8-2 with a shift from one of the current large freighters operating at OAK (the MD-11) being replaced with a new large aircraft (NLA) that may not yet be in production or a new version of one of today's other larger aircraft.

Table 8-2 Freighter Fleet Mix Historical and Forecast

Aircraft	2018	2019	PAL 1 2028	PAL 2 2038
Wide-Body	**14,120**	**14,140**	**15,850**	**16,940**
McDonnell Douglas MD-11	5,300	4,900	2,660	1,270
Boeing 767-300	4,720	4,360	5,050	5,670
Airbus A300-600	2,290	2,640	1,920	1,230
McDonnell Douglas DC-10	780	590	420	280
Boeing 777-200	1,000	1,580	2,420	3,390
Other (& NLA)	30	70	3,380	5,100
Narrow-Body	**2,710**	**2,710**	**3,040**	**3,250**
Boeing 757-200	2,707	2,710	3,040	3,250
Other	3	0	0	0
Piston	**3,841**	**3,848**	**4,310**	**4,610**
Cessna 208 Caravan	3,728	3,755	4,186	4,443
Other	113	93	124	167

Freighter Total	**20,671**	**20,698**	**23,200**	**24,800**

Sources: Airport Statistics; U.S. DOT Reports Air Carrier Statistics Database (T-100); Passur flight radar data; Landrum & Brown

8.3 General Aviation Fleet Mix

The total general aviation fleet mix for the Airport is based on the forecast of total GA operations at the Airport with the segment and specific aircraft type shares increasing or decreasing with the impact of current trends and predicted industry shifts in trends based on popularity, preference and demand. In general, the demand for small piston aircraft has been declining for decades at U.S. airports and this is generally true at OAK as well. At most airports, the business jet market has shown the biggest growth, and this is expected to be true at OAK for future fleet projections. Table 8-3 presents the projections of general aviation operations at OAK by aircraft segment and specific aircraft type. The predicted fleet mix is a general prediction of future operations based on the most common aircraft types currently in operation at the Airport, with many similar types and models combined or summed in an 'other' category due to the numerous models and variants in use.

Table 8-3 General Aviation Fleet Mix Historical and Forecast

Aircraft	**2018**	**2019**	**PAL 1 2028**	**PAL 2 2038**
Gulfstream III/IV/V/VI	3,309	3,824	4,786	5,783
Bombardier Challenger 300/600	3,223	3,726	4,663	5,634
Cessna 560/560XL	2,164	2,501	3,130	3,782
Dassault Falcon	2,032	2,348	2,939	3,551
BAe HS 125/700-800/Hawker 800	1,036	1,198	1,499	1,812
Cessna Citation X	996	1,151	1,441	1,741
Cessna Citation Sovereign	813	940	1,176	1,421
Cessna Citation Jet 525	704	814	1,018	1,231
Other (inc. Embraer 135/145)	5,127	5,926	7,418	8,961
Pilatus PC-12	4,968	4,294	6,079	6,961
Cessna 208 Caravan	3,964	3,427	4,851	5,554
Beech Super King Air 350	1,283	1,109	1,570	1,798
Embraer Phenom 100	858	741	1,050	1,202
Embraer Phenom 300	849	734	1,039	1,190
Beech 200 Super King	770	665	942	1,079
Other	3,766	3,256	4,608	5,276
Business Aviation Total	**35,862**	**36,654**	**48,209**	**56,976**
Cessna 172 Skyhawk	21,704	22,549	19,808	18,828
Piper PA-28 Cherokee	12,361	12,843	11,282	10,723
Cessna 182 Skylane	7,056	7,331	6,439	6,121
Cessna 152	3,791	3,939	3,460	3,289
Cirrus SR22	3,646	3,788	3,327	3,163
Cessna 210	1,810	1,881	1,652	1,570
Other	18,169	18,876	16,581	15,761

General Aviation Total	**68,537**	**71,207**	**62,549**	**59,455**

Sources: Airport Statistics; US DOT Reports Air Carrier Statistics Database (T-100); Traffic Flow Management System Counts (TFMSC); Landrum & Brown

9 Design Day Flight Schedules

Design day flight schedules (DDFS) are beneficial for establishing peak period demands used to calculate facility requirements and test facility sizing. To support both the terminal facility planning and airfield facility planning, two design day flight schedules were developed. One flight schedule focuses on commercial passenger activity to drive terminal requirements and the other focuses on freighter, general aviation, and military flight operations to support airfield and airspace simulations and cargo facility requirements.

9.1 Design Day Flight Schedules Methodology

The methodologies for developing the DDFS for each component of traffic are similar but rely on different peaking characteristics. The approaches for baselining and developing each set of schedules is described below.

9.1.1 Commercial Passenger Activity

To serve as a basis for calculating terminal requirements, average day peak month (ADPM) enplanements and deplanements were calculated. The peak month in terms of passenger enplanements and operations is July, representing between 9.2% and 9.4% of total annual passengers over the past several years. The design day schedule is based on an average day in July (i.e. the total number of departing seats for the month divided by 31).

A weekday from published airline schedules closest to the theoretical average day was selected as the basis for the development of future flight schedules (July 12, 2018). Accordingly, airline schedule data was collected to determine arrival and departure times, as well as aircraft types and seat capacities. This schedule data was then supplemented with load factor, origin-destination, and connecting passenger information from U.S. Department of Transportation T-100 and origin-destination traffic reports to determine passenger enplanements and deplanements. The 2018 schedule was re-baselined to reflect July 2019 changes. For future flight schedules, the July 2019 ADPM schedule was grown based on forecast passengers and operations, as well as interviews conducted with select airlines serving the Airport.

Design day flight schedule factors were established to define the relationship to peak hour, peak day, and peak month. Those factors can be seen in Table 9-1 below. While there is some seasonality in the flight schedule patterns at OAK, there has been little historical change in the peak month factors, so the peak month is assumed to stay constant throughout the planning period. The average day is held constant as well given the historical trends surrounding day-to-day schedule variations during the peak month. The peak hour as a percent of annual was allowed to vary throughout the planning period so as not to constrain organic schedule growth or force hub carriers to schedule flights that do not align with their hubbing strategies.

Table 9-1 Design Day Flight Schedule Factors

	Operations	Passengers
Peak month as a percent of annual	held constant for both domestic (9.05%) and international (10.16%) in order to maintain historical peak month trends	held constant for both domestic (9.43%) and international (11.61%) in order to maintain historical peak month trends
Average day as a percent of annual	held constant throughout planning period to maintain historical average day peak month (ADPM) trends for domestic (0.29%) and international (0.42%)	held constant throughout planning period to maintain historical ADPM trends for domestic (0.30%) and international (0.48%)
Peak hour as a percent of annual	varied throughout the planning period to accommodate arrivals and departures associated with new routes	varied throughout the planning period to accommodate arrivals and departures associated with new routes

Source: InterVISTAS analysis

Passenger growth is derived from one of two sources: (1) adding new flights (operations), and (2) up-gauging existing flights to larger aircraft. When looking at underserved markets for which to expand airline service, it is important to note that OAK has nonstop service to 21 of the 30 largest airports. Service to airports east of the Mississippi River, however, is underrepresented. Many of these underserved markets are accommodated in the PAL 1 and PAL 2 design day flight schedule development, as the shift in the share of passengers using OAK over other Bay Area airports grows.

As the anchor tenant, Southwest operates a relatively mature schedule at OAK, with existing service to 35 airports. Given its current exclusive Boeing 737 fleet mix (aircraft with either 143 or 175 seats), however, Southwest has a limited ability to up-gauge to larger aircraft. As a result, growth for Southwest is expected to occur through additional frequencies to existing destinations as well as new frequencies to unserved markets in their North and Central American network which were previously reached via connection.

For OALs serving OAK as a spoke market, the airline hubs dictate most arrival and departure times. Because of this, some additional passenger and operations growth is expected in the morning departure peak, as not all hub destinations are presently served. More aircraft up-gauging is anticipated for OALs as these airlines have more diverse fleets and the hubs that they serve are considerably more congested from a gate and apron perspective.

9.1.2 Freighter, General Aviation, and Military Activity

In order to evaluate the peaking patterns at OAK, the flight by flight details for 2016 and 2017 from PASSUR radar data (arrivals and departures) were analyzed and used to segment annual cargo, general aviation and military aircraft operations forecasts into monthly, daily, and hourly equivalents. According to the radar data, August was found to be the peak month for general activity while December was the peak month for cargo activity.

For support of potential cargo facility planning activities, the freighter operations peak period demand is shown in two scenarios: (peak general month of August, and peak cargo month of December) so that the larger demand of the holiday season in the U.S. is represented as the true cargo peak in comparison to the passenger peak in August.

It is estimated that the month of August represents a 9.0% share of total annual freighter operations, 9.4% of annual general aviation operations and 9.9% of the total annual military operations. Military

operations peaked in January 2017 while cargo operations peaked in December. A typical day during the peak month accounts for about 3.2% of the monthly operations, with 3.3% used for general aviation, 5.3% for cargo and 5.4% for military due to more activity during specific weekdays. It was assumed that the percentage factors of peak month, design day, and peak hour would remain constant from 2019 to 2038, with allowance for a small increase in total peak hour cargo operations due to the need to accommodate large banks of traffic for the main daily sorting operation.

9.2 Design Day Flight Schedule Results – Commercial Passenger Activity

A summary of the design day passengers and operations for each of the planning activity levels is provided in Table 9-2.

Table 9-2 Design Day Flight Schedule Results

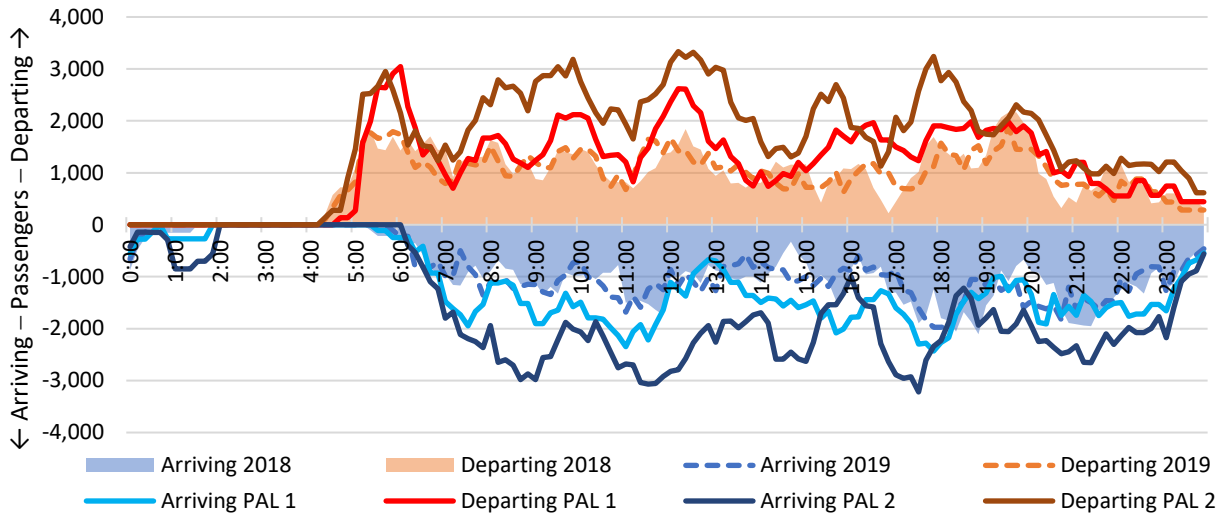
	2018	2019	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	132,830	181,270
Daily				
Deplaned Passengers	21,361	20,658	27,451	38,630
Domestic Passengers	19,876	19,640	24,219	33,286
International Passengers	1,485	1,018	3,232	5,344
Enplaned Passengers	21,302	20,600	27,491	38,689
Domestic Passengers	19.818	19,587	24,216	33,270
International Passengers	1,484	1,013	3,275	5,420
Operations	356	346	414	562
Arriving Operations	178	173	207	281
Departing Operations	178	173	207	281
Schedule Parameters				
Load Factors	78.7%	78.6%	79.0%	80.9%
Domestic Load Factor	78.6%	78.5%	78.8%	80.6%
International Load Factor	80.7%	80.0%	81.2%	82.5%
Seats per Operation	152.2	151.8	167.9	170.1
Domestic	148.5	149.6	161.9	163.1
International	229.1	211.5	235.8	233.3

Source: InterVISTAS analysis

The morning "head-start" departure peak between 5:00am and 7:00am increases in PAL 1 and PAL 2, but there is not a pronounced increase in late evening arrivals. As a west coast market, there is often a peaked morning departure bank to serve eastern hubs, but the time zone patterns can meter those arrivals back to OAK in the evening. Additionally, it is not uncommon to see some ultra-low cost carriers (ULCCs) schedule RON arrivals to align with crew rest periods.

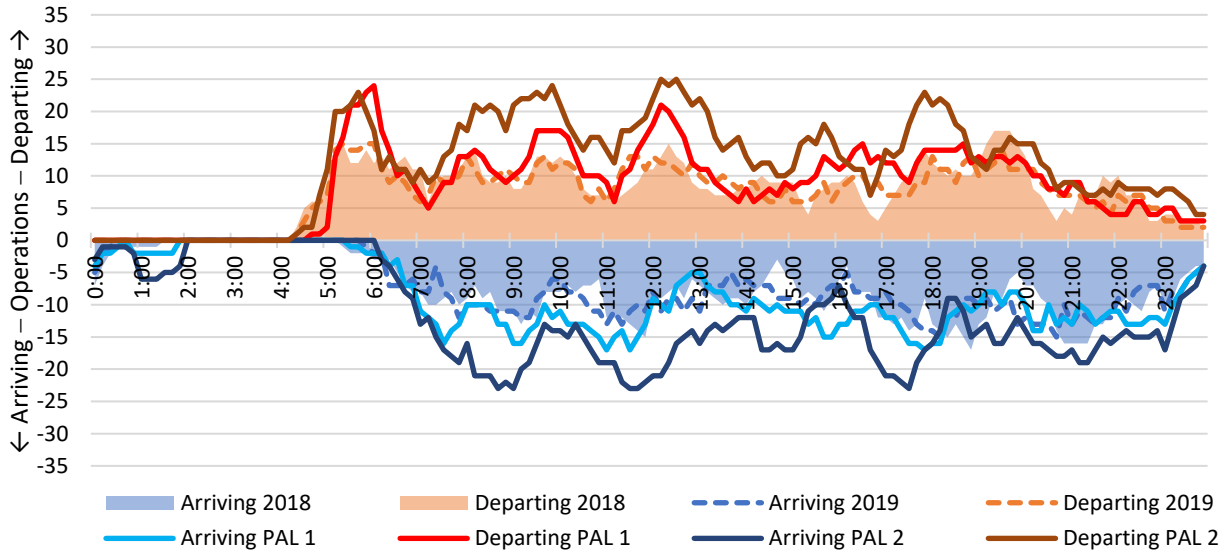
Despite increases during other times of the day, one of the largest departure peaks (driven by domestic) continues to be around midday. This allows OALs an additional frequency to reach their hubs which are almost entirely located east of OAK. This departure bank is preceded by a large arrival bank just before midday. These departure and arrival banks for PAL 1 and PAL 2 can be seen in Figure 9-1 for passengers and Figure 9-2 for operations.

Figure 9-1 Rolling Departure and Arriving Passengers in PAL 1 and PAL 2



Source: InterVISTAS analysis

Figure 9-2 Rolling Departure and Arriving Operations in PAL 1 and PAL 2



Source: InterVISTAS analysis

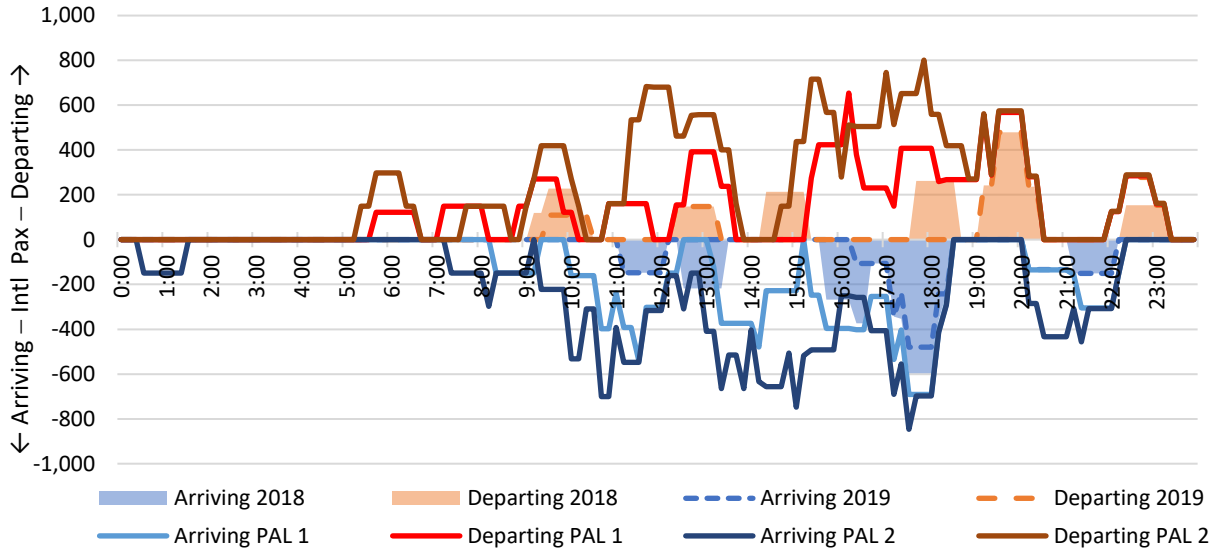
The Southwest operating day is longer in the PAL 1 and PAL 2 flight schedules than it is in 2018 and 2019. Some flights are projected to arrive into OAK as late at 1:40am and depart as early at 5:35am in PAL 1. The operating day in PAL 2 extends to between 5:15am and 1:55am. This longer operating day allows for additional destinations to be served and for passengers to access additional connecting banks across their network.

The PAL 1 and PAL 2 passenger and operation daily profiles do not grow uniformly because Southwest provided flight schedule inputs for each of these future years. The Southwest flights, while not tied to specific destinations, were matched to create arrival and departure turns assuming similar ground times

to match Southwest's current operation. The RONs were matched by hand using a LIFO methodology to minimize gate occupancy and simplify towing operations.

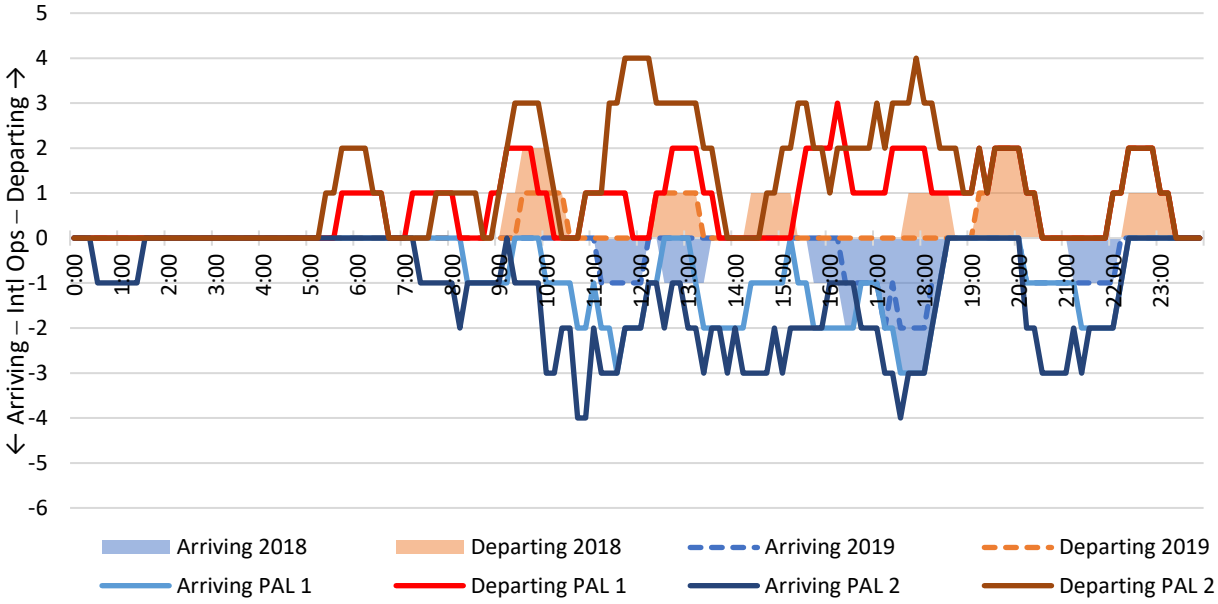
Future international flights fill-in primarily in during the afternoon as Trans-Atlantic service grows faster than Trans-Pacific. Given time zone and travel block times, Trans-Atlantic operations generally turn at west coast cities during the afternoon and evening while Trans-Pacific operations generally turn in the late-morning or late-evening. Four peak hour international departures and four peak hour international arrivals are forecast in PAL 2, with about 800 passengers in the departure peak and 850 in the arrivals peak. Some of these flights may be precleared upon arrival from Canada or Europe depending on departure time at origin and other regulations/international agreements concerning US Preclearance. The international passenger and operations profiles for PAL 1 and PAL 2 can be seen in Figure 9-3 and Figure 9-4, respectively.

Figure 9-3 Rolling International Departing and Arriving Passengers in PAL 1 and PAL 2



Source: InterVISTAS analysis

Figure 9-4 Rolling International Departing and Arriving Operations in PAL 1 and PAL 2



Source: InterVISTAS analysis

A summary of the peak hour passenger and operation characteristics for the planning levels is provided in Table 9-3.

Table 9-3 Peak Hour Design Day Flight Schedule Results

	2018	2019	PAL 1 2028	PAL 2 2038
Annual Passengers	13,594,251	13,378,411	17,585,709	24,685,035
Annual Airline Operations	115,443	113,272	132,830	181,270
Peak Rolling Hour				
Deplaned Passengers	2,107	1,973	2,431	3,218
Domestic Passengers	2,107	1,704	2,107	2,835
International Passengers	596	480	691	847
Enplaned Passengers	2,167	1,874	3,045	3,334
Domestic Passengers	1,830	1,795	2,923	2,856
International Passengers	479	479	654	801
Operations	27	27	31	46
Arriving Operations	17	15	17	23
Departing Operations	17	15	24	25

Source: InterVISTAS analysis

9.2.1 Overnight Commercial Passenger Aircraft Demand

There are 46 aircraft that remain overnight in the PAL 2 ADPM flight schedule, of which 28 are operated by Southwest. The Southwest "head start" bank includes 19 departures and occurs between 5:00am and 7:00am before the first arrival occurs, allowing for gates to accommodate one or two departure-only operations before the first arrival. Southwest's projected aircraft on the ground profile is shown in Figure 9-5.

Figure 9-5 Southwest Overnight Aircraft Demand

Source: InterVISTAS analysis

9.3 Design Day Flight Schedule Results – Freighter, General Aviation, and Military Activity

Table 9-4, Table 9-5, Table 9-6, and Table 9-7 provide the forecasts of estimated peak period operations at OAK for freighter, general aviation, and military through the forecast period of 2019 to 2038.

Table 9-4 Freighter Peak Period Operations Forecast (Peak General Month)

Freighter	**2018**	**2019**	**PAL 1 2028**	**PAL 2 2038**
Annual	20,671	20,698	23,200	24,800
DDFS Month (August)	1,867	1,869	2,095	2,240
% of annual	*9.0%*	*9.0%*	*9.0%*	*9.0%*
Average Day	99	99	111	119
% of DDFS month	*5.3%*	*5.3%*	*5.3%*	*5.3%*
Peak Hour Arrivals	9	9	11	11
% of avg day	*9.5%*	*9.5%*	*9.5%*	*9.5%*
Peak Hour Departures	11	11	13	14
% of avg day	*11.6%*	*11.6%*	*11.6%*	*11.6%*
Peak Hour Total Ops	11	11	13	14
% of avg day	*11.6%*	*11.6%*	*11.8%*	*11.9%*

Sources: Airport Statistics; Landrum & Brown

Table 9-5 Freighter Peak Period Operations Forecast (for Cargo Facility Planning)

Freighter	**2018**	**2019**	**PAL 1 2028**	**PAL 2 2038**
Annual	20,671	20,698	23,200	24,800
Peak Month (December)	2,418	2,421	2,713	2,900
% of annual	*11.7%*	*11.7%*	*11.7%*	*11.7%*
Average Day	127	127	142	152
% of peak month	*5.2%*	*5.2%*	*5.2%*	*5.2%*
Peak Hour Arrivals	10	10	12	12
% of avg day	*8.2%*	*8.2%*	*8.2%*	*8.2%*
Peak Hour Departures	12	12	14	15
% of avg day	*9.7%*	*9.7%*	*9.7%*	*9.7%*
Peak Hour Total Ops	14	14	16	17

% of avg day	*11.2%*	*11.2%*	*11.2%*	*11.2%*

Sources: Airport Statistics; Landrum & Brown

Table 9-6 General Aviation Peak Period Operations Forecast

General Aviation	**2018**	**2019**	**PAL 1 2028**	**PAL 2 2038**
Annual	104,399	107,861	110,758	116,431
Peak Month	9,776	10,100	10,371	10,902
% of annual	*9.4%*	*9.4%*	*9.4%*	*9.4%*
Average Day	327	337	346	364
% of peak month	*3.3%*	*3.3%*	*3.3%*	*3.3%*
Peak Hour Arrivals	31	32	32	34
% of avg day	*9.4%*	*9.4%*	*9.4%*	*9.4%*
Peak Hour Departures	27	28	29	31
% of avg day	*8.4%*	*8.4%*	*8.4%*	*8.4%*
Peak Hour Total Ops	46	47	49	51
% of avg day	*14.0%*	*14.0%*	*14.0%*	*14.0%*

Sources: Airport Statistics; Landrum & Brown

Table 9-7 Military Peak Period Operations Forecast

Military	**2018**	**2019**	**PAL 1 2028**	**PAL 2 2038**
Annual	1,230	926	1,000	1,000
DDFS Month (August)	121	91	99	99
% of annual	*9.9%*	*9.9%*	*9.9%*	*9.9%*
Average Day	6	6	6	6
% of DDFS month	*5.0%*	*5.4%*	*5.4%*	*5.4%*
Peak Hour Arrivals	2	2	2	2
% of avg day	*27.9%*	*27.9%*	*27.9%*	*27.9%*
Peak Hour Departures	2	2	2	2
% of avg day	*33.3%*	*33.3%*	*33.3%*	*33.3%*
Peak Hour Total Ops	2	2	2	2
% of avg day	*33.3%*	*33.3%*	*33.3%*	*33.3%*

Sources: Airport Statistics; Landrum & Brown

Note: Peak Hour Military operations were rounded up

10 Appendix

Appendix A Summary of Oakland International Airport Forecast – FAA Template

	Forecast					Compound Annual Growth Rates			
	Base Year 2019	Base Year+1 2020	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034	Base Year+1 2020	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034
Passenger Enplanements									
Air Carrier	6,569,964	3,316,660	7,189,321	8,874,856	10,621,100	-49.5%	1.8%	3.1%	3.3%
Commuter/Air Taxi	138,656	143,620	157,605	175,222	192,122	3.6%	2.6%	2.4%	2.2%
Total Enplanements	**6,708,620**	**3,460,280**	**7,346,925**	**9,050,078**	**10,813,222**	**-48.4%**	**1.8%**	**3.0%**	**3.2%**
Aircraft Operations									
Itinerant									
Air Carrier	131,544	94,914	127,438	157,566	182,040	-27.8%	-0.6%	1.8%	2.2%
Commuter/Air Taxi	31,622	26,123	27,388	30,542	33,568	-17.4%	-2.8%	-0.3%	0.4%
Total Commercial Operations	*163,166*	*121,037*	*154,826*	*188,107*	*215,608*	*-25.8%*	*-1.0%*	*1.4%*	*1.9%*
General Aviation	39,390	27,043	43,829	44,881	45,724	-31.3%	2.2%	1.3%	1.0%
Military	534	449	550	550	550	-15.9%	0.6%	0.3%	0.2%
Local									
General Aviation	40,883	26,964	39,003	37,782	36,756	-34.0%	-0.9%	-0.8%	-0.7%
Military	468	326	450	450	450	-30.3%	-0.8%	-0.4%	-0.3%
Total Operations	**244,441**	**175,855**	**238,657**	**271,771**	**299,087**	**-28.1%**	**-0.5%**	**1.1%**	**1.4%**
Peak Hour Operations	**76**	**65**	**80**	**87**	**94**	**-14.5%**	**1.0%**	**1.4%**	**1.4%**
Cargo/Mail									
Enplaned and Deplaned Tons	655,441	672,946	725,134	781,559	836,829	2.7%	2.0%	1.8%	1.6%
Based Aircraft									
Single Engine (Nonjet)	162	161	158	154	150	-0.6%	-0.5%	-0.5%	-0.5%
Multi Engine (Nonjet)	24	24	24	24	25	0.0%	0.0%	0.0%	0.3%
Jet Engine	72	73	77	81	86	1.4%	1.4%	1.2%	1.2%
Helicopter	7	7	8	9	10	0.0%	2.7%	2.5%	2.4%
Other	0	0	0	0	0	-	-	-	-
Total Based Aircraft	**265**	**265**	**267**	**268**	**271**	**0.0%**	**0.2%**	**0.1%**	**0.1%**

Note: Data is reflected in Federal Fiscal Years

	Forecast					Compound Annual Growth Rates			
	Base Year 2019	Base Year+1 2020	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034	Base Year+1 2020	Base Year+5 2024	Base Year+10 2029	Base Year+15 2034
Operational Factors									
Average Aircraft Size (seats)									
Air Carrier – Passenger	149	152	162	165	167	2.0%	1.7%	1.0%	0.8%
Average Enplaning Load Factor									
Air Carrier - Passenger	79.3%	49.2%	79.7%	80.1%	80.6%	-38.0%	0.1%	0.1%	0.1%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/

Appendix B Comparison of OAK and TAF Forecasts – FAA Template

	Year	OAK Forecast	FAA TAF	OAK vs. TAF % Difference
Passenger Enplanements				
Base Year	2019	6,708,620	6,563,567	2.2%
Base Year + 5 yrs.	2024	7,346,925	7,107,578	3.4%
Base Year + 10 yrs.	2029	9,050,078	7,868,500	15.0%
Base Year + 15 yrs.	2034	10,813,222	8,812,573	22.7%
Commercial Operations				
Base Year	2019	163,166	163,166	0.0%
Base Year + 5 yrs.	2024	154,826	175,545	-11.8%
Base Year + 10 yrs.	2029	188,107	191,656	-1.9%
Base Year + 15 yrs.	2034	215,608	211,158	2.1%
Total Operations				
Base Year	2019	244,441	244,441	0.0%
Base Year + 5 yrs.	2024	238,657	257,710	-7.4%
Base Year + 10 yrs.	2029	271,771	274,134	-0.9%
Base Year + 15 yrs.	2034	299,087	293,951	1.7%

Note: Data is reflected in Federal Fiscal Years

Source: Airport statistics data for historical; U.S. DOT T100 data; InterVISTAS analysis for forecasts.
FAA TAF: https://www.faa.gov/data_research/aviation/taf/