Reno-Tahoe Airport Authority

DECEMBER 2018

Reno-Tahoe International Airport
MASTER PLAN

CHAPTER 2:
Aviation Activity Analysis and Forecast

AVIATION ACTIVITY ANALYSIS AND FORECAST

Introduction

This chapter presents an air service market evaluation, an analysis of historical trends, and 20-year forecasts of commercial and noncommercial aviation activity. Commercial aviation activity includes passenger and all-cargo service. Noncommercial activity includes general aviation (GA) and military operations. The air service market study estimates the "True Market" for Reno-Tahoe International Airport (RNO) by evaluating market trends to explore the potential for air service expansion. The identification of market trends is the result of analyzing current airline service, assessing airline performance, and comparing RNO with other airports that provide air service within the region. The analysis of historical trends provides the context for the development of the forecasts and informs model specifications and assumptions. The forecasts will serve as the basis for subsequent analyses in the Master Plan, such as the assessment of facility requirements, demand/capacity analysis, development of a 20-year capital improvement plan, and environmental impact analysis. The details of the proposed forecasting approaches are described below. The resulting forecasts are compared with the latest Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) for RNO.

Air Service Market Evaluation

In support of the aviation forecast for RNO, an air service evaluation helped to develop the true market estimate. The true market estimate gives RNO the most useful information about local passenger travel patterns relative to commercial airline service. This air service market evaluation comprises a true market estimate, market performance, and route performance studied for seven of the eight airlines serving passengers at RNO, listed in **Table 2-1** below. Volaris, as a non-domestic provider, is not required to report commercial passenger activity through U.S. Department of Transportation (DOT).

The air service market evaluation section will briefly describe the methodology and the catchment area used in the evaluation and will highlight the trends from the collected data through the year ending (YE) June 30, 2016. This section also addresses the service gaps and opportunities presented for RNO, concluding with the overview of the opportunities for both incumbent and new airlines.

Table 2-1: Airlines Serving Passengers at RNO

Airline	Abbreviation
Alaska	AS
Allegiant	G4
American	AA
Delta	DL
JetBlue	B6
Southwest	WN
United	UA
Volaris	Y4

True Market Estimate

The primary objective of this evaluation was to develop information on the travel patterns of passengers who live in the area.

The analysis relied on a combination of Airline Reporting Corporation (ARC) tickets (catchment area and online travel agencies) and U.S. DOT data, calculating the true market for the year end (YE) June 30, 2016. This data did not capture tickets issued directly by airline websites, and the survey sample consisted of 44,664 tickets, which is consistent with industry survey standards.

Figure 2-1: RNO Primary Catchment Area 2016

The catchment area is defined as the geographic area where RNO can reasonably expect to draw passenger traffic and is representative of the local market. This is significant because it includes the population of travelers who ideally should use RNO based on the drive time. RNO's primary catchment area, shown in **Figure 2-1**, comprises 92 zip codes, and had a 2016 population of 776,930.

The true market summary is calculated by looking at the actual passenger use versus the total passengers eligible to use the airport based on the catchment area. RNO had a true market of 3,665,693 origin and destination (O&D) passengers, shown in **Table 2-2,** which is 5,021 total passengers daily each way (PDEW), meaning an estimated 279 PDEW use alternate airports.

The overall true market number represents 93 percent domestic travel and seven percent international travel. RNO retained 94 percent of total passengers, as shown in **Figure 2-2**, which equaled 96 percent of domestic travel, and 75 percent of international retention.

Table 2-2: True Market Summary

Rank	Origin Airport	YE 2Q 2016	
		PAX	%
Domestic			
1	**RNO**	**3,281,368**	**96**
2	Sacramento (SMF)	80,690	2
3	San Francisco (SFO)	63,133	2
	Subtotal	3,425,192	100
International			
1	**RNO**	**180,662**	**75**
2	SFO	50,109	21
3	SMF	9,730	4
	Subtotal	240,501	100
Domestic and International			
1	**RNO**	**3,462,030**	**94**
2	SFO	113,242	3
3	SMF	90,420	3
	Total	3,665,693	100

Source: Mead & Hunt, Inc.; YE June 30, 2016

Figure 2-2: True Market Summary
San Francisco International Airport (SFO) & Sacramento International Airport (SMF)

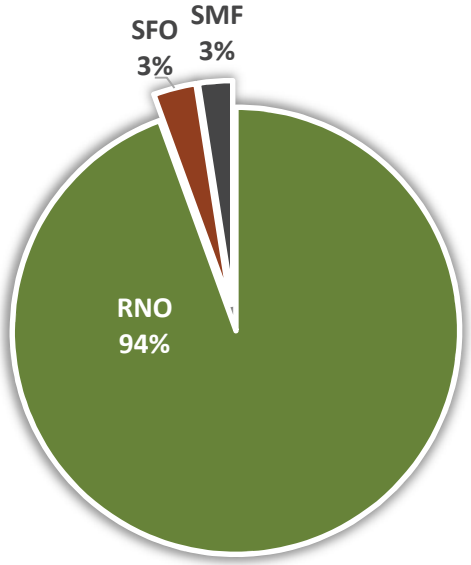


Table 2-3 lists the top 25 domestic destinations. The top five domestic markets included McCarran International Airport in Las Vegas (LAS), Los Angeles International Airport (LAX), Phoenix Sky Harbor International Airport (PHX), Seattle-Tacoma International Airport (SEA), and San Diego International Airport (SAN). Las Vegas was the top market with 435,015 annual passengers or 599 PDEW. Of note, the top 25 markets generate 65 percent of total air travel, and in the analysis, markets with nonstop service tended to have a higher retention rate than markets without nonstop service.

Table 2-4 lists the top 15 international destinations. These markets were estimated at 240,501 annual passengers or 329 PDEW. Within these markets, the top three were Los Cabos International Airport (SJD), Cancun International Airport (CUN), and Vancouver International Airport (YVR). RNO retention rates were much lower internationally, due in part to the service at RNO primarily being domestic, as well as RNO's relative proximity to San Francisco International Airport (SFO) and their significant international service.

Table 2-5 shows the top 50 true markets ranked by destination**,** illustrates RNO's O&D passengers to each destination, and lists RNO's totals for domestic, international, and all markets within these top 50 including the retention/diversion estimates for each.

Table 2-3: Top 25 Domestic Destinations

Rank	Destination		Origin Airport %			Total Pax
			RNO	SMF	SFO	
1	Las Vegas, NV	LAS	**99**	0	0	435,015
2	Los Angeles, CA	LAX	**97**	1	1	288,235
3	Phoenix, AZ	PHX	**97**	2	1	193,021
4	Seattle-Tacoma, WA	SEA	**91**	6	3	179,347
5	San Diego, CA	SAN	**99**	0	1	160,718
6	Denver, CO	DEN	**99**	1	1	147,844
7	Portland, OR	PDX	**95**	3	1	105,088
8	New York JFK, NY	JFK	**93**	2	4	98,179
9	Dallas-Fort Worth, TX	DFW	**93**	4	3	72,435
10	Salt Lake City, UT	SLC	**96**	3	2	69,243
11	Chicago O'Hare, IL	ORD	**95**	2	4	64,998
12	San Jose, CA	SJC	**100**	0	0	52,012
13	Boston, MA	BOS	**90**	2	7	51,915
14	Minneapolis, MN	MSP	**96**	2	2	47,933
15	Orange County, CA	SNA	**99**	0	1	46,022
16	Orlando, FL	MCO	**94**	4	2	45,255
17	Atlanta, GA	ATL	**94**	4	2	42,560
18	Chicago Midway, IL	MDW	**99**	0	0	42,056
19	Austin, TX	AUS	**97**	1	2	38,094
20	Philadelphia, PA	PHL	**90**	7	3	35,370
21	Baltimore, MD	BWI	**96**	3	1	35,220
22	Washington Reagan, DC	DCA	**96**	2	2	32,943
23	Detroit, MI	DTW	**97**	2	1	32,418
24	Houston Bush, TX	IAH	**98**	1	1	32,351
25	Newark, NJ	EWR	**89**	2	9	30,399
Top 25 Domestic			**96**	**2**	**2**	**2,378,670**
Total Domestic			**96**	**2**	**2**	**3,425,192**

Source: Mead & Hunt, Inc.; YE June 30, 2016
Sacramento International Airport (SMF), San Francisco International Airport (SFO)

Table 2-4: Top 15 International Destinations

Rank	Destination		Origin Airport %			Total Pax
			RNO	SFO	SMF	
1	San Jose del Cabo, Mexico	SJD	**94**	4	2	13,952
2	Cancun, Mexico	CUN	**87**	7	6	13,552
3	Vancouver, Canada	YVR	**90**	6	3	11,244
4	Toronto, Canada	YYZ	**91**	6	3	9,998
5	Mexico City, Mexico	MEX	**87**	4	8	9,553
6	London Heathrow, UK	LHR	**78**	19	3	8,482
7	Puerto Vallarta, Mexico	PVR	**91**	7	3	7,708
8	Guadalajara, Mexico	GDL	**87**	2	11	5,746
9	Manila, Philippines	MNL	**61**	39	0	4,458
10	Calgary, Canada	YYC	**90**	5	5	4,436
11	Montreal, Canada	YUL	**85**	14	1	4,189
12	San Jose, Costa Rica	SJO	**77**	14	9	3,873
13	Frankfurt, Germany	FRA	**73**	26	1	3,868
14	Paris De Gaulle, France	CDG	**77**	22	1	3,815
15	Dublin, Ireland	DUB	**70**	28	2	3,437
Top 15 International			**85**	**12**	**4**	**128,080**
Total International			**75**	**21**	**4**	**240,501**

Source: Mead & Hunt, Inc.; YE June 30, 2016

Analysis of Current Airline Service (Market Performance)

This section highlights traffic and capacity trends, revenue and fare trends, and the O&D revenue market share by airline. The section also highlights regional comparisons for the domestic market based on YE 2Q 2016.

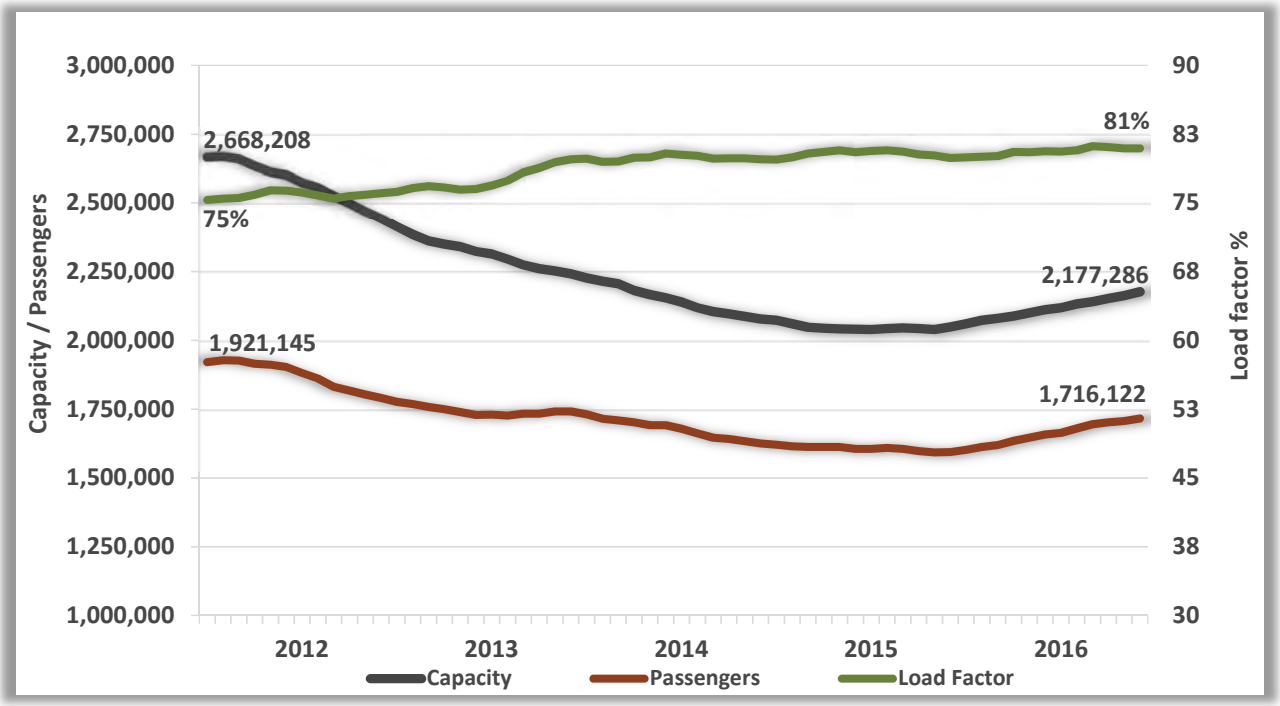
As far as traffic and capacity trends, YE 2Q 2016 year-over-year capacity was up six percent and passengers were up eight percent, as **Figure 2-3** shows. These factors drove a one percentage point increase in load factor (percent of seats sold), with capacity (total available seats) and passengers (traveling public) trending positively. As far as revenue and fare trends, origin and destination revenue were increasing with fares remaining stable, and RNO fares continue to be lower than the U.S. average, as shown in **Figure 2-4**.

Table 2-5: Top 50 Domestic Destinations

Rank	Destination		RNO O&D Passengers	Retention %	Diverting Pax		Total PAX
					SFO	SMF	
1	Las Vegas, NV	LAS	432,402	99	1,900	713	435,015
2	Los Angeles, CA	LAX	280,401	97	3,590	4,243	288,235
3	Phoenix, AZ	PHX	187,274	97	2,612	3,135	193,021
4	Seattle-Tacoma, WA	SEA	161,860	90	5,106	12,381	179,347
5	San Diego, CA	SAN	159,121	99	925	672	160,718
6	Denver, CO	DEN	145,942	99	1,122	779	147,844
7	Portland, OR	PDX	99,595	95	1,630	3,863	105,088
8	New York JFK, NY	JFK	91,199	93	4,653	2,327	98,179
9	Dallas-Fort Worth, TX	DFW	67,031	93	2,252	3,152	72,435
10	Salt Lake City, UT	SLC	66,057	95	1,136	2,050	69,243
11	Chicago O'Hare, IL	ORD	61,384	94	2,409	1,205	64,998
12	San Jose, CA	SJC	52,012	100	0	0	52,012
13	Boston, MA	BOS	46,462	89	4,240	1,213	51,915
14	Minneapolis, MN	MSP	45,898	96	1,035	1,000	47,933
15	Orange County, CA	SNA	45,347	99	450	225	46,022
16	Orlando, FL	MCO	42,361	94	1,109	1,785	45,255
17	Atlanta, GA	ATL	40,071	94	783	1,705	42,560
18	Chicago Midway, IL	MDW	41,831	99	104	121	42,056
19	Austin, TX	AUS	36,915	97	646	533	38,094
20	Philadelphia, PA	PHL	31,542	89	1,268	2,559	35,370
21	Baltimore, MD	BWI	33,591	95	391	1,238	35,220
22	Washington Reagan, DC	DCA	31,672	96	694	576	32,943
23	Detroit, MI	DTW	31,420	97	426	571	32,418
24	Houston Bush, TX	IAH	31,714	98	182	455	32,351
25	Newark, NJ	EWR	26,522	87	3,064	813	30,399
26	Houston Hobby, TX	HOU	28,233	100	0	0	28,233
27	San Antonio, TX	SAT	27,681	99	222	74	27,977
28	Honolulu, HI	HNL	23,034	85	1,430	2,528	26,993
29	St. Louis, MO	STL	25,224	94	607	1,040	26,871
30	Nashville, TN	BNA	25,596	96	0	1,131	26,727
31	Tampa, FL	TPA	25,466	96	81	867	26,413
32	Kansas City, MO	MCI	25,608	98	160	337	26,105
33	Ontario, CA	ONT	24,624	99	88	184	24,896
34	San Francisco, CA	SFO	24,762	100	0	0	24,762
35	Fort Lauderdale, FL	FLL	21,252	90	1,888	595	23,735
36	Washington Dulles, DC	IAD	21,352	93	806	708	22,866
37	Charlotte-Douglas, NC	CLT	22,102	97	218	464	22,784
38	Spokane, WA	GEG	22,243	98	69	379	22,691
39	Dallas Love, TX	DAL	22,397	100	47	59	22,503
40	New Orleans, LA	MSY	20,615	97	333	255	21,203
41	Albuquerque, NM	ABQ	20,029	97	139	417	20,585
42	Raleigh/Durham, NC	RDU	18,272	91	860	940	20,072
43	Kahului, HI	OGG	16,234	83	960	2,448	19,641
44	Burbank, CA	BUR	18,661	99	72	72	18,805
45	Indianapolis, IN	IND	17,577	97	422	89	18,087
46	Anchorage, AK	ANC	15,538	89	402	1,608	17,549
47	Boise, ID	BOI	17,502	100	0	0	17,502
48	Milwaukee, WI	MKE	16,597	96	409	273	17,279
49	Tucson, AZ	TUS	16,877	99	163	0	17,040
50	New York LaGuardia, NY	LGA	15,874	97	182	301	16,357
Total Domestic			**3,281,368**	**96**	**63,133**	**80,690**	**3,425,192**
Total International			**180,662**	**75**	**50,109**	**9,730**	**240,501**
Total All Markets			**3,462,030**	**94**	**113,242**	**90,420**	**3,665,693**

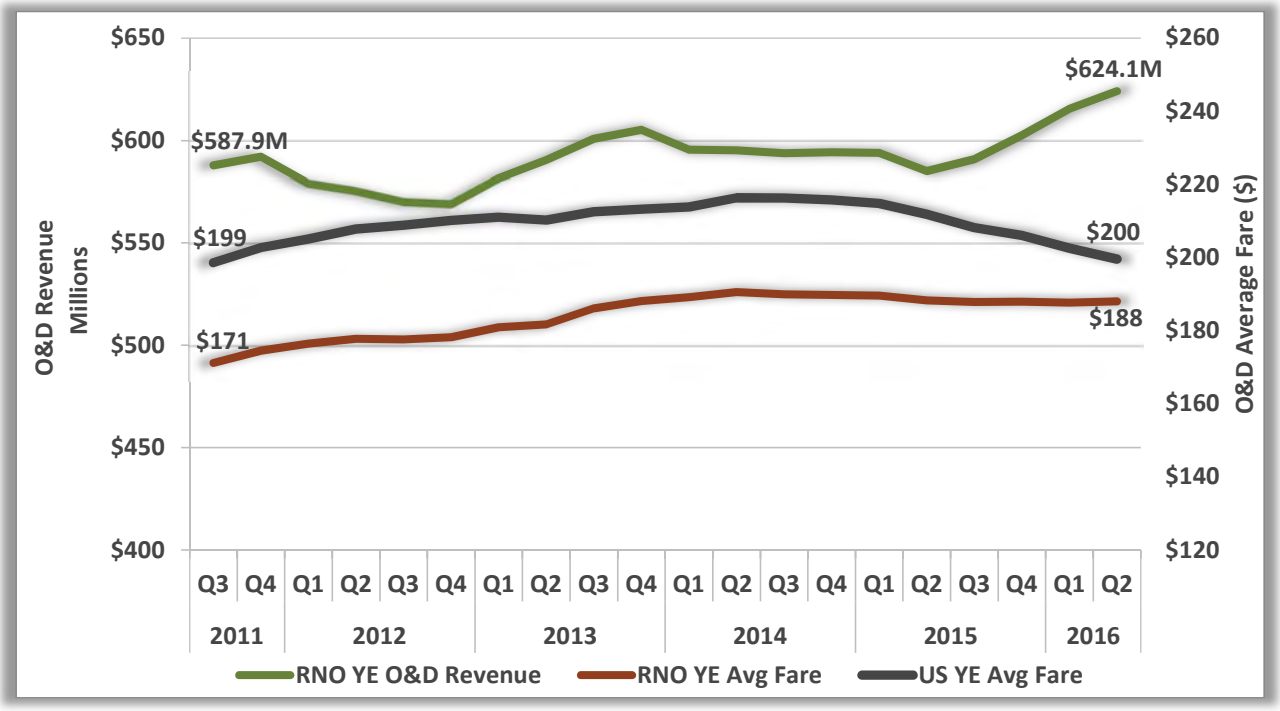
Source: Mead & Hunt, Inc.; YE June, 30 2016
Passengers daily each way (PDEW)

Figure 2-3: Traffic and Capacity Trends



Source: Diio Mi T-100 Seats/Onboards 12-month non-directional, one-way rolling average; LF=RPMs/ASMs

Figure 2-4: Revenue and Fare Trends



Source: Diio Mi (total O&D passengers and revenue)

Table 2-6 compares RNO with the other airports serving domestic markets in the region through YE June 30, 2016. RNO ranked 14th largest in the FAA West Region, which includes California, Arizona, Hawaii, and Nevada, based on number of total passengers. RNO's passenger and revenue growth outpaced the FAA West Region. RNO's fares increased one percent in contrast with fares for the region decreasing by four percent. The decrease in RNO's yield was similar to the regional average decline. This apparent contradiction is due to passengers flying slightly longer distances during this period, and the fare being calculated as an average over the distance traveled, or the fare divided by the miles traveled.

Table 2-6: Regional Comparisons – Domestic Only, YE June 30, 2016

Rank	Airport		Passengers	Revenue (000s)	Average Fare	Average Yield	YOY Change			
							Pax	Rev	Fare	Yield
1	Los Angeles, CA	LAX	20,038,447	$3,700,815	$185	11.8¢	10%	1%	(8%)	(8%)
2	Las Vegas, NV	LAS	16,131,908	$2,262,677	$140	11.5¢	9%	1%	(7%)	(8%)
3	San Francisco, CA	SFO	14,192,653	$2,939,966	$207	13.0¢	6%	3%	(3%)	(1%)
4	Phoenix, AZ	PHX	11,738,283	$1,918,896	$163	13.8¢	7%	4%	(3%)	(3%)
5	San Diego, CA	SAN	8,605,799	$1,481,202	$172	12.9¢	5%	2%	(3%)	(4%)
6	Honolulu, HI	HNL	5,327,405	$1,264,101	$237	11.5¢	1%	3%	2%	1%
7	Oakland, CA	OAK	4,960,227	$703,289	$142	14.3¢	7%	8%	1%	(3%)
8	Orange County, CA	SNA	4,658,694	$781,818	$168	15.7¢	8%	3%	(4%)	(4%)
9	San Jose, CA	SJC	4,474,656	$730,609	$163	15.4¢	6%	5%	(1%)	(2%)
10	Sacramento, CA	SMF	4,301,125	$734,181	$171	15.4¢	6%	5%	(1%)	(3%)
11	Kahului, HI	OGG	2,444,215	$566,981	$232	12.0¢	5%	5%	0%	(2%)
12	Burbank, CA	BUR	1,953,575	$270,457	$138	20.4¢	2%	3%	1%	0%
13	Ontario, CA	ONT	1,947,692	$325,178	$167	16.5¢	1%	1%	0%	(2%)
14	**Reno, NV**	**RNO**	**1,572,969**	**$271,505**	**$173**	**15.6¢**	**7%**	**8%**	**1%**	**(3%)**
15	Tucson, AZ	TUS	1,401,825	$267,431	$191	16.3¢	(2%)	(1%)	0%	(1%)
16	Lihue, HI	LIH	1,292,657	$294,079	$227	12.6¢	3%	3%	0%	(1%)
17	Kona, HI	KOA	1,216,952	$286,008	$235	12.9¢	4%	3%	0%	(4%)
18	Long Beach, CA	LGB	1,177,654	$134,287	$114	13.3¢	(3%)	(9%)	(7%)	(2%)
19	Palm Springs, CA	PSP	723,044	$141,923	$196	15.8¢	0%	(1%)	(1%)	(1%)
20	Phoenix Mesa, AZ	AZA	663,302	$54,114	$82	8.0¢	5%	(3%)	(8%)	(8%)
21	Hilo/Hawaii, HI	ITO	602,981	$76,121	$126	19.0¢	1%	2%	0%	(3%)
22	Fresno, CA	FAT	567,801	$120,385	$212	18.0¢	1%	2%	1%	4%
23	Santa Barbara, CA	SBA	277,457	$67,899	$245	19.0¢	(3%)	(1%)	1%	0%
24	Monterey, CA	MRY	177,080	$34,789	$196	18.7¢	6%	0%	(6%)	(2%)
25	Santa Rosa, CA	STS	138,960	$19,037	$137	24.3¢	23%	22%	(1%)	(1%)
Total/Average			**111,654,107**	**$19,712,744**	**$177**	**13.0¢**	**6%**	**2%**	**(4%)**	**(4%)**

Source: Diio Mi – YE June 30, 2016

Regional Air Service Comparison (Route Performance)

The route performance section covers the load factor trends, revenue per available seat mile (RASM) performance, and RASM trends. Overall, thirteen markets had declining load factors for the second quarter of 2016 compared to the second quarter of 2015, with only six markets showing improvement. RNO load factors for the same period declined one percentage point driven by a seven percent increase in capacity.

RASM trends for Alaska Airlines, Allegiant Airlines, American Airlines, Delta, and JetBlue Airlines show mixed results for the second quarter, with six markets improving and five markets having decreasing RASMs. The most significant changes were positive on Alaska Airlines route to San Jose (SJC) and Delta Airlines route to Minneapolis (MSP) increasing 17-19 percent year over year (YOY). For Southwest and United Airlines, overall second quarter RASMs were down one percent YOY; however, results were mixed with seven markets improving and three markets having decreasing RASMs.

Air Service Assessment (Service Gaps and Opportunities)

During the evaluation, gaps in commercial service emerged that present strong opportunities for RNO. This section of the report documents the findings of the data collection and analysis in terms of existing airlines, nonstop service, and air service opportunities for both incumbent and new airlines. As **Figure 2-5** shows, as of 2016 RNO has eight airlines (the seven domestic carriers and international carrier Volaris) providing service to 22 destinations.

Figure 2-5: RNO Airline Service Destination Map

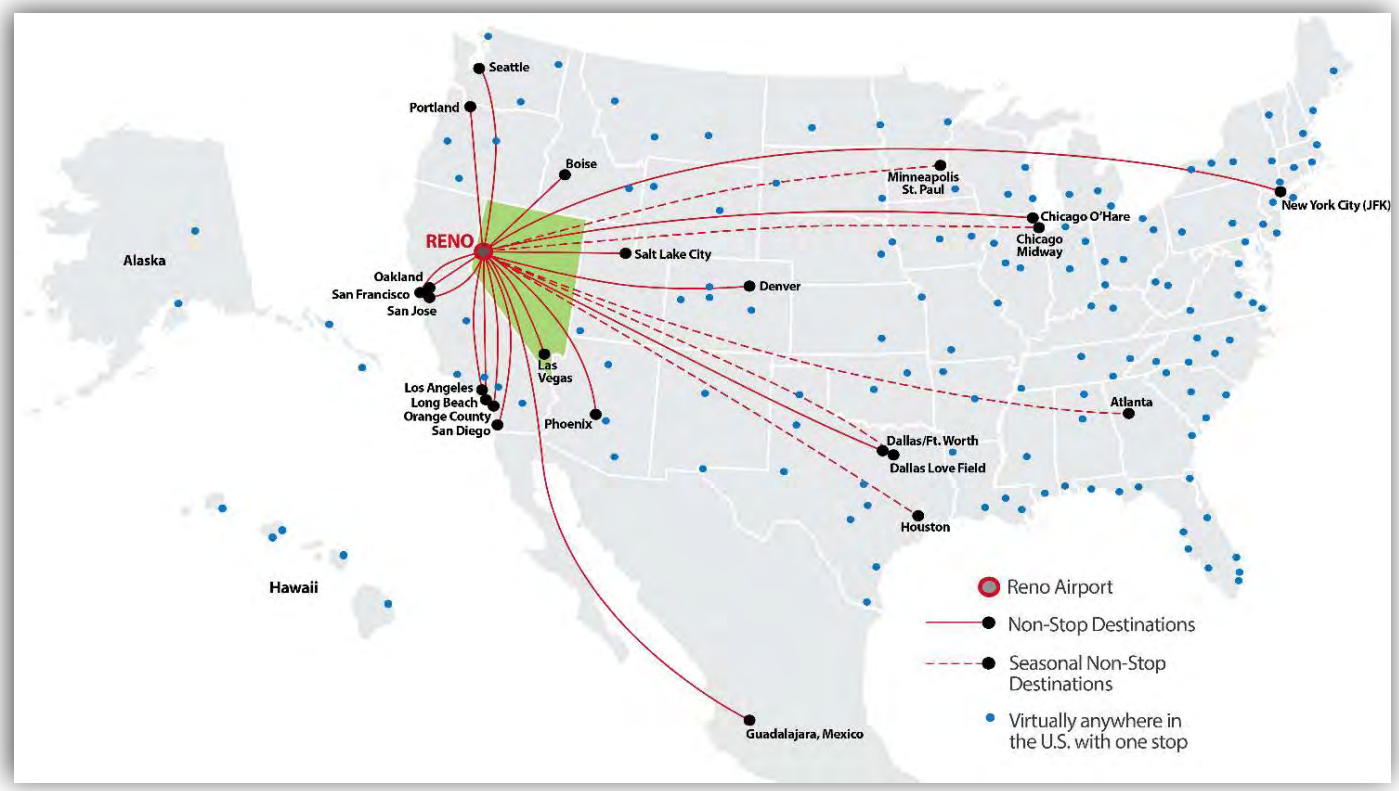


Table 2-7 ranks RNO's top 25 destinations and PDEWs by destination, as well as the average flights and seats per week, and the market load factor those numbers represent. Several items are worth noting. Airlines as of YE June 30, 2016, include Alaska, Allegiant, American, Delta, JetBlue, Southwest, United and Volaris. Potential new entrants for domestic air service include two growing airlines: Frontier, which previously stopped service in August 2007, and Spirit. Large local markets without nonstop service include: Logan International Airport (BOS) with 71 PDEW, Minneapolis-St. Paul International Airport (MSP) to year-round with 66 PDEW, Orlando International Airport (MCO) with 62 PDEW, Austin-Bergstrom International Airport (AUS) with 52 PDEW, Philadelphia International Airport (PHL) with 49 PDEW, Baltimore-Washington International Airport (BWI) with 48 PDEW, Ronald Reagan Washington National Airport (DCA) with 45 PDEW, Detroit Metropolitan Airport (DTW) with 44 PDEW, and Newark Liberty International Airport (EWR) with 42 PDEW. United Airlines George Bush Intercontinental Airport (IAH) is a market in need of additional frequency due to high load factors and strong unit revenue. In March 2017, RNO offered nonstop service to 16 of the top 25 destinations with 395 weekly departures on 48,510 weekly seats.

Table 2-7: Top 25 Destinations by PDEW

Rank	Destination		PDEW	Average / Week		Market LF
				Flights	Seats	
1	Las Vegas, NV	LAS	595.9	69	10,123	76.1
2	Los Angeles, CA	LAX	394.8	56	5,397	70.0
3	Phoenix, AZ	PHX	264.4	35	4,786	78.2
4	Seattle-Tacoma, WA	SEA	245.7	27	2,052	81.2
5	San Diego, CA	SAN	220.2	13	1,859	74.2
6	Denver, CO	DEN	202.5	28	3,877	86.3
7	Portland, OR	PDX	144.0	20	1,520	79.3
8	New York JFK, NY	JFK	134.5	7	1,050	86.0
9	Dallas-Fort Worth, TX	DFW	99.2	14	2,240	82.1
10	Salt Lake City, UT	SLC	94.9	26	3,627	81.9
11	Chicago O'Hare, IL	ORD	89.0	7	1,120	80.7
12	San Jose, CA	SJC	71.2	13	988	64.4
13	Boston, MA	BOS	71.1	0	0	N/A
14	Minneapolis, MN	MSP	65.7	0	0	92.4
15	Orange County, CA	SNA	63.0	7	532	80.4
16	Orlando, FL	MCO	62.0	0	0	N/A
17	Atlanta, GA	ATL	58.3	1	180	N/A
18	Chicago Midway, IL	MDW	57.6	4	668	92.0
19	Austin, TX	AUS	52.2	0	0	N/A
20	Philadelphia, PA	PHL	48.5	0	0	N/A
21	Baltimore, MD	BWI	48.2	0	0	N/A
22	Washington Reagan, DC	DCA	45.1	0	0	N/A
23	Detroit, MI	DTW	44.4	0	0	N/A
24	Houston Bush, TX	IAH	44.3	2	152	94.3
25	Newark, NJ	EWR	41.6	0	0	N/A

Source: Mead & Hunt, Inc. YE June 30, 2016; March 2017 schedules and YE October 2016 LFs

RNO has a relatively high retention rate and supports the catchment area population of more than 750,000.

Based on the air service market trends derived from this study, March 2017 capacity is expected to be up 19 percent YOY, which indicates RNO is experiencing significant growth mainly driven by increases from all incumbent airlines except American and Volaris Airlines. Carriers that have increased their schedule may be cautious about further expansion if the scheduled capacity is unfilled and will likely want to see that extra capacity sold and used at reasonable levels before expanding again in the near term.

RNO has service to all its top 10 markets including to John F. Kennedy International Airport (JFK) in New York, which began in June 2015. While New York nonstop service exists, United Airlines' service to EWR or Washington Dulles International Airport (IAD) are options given the large regional local market sizes with no nonstop service. While DCA may be the preferred airport for Washington D.C. area, IAD or BWI would offer significantly more potential international connections.

Additional nonstop service to eastern markets such as BOS, DTW, MCO and PHL should be explored along with continuing to meet with airlines not serving RNO as of the time of this study, such as Frontier Airlines and Spirit Airlines. Eastern destinations could be more challenging to attract and retain service, as they require a greater cost investment by the airlines due to the longer distances being flown. These costs make the economics of the routes more challenging to sustain.

Incumbent Airline Opportunities

Overall, when including domestic and international travelers, Southwest Airlines was the largest carrier at RNO at YE June 30, 2016. Southwest Airlines carried about 1.5 million passengers, ahead of American Airlines with 735,000 passengers, United Airlines with 415,000, Alaska Airlines with 396,000, Delta with 247,000, JetBlue with 82,000, and Volaris and Allegiant each carrying approximately 35,000 annual onboard passengers to and from RNO. Load factors for all airlines averaged 81 percent with United Airlines and JetBlue averaging 86 percent, and Volaris averaging the lowest at 73 percent. Overall industry load factors in the mid-80s still leaves some room for passenger growth on the current schedule, especially for Alaska Airlines and Southwest Airlines with their percent of seats sold just under 80 percent.

Trends point to Alaska Airlines' overall March capacity being up 17 percent YOY. However, the merger with Virgin-America may offer opportunities for additional expansion beyond John Wayne Airport (SNA) in Orange County to markets such as SFO and SAN as they work through their combined networks. With Allegiant's year-round service to just LAS at the time of this study, opportunities for new markets such as AUS exist. AUS is a top 20 market without nonstop service. Due to the nonstop service already provided from RNO to both PHX and SAN, service to Phoenix-Mesa Gateway Airport (AZA) or SAN would present challenges. For example, Allegiant may be reluctant to serve another market with direct competition even though they serve LAS in conjunction with Southwest Airlines today.

Expanding Delta's presence beyond Salt Lake City International Airport (SLC) is another viable option to explore as both Hartsfield-Jackson Atlanta International Airport (ATL) and MSP have had less than daily service and both are a top 20 market without daily nonstop service. Even though United Airline's capacity is trending upward 16 percent, they are running high load factors in the RNO market. As a result, additional frequencies to IAH or nonstops to additional eastern markets like Chicago O'Hare International Airport (ORD), IAD or EWR could be considered. Southwest has added the greatest number of seats YOY in the RNO market expanding into Dallas Love Field (DAL) and Oakland International Airport (OAK); therefore, Southwest may want to give the new service time to ramp up before expanding further. With the addition of Long Beach Airport (LGB), JetBlue has doubled its capacity from the RNO market and may also want to give the service time to prove itself. Volaris flies to Guadalajara International Airport (GDL) three times per week and has generated load factors above 80 percent in certain months. Volaris could look to expand to additional destinations such as CUN or Mexico City International Airport (MEX).

New Airline Opportunities

Several airlines do not currently operate at RNO and are potential operators of new service. These include Frontier Airlines, Spirit Airlines, and some low cost international carriers such as WOW Air that continue to grow and expand their footprint across the U.S. To attract these potential airlines, RNO would need to experience either local market growth and/or target a hub that could provide connections beyond the target city to be economically viable. Canadian carriers like WestJet are an example of this scenario.

Other airline opportunities may arise, such as pro-rate flying on regional airlines like SkyWest Airlines, or scheduled charter service on evolving carriers like Air Florida, Falcon Air Express, Omni Air, Miami Air International, or Sun Country. Previous attempts at attracting international service to London were successful by working with key stakeholders though the Customs and Border Protection (CBP) staffing issues will need to be examined. Targeting tour operators such as Thomas Cook, Apple Vacations, or Vacation Express can be another way to expand international service.

Air Service Market Evaluation Summary

With more than 775,000 people in the RNO primary catchment area, a true market of 3.67 million O & D travelers translates to 93 percent domestic travel, and seven percent, international. RNO retains 94 percent within the top 25 markets, which generate 65 percent of total air travel.

In terms of market performance, based on YE June 30, 2016, capacity, passengers, and load factor improved YOY and were trending positively. RNO fares were lower than the U.S. average and were stable while O&D airline revenue was increasing, with Southwest Airlines and American Airlines leading in revenue share at RNO. RNO passenger and revenue growth outpaced other airports within the West region. This appears to contradict the reported results in the bullets below, but it is important to keep in mind that RASMs are the metric used to analyze route performance. RASMs combine the average fare and load factor, which leads to the seeming contradiction.

In terms of route performance, the bullets below summarize the results for the airlines serving passengers at RNO:

- Alaska (AS): RNO had above average RASM at SNA/Portland International Airport (PDX)/San Jose International Airport (SJC)/SEA, but below average at Boise Airport (BOI) – SJC, although the RASM experienced strong YOY improvement.
- Allegiant (G4): RNO had above average RASM at LAS.
- American (AA): RNO had below average RASM at ORD/Dallas/Fort Worth International Airport (DFW)/PHX, and average at LAX.
- Delta (DL): RNO had below average RASM at SLC – MSP, but operated seasonally on Saturdays only and ran high load factors.
- JetBlue (B6): RNO had below average RASM at JFK, where service began June 2015. LGB was not analyzed due to service starting September 2016.
- Southwest (WN): RNO had average RASM at LAS/LAX/SAN, and below average at Chicago Midway International Airport (MDW)/PHX/Denver International Airport (DEN)/OAK. Service to OAK began June 2016.
- United (UA): RNO had above average RASM at IAH/SFO, average at LAX, and below average at DEN.

Appendix F provides additional information regarding route performance for each of the airlines currently serving RNO.

Commercial Passenger Traffic

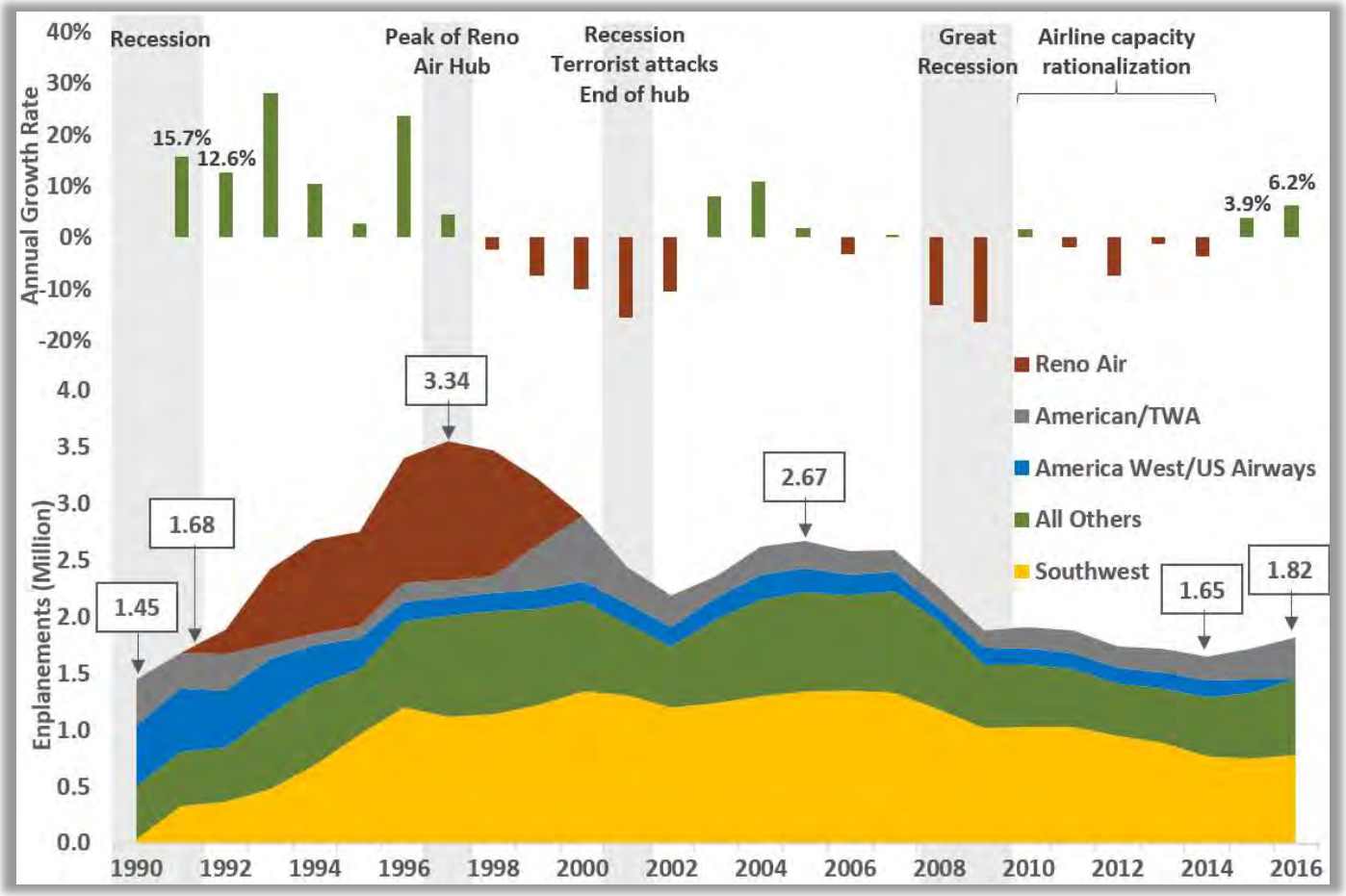
This section discusses the historical trends in commercial passenger traffic at RNO and presents forecasts for the 20-year period ending in 2036. The analysis of historical trends sets the context for model specifications and assumptions used in forecast development.

Historical Enplanement Trends

Enplanement History Since 1990

In 2016 RNO posted its second consecutive year of growth in commercial passenger traffic, seeing 6.4 percent in growth of total passengers (enplaned and deplaned). Passenger enplanements increased 6.2 percent to 1.82 million, surpassing the previous year's increase of 3.9 percent, as shown in **Figure 2-6**. These increases ended seven consecutive years of decreases that began in 2008, when the U.S. economy entered a recession. The increases also halted an overall downward trend since 1997 when enplanements reached an all-time peak level of 3.34 million at the height of Reno Air's hub operations at RNO.

Figure 2-6: RNO's Enplanement Trends since 1990



Sources: U.S. BTS T-100 data for 1990-2008, RTAA records for 2009-2016, and Unison Consulting, Inc.

From 1990 through 1997, RNO experienced an unprecedented growth in enplanements with the expansion of low-fare service by Reno Air and Southwest Airlines amid a long-running U.S. economic expansion. Southwest Airlines began service in 1990 and rapidly ramped up its operations, gaining the largest airline share of RNO enplanements by 1996.

Reno Air, a start-up low-fare carrier, began service in 1992 with RNO as its home base and main network hub. Reno Air expanded operations quickly and competed closely with Southwest Airlines, besting Southwest in 1997 for the largest market share at RNO.

A pivotal change occurred in 1993 when Reno Air entered an alliance with American Airlines to handle American's regional traffic. In 1999, American Airlines acquired Reno Air, which flew its last flight in August that year. At the time of the acquisition, American intended to use Reno Air to expand its network, but plans changed following the 2001 U.S. economic recession and terrorist attacks. Financial pressures led American to dispose of Reno Air's entire fleet to reduce capacity and dismantle Reno Air's network including the RNO hub. These actions downgraded RNO to a secondary airport in American's route system.

During the same period, RNO, along with other U.S. airports, faced weak air travel demand from the economic recession, security concerns after the terrorist attacks, and a decrease in short-haul air travel due to the new stringent security measures. After peaking in 1997, enplanements at RNO decreased in five consecutive years through 2002.

In 2003, the trend reversed and annual enplanements at RNO increased in three consecutive years. During the same period, jet fuel prices began to rise, and the U.S. economy began to slow again, ultimately entering another recession in 2008-2009, which has come to be known as the Great Recession. This was the longest and deepest post-World War II recession.

Airlines responded by cutting domestic seat capacity, cutting service on less profitable routes, increasing load factors, transferring routes between mainline and regional service, retiring old aircraft, changing pricing structures, and implementing various cost-cutting measures. Mounting financial pressures led to airline bankruptcies and a consolidation wave that has left the industry with only four major airlines controlling 80 percent of the U.S. market. The Great Recession dampened air travel demand in leisure markets like Reno more than in other markets with large business centers. Airline capacity cuts, which continued long after the end of the Great Recession, hurt smaller airports like RNO more than larger airports.

As a result of these factors, passenger traffic at RNO decreased to 1.65 million enplanements in 2014, the lowest level in 26 years. The growth in the past two years increased enplanements by 10.3 percent, to 1.82 million in 2016, about the same as the level in 1992, the second full year of Southwest's operations at RNO and the year Reno Air started service. The enplanement level in 2016 was slightly more than one half of the all-time peak level in 1997 and more than two-thirds of the highest level reached just before the Great Recession.

The growth in RNO enplanements in the past two years can be attributed to two positive trends: the regional economic recovery is finally gaining momentum, and airlines are beginning to add capacity. At RNO, all airlines increased scheduled seats over the two-year period, with Alaska Airlines adding the largest number of seats. RNO also gained two new airlines, JetBlue and Volaris, and JetBlue added the second largest number of seats.

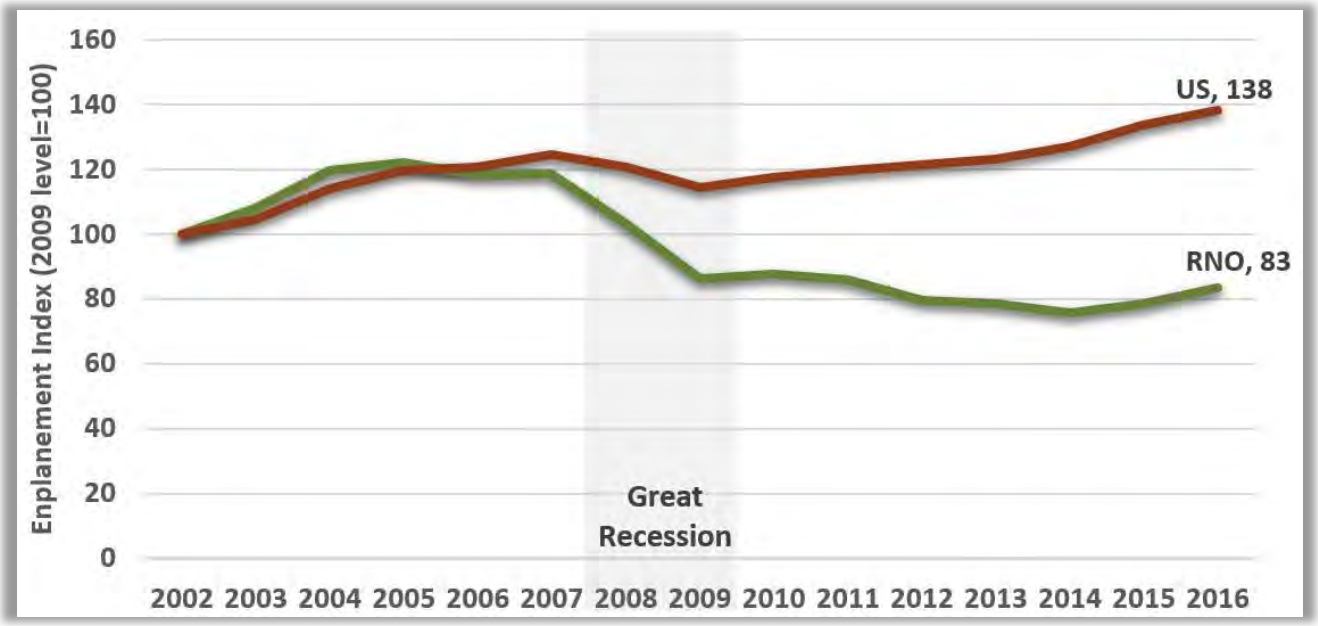
Comparison of RNO and U.S. Enplanement Trends since 2002

Figure 2-7 compares the enplanement growth trends at RNO with the national trends since 2002. Through 2005, RNO was outperforming the nation in enplanement growth. By 2005, RNO's enplanements had grown 22 percent from 2002, while U.S. total enplanements had grown only 19 percent. In 2006, RNO began to fall behind as enplanements began to decrease, while total U.S. enplanements continued to increase through 2007.

In 2008-2009, the U.S. economy entered the Great Recession, and enplanements decreased nationwide. RNO suffered proportionally larger decreases in enplanements. After the Recession ended in 2009, U.S. total enplanements grew steadily each year and surpassed their pre-recession level in 2014. By 2016, U.S. total enplanements had grown to 138 percent of their level in 2002.

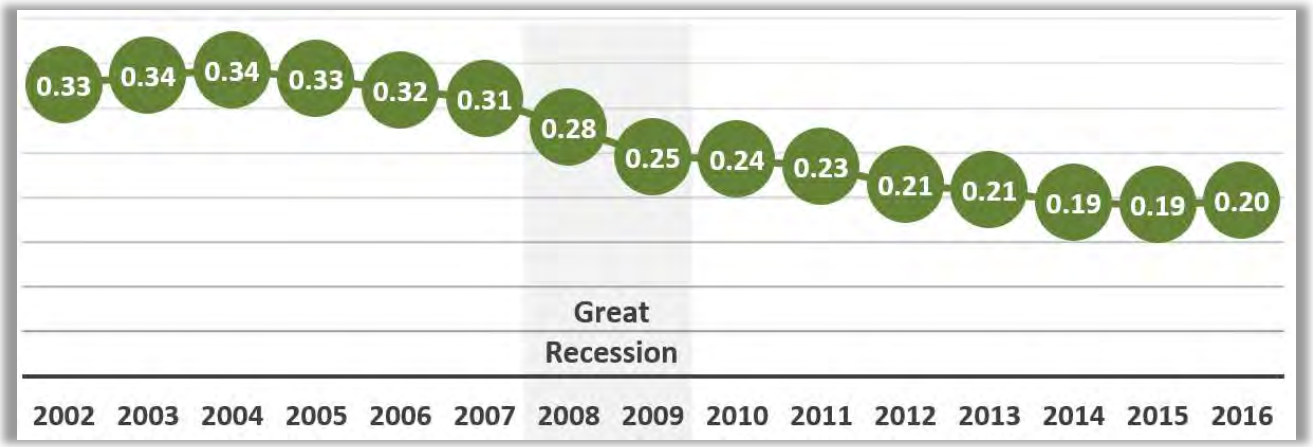
RNO experienced the opposite as enplanements continued to decrease through 2014. RNO reversed the trend in 2015 and has tracked national growth trends since then. Despite growing more than 10 percent over the past two years, however, RNO's enplanements remained well below pre-recession levels. In 2016, RNO enplanements were still only at 83 percent of the 2002 level. As **Figure 2-8** shows, RNO's share of total U.S. enplanements decreased from 0.3 percent before the recession to 0.2 percent after the recession.

Figure 2-7: RNO and U.S. Enplanements – Cumulative Growth Since 2002



Sources: RTAA records for RNO enplanements, U.S. Bureau of Transportation Statistics T-100 Market Data for U.S. total enplanements, and Unison Consulting, Inc. The data labels show cumulative growth through 2016.

Figure 2-8: RNO's Share (%) of U.S. Total Enplanements

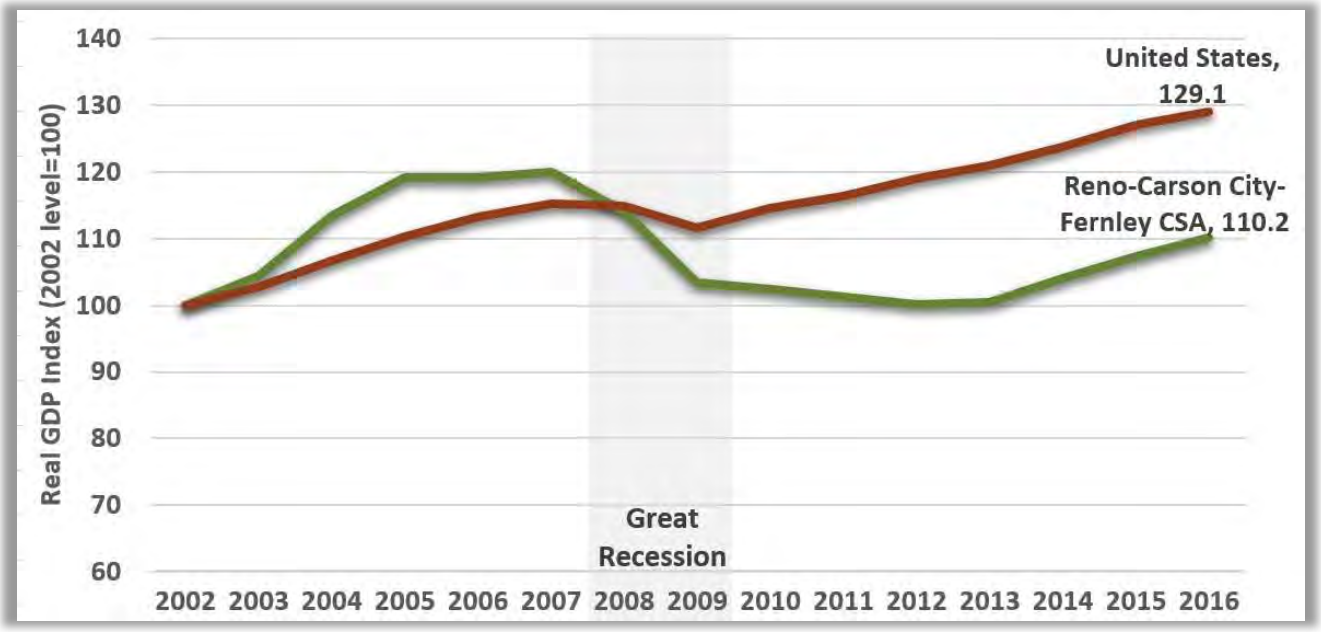


Sources: RTAA records for RNO enplanements, U.S. Bureau of Transportation Statistics T-100 Market Data for U.S. total enplanements, and Unison Consulting, Inc.

The following factors explain the divergence of RNO's enplanement growth trends from the national enplanement growth trends:

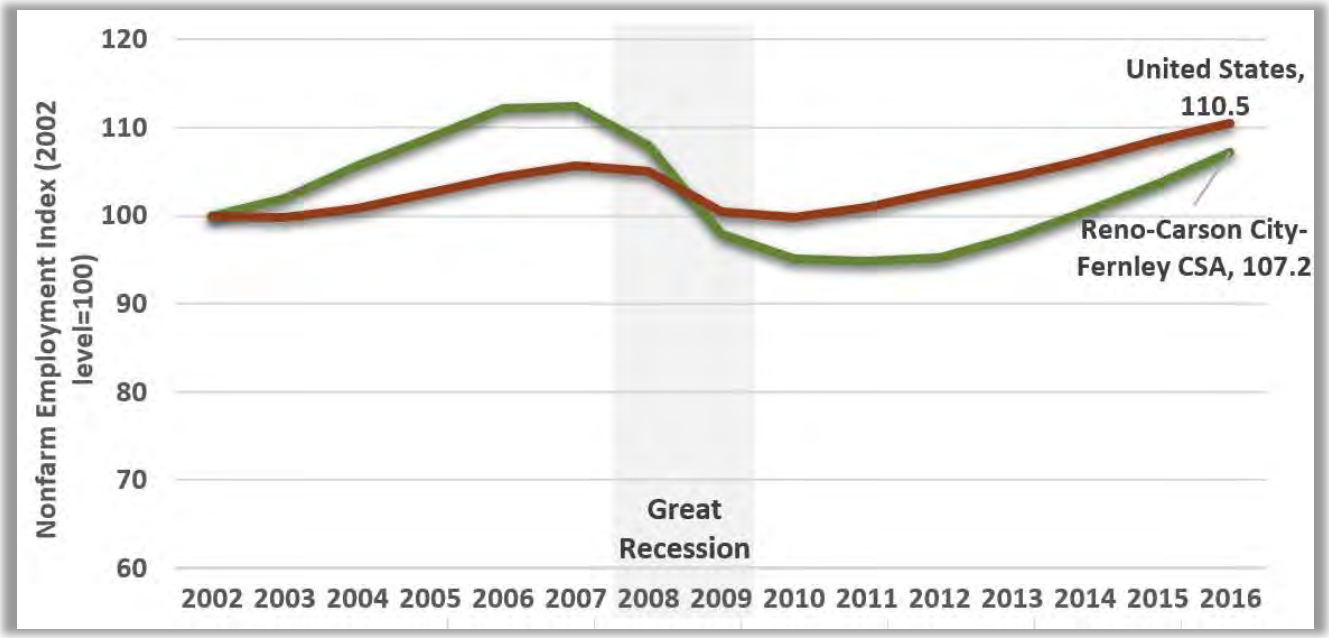
- Divergent economic trends: Compared to the U.S. economy, the regional economy declined more sharply during the 2008-2009 recession and continued to decline through 2013, four years into the national economic recovery and expansion, as shown in **Figure 2-9**.
- Divergent employment trends: The nonfarm employment level in the Reno-Carson City-Fernley combined statistical area (Reno CSA) fell more sharply during the recession and began to recover a year later than the U.S. nonfarm employment level, as shown in **Figure 2-10**.
- Divergent trends in available airline seats: U.S. airlines cut system-wide domestic seat capacity during the recession and kept capacity flat through 2014. RNO suffered deeper cuts, which continued through 2014, as shown in **Figure 2-11**.

Figure 2-9: Comparison of the Reno CSA and U.S. Overall Economic Growth Trends



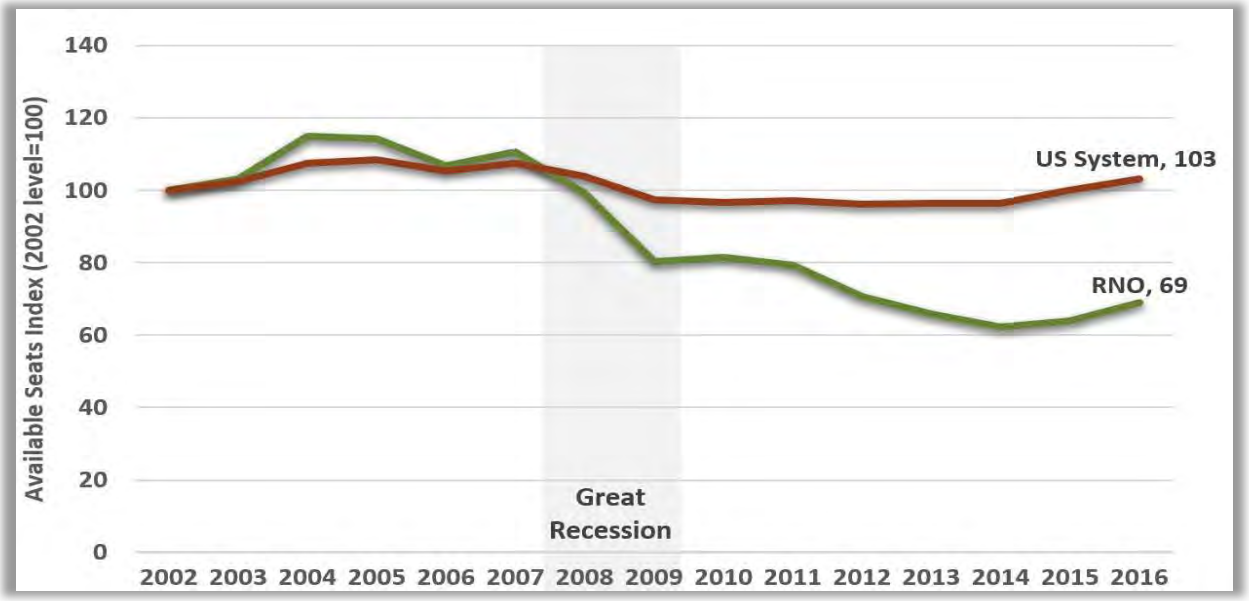
GDP – Gross Domestic Product
Sources: U.S. Bureau of Economic Analysis, Moody's Analytics, and Unison Consulting, Inc.

Figure 2-10: Comparison of the Reno CSA and U.S. Employment Growth Trends



Sources: U.S. Bureau of Labor Statistics, Moody's Analytics, and Unison Consulting, Inc.

Figure 2-11: Comparison of Trends in Available Seats at RNO and Nationwide (U.S. Carriers, Domestic Segment Only)

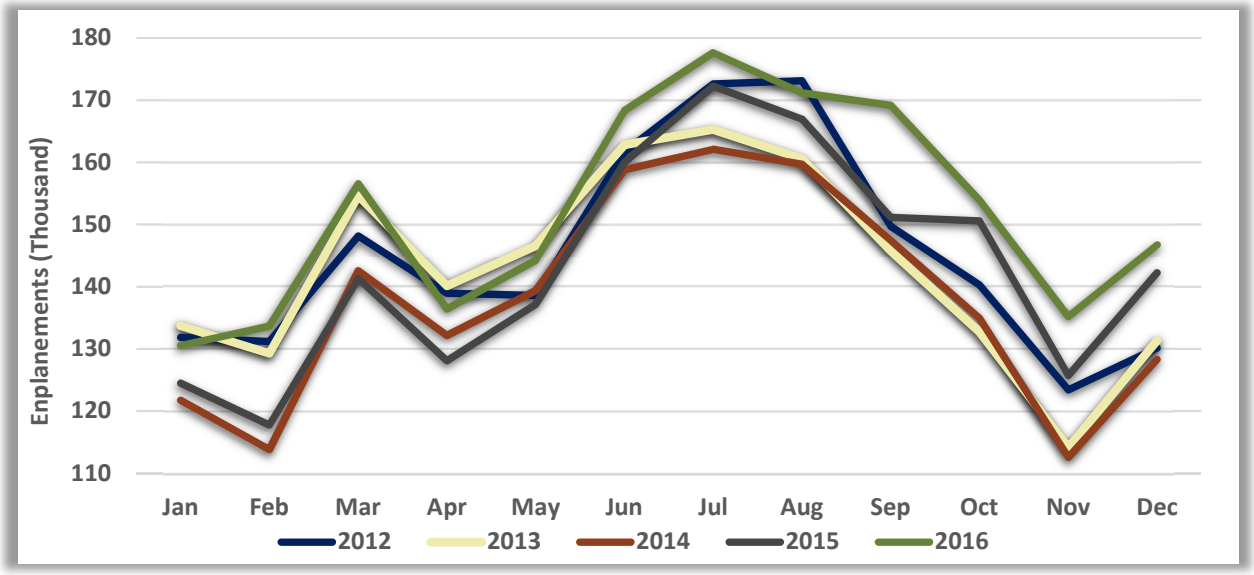


Sources: U.S. Bureau of Transportation Statistics T-100 Domestic Segment Data on Available Seats and Unison Consulting, Inc.

Monthly Enplanement Trends

A seasonal pattern in enplanements is typical at most airports as it is at RNO, as shown in **Figure 2-12**. During the year, enplanements at RNO typically reach their highest level in July, the peak of summer leisure travel. They typically reach their lowest level in November, before the winter ski season, except in 2015 when enplanements were lowest in February and in 2016 when enplanements were lowest in January.

Figure 2-12: Monthly Enplanement Trends at RNO



Sources: RTAA records and Unison Consulting, Inc.

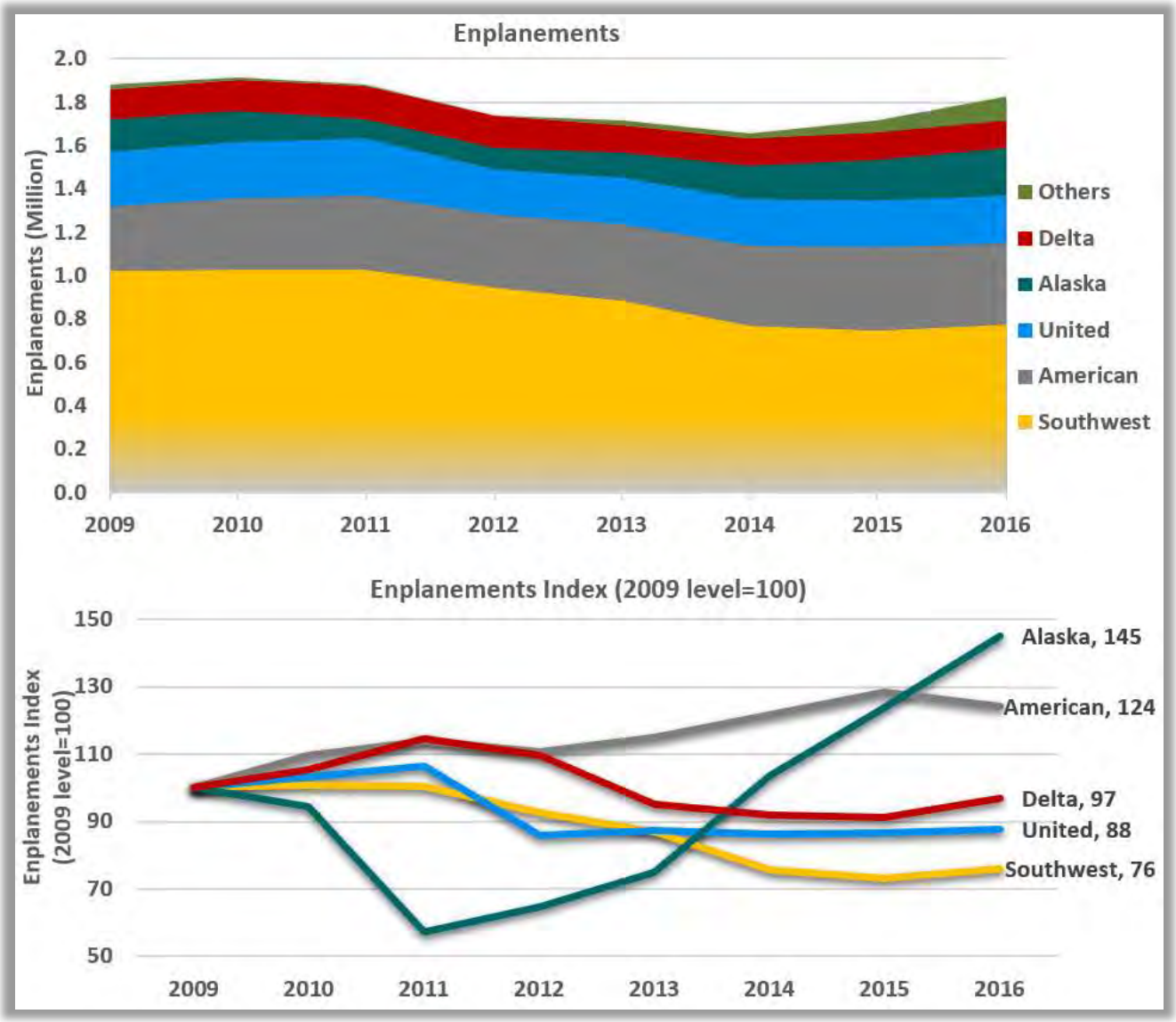
Enplanement Trends by Airline from 2009

Figure 2-13 shows RNO's enplanement trends by airline since 2009, the year during which the Great Recession ended in June. RNO's enplanements continued to decrease until the past two years and, by 2016, were still down 3.1 percent from 2009. Southwest Airlines, RNO's largest passenger carrier, was responsible for much of the decrease, especially in short haul flights. United and Delta also posted decreases from 2009 to 2016. The increases in enplanements by American, Alaska, and other airlines, especially newcomer JetBlue, offset some of the decreases in enplanements by Southwest, United, and Delta. In 2014, total enplanements reached their lowest level for the period, which was also the lowest level in 26 years. Since 2014, total enplanements have been increasing, with all the airlines posting net increases between 2014 and 2016.

Southwest Airlines remains the largest passenger carrier at RNO, with a 43 percent share of total enplanements in 2016, as shown in **Figure 2-14**. However, this share decreased from 54 percent in 2009, which allowed other airlines to increase market shares. American Airlines, including US Airways' enplanements, increased its enplanement share from 16 to 21 percent; Alaska Airlines, from 8 to 12 percent; and new entrants JetBlue, Volaris, and Allegiant gained a combined share of 6 percent in 2016. During the same period, United's market share decreased slightly from 13 to 12 percent, and Delta maintained its market share of 7 percent.

America West merged with US Airways prior to 2009, and US Airways merged with American Airlines in 2013. The charts in **Figure 2-14** and **Figure 2-15** show the combined enplanements of US Airways and American Airlines, which grew in share from 2009 to 2016.

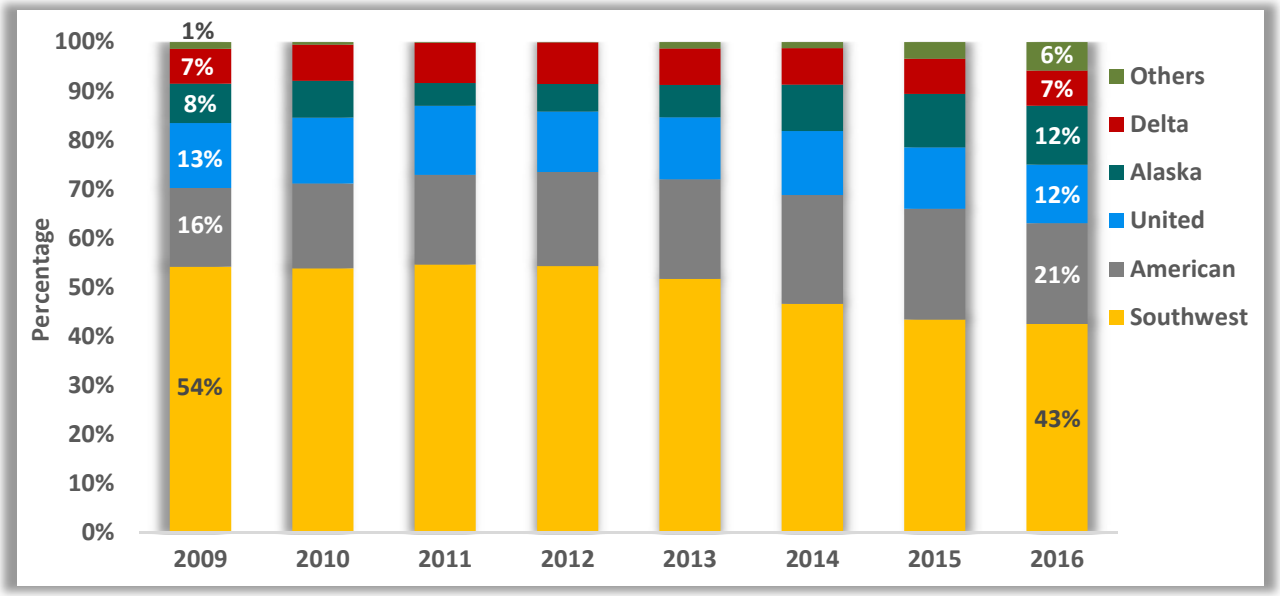
Figure 2-13: RNO Enplanements by Airline



Sources: RTAA records and Unison Consulting, Inc.

1. The bottom chart showing enplanement growth trends for individual airlines does not show the "Others" category. Subtotal enplanements by this category of airlines quadrupled from 2009 to 2016 because of the entry of JetBlue, Volaris, and Allegiant into RNO.
2. The numbers for American Airlines include the combined traffic of American Airlines, US Airways, and their regional affiliates, before and after the merger. American Airlines and US Airways merged in 2013, and the US Airways brand was retired in 2015.
3. The numbers for United Airlines include Continental Airlines' traffic prior to their merger in 2011.

Figure 2-14: Airline Shares of RNO Enplanements



Sources: RTAA records and Unison Consulting, Inc.

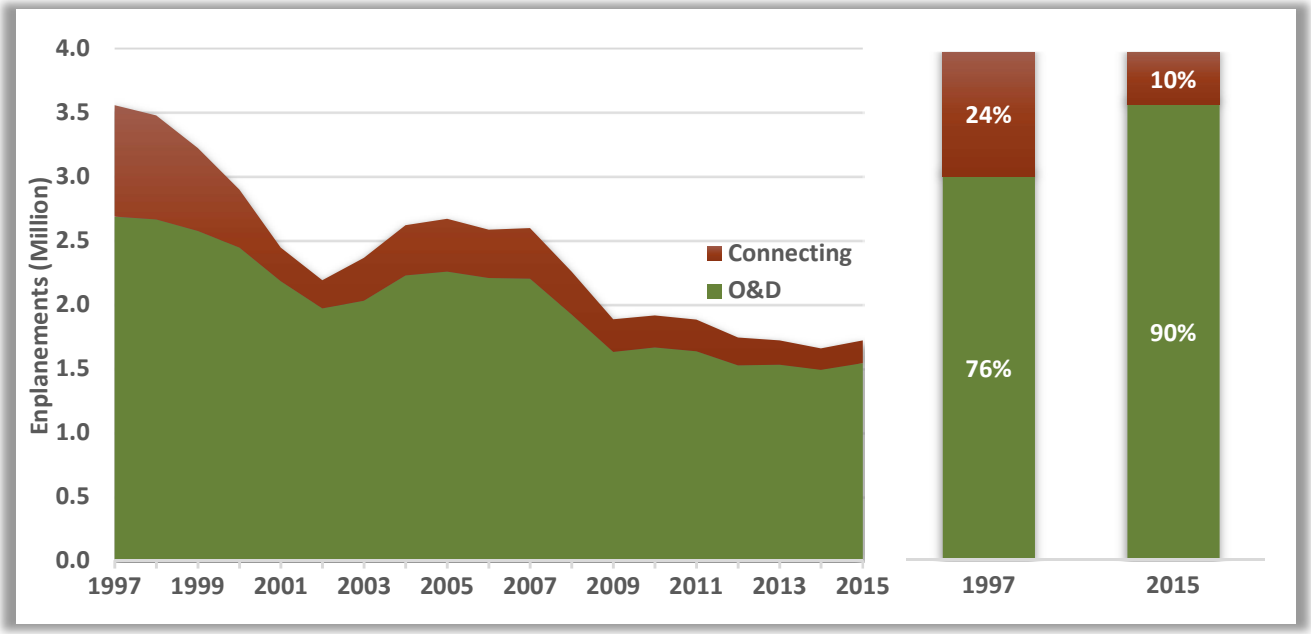
The recent wave of consolidation prompted airlines to renew efforts to streamline operations and optimize networks, cut overall system capacity, and shift their focus away from protecting market share to achieving profitability. In the process, they moved flights from smaller markets like RNO to larger markets where they could gain scale and network economies and make higher profits.

In addition, three specific developments likely contributed to the decrease in Southwest Airlines' activity at RNO: the repeal of the Wright Amendment, Southwest Airlines' acquisition of AirTran Airways, and the conditions for the U.S. Department of Justice's approval of the American Airlines-US Airways merger. The repeal of the Wright Amendment lifted restrictions at Southwest Airlines' home base, Dallas Love Field (DAL), on one-stop through service effective October 2007 and on nonstop service effective October 2014, allowing Southwest to increase flights at DAL. The acquisition of AirTran Airways in May 2013 opened international markets for Southwest. With the merger of American Airlines and US Airways, Southwest gained access to gates at DCA, La Guardia Airport (LGA), and BOS that American Airlines and US Airways had to give up as a condition to the approval of the merger. Due to a finite number of aircraft, Southwest's expansion at these airports was made possible by decreasing flights at other airports, including RNO.

Composition of Passenger Traffic at RNO

RNO's passenger traffic consists largely of O&D traffic, as shown in **Figure 2-15**, which was estimated to account for 90 percent of total enplanements in 2015. In 1997, at the height of Reno Air's hub operations at RNO, O&D traffic accounted for about 76 percent. RNO's passenger traffic also consisted entirely of domestic passengers, until Volaris began the RNO-GDL service in December 2014. By 2016, Volaris enplaned more than 20,000 passengers, capturing a 1 percent share.

Figure 2-15: Enplanements – O&D and Connecting Traffic Shares

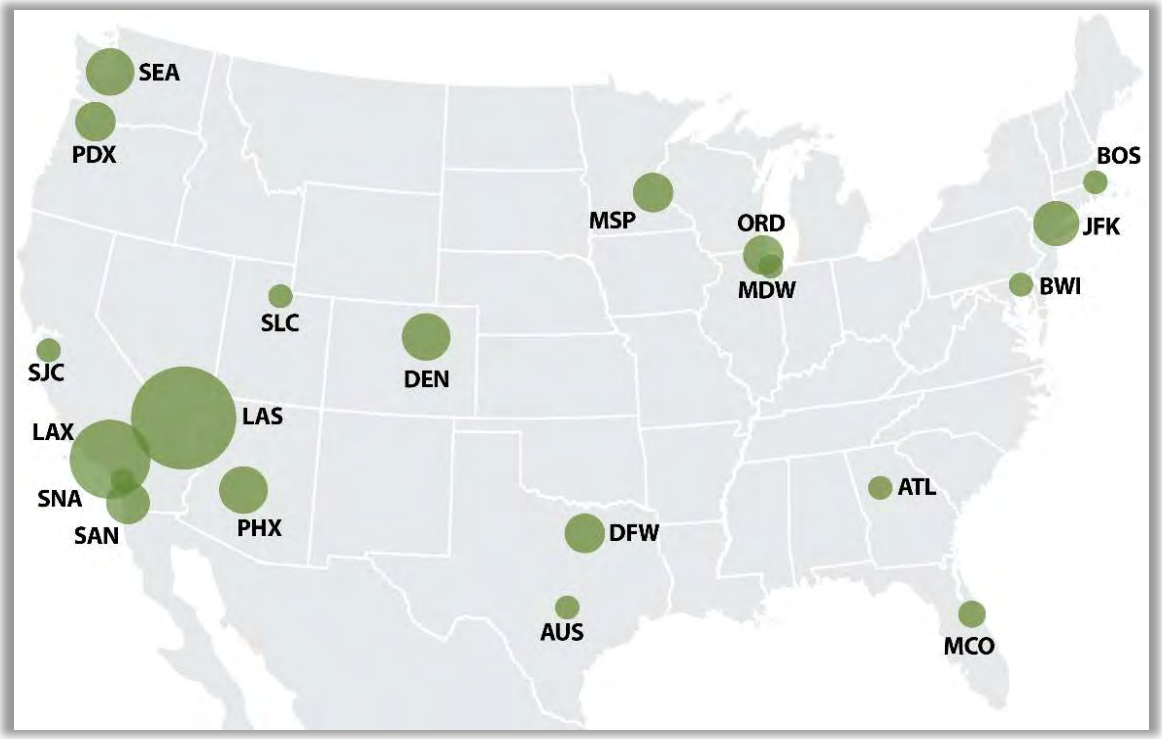


Sources: RTAA records, U.S. Bureau of Transportation Statistics T-100 Market Data, U.S. Bureau of Transportation Statistics DB1B O&D Market Data accessed through Data Base Products, Inc., and Unison Consulting, Inc.

Top 20 O&D Markets

Figure 2-16 shows RNO's top 20 O&D airport markets. Las Vegas McCarran International Airport tops the list with a 13.4 percent share, followed by LAX with 8.2 percent, and Phoenix Sky Harbor International Airport with 5.3 percent.

Figure 2-16: RNO's Top 20 O&D Airport Markets



Airport	Code	Share of RNO O&D Passengers
Las Vegas McCarran International Airport, NV	LAS	13.4%
Los Angeles International Airport, CA	LAX	8.2%
Phoenix Sky Harbor International, AZ	PHX	5.3%
Seattle/Tacoma International Airport, WA	SEA	4.7%
San Diego International Airport, CA	SAN	4.7%
Denver International Airport, CO	DEN	4.2%
Portland International Airport, OR	PDX	3.1%
John F Kennedy International Airport, NY [1]	JFK	2.7%
Salt Lake City International Airport, UT	SLC	2.1%
Dallas/Fort Worth International Airport, TX	DFW	1.9%
Chicago O' Hare International Airport, IL	ORD	1.8%
Orange County John Wayne Airport, CA	SNA	1.7%
San José International Airport, CA	SJC	1.6%
Minneapolis-St Paul International Airport, MN	MSP	1.5%
Orlando International Airport, FL	MCO	1.4%
Boston Logan International Airport, MA	BOS	1.4%
Atlanta Hartsfield-Jackson International Airport, GA	ATL	1.3%
Chicago Midway International Airport, IL	MDW	1.2%
Austin-Bergstrom International Airport, TX	AUS	1.2%
Baltimore/Washington International Airport, MD	BWI	1.0%

Sources: U.S. Bureau of Transportation Statistics DB1B O&D Market Data accessed through Data Base Products, Inc., Bing Maps, and Unison Consulting, Inc.

1. RNO O&D passengers using Newark Liberty International Airport (EWR) and La Guardia Airport (LGA) combined account for another 1.3%.

Historical Trends in Scheduled Passenger Airline Service

The following figures show the trends in scheduled passenger airline service at RNO:

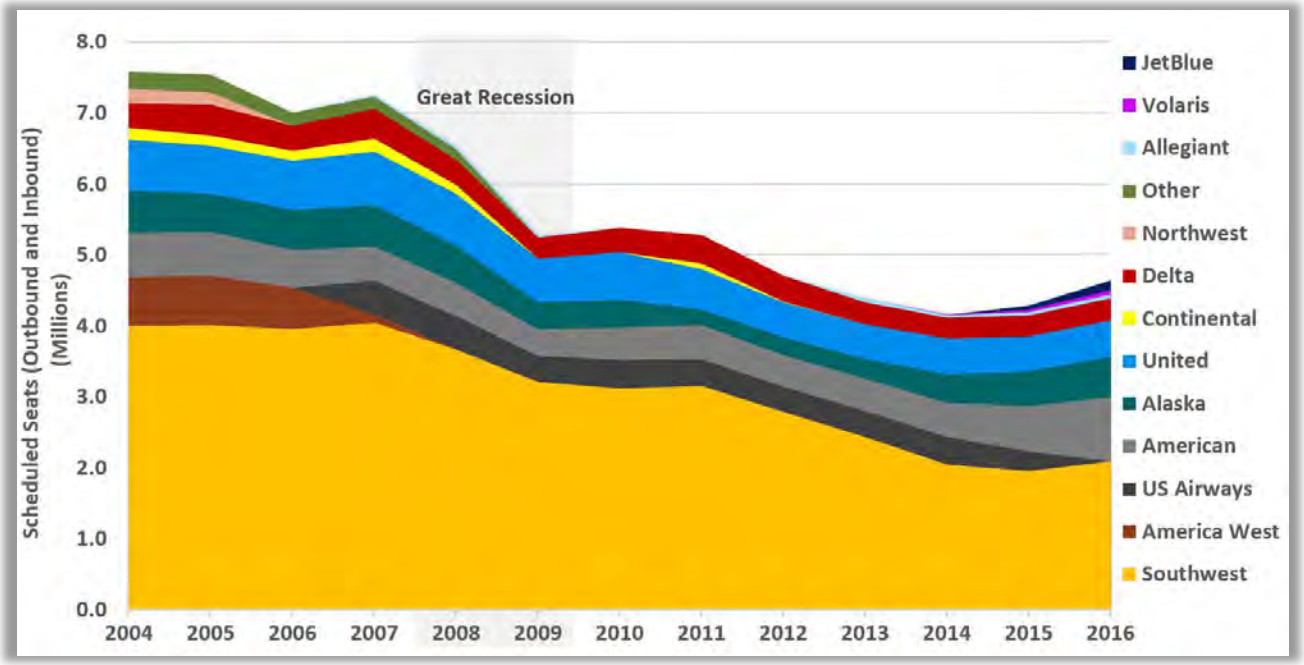
- Scheduled seats from 2004 (**Figure 2-17**)
- Scheduled seats by major carriers from 2004 (**Figure 2-18**)
- Scheduled flights from 2004 (**Figure 2-19**)
- Fleet mix and average seats per flight in 2004 and 2016 (**Figure 2-20**)
- Number of nonstop destinations served from RNO from 2004 (**Figure 2-21**)
- Scheduled service by airline from 2012 (**Figure 2-22**)

Seats provide the best measure for airline service capacity. Since 2004, scheduled seats at RNO have decreased by about 40 percent, as shown in **Figure 2-17**. Southwest Airlines, RNO's largest passenger carrier, was responsible for much of the decrease, but all the other major carriers also contributed. Unfavorable economic conditions, airline industry consolidation, and airline capacity rationalization explain the overall decrease in airline industry capacity, which fell disproportionately on RNO and other small hub airports.

Southwest experienced other milestones such as regulatory changes, acquisition of AirTran Airways, and requisite access to more gates at other airports as a condition of the 2013 merger. These milestones allowed Southwest to expand elsewhere, made possible by cutting capacity at RNO and other airports, due to the limited number of aircraft available for use and the lack of crew to fly them. Additionally, heightened economic uncertainty during the Great Recession and the subsequent slow recovery made it unwise for Southwest (and other airlines) to incur large capital costs by buying new aircraft. In fact, one of the strategies that was key to airlines' survival during the years of the recession was to retire inefficient aircraft, defer deliveries of aircraft on order, and hold off on new aircraft orders.

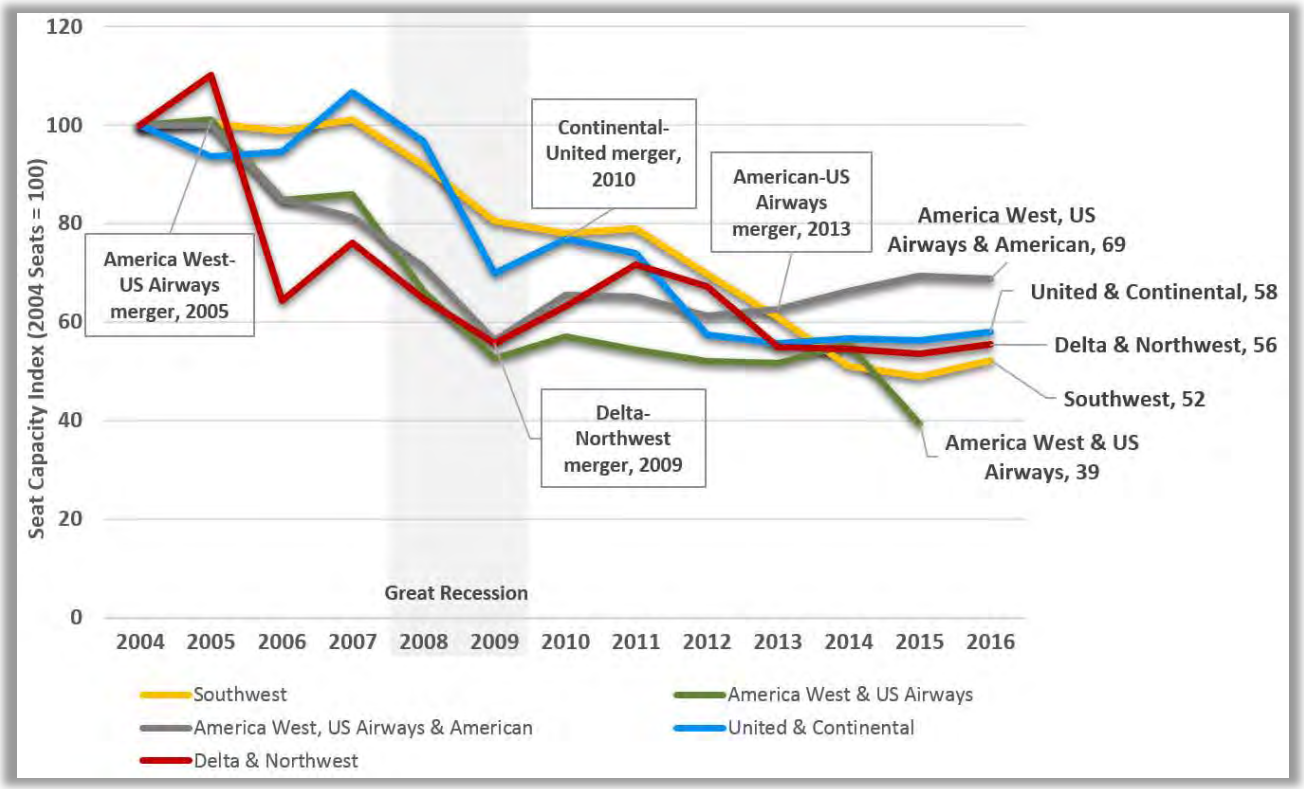
Figure 2-19 shows how mergers have affected scheduled seats by major airlines at RNO. Of all the mergers since 2004, the America West-US Airways merger in 2005 and the Continental-United merger in 2010 clearly caused decreases in the combined seats of those airlines at RNO.

Figure 2-17: Trends in Scheduled Seats at RNO from 2004



Sources: Diio Mi Schedule data from RTAA and Unison Consulting, Inc.

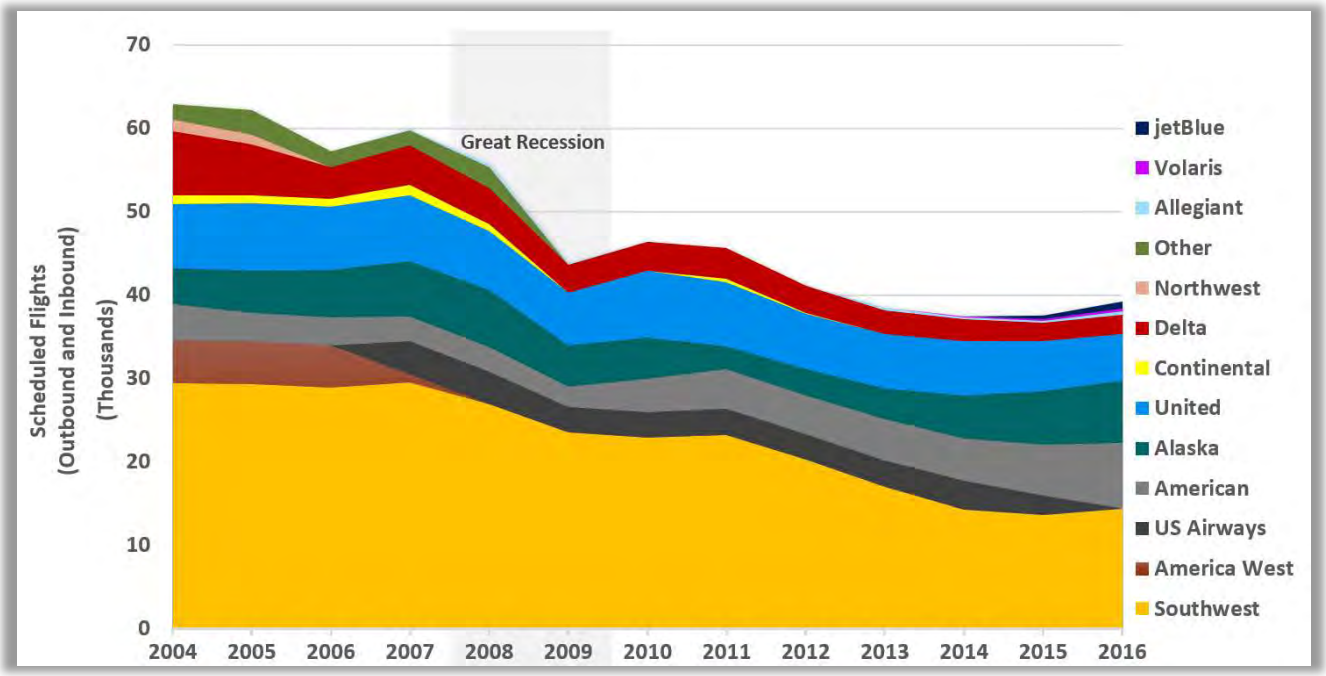
Figure 2-18: Trends in Scheduled Seats of Major Airlines at RNO from 2004



Sources: Diio Mi Schedule data from RTAA and Unison Consulting, Inc.

Scheduled flights have decreased as much as scheduled seats, as **Figure 2-19** shows.

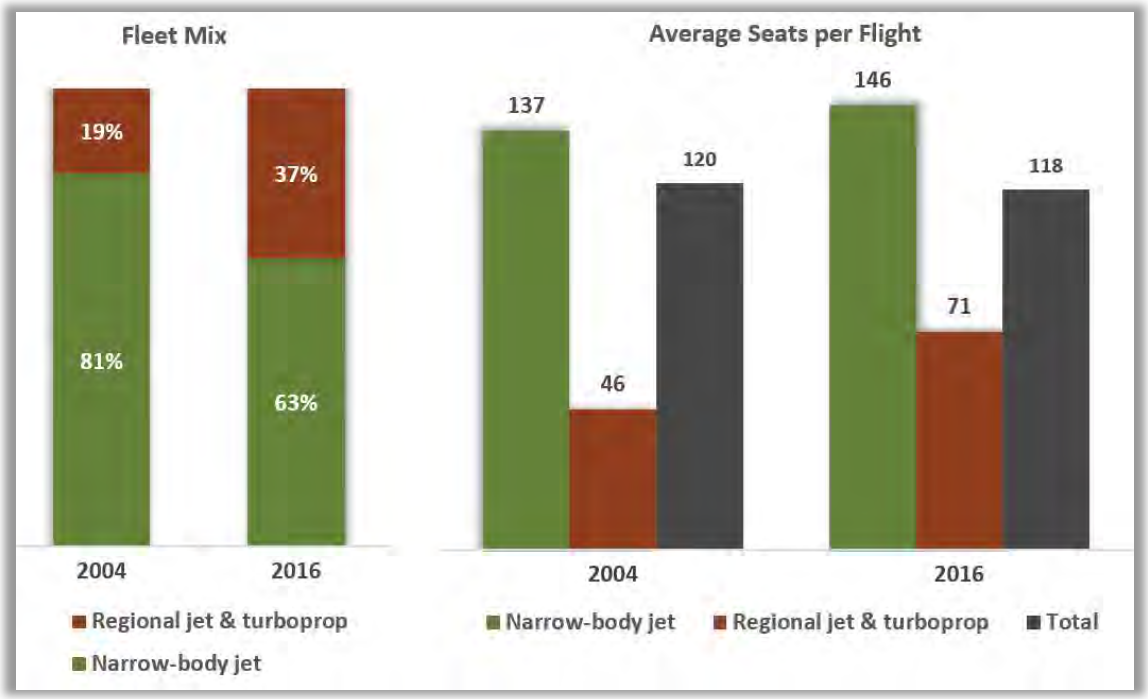
Figure 2-19: Trends in Scheduled Flights at RNO from 2004



Sources: Diio Mi Schedule data from RTAA and Unison Consulting, Inc.

The mix of aircraft serving RNO has also changed, as shown in Figure 2-20. The proportion of narrow body jet aircraft decreased from 81 percent in 2004 to 63 percent in 2016, as the proportion of smaller aircraft, namely regional jet and turboprop aircraft, increased from 19 percent in 2004 to 37 percent in 2016. As a result, the average number of seats on each flight decreased slightly from 120 in 2004 to 118 in 2016. Within the narrow-body jet fleet, however, airlines have been adding seats to existing aircraft, so that the average seat capacity on each narrow-body jet aircraft has increased. Within the regional jet and turboprop fleet, the smaller 50-seat aircraft have been replaced with larger aircraft, so that the average seat capacity in this equipment group has also increased.

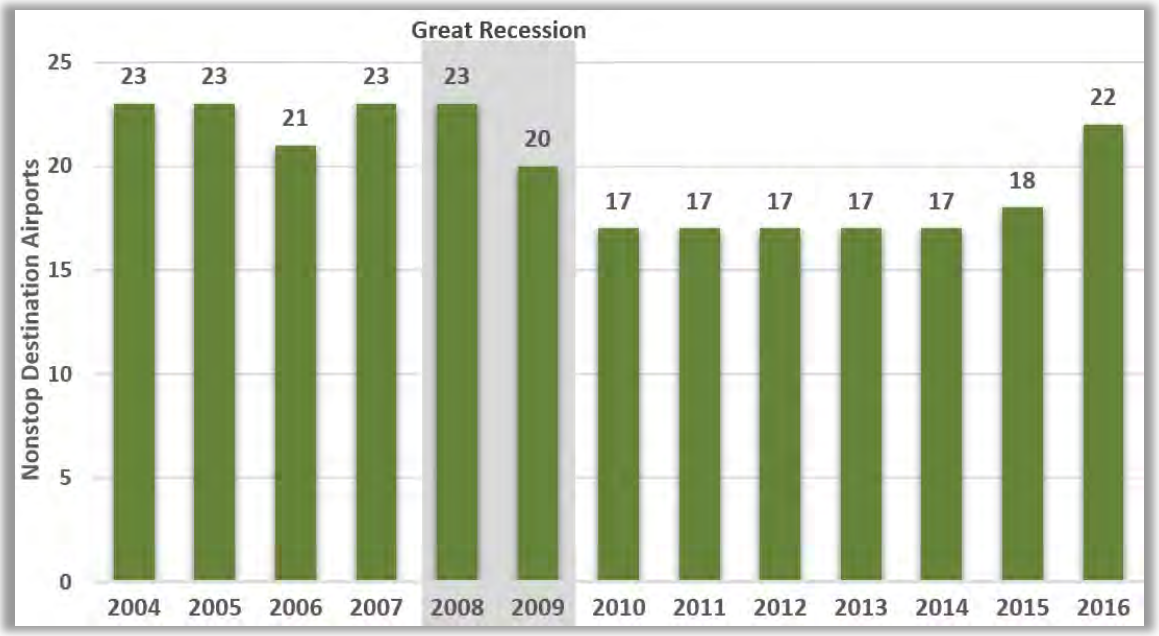
Figure 2-20: Fleet Mix and Average Seats per Flight



Sources: Diio Mi Schedule data from RTAA and Unison Consulting, Inc.

The number of airport destinations served nonstop from RNO, shown in **Figure 2-21,** increased to 22 in 2016 from a low of 17 in 2010-2014. In 2004-2009, the number of airport destinations had reached a high of 23.

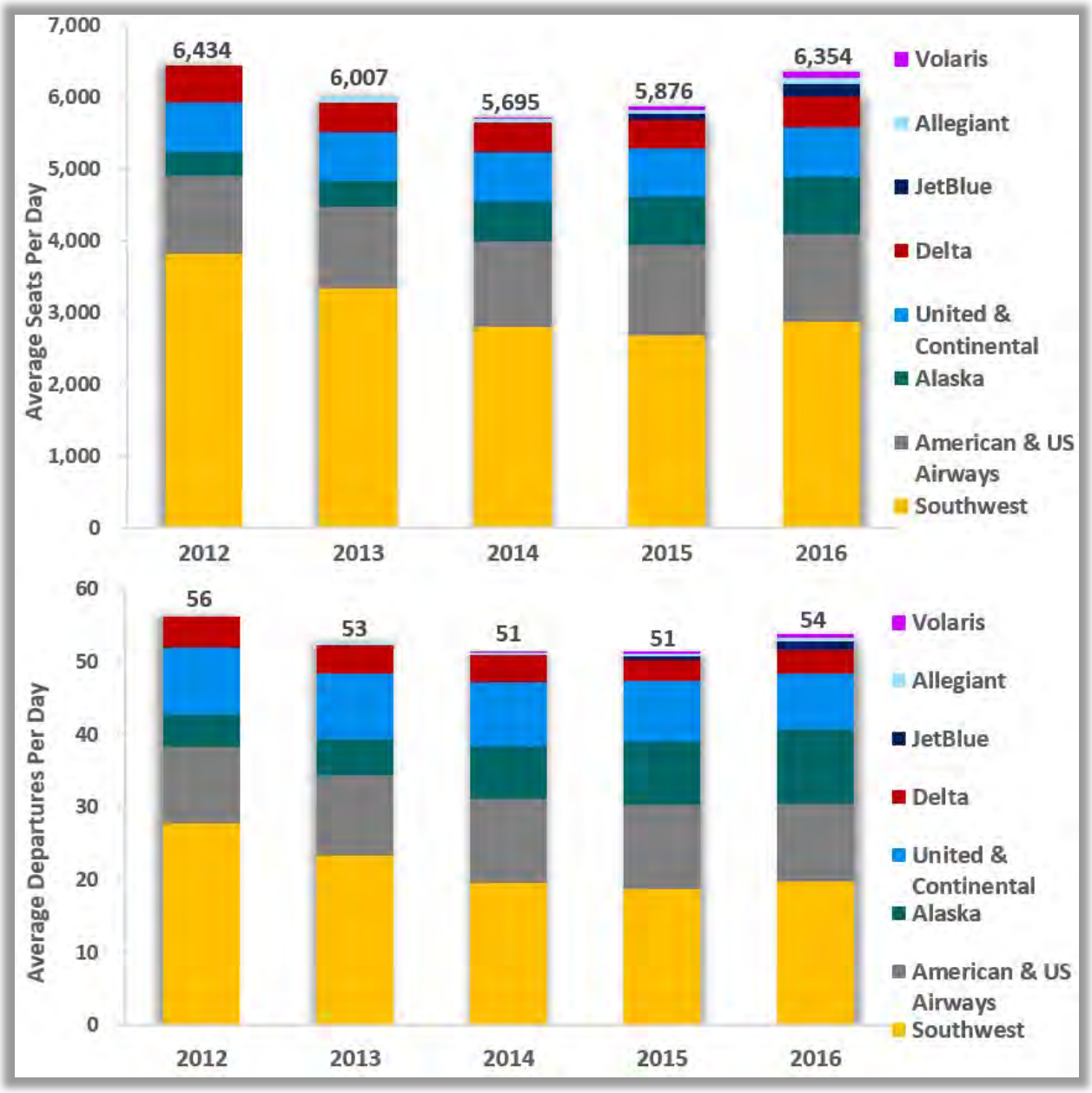
Figure 2-21: Number of Airport Destinations with Nonstop Flights from RNO



Sources: Diio Mi Schedule data from RTAA and Unison Consulting, Inc.

Figure 2-22 shows the trends in scheduled service originating from RNO by airline over the last five years. Southwest still accounts for the most number of seats and flights offered at RNO, although its average daily scheduled seats decreased from 3,800 in 2012 to 2,800 in 2016, and its average daily flights decreased from 28 in 2012 to 20 in 2016. American Airlines follows in second position, increasing its average daily scheduled seats from 1,000 in 2012 to 1,200 in 2016 while maintaining 11 flights per day on average. For the entire airport, scheduled seats decreased from 6,400 per day in 2012 to 6,300 per day in 2016 and scheduled flights decreased from 56 per day in 2012 to 54 per day in 2016, on average.

Figure 2-22: Trends in Scheduled Outbound Service by Airline from RNO from 2012

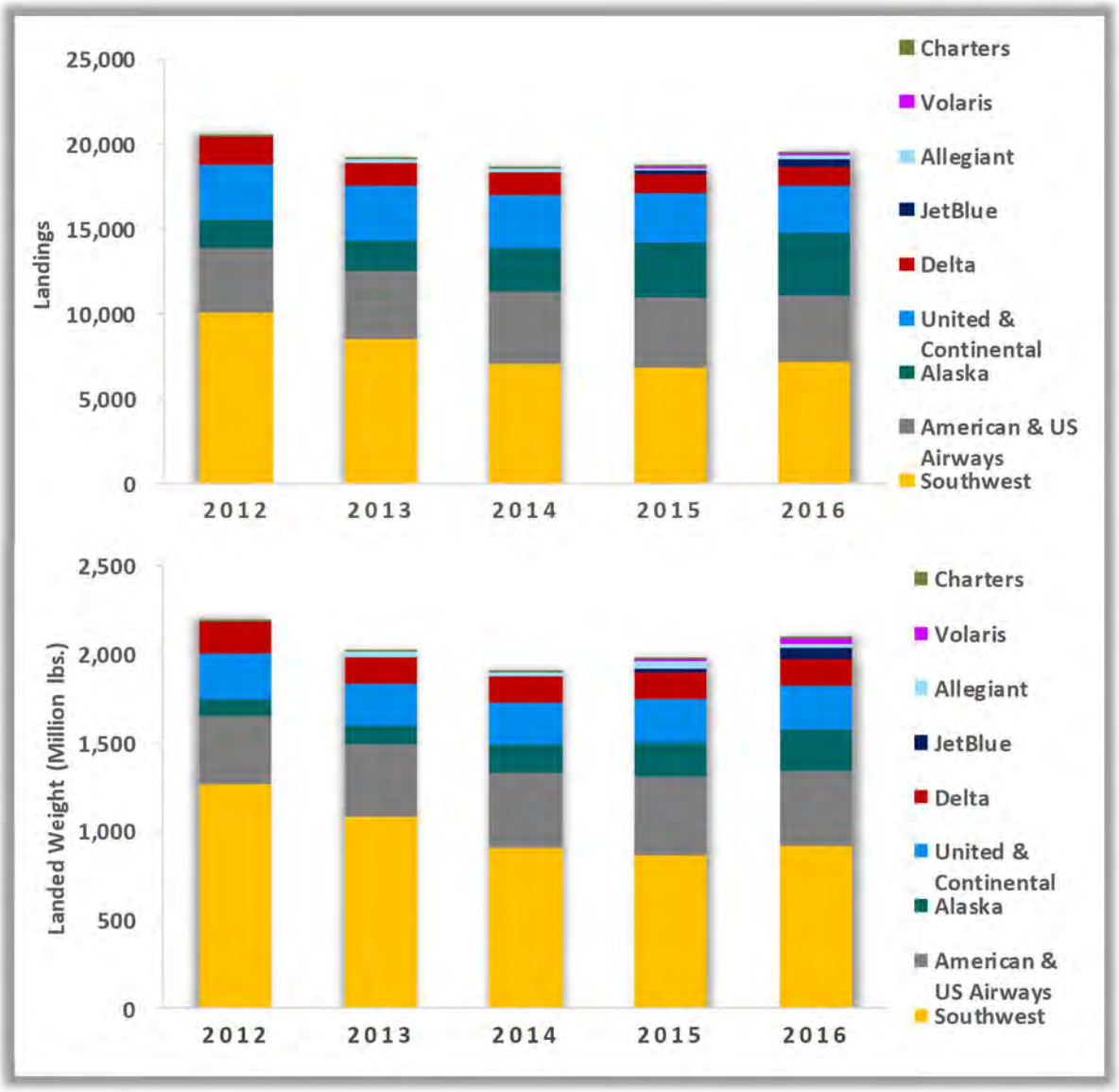


Sources: OAG Schedules Analyzer and Unison Consulting, Inc.

Landings and Landed Weight

The trends in number of aircraft landings and landed weight by commercial passenger airlines reflect the same declining trend through 2014 and the beginning of recovery in 2015 and 2016 observed by enplanements, shown in **Figure 2-23**. Southwest Airlines accounts for the largest shares of landings and landed weight, and American Airlines accounts for the second largest shares.

Figure 2-23: Trends in Landings and Landed Weight by Airline from RNO from 2012

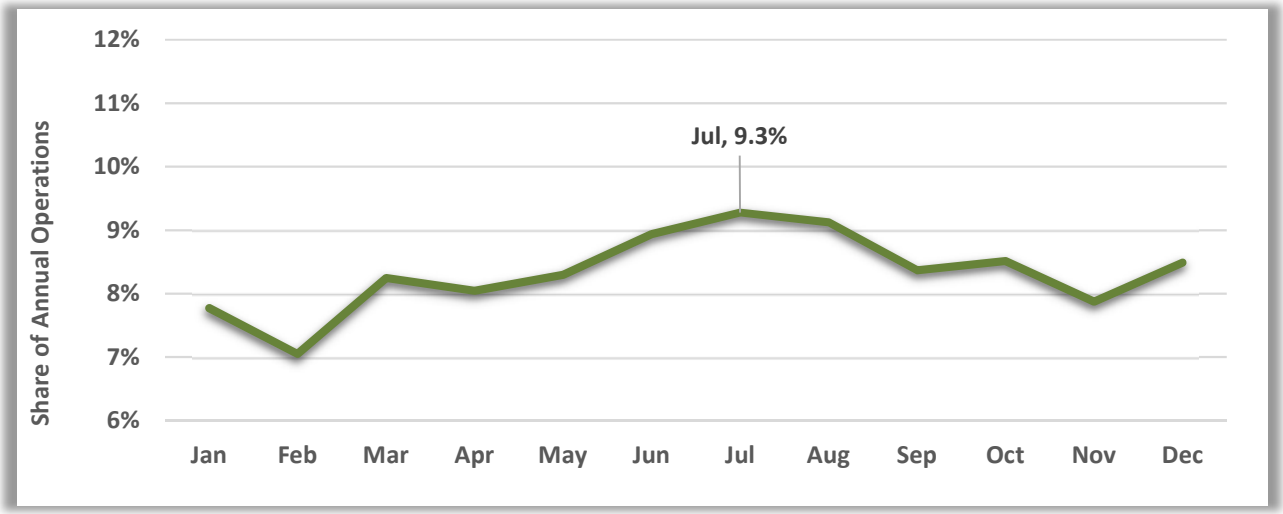


Sources: OAG Schedules Analyzer and Unison Consulting, Inc.

Commercial Passenger Aircraft Operations by Month and Time of Day

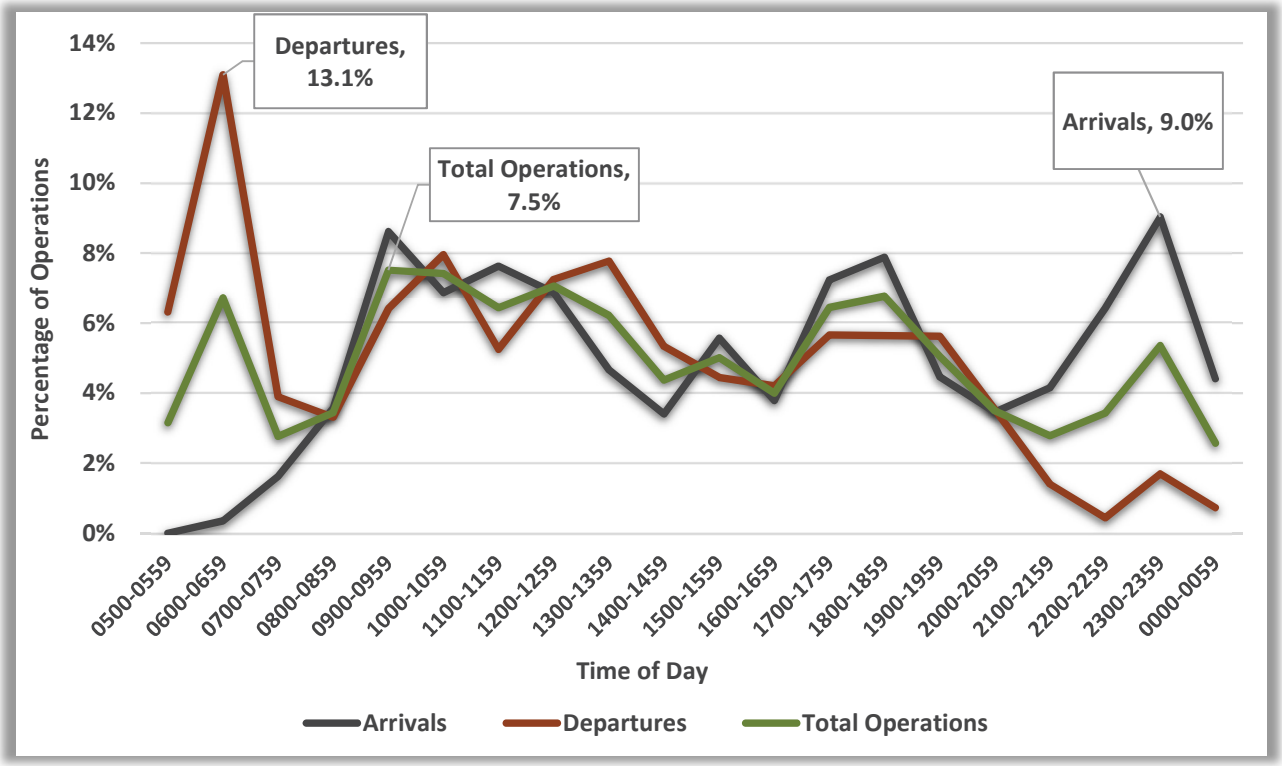
Figure 2-24 shows the monthly distribution of commercial passenger aircraft operations at RNO, based on airline flight schedules for 2015-2017. The peak month is July, with an average of 9.3 percent of annual operations taking place during this month. **Figure 2-25** shows the hourly distribution of operations during the average day in July, also based on airline flight schedules for 2015-2017. Arrivals and departures are distributed differently throughout the day. The peak hour for aircraft departures is from 6 to 6:59 a.m.; 13.1 percent of daily departures take place during this hour. The peak hour for aircraft arrivals is from 11 to 11:59 p.m.; nine percent of daily arrivals take place during this hour. The peak hour for total aircraft operations (departures and arrivals) is from 9 to 9:59 a.m.; or 7.5 percent of total daily operations take place during this hour.

Figure 2-24: Monthly Distribution of Commercial Passenger Aircraft Operations



Sources: OAG Schedules Analyzer and Unison Consulting, Inc. The distribution is based on scheduled flights for 2015-2017.

Figure 2-25: Peak Month Average Day Distribution of Commercial Passenger Aircraft Operations



Sources: OAG Schedules Analyzer and Unison Consulting, Inc. The distributions are based on scheduled flights for July in 2015-2017.

Forecast Commercial Passenger Traffic

Methodology

The approach to forecasting commercial passenger aviation activity uses the following modeling techniques:

- Hybrid forecasting framework
- Multivariate time series regression analysis
- Scenario forecasting
- Forecast risk analysis using Monte Carlo simulation

The models use data from various sources, including the following:

- Reno-Tahoe Airport Authority
- Airline flight schedules
- Airline websites and annual reports
- Online airline fleet data sources
- U.S. Bureau of Transportation Statistics databases and publications
- Federal Aviation Administration databases and publications
- U.S. Bureau of Census
- U.S. Bureau of Labor Statistics
- U.S. Bureau of Economic Analysis
- Moody's Analytics
- 2015-2019 Northern Nevada Regional Growth Study prepared by the Economic Planning Indicator Committee (EPIC).

The hybrid forecasting framework incorporates both supply and demand considerations. The forecast for the first year is supply-driven, based primarily on published airline flight schedules for up to one year ahead. Airlines plan their schedules based on passenger bookings, and the schedules therefore reflect near-term market demand. The schedules also establish the baseline data on commercial aircraft operations and fleet mix.

Beyond the first year, forecasts are demand-driven. Market demand factors drive growth in enplanements. Forecast enplanement levels, in turn, determine the number of aircraft operations and corresponding landed weight, along with assumptions regarding trends in boarding load factors and changes in aircraft fleet mix.

Multivariate time series regression analysis links enplanement growth to trends in market demand drivers. This type of analysis combines elements of multiple regression and time series regression methods. This econometric modeling technique provides the ability to incorporate many explanatory variables, quantify the contribution of each explanatory variable to aviation activity trends, and account for time trends and any serial correlation in time series data. The model estimation process using the least squares method is designed to minimize forecast errors. Using two-stage least squares (TSLS) estimation method also addresses the potential endogeneity of real passenger yield, one of the key drivers of passenger traffic.

The regression model specification for RNO passenger traffic is based on the underlying theory of consumer demand and the dynamics of traffic growth at RNO. The regression coefficients that measure contributions of market demand drivers (explanatory variables) to RNO enplanement growth trends are estimated using historical annual and quarterly data from 1990, controlling for the effects of any structural changes in air service and extra-ordinary events like the 2001 terrorist attacks. The estimated regression coefficients are then used to generate forecasts of RNO enplanements based on projected trends for the model explanatory variables.

Since American Airlines ended the former Reno Air's hub operations at RNO in 2001, connecting traffic has decreased, increasing the O&D traffic share to 90 percent of total enplanements. For the regression model of passenger traffic, O&D enplanements serve as the dependent variable, effectively controlling for the significant fluctuation in enplanement levels due to connecting traffic.

The key explanatory variables (independent variables) in the regression model of passenger traffic are as follows:

- Economic trends: The regression model includes two economic indicators: the real per capita gross domestic product (GDP) for the Reno-Carson City-Fernley, NV, CSA to indicate regional economic trends, and the U.S. unemployment rate to indicate national economic trends.[1] The regression coefficient estimates for these variables confirm their expected effects on RNO enplanement trends. Holding all other factors constant, growth in regional real per capita GDP and decreases in U.S. unemployment rate, indicating overall national economic growth, promote growth in RNO enplanements. Conversely, economic downturns and increases in unemployment decrease RNO enplanements.
- Airline yield trends: Consumer demand is inversely related to price. Demand increases when price decreases and decreases when price increases, if all other things are equal. The regression model estimation results confirm this relationship strongly applies to RNO passenger traffic. The regression model uses the average real passenger yield at RNO as the indicator for the price of air travel. Passenger yield, which is the average revenue per passenger mile, is a better price indicator than the average fare, because it controls for trip distance.[2]

Figures 2-26, 2-27, 2-28, and **2-29** show the projections of the most likely trends in the key demand drivers:

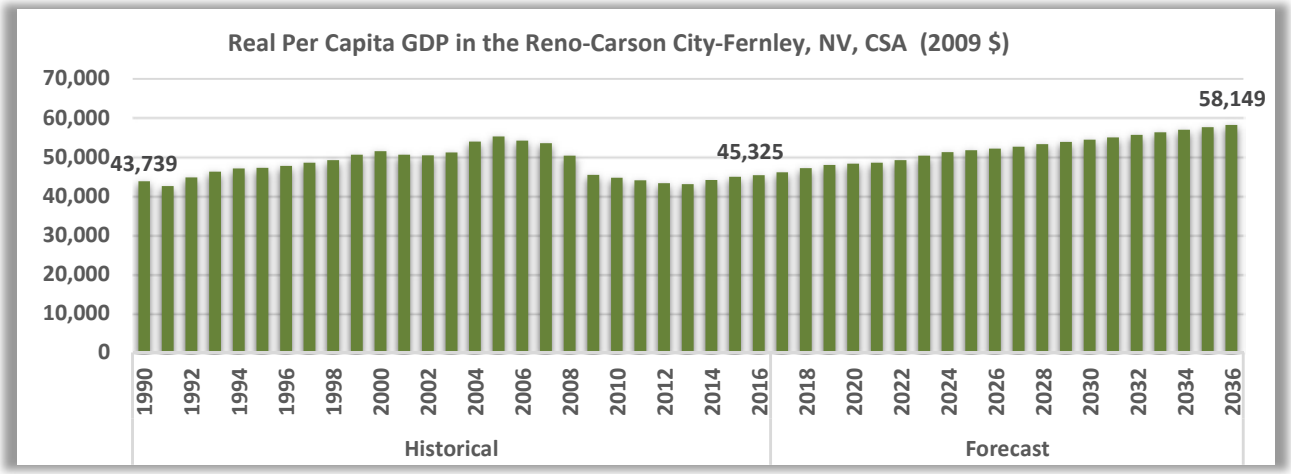
- Regional economic trends: The regional real per capita GDP decreased sharply during the last recession. Altogether it decreased for eight years straight through 2013. The regional economy began to turn around in 2014 and has since grown steadily along with the national economy, albeit at the same slow pace. According to economic forecasts by Moody's Analytics, the regional real per capita GDP will continue growing at an average pace of 1.3 percent annually over the 20-year forecast period, 2017-2036. Moody's Analytics' economic forecasts anticipate some cyclicality in the medium term, showing a mild acceleration of growth in the regional economy over the next three years—consistent with the forecast in EPIC's Northern Nevada Regional Growth Study for 2015-2019—before growth slows again. The long-term forecast, however, does not anticipate any deep downturns in the regional economy like the one experienced during the Great Recession.

[1] These two economic indicators proved to be better predictors of RNO enplanement trends than the other economic indicators tested: aggregate and per capita personal income in the Reno-Carson City-Fernley, NV, CSA; nonfarm employment in the Reno-Carson City-Fernley, NV, CSA; and U.S. nonfarm employment. Population at the CSA level was also tested as an explanatory variable.

[2] Airline yield may not be totally independent of passenger traffic levels. The use of TSLS corrects for the potential endogeneity of airline yield. With TSLS, the model estimation is done in two stages. In the first stage, airline yield is regressed on the following independent variables: nonfarm employment in the Reno CSA, real per capita GDP in the Reno CSA, U.S. unemployment rate, real jet fuel price, the variables that control for the changes in air service by Reno Air and Southwest airlines, and the variables that capture post-9/11 structural changes.

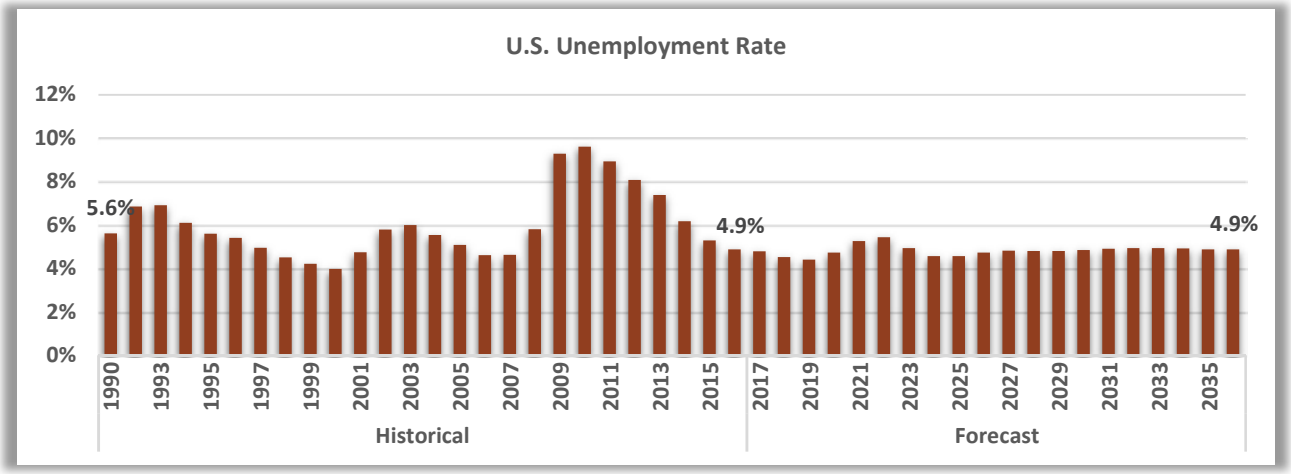
- National economic trends: Reflecting improving national economic conditions, the U.S. unemployment rate has been declining steadily from a peak level of 9.6 percent reached in 2010. The 4.9 percent U.S. unemployment rate in 2016 reflects a national economy near full employment. According to Moody's Analytics' economic forecast, the U.S. unemployment rate will continue to decline for another three years before rising again, but it will not rise to levels reached during the Great Recession. It will rise to 5.4 percent in 2022 and then taper at 4.9 percent.
- Airline yield trends: The average real passenger yield at RNO had been on a long-term decreasing trend through 2004. Then it began to increase in 2005 and continued increasing through 2014—Southwest Airlines was cutting capacity at RNO during this period. In the past two years, the average real passenger yield at RNO has been decreasing again. For the master plan forecast, the average real passenger yield at RNO is set to follow FAA's projected trend for U.S. mainline air carriers. It will remain essentially flat over the first 10 years of the forecast period and then decrease very slightly over the following 10 years. See footnote 2 on the previous page.

Figure 2-26: Historical and Projected Trends in Reno CSA Real Per Capita GDP



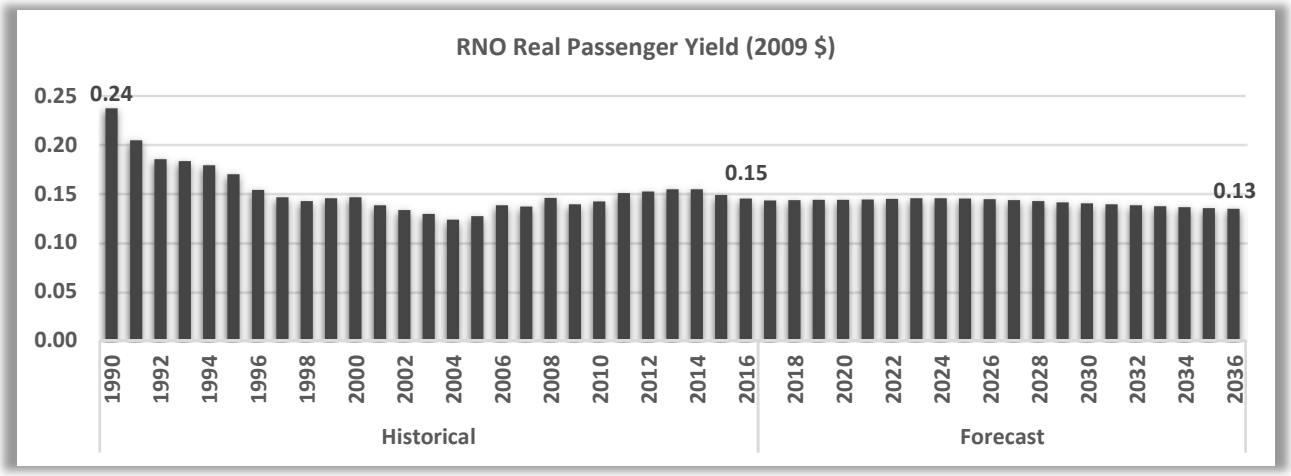
Sources: U.S. Bureau of Economic Analysis, Moody's Analytics, and Unison Consulting, Inc.

Figure 2-27: Historical and Projected Trends in U.S. Unemployment Rate



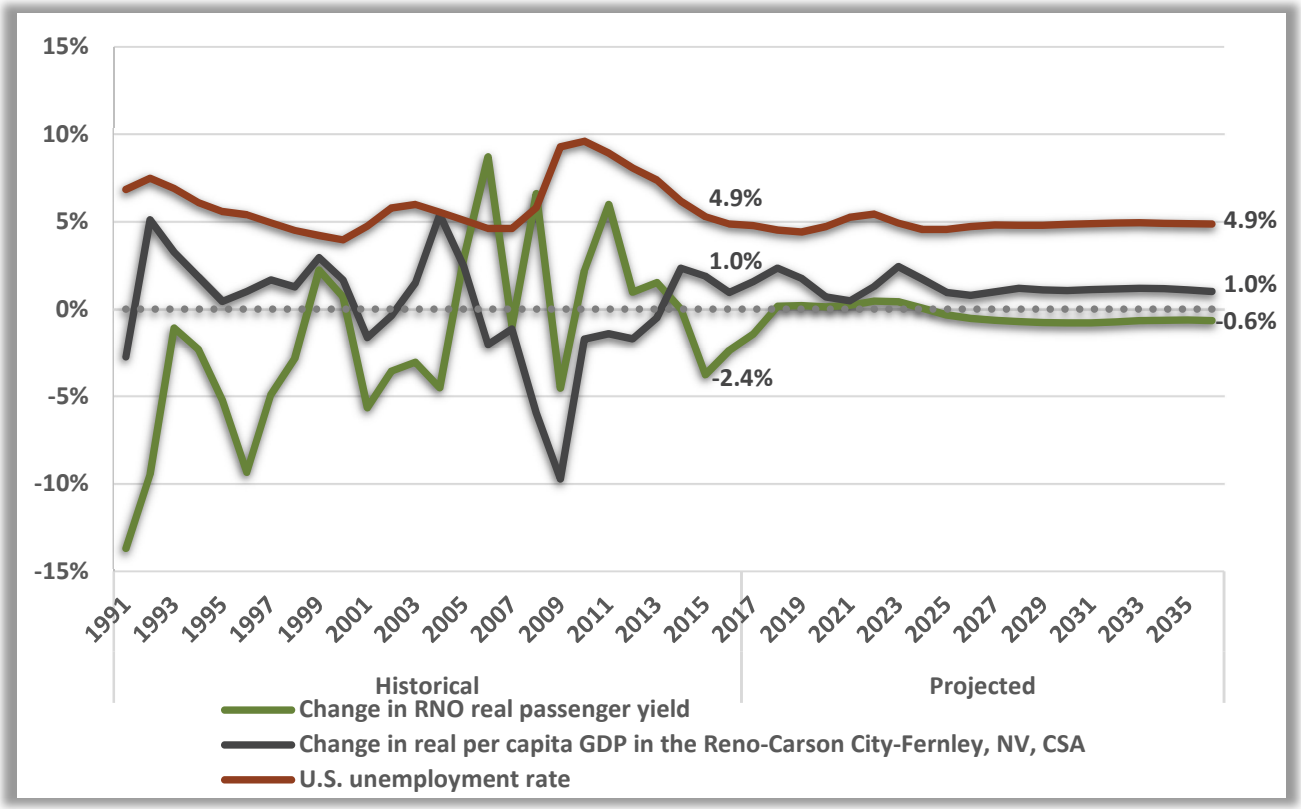
Sources: U.S. Bureau of Economic Analysis, Moody's Analytics, and Unison Consulting, Inc.

Figure 2-28: Historical and Projected Trends in RNO Real Passenger Yield



Sources: U.S. Bureau of Transportation Statistics DB1B, Federal Aviation Administration, and Unison Consulting, Inc.

Figure 2-29: Historical and Projected Annual Change in Key Market Demand Drivers



Sources: U.S. Bureau of Transportation Statistics DB1B for historical data on RNO real passenger yield; Federal Aviation Administration for projected trend in real passenger yield; U.S. Bureau of Economic Analysis of historical real per capita GDP in the Reno-Carson City-Fernley, NV, CSA; U.S. Bureau of Labor Statistics for historical U.S. unemployment rate; Moody's Analytics for projected real per capita GDP in the Reno-Carson City-Fernley, NV, CSA; and projected U.S. unemployment rate, and Unison Consulting, Inc., for analysis.

Since 1990, RNO has gone through significant changes in airline service, particularly from Reno Air, which operated at RNO from 1992 to 1999, and from Southwest Airlines, which has operated at RNO since 1990. To account for the effects of these changes, the regression model includes the following variables:

- Number of nonstop destinations served by Reno Air, as a percentage of total nonstop destinations served from RNO.
- Number of nonstop destinations served by Southwest Airlines, as a percentage of total nonstop destinations served from RNO.

The regression model also includes an explanatory variable to account for the adverse effects of the terrorist attacks in 2001 and the subsequent structural changes in the travel market and the airline industry. The terrorist attacks had profound effects on the airline industry and airports, including RNO. They caused a sharp decrease in enplanements following the attacks in 2001 and the following year. They prompted more stringent security screening processes at airports that caused lasting changes in the demand for air travel. They set in motion various other structural changes in the airline industry. To curb financial losses following the terrorist attacks, American Airlines disposed of the Reno Air fleet it acquired in 1999, dismantled Reno Air's network, and closed the RNO connecting hub.

After 2001, aviation fuel prices began to rise, reaching record levels by 2008. The rise in fuel costs aggravated financial pressures in the airline industry, prompting airlines to change business models, cut costs, cut capacity, and consolidate through mergers. These are changes that affect RNO to this day. Preliminary specifications of the regression model included aviation fuel prices as an explanatory variable. It was excluded in the final model because its coefficient was statistically insignificant. Fuel prices as an explanatory variable also did not add to the model's overall predictive power, likely because the effects are already captured by the other explanatory variables, such as the economic indicators, airline passenger yield, and the variable accounting for structural changes since the terrorist attacks in 2001.

The regression model was estimated twice, using annual data and quarterly data. This approach resulted in similar measures for the contribution of each of the market drivers to RNO passenger traffic trends, producing similar forecasts for RNO passenger traffic growth. The measured contributions (coefficient estimates) of all the explanatory variables are consistent with theory and expectations. They are all statistically significant. That means they show strong evidence that they really influence passenger traffic trends. The regression model has an adjusted R-squared of 0.96, meaning that the model and all its explanatory variables explain 96 percent of variations in RNO O&D enplanements, which account for 90 percent of total enplanements.

The model coefficient estimates measuring the contributions of market drivers to growth in RNO's enplanements, along with projections of trends in the key market demand drivers, produce the forecast growth in enplanements beyond the first year of the forecast period. Recognizing uncertainty in the future trends of key market drivers, alternative forecasts were developed using Monte Carlo simulation. A comprehensive approach to forecast risk analysis Monte Carlo simulation uses probability distributions and random sampling techniques for assigning future values to the key explanatory variables of the regression model. The simulation, involving 5,000 iterations, produced a wide range of possible scenarios for future enplanement growth and corresponding percentile rankings. Percentiles provide an indication of the likelihood of each of the forecast scenarios.

Figure 2-30 shows the range of forecast enplanements, which include select Monte Carlo simulation results and the recommended Master Plan forecast. **Figure 2-31** also shows a high growth forecast, a low growth forecast, and the FAA TAF for comparison. The Master Plan forecast is based on the following scenario:

- Organic growth: Organic growth in RNO enplanements would proceed as determined by the following factors: (1) the growth in scheduled seat capacity at RNO in 2017, and (2) the most likely trends for the key market demand drivers (i.e. regional economy, national economy, and passenger yield).
- Aggressive air service development: RTAA's air service development efforts would increase RNO's market capture rate to 100 percent by 2022, from the current market capture rate of 94 percent for domestic traffic and 75 percent for international traffic estimated by the True Market Study.

The resulting forecast annual enplanements are within no more than 2 percent of the forecast annual enplanements under the FAA TAF. They are closest to the 60-percentile result in 2018, the 65-percentile results in 2019 and in 2030-2036, the 70-percentile results in 2020 and in 2026-2029, and the 70-percentile results in 2021-2025. Under the Master Plan forecast, RNO's share of forecast U.S. enplanements (FAA's March 2016 Aerospace Forecasts) would remain under 0.25 percent, meaning that RNO would remain a small hub, except in 2024. RNO's enplanements would approach their pre-recession peak level of 2.67 million by 2032.

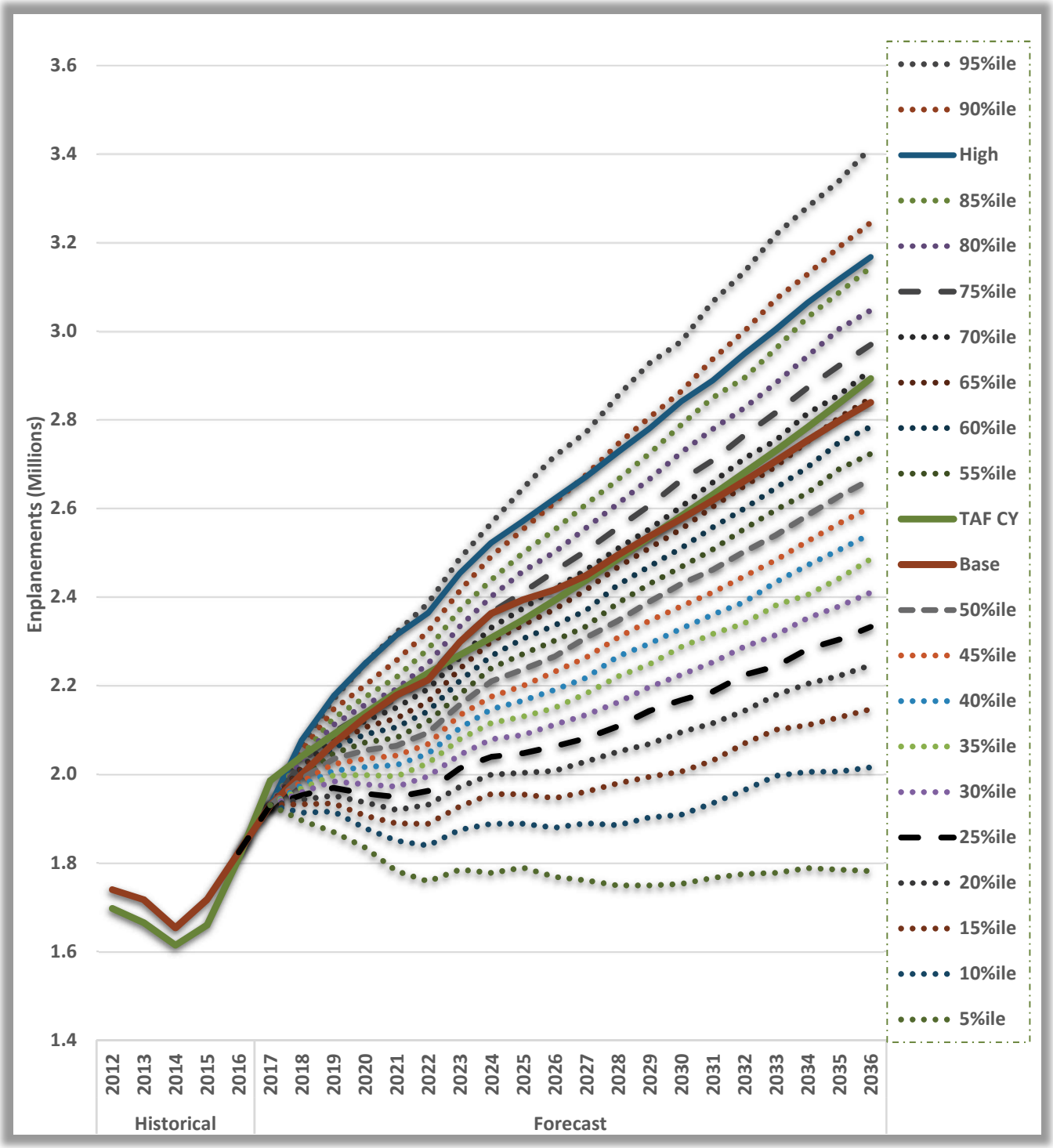
The high growth forecast is based on the following assumptions:

- Organic growth: Organic growth in RNO enplanements would follow the 75-percentile growth rates, largely driven by more favorable regional and national economic conditions than projected for the Master Plan forecast.
- Aggressive air service development: In addition to organic growth, aggressive air service development efforts would increase RNO's market capture rate to 100 percent by 2021.

Under the high growth forecast, annual enplanements are closest to the 95 percentiles in 2017-2023, 90 percentiles in 2024-2030, and 85 percentiles in 2031-2036. They are higher than the TAF by no more than 10 percent through 2036. RNO's share of total U.S. enplanements would increase to at least 0.25 percent, qualifying as a medium hub, by 2019. RNO's enplanements would reach their pre-recession peak level of 2.67 million by 2027.

The 25-percentile result is recommended for a low growth scenario that can be used as a conservative basis for financial analysis. Forecast annual enplanements are lower than the TAF by no more than 8 percent through 2020, 15 percent through 2029, and 19 percent through 2036.

Figure 2-30: Historical and Forecast Total Enplanements



Sources: RTAA for historical data, FAA for the TAF, and Unison Consulting, Inc. for the base regression and Monte Carlo simulation forecasts.

Table 2-8 shows the forecast enplanements for the Master Plan forecast, low growth, and high growth scenarios. **Table 2-9** shows the corresponding forecast passenger aircraft landings, and **Table 2-10** shows the corresponding forecast passenger aircraft landed weight.

Table 2-8: Forecast Enplanements

Scenario	Enplanements (Thousand)				Compound Annual Growth Rate		
	Actual	Forecast			Forecast		
Master Plan (MP) Forecast	**2016**	**2021**	**2026**	**2036**	**2016-2021**	**2021-2026**	**2026-2036**
Domestic	1,803	2,150	2,385	2,802	3.6%	2.1%	1.6%
International	20	28	32	38	6.8%	2.7%	1.6%
Total	1,824	2,178	2,417	2,839	3.6%	2.1%	1.6%
Low Growth							
Domestic	1,803	1,928	2,041	2,308	1.4%	1.1%	1.2%
International	20	21	22	25	0.4%	1.1%	1.2%
Total	1,824	1,949	2,063	2,304	1.3%	1.1%	1.2%
High Growth							
Domestic	1,803	2,284	2,587	3,126	4.8%	2.5%	1.9%
International	20	31	35	42	8.7%	2.5%	1.9%
Total	1,824	2,315	2,622	3,168	4.9%	2.5%	1.9%
TAF, CY, as of Jan. 2017	1,810	2,185	2,393	2,893	3.8%	1.8%	1.9%
Ratio of MP Total to TAF	1.01	1.00	1.01	0.98			
Ratio of Low Total to TAF	1.01	0.89	0.86	0.81			
Ratio of High Total to TAF	1.01	1.06	1.10	1.09			

Sources: RTAA for actual data, FAA for TAF, and Unison Consulting, Inc. for the forecasts.
The figures for domestic and international enplanements may not add to the total enplanements due to rounding. Total passengers equal two times enplanements.

Table 2-9: Forecast Commercial Passenger Aircraft Landings

Scenario	Landings (Thousand)				Compound Annual Growth Rate		
	Actual	Forecast			Forecast		
	2016	**2021**	**2026**	**2036**	**2016-2021**	**2021-2026**	**2026-2036**
Master Plan Forecast	19.5	23.0	24.7	27.7	3.3%	1.4%	1.1%
Low Growth	19.5	20.6	21.1	22.5	1.1%	0.4%	0.6%
High Growth	19.5	24.3	26.6	30.2	4.5%	1.8%	1.3%

Sources: RTAA for actual data, FAA for TAF, and Unison Consulting, Inc. for the forecasts.
Aircraft landings are assumed to equal aircraft departures; therefore, aircraft operations equal two times aircraft landings.

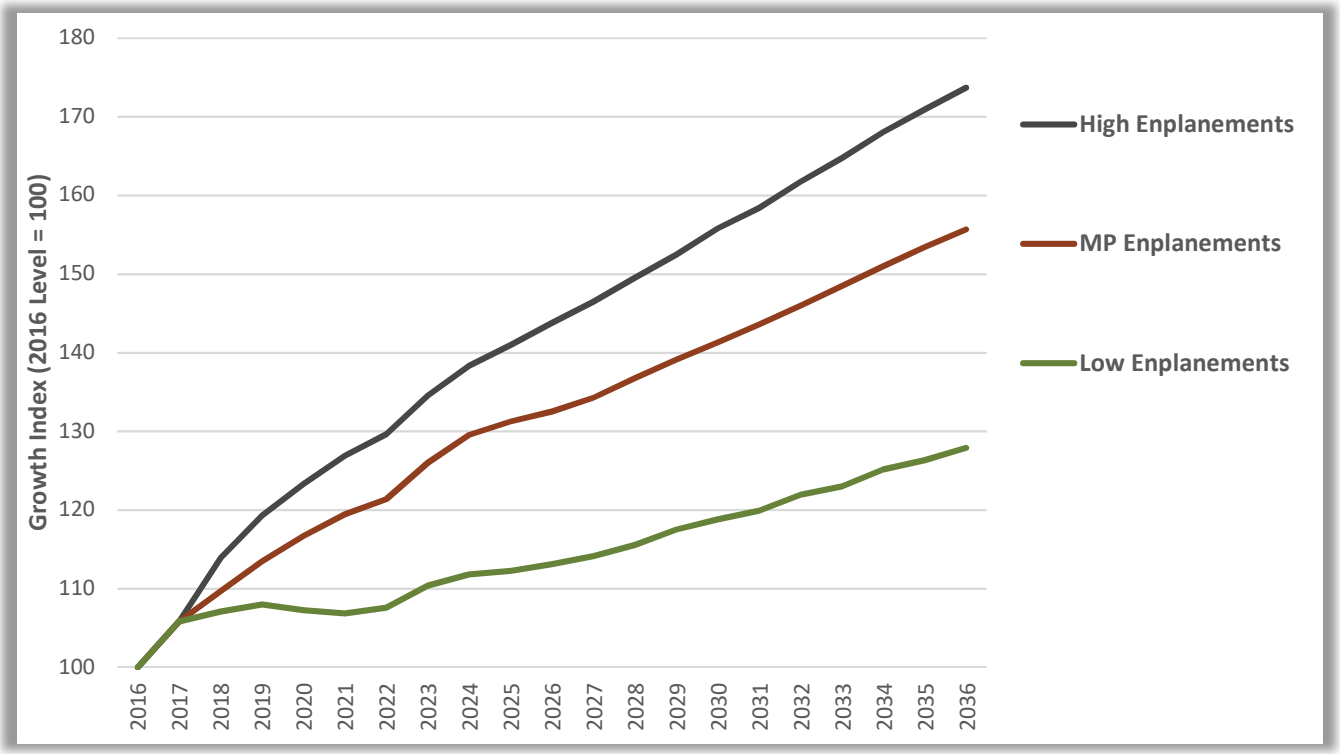
Table 2-10: Forecast Commercial Passenger Aircraft Landed Weight

Scenario	Landed Weight (Million Pounds)				Compound Annual Growth Rate		
	Actual	Forecast			Forecast		
	2016	**2021**	**2026**	**2036**	**2016-2021**	**2021-2026**	**2026-2036**
Master Plan Forecast	2,095	2,504	2,767	3,237	3.6%	2.0%	1.6%
Low Growth	2,095	2,241	2,362	2,628	1.4%	1.1%	1.1%
High Growth	2,095	2,646	2,986	3,536	4.8%	2.4%	1.7%

Sources: RTAA for actual data, FAA for TAF, and Unison Consulting, Inc. for the forecasts.

Figure 2-31 shows the forecast growth in enplanements, under the Master Plan forecast, low growth and high growth scenarios. Enplanements compared with landings grow at a slower pace because of continuing efforts by airlines to improve load factors and up-gauge their fleet. Compared with landings, landed weight grows at faster pace due to fleet up-gauging within both the narrow-body jet and regional jet & turboprop aircraft groups.

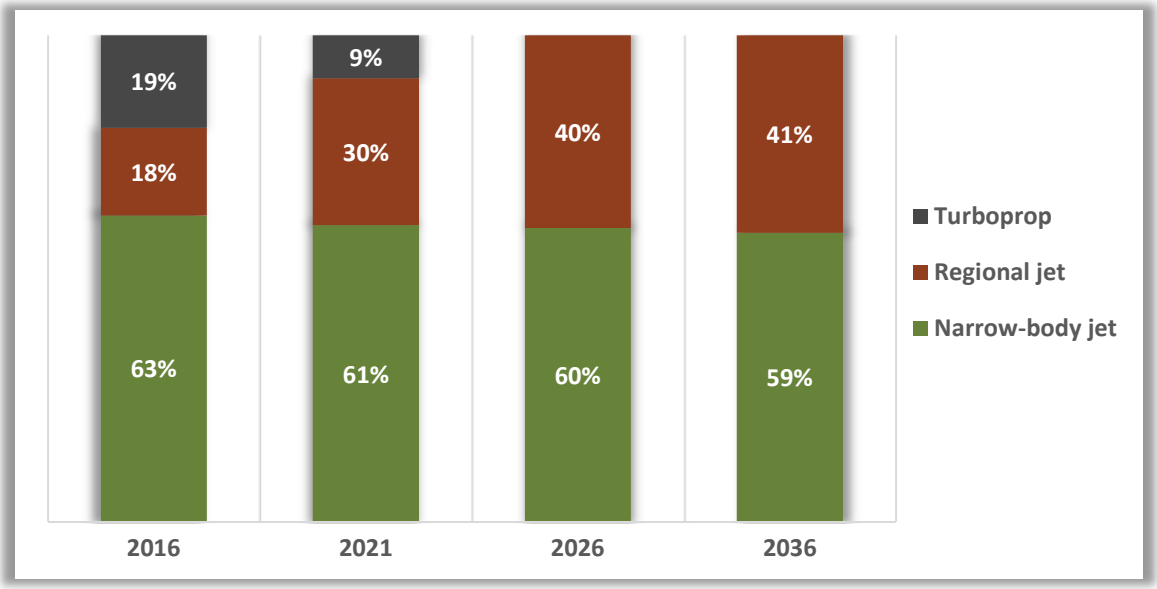
Figure 2-31: Forecast Scenario Growth In Enplanements



Source: Unison Consulting, Inc.

Figure 2-32 shows the composition of the passenger aircraft fleet serving RNO. Narrow-body jets account for most of aircraft operations: 65 percent in 2016, decreasing slightly to 63 percent in 2021, and then increasing back to 65 percent in 2036. Regional jet and turboprop aircraft account for the remaining share of 35 percent in 2016, increasing to 37 percent in 2021. Turbo prop aircraft are phased out completely by 2026, so that regional jet aircraft account for the remaining share of 36 percent by 2026 and 35 percent by 2036. The fleet mix projections consider the age of each aircraft used by each airline at RNO, the types and age of other aircraft in each airline's fleet and expected new aircraft deliveries. Assuming a 30-year useful life, older aircraft are phased out and replaced by newer similar aircraft in an airline's fleet.

Figure 2-32: Forecast Fleet Mix (Shares by Aircraft Group) – Commercial Passenger Carriers



Sources: OAG Schedules Analyzer and Unison Consulting, Inc.

Table 2-11 shows the calculations for the peak month average day (PMAD) peak hour number of operations for commercial passenger carriers.

Table 2-11: Peak Month Average Day Peak Hour Operations – Commercial Passenger Carriers

Scenario	2016	2021	2026	2036
Master Plan Forecast				
Annual Operations	38,900	45,900	49,200	55,100
Peak Month (9.3% of CY Total)	3,600	4,300	4,600	5,100
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	117	137	147	165
PMAD Peak Hour (7.5% of PMAD Subtotal)	9	10	11	12
Low Growth Forecast				
Annual Operations	38,900	41,100	42,000	45,300
Peak Month (9.3% of CY Total)	3,600	3,800	3,900	4,200
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	117	123	126	136
PMAD Peak Hour (7.5% of PMAD Subtotal)	9	9	9	10
High Growth Forecast				
Annual Operations	38,900	48,500	53,100	61,100
Peak Month (9.3% of CY Total)	3,600	4,500	4,900	5,700
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	117	145	159	183
PMAD Peak Hour (7.5% of PMAD Subtotal)	9	11	12	14

Sources: OAG Schedules Analyzer and Unison Consulting, Inc. Annual operations and peak month operations are rounded to the nearest hundred.

Table 2-12 shows the calculations for the PMAD peak hour number of passengers.

Table 2-12: Master Plan Forecast Peak Month Average Day Peak Hour Passengers – Commercial Passenger Carriers

Scenario	2016	2021	2026	2036
Master Plan Forecast				
Annual Passengers	3,647,200	4,357,000	4,833,500	5,678,700
Peak Month (9.3% of CY Total)	333,900	398,900	442,600	520,000
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	10,773	12,869	14,277	16,773
PMAD Peak Hour (7.5% of PMAD Subtotal)	829	990	1,099	1,291
Low Growth Forecast				
Annual Passengers	3,647,200	3,898,300	4,126,300	4,665,200
Peak Month (9.3% of CY Total)	333,900	356,900	377,800	427,200
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	10,773	11,514	12,188	13,779
PMAD Peak Hour (7.5% of PMAD Subtotal)	829	886	938	1,060
High Growth Forecast				
Annual Passengers	3,647,200	4,629,300	5,244,600	6,335,500
Peak Month (9.3% of CY Total)	333,900	423,900	480,200	580,100
Peak Month Average Day (PMAD) (PM Subtotal/31 days)	10,773	13,674	15,491	18,713
PMAD Peak Hour (7.5% of PMAD Subtotal)	829	1,052	1,192	1,440

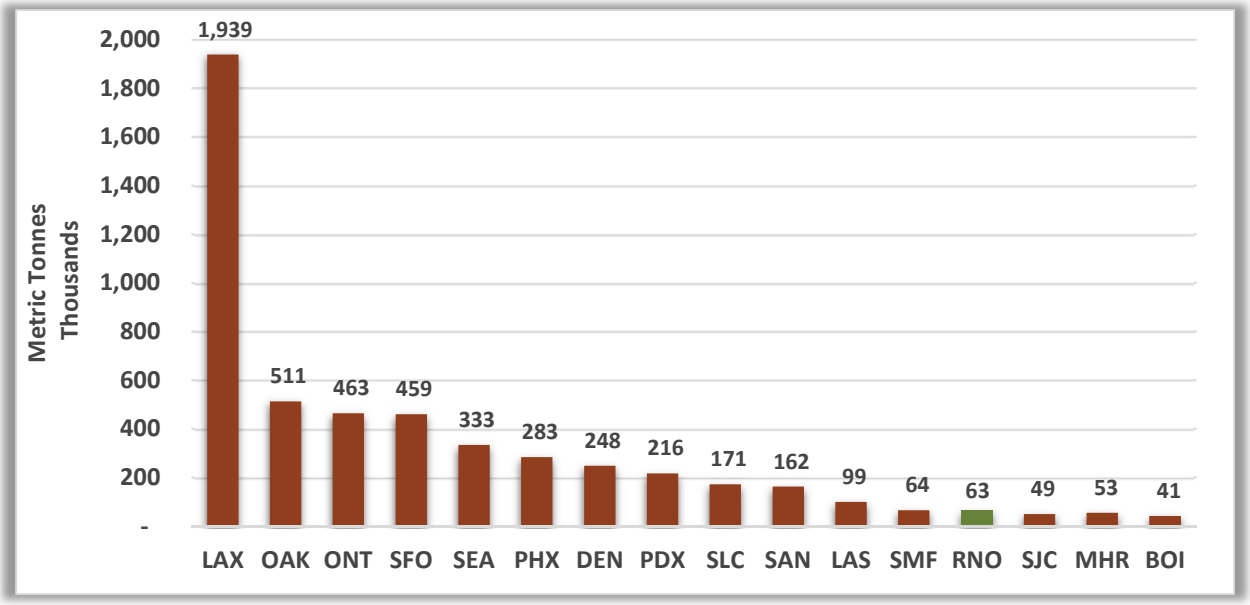
Sources: OAG Schedules Analyzer and Unison Consulting, Inc. Annual passengers and peak month passengers are rounded to the nearest hundred.

Commercial Air Cargo

Regional Competition

While national dynamics undoubtedly impact local and regional demand, RNO's competitive environment is more clearly delineated on a regional basis. RNO's service area potentially overlaps with at least six airports that rank among the top 20 U.S. airports ranked by annual tonnage. LAX accounts for as much total cargo tonnage as the next five largest airports in the region and as much daily international cargo capacity as all other airports in the region. Accounting for more than half its total, LAX's international cargo exceeded a million tonnes in 2015. In order, the next largest international cargo gateways in the region are SFO, SEA and PDX. Since 2000, LAX has continued to add international freighter operations, even as its nearest competitor, SFO, suffered freighter service losses. SEA has experienced only modest freighter growth but has been greatly enhanced by the expansion of hub carrier Delta's transpacific gateway there. PDX has only periodically attracted scheduled international freighter service because of subsidies proffered by the State of Oregon. **Figure 2-33** shows total air cargo tonnage for airports in the Western U.S for 2015.

Figure 2-33: Total Air Cargo Tonnage (Metric) for Top U.S. West Airports for Calendar Year 2015



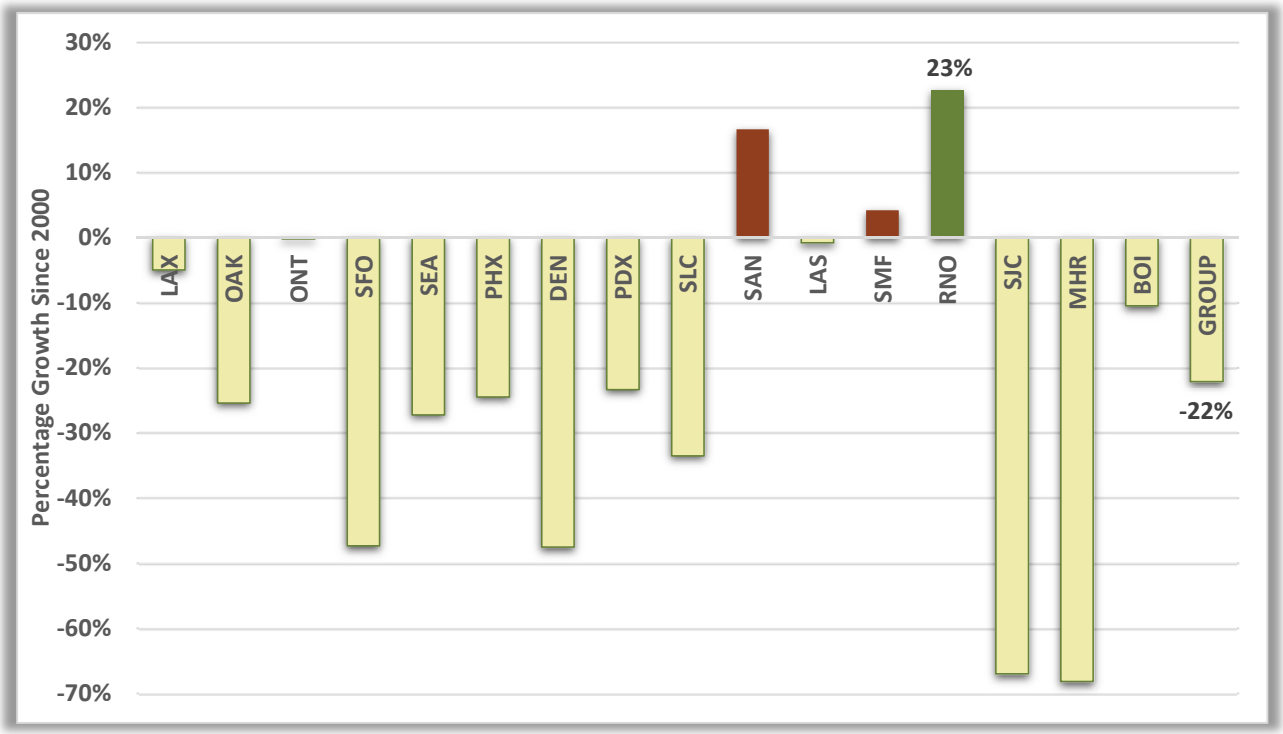
Sources: Airports Council International – North America and Webber Air Cargo, Inc.

In terms of tonnage alone, LAX's nearest competitors are not major international gateways but rather the regional hubs of integrated carriers FedEx and UPS. OAK for FedEx and southern California's Ontario National Airport (ONT) for UPS provide hubs for shipments moving entirely within the western region, as well as linkages two integrated carriers' national hubs, Memphis International Airport (MEM) for FedEx and Louisville International Airport (SDF) for UPS, and other regional hubs. As with most cargo or passenger hubs, OAK and ONT owe their high rankings more to connecting traffic than to local demand. Apart from the international gateways and integrator hubs, all other airports in the region serve similar functions as spokes serving local demand in cargo carrier networks – albeit with slight variances for passenger hubs and marginal international passenger service at PHX, DEN and SLC.

For airport operators aspiring to nurture cargo growth, these gateway and hub networks impose barriers. At international gateways, freight forwarders and other shippers rely upon network connectivity – the mix of carriers (passenger and all-cargo), flight frequencies and direct destinations. The dominance of a gateway such as LAX, which offers both passenger and freighter service to every single transcontinental market served by any other gateway on North America's west coast, makes new alternative gateways extremely unlikely. Many freight forwarders and shippers based nearer rival gateways such as SFO and SEA still truck cargo to/from LAX due simply to the reliability of the unique diversity of service offerings.

Similarly, the presence of regional integrated carrier hubs at ONT and OAK limit growth of any other airport in the region by either carrier to organically grow based upon local or regional demand. Notably, the RNO market has been uncommonly strong in terms of local demand through what has been a difficult period for most U.S. airports. Illustrated in **Figure 2-34**, according to the Phase 1: Air Cargo Market Study completed by Campbell-Hill Aviation Group, LLC in August 2015, RNO's competitive advantages are "based on a location with excellent access to the Western U.S., a positive business environment, and the continued expansion of industrial activity." RNO must rely on organic cargo growth because it is not a regional hub, nor a hub for any domestic all-cargo airline. Without the connecting traffic of a hub, RNO's cargo growth depends upon demand generated by local industry within its service area. RNO's annual tonnage grew by about 10,000 metric tonnes while regional tonnage dropped by about 1.5 million tonnes.

Figure 2-34: Air Cargo Growth at Major West Airports from Calendar Year 2000 through 2015



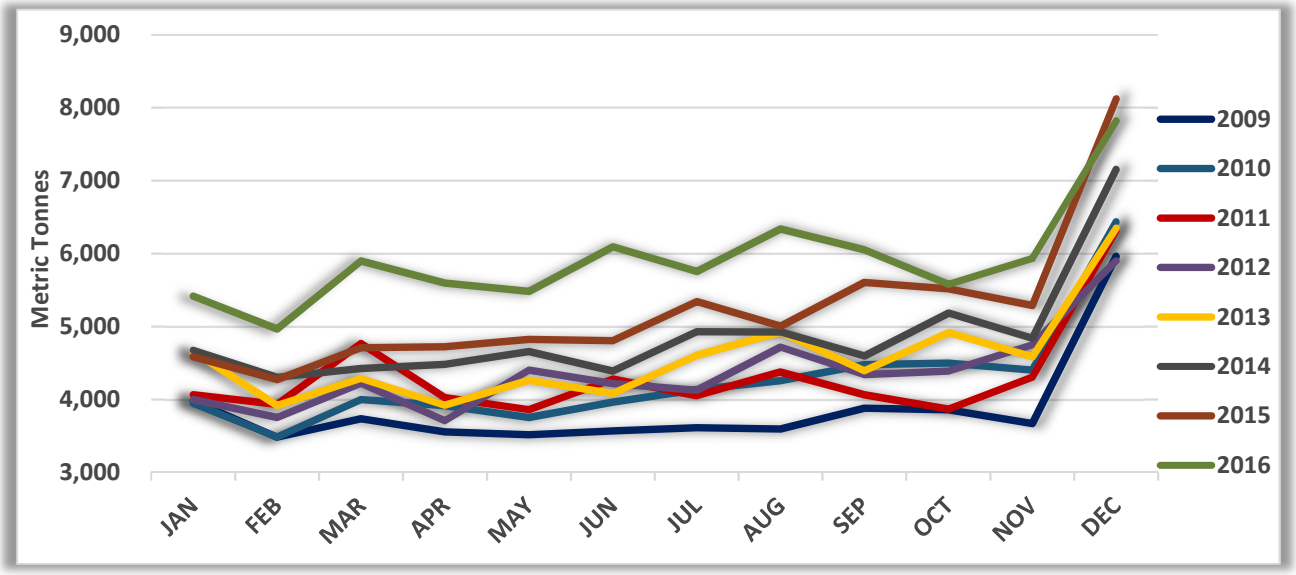
Sources: Airports Council International – North America and Webber Air Cargo, Inc.

For nearly all U.S. airports, calendar year 2000 was the peak year for cargo tonnage before an extended decline from which most have yet to entirely emerge. At LAX, double-digit growth in international cargo has been insufficient to offset double-digit decreases in domestic cargo. The extended recession following 9/11 combined with unprecedented fuel costs have forced several former major all-cargo carriers such as BAX Global, Emery Worldwide and Kitty Hawk to ground freighter aircraft, to be acquired, or into bankruptcy. During the same period, DHL acquired the former Airborne Express before withdrawing from the US domestic market to concentrate entirely on international shipments to/from the U.S. market. While DHL remains a global powerhouse active in other regions of the world, it withdrew from the head-to-head competition with FedEx and UPS for domestic shipments in the U.S.

Historic Cargo Trends

Figure 2-35 shows the RNO market has a pronounced peak month for air cargo tonnage with December roughly doubling the tonnage of average months during the recent growth period. For master planning purposes, peak months are useful for gauging the adequacy of airport capacity.

Figure 2-35: RNO Total Air Cargo Tonnage by Month for Calendar Years 2009 through 2016



Sources: The Reno-Tahoe Airport Authority with additional analysis by Webber Air Cargo, Inc.

The integrated carriers have a variety of means by which to accommodate tonnage growth, not least the tradeoff between frequencies and aircraft gauge. Furthermore, carriers blend routing decisions into that tradeoff with the result that more and/or larger freighters can be used in a market than its own demand would otherwise justify. For example, DHL's B737 freighter operates over DEN to and from its Cincinnati/ Northern Kentucky International Airport (CVG) hub and RNO to maximize revenue payloads. FedEx routes flights over Fresno Yosemite International Airport (FAT) and occasionally LAS between RNO and western hub OAK but operates nonstop between its MEM hub and RNO. UPS uses stops in SLC, DEN, Mather Air Force Base (MHR), PDX, and Boeing Field (BFI) in Seattle to complement routes connecting RNO to regional hubs at ONT, PHL and its global hub in SDF. Consequently, carriers can occasionally accommodate increased tonnage in a market by simply increasing the payload dedicated to that market (possibly by eliminating stops in other markets) without adding frequencies or increasing aircraft size.

For seasonal peaks, airlines are reluctant to purchase aircraft but instead may lease them from aircraft, crew, maintenance and insurance (ACMI) companies. An example is Atlas Air Worldwide Holdings, which is the holding company for Atlas Air and Southern Air, as well as the majority shareholder of Polar Air Cargo. DHL is the minority (49 percent) shareholder in Polar and uses Southern Air to serve RNO. DHL also uses Redding Aero with turboprop Cessna Caravans for service to SFO with intermediate service over MHR inbound.

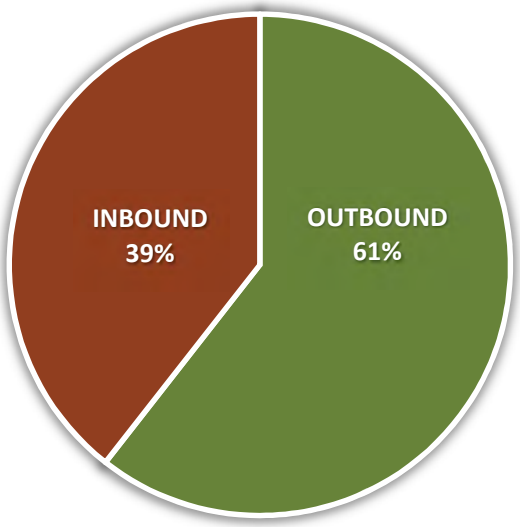
While the increase in landing weights and decrease in frequencies at RNO in recent years indicates a trend toward heavier freighters, a ceiling exists for how large of freighters should reasonably be anticipated for planning purposes at RNO. As RNO continues to serve only as a spoke in domestic networks for integrated carriers, the basic fleet mix is likely to remain with adjustments more prone to involve frequencies and elimination of non-hub stops. Currently, DHL's main service is a single daily (Monday through Friday) B737-400 and a Cessna 208 (Caravan) supplementing capacity. FedEx's fleet at RNO currently entails Boeing 757-200 and MD10-30 aircraft but FedEx may also use MD-11 and A300-600 freighters. UPS currently uses B757-200, B767-300 and A300-600 freighters.

While RTAA has studied its potential need to accommodate larger aircraft, that demand is unlikely to come from all-cargo operators on any but an occasional charter. In gauging ramp capacity, schedules are as significant as fleets. FedEx and UPS operate in "windows" that allow aircraft parking positions to be reused in a 24-hour day. FedEx's current holiday (peak) schedule has five daily landings and five daily departures at RNO on Tuesday, Wednesday, Thursday, and Friday with reduced schedules on other days. However, FedEx's schedules have two morning arrivals and departures completed within a 3.5-hour window about nine hours before evening operations begin, and the third of its evening flights is scheduled to arrive after the first leaves. Unless FedEx experiences a delay locally or as a derived effect in its system, it should not have more than two aircraft parked at RNO simultaneously. UPS has similar morning and evening windows scheduled to minimize the number of concurrent aircraft on the ground. UPS has a maximum of seven daily arrivals and seven departures but could go to ten each in the week before Christmas. UPS occasionally requires three aircraft parking positions, which is a challenge since it must use one of three contiguous positions for ground support equipment storage and handling. Both FedEx and UPS attempt to have weekday aircraft on the ground for only 90-120 minutes.

Requirements for separation of aircraft restrict which aircraft can be parked simultaneously on RNO's ramps. FedEx and UPS may use a reliever ramp between the cargo complex and the passenger terminal, except when used for Customs clearance for international passengers. The cargo carriers support growing international passenger service at RNO but without new infrastructure, growth will continue to impact access for them.

Figure 2-36 substantiates a perception shared by both FedEx and UPS that Reno is a significantly stronger outbound market. Further review of FAA T-100 data shows that outbound cargo is roughly 50 percent higher than inbound cargo for the two integrators and for the belly cargo carriers, while DHL has a slight imbalance in favor of inbound tonnage. To resolve such imbalances, carriers will schedule additional stops, in both directions, between RNO and the hub.

Figure 2-36: RNO Shares of Enplaned and Deplaned Cargo for Calendar Year 2016



Sources: FAA T-100 with additional analysis by Webber Air Cargo, Inc.

On-airport real estate is typically priced higher, motivating carriers to minimize their on-airport footprint. However, bankruptcies and mergers of multiple all-cargo carriers often have resulted in lower occupancy that drives leasing closer to off-airport rates. Still, on-airport cargo facilities are much more marketable to carriers and handlers specifically needing to locate there, while freight forwarders and trucking companies whose demand is multi-modal are inclined to locate distribution centers off-airport. Even FedEx and UPS have much local warehouse capacity nearby but off-airport. These are principally used for shipments that do not require overnight air transport but can also supplement on-airport warehouse capacity during peak seasons when containers may be trucked directly to/from the aircraft ramp through the gate, rather than through the warehouse.

With relatively few transfers between aircraft ("tail-to-tail"), RNO's cargo operations almost entirely match truck and van transport to/from the landside docks of cargo buildings to interface with warehouse laborers. All RNO's cargo buildings are located north of the passenger terminal on the west side of the airfield with direct gate access to the roadways and contiguous apron access on the airside.

With only belly cargo capacity, Southwest Airlines was RNO's third-largest cargo carrier in 2015. With a dramatic increase in mail, American Airlines has closed some of the gap with Southwest Airlines among belly carriers at RNO. While other U.S. belly carriers outsource cargo handling and warehouse operations, Southwest Airlines has been prone to keep these functions in-house. With very little automation, pure belly cargo operations tend to be less efficient (requiring more space per ton of cargo). Narrow-body aircraft operated by Southwest and other largely domestic carriers cannot accommodate cargo containers or pallets.

The Air Cargo Market Analysis performed by Campbell-Hill Aviation Group in 2015 concluded that RNO is adequately served in terms of domestic cargo service but that local companies could be at a disadvantage due to limited access to international markets. On the contrary, initial findings indicate that RNO's prospects for international air service development are relatively remote, but RNO imposes existing challenges for carriers already accounting for about 95 percent of annual tonnage. While reasons for RNO's lack of international all-cargo service are almost certainly market-related and therefore unlikely to be affected by RTAA's initiatives, negative impacts on its domestic operations are facilities-oriented and therefore within its sphere of influence.

Forecast Air Cargo Activity

Forecast development for air cargo activity uses a hybrid approach combining the use of institutional industry forecasts and regression techniques. In particular, institutional forecasts set the limits of long-term growth. Given these limits, regression analysis produced annual forecasts of air cargo traffic for the Master Plan and two alternative growth scenarios (low and high).

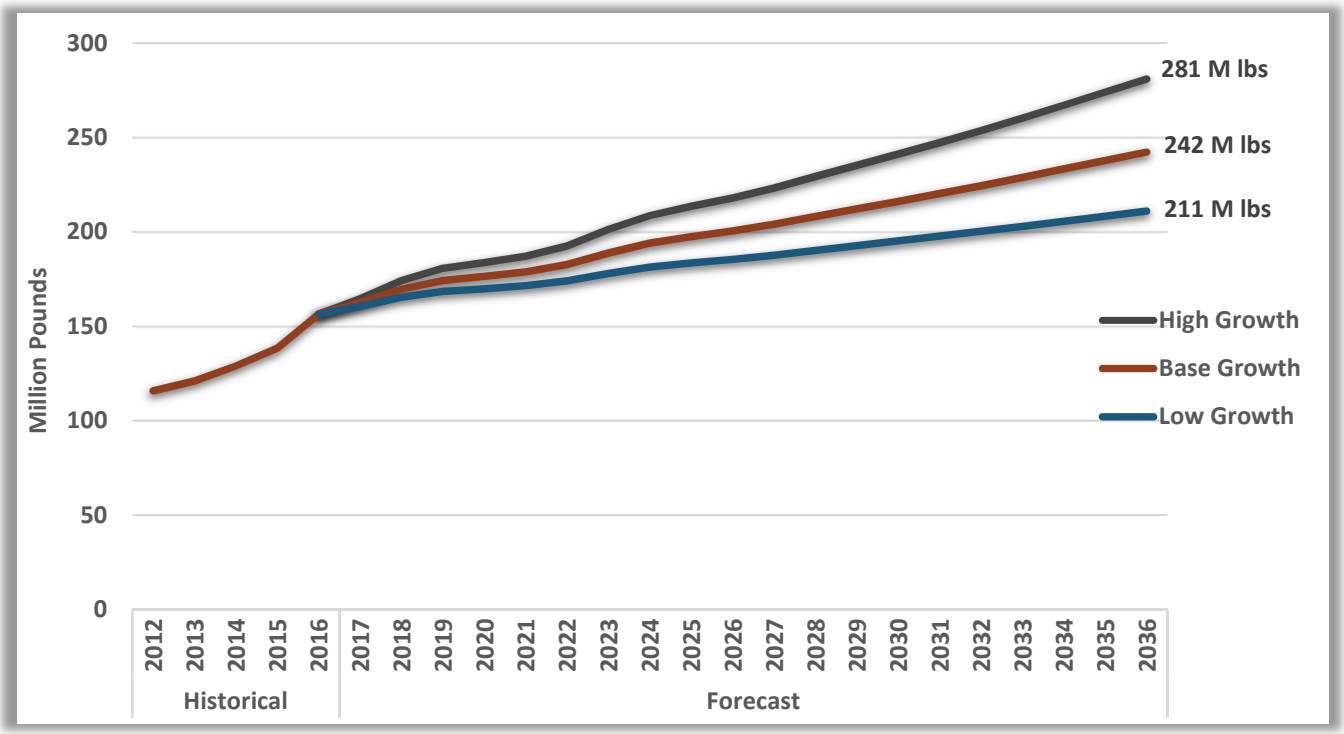
Between calendar year 2000, which was the peak year for most U.S. airports, and 2015 (inclusive), RNO's total cargo had a compound annual growth rate (CAGR) of 1.37 percent that may seem modest, but it occurred during a double-digit tonnage decrease for the combined top 16 cargo airports in its region. Using a simple time-series analysis for RNO's growth rate implies that the recent past is replicable, which is an unlikely assumption. For the U.S. air cargo industry, the period since 2000 had unprecedented upheavals with extraordinary recessions hitting demand drivers, and a sustained period of unprecedented increases in fuel costs that caused the premature retirement of many older freighters. Many formerly major all-cargo carriers, such as Airborne Express, BAX Global, Emery Worldwide and Kitty Hawk, either ceased operations or were acquired by larger carriers that rationalized their operations into their own networks. One would be unlikely to project continued losses for most airports in the region based on that extraordinary period. Since RNO fared comparatively well a slightly more optimistic forecast going forward may seem justified, but also casts doubt on the straight application of the historical CAGR.

Similarly, multiple regression analysis alone would not be sufficient for developing long-term forecasts for RNO because the historical associations of air cargo with traditional market drivers have diverged since the U.S. transformed into more of a service economy less reliant upon manufacturing. Moreover, cargo is much more flexible than passenger demand with shipments routinely trucked 500-1,000 miles to access international gateways, as well as final users. At localized markets like RNO, trucking offers a readily available substitute for air cargo services.

For RNO, the application of institutional forecasts, such as those of Airbus and/or Boeing, would be informative. For example, Airbus projects domestic U.S. air cargo to grow at a CAGR of 1.7 percent for the period 2015-2025 and 1.6 percent for period 2025-2035. The U.S. all-cargo market is the most mature in the world and has fully absorbed the results of deregulation over the last 45 years. Therefore, modest future growth rates, which are significantly more conservative than international growth rates, are well justified, especially since domestic cargo transport is more susceptible to modal substitution than intercontinental transport for which trucks cannot compete. Given RNO's historical CAGR of 1.37 percent between 2000 and 2015 during a period of contraction, the Airbus forecasts of 1.6 to 1.7 percent are within a credible band of expectations. As DHL's tonnage at RNO is largely international, a slight premium could be applied to its market share. Boeing projects a more optimistic 2.2 percent growth rate for the period 2015-2035.

For the RNO master plan, the Master Plan air cargo consultant recommends a forecast growth rate between 1.5 and 2.2 percent rate for RNO air cargo. The Master Plan forecast uses the upper bound of this range, 2.2 percent average annual growth rate for the 20-year forecast period. The low growth forecast uses the lower bound of 1.5 percent average annual growth. The high growth forecast is derived from the results of a regression analysis of RNO air cargo on national economic trends and regional economic trends. The national economic trends are measured by real U.S. per capita GDP, while the regional economic trends are measured by nonfarm employment in the Reno CSA. The results from the regression analysis are used in combination with the institutional forecasts to produce the annual forecasts shown in **Figure 2-37**.

Figure 2-37: Forecast Air Cargo (Enplaned and Deplaned)



Source: RTAA for historical data and Webber Air Cargo for the forecasts.

All cargo operations are anticipated to grow more modestly. As a result the growth in cargo tonnage will be spread among FedEx and UPS, with very small shares going to DHL and to passenger carriers as belly cargo. Moreover, cargo growth can be met through larger aircraft and dedicating more payload to RNO on multi-stop routes, which are common to RNO, before additional operations become necessary.

Currently, FedEx at 61 percent and UPS at 33 percent account for a combined 94 percent market share at RNO with the balance being DHL at 3 percent and all passenger airlines at a combined 3 percent. These relative shares are projected to remain the same over the forecast period. The only means by which belly cargo's market share at RNO would grow is if RNO attracts transcontinental passenger flights with more cargo-friendly belly capacities than RNO's current domestic flights. This would increase tonnage slightly but would not increase all-cargo operations, because that marginal contribution would be on passenger flights.

All three all-cargo incumbents have established hub-and-spoke networks that should limit RNO's use as a spoke serving local and regional O&D demand. The most impressive recent growth rate has been by DHL, which still only amounts to a three percent market share.

In the near to medium-term, the most unpredictable aspect of domestic cargo growth at RNO will be whether Amazon expands its Prime Air network to include RNO, and how much of that growth will be stimulus versus a cannibalization of demand already transported for Amazon by incumbent carriers at RNO.

RNO's roughly 20 percent growth between 2000 and 2015 amounts to a net gain of about 10,000 metric tonnes spread over fifteen years. Using a five-day work week, that increase amounts to about 40 tonnes/day. That would be the low end of payloads for a single medium wide-body freighter aircraft used by FedEx and UPS for domestic flights. It must be further discounted because that increase would be split between an inbound and outbound operation. Moreover, that growth is not captured by a single carrier but spread among multiple carriers.

Cargo carriers have multiple means of accommodating increased demand without adding additional operations. Specifically, carriers can increase aircraft gauge, as well as increase the payload dedicated to the local market when aircraft is shared among multiple stops on routes between hubs and spokes. The extent to which DHL, FedEx, and UPS already use multiple stops was documented in previous cargo analysis for the master plan effort.

The domestic market share stays at 100 percent. Apart from infrequent international charter flights, RNO's scheduled annual cargo tonnage in recent years has come entirely from domestic operations. Most international demand from RNO's service area is served by truck to and from LAX, with SFO as a strong secondary alternative and tertiary options such as SEA and other predominantly belly cargo, for international capacity, gateways. Although cultivating international cargo flights has been an occasional priority for RTAA, forecasting RNO's tonnage to remain almost entirely domestic is justified. Even during the challenging period since 2000, LAX expanded its dominance over other west coast gateways, which still have surplus capacity before RNO is likely to become a compelling option. Notably, all tonnage reported for DHL and its ACMI carriers comprises international shipments transported on domestic flights to and from DHL's international gateways, principally its CVG hub. But for reporting and forecasting purposes, this would still be reflected as domestic cargo.

Table 2-13 summarizes the forecasts of air cargo activity for three scenarios: base, low and high growth. Total air cargo would grow from 156.4 million pounds in 2016 to 242.3 million pounds in 2036 under the master plan forecast growth scenario, to 211 million pounds under the low growth scenario, and to 281 million pounds under the high growth scenario. All-cargo carriers are projected to continue to account for the predominant share (97 percent), and passenger carriers (belly cargo) account for the remaining share (3 percent). All-cargo carrier operations and landed weight are projected to grow at a slower pace than total cargo under the master plan and high growth scenarios, because much of the growth in total cargo could be accommodated with increased payload on each flight. Under the low growth scenario, all-cargo carrier operations and landed weight are projected to remain constant over the forecast period, because the projected growth in air cargo could be accommodated by increasing payload on existing flights even without any change in aircraft.

Current 2016 fleet mix for cargo carriers is shown in **Table 2-14**. Cargo operators typically use aircraft over a longer lifespan than passenger air carrier airlines. Cargo operators have shown to operate aircraft over 30 years after delivery. FedEx has indicated MD 10 and 11 series aircraft will be phased out by 2021 and replaced by Boeing 767/300. The forecasts assume no other changes in the cargo fleet mix serving RNO. More information on future cargo equipment will be presented in **Chapter 3 – Facility Requirements**.

Table 2-13: Forecast Air Cargo Activity

Measure or Scenario	Levels				Compound Annual Growth Rate			
	Actual	Forecast			Forecast			
	2016	2021	2026	2036	2016-2021	2021-2026	2026-2036	2016-2036
Enplaned and Deplaned Air Cargo (Million Pounds)								
Master Plan	156.4	178.9	200.5	242.3	2.7%	2.3%	1.9%	2.2%
All-cargo	151.8	173.7	194.7	235.2	2.7%	2.3%	1.9%	2.2%
Belly cargo	4.6	5.2	5.9	7.1	2.7%	2.3%	1.9%	2.2%
Low Growth	156.4	171.5	185.4	211.0	1.9%	1.6%	1.3%	1.5%
All-cargo	151.8	166.5	180.0	204.9	1.9%	1.6%	1.3%	1.5%
Belly cargo	4.6	5.0	5.4	6.2	1.9%	1.6%	1.3%	1.5%
High Growth	156.4	187.1	218.0	281.0	3.7%	3.1%	2.6%	3.0%
All-cargo	151.8	181.7	211.7	272.8	3.7%	3.1%	2.6%	3.0%
Belly cargo	4.6	5.5	6.4	8.2	3.7%	3.1%	2.6%	3.0%
All-Cargo Aircraft Operations (Thousand)								
Master Plan	5.0	5.2	5.4	5.8	0.7%	0.7%	0.7%	0.7%
Low Growth	5.0	5.0	5.0	5.0	0.0%	0.0%	0.0%	0.0%
High Growth	5.0	5.4	5.8	6.7	1.5%	1.5%	1.5%	1.5%
All-Cargo Aircraft Landed Weight (Million Pounds)								
Master Plan	611	580	600	644	-1.1%	0.7%	0.7%	0.3%
Low Growth	611	560	560	560	-1.8%	0.0%	0.0%	-0.4%
High Growth	611	602	647	748	-0.3%	1.5%	1.5%	1.0%

Sources: Unison Consulting, Inc., and Webber Air Cargo

Table 2-14: All-Cargo Carrier Fleet Mix

All-Cargo Carrier/Aircraft	Share of All-Cargo Aircraft Operations (2016)	Share of All-Cargo Aircraft Operations (Future)
FedEx	**44.4%**	**44.4%**
A300-600	0.6%	0.6%
Boeing 757-200	23.1%	23.1%
MD 10-30 / 11 (to be phased out)	20.7%	N/A
B-767/300ER (New)	N/A	20.7%
UPS	**35.8%**	**35.8%**
A300-600	15.6%	15.6%
B757-200	18.8%	18.8%
B-767/300ER	1.3%	1.3%
DHL	**19.9%**	**19.9%**
B737-400 (main)	10.4%	10.4%
Turboprop - Cessna 208 (supplement)	9.5%	9.5%

Source: RTAA records, Detail Landing Report CY 2016
Percentages may not equal 100 due to rounding.

The peak month for all-cargo carrier operations is December. On average, 12 percent of all-cargo carrier operations take place during this month. The forecast of all-cargo carrier operations for the peak month is based on the monthly distribution of all-cargo operations for the last three years, illustrated in **Table 2-15**.

Table 2-15: Monthly Distribution and the Peak Month of All-Cargo Carrier Operations

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	8.3%	7.6%	7.7%	8.0%	8.1%	7.6%	9.0%	8.3%	7.6%	8.7%	7.6%	11.4%
2015	8.1%	7.2%	7.5%	7.8%	7.6%	7.5%	8.5%	7.6%	8.6%	9.1%	8.1%	12.3%
2016	7.9%	7.3%	8.6%	8.1%	7.6%	8.5%	8.0%	8.5%	8.1%	7.9%	8.1%	11.5%
2014-2016	**8.1%**	**7.4%**	**8.0%**	**8.0%**	**7.8%**	**7.9%**	**8.5%**	**8.1%**	**8.1%**	**8.6%**	**7.9%**	**11.8%**

Sources: RTAA for actual data on all-cargo carrier landings in 2014-2016 and Unison Consulting, Inc. for analysis.

Table 2-16 shows the forecast annual, peak month, PMAD, and PMAD peak hour aircraft operations for all-cargo carriers.

Table 2-16: Peak Month Average Day Peak Hour Operations – All-Cargo Carriers

Scenario	2016	2021	2026	2036
Master Plan Forecast				
Annual Operations	5,040	5,220	5,406	5,798
Peak Month (11.8% of CY Total)	593	615	636	683
PMAD (PM Subtotal/31 days)	19	20	21	22
PMAD Peak Hour (14.3% of PMAD Subtotal)	3	3	3	3
Low Growth Forecast				
Annual Operations	5,040	5,040	5,040	5,040
Peak Month (11.8% of CY Total)	593	593	593	593
PMAD (PM Subtotal/31 days)	19	19	19	19
PMAD Peak Hour (14.3% of PMAD Subtotal)	3	3	3	3
High Growth Forecast				
Annual Operations	5,040	5,420	5,828	6,738
Peak Month (11.8% of CY Total)	593	638	686	793
PMAD (PM Subtotal/31 days)	19	21	22	26
PMAD Peak Hour (14.3% of PMAD Subtotal)	3	3	3	4

Sources: OAG Schedules Analyzer and Unison Consulting, Inc

Noncommercial Aviation Activity

Noncommercial aviation activity includes operations of GA and military aircraft. This section describes the historical trends particularly in GA operations at RNO and nationwide. It presents forecasts of GA operations, military operations, and based aircraft for RNO.

GA is important to the region and the region's airport system. The RTAA considers GA to be a key contributor to regional economic growth and development, and an integral component of the airport system and RNO's future development. One of RTAA's strategic goals is to optimize GA at RNO by: (1) encouraging a variety of FBO contracts and other service vendors, (2) attracting jet service centers and maintenance/repair facilities, and (3) optimizing GA customer service experience.

GA services are provided by RNO's Fixed Based Operator (FBO), Atlantic Aviation. Atlantic Aviation is the largest FBO in the United States. Open 24/7, Atlantic Aviation RNO provides comprehensive GA services including fueling, deicing, executive terminal services, aircraft maintenance, hangar rentals, among others. In 2013, Atlantic Aviation embarked on a $9 million total rebuild of its FBO facility at RNO to enhance service offerings to GA customers.

Other GA businesses and services based at RNO include:

- Civil Air Patrol-Nevada Wing, which provides cadet programs, aerospace education, and emergency services;
- Dassault Aircraft Services, a 40,000-square-foot service center, fully capable of performing troubleshooting, scheduled and unscheduled maintenance, and inspections up to and including "C" checks for Falcon Jet business aircraft;
- Flying Start Aero, Northern Nevada's only Cessna Pilot Center providing pilot instruction and scenic-photo tours over Lake Tahoe and the surrounding points of interest;
- Global Aviation Services, one of the fastest growing maintenance service providers in North America with a network of more than 180 technicians at 53 airports;
- Reno Flying Service, serving GA needs since the 1940s, the only full-service aircraft maintenance shop at RNO; and
- WhisperJet Helicopters, established in 1993 to provide helicopter rental, parts sales, and maintenance services.

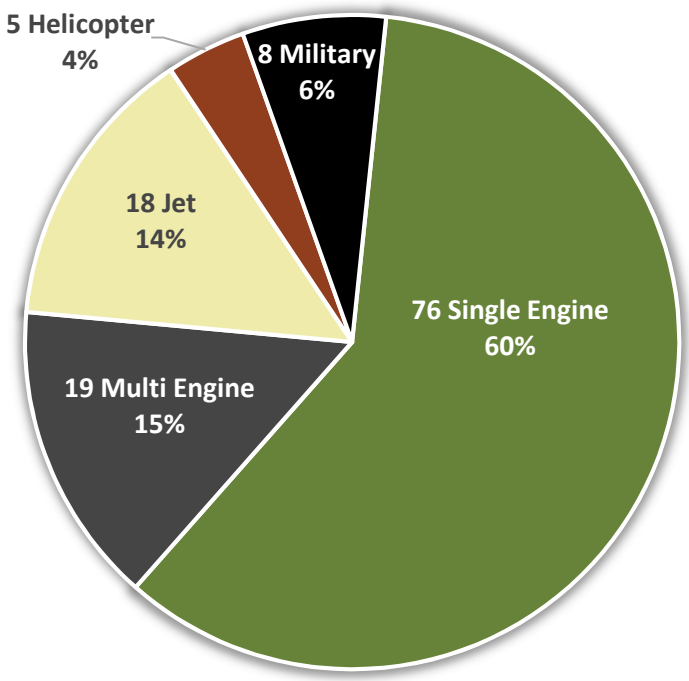
Historical Trends in Noncommercial Aviation Activity

Airport Trends

RNO's GA activity, comprised of itinerant and local operations, covers non-commercial and non-military passenger or cargo services provided at RNO. Itinerant operations are flights going to and coming from a different airport and have generally accounted for the large majority of RNO's GA operations. Local operations include flights within the local traffic pattern of an airport or within sight of an airport. Local GA operations typically include operations related to personal and instructional flying and include flights to designated practice areas within 20 miles of an airport. Most business and corporate-related GA activity is grouped under itinerant operations. Other aerial GA activities, such as sightseeing, observation, air medical, etc., account for a small share of GA operations, and would also fall under the local GA category.

Various types of GA aircraft are used to cover a broad spectrum of local GA service needs at RNO. GA aircraft based at RNO range from one-seat single piston airplanes to long-range corporate jets. In 2015, single-engine airplanes accounted for 60 percent of RNO's based aircraft, while multi-engines accounted for 15 percent, and jets accounted for 14 percent. The remaining based aircraft include helicopters at 4 percent and military planes at 6 percent. **Figure 2-38** shows the composition of based aircraft types at RNO.

Figure 2-38: RNO Based Aircraft Composition, 2015

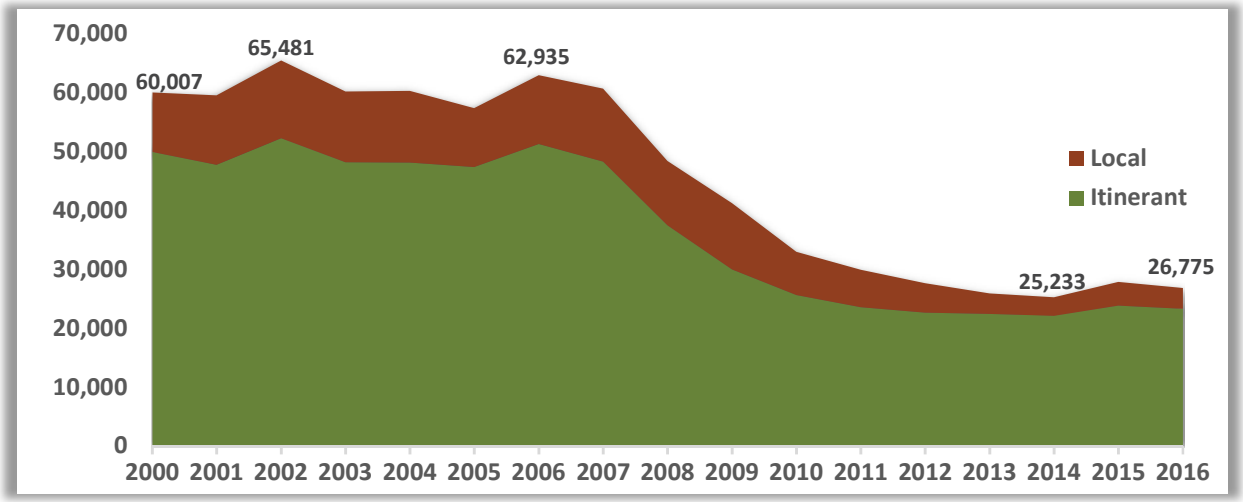


Source: Airport IQ 5010 and Unison Consulting, Inc.

Since GA activity typically satisfies local demands for air transport, including business travel, emergency transport, flight instruction and recreational flying, it is sensitive to both national and local economic conditions. RNO's GA activity has declined since the early 1990s, and especially since the Great Recession of 2008-2009. Annual GA activity was more than halved after the recession, declining from over 60,000 to around 27,000 operations per year. Commensurate to this decline, the number of based aircraft at the RNO has also decreased over the past two and a half decades. In addition to the economic impacts associated with the recession, other factors such as high oil prices and changes in the labor market and aircraft production have played a role in depressing GA activity at RNO.

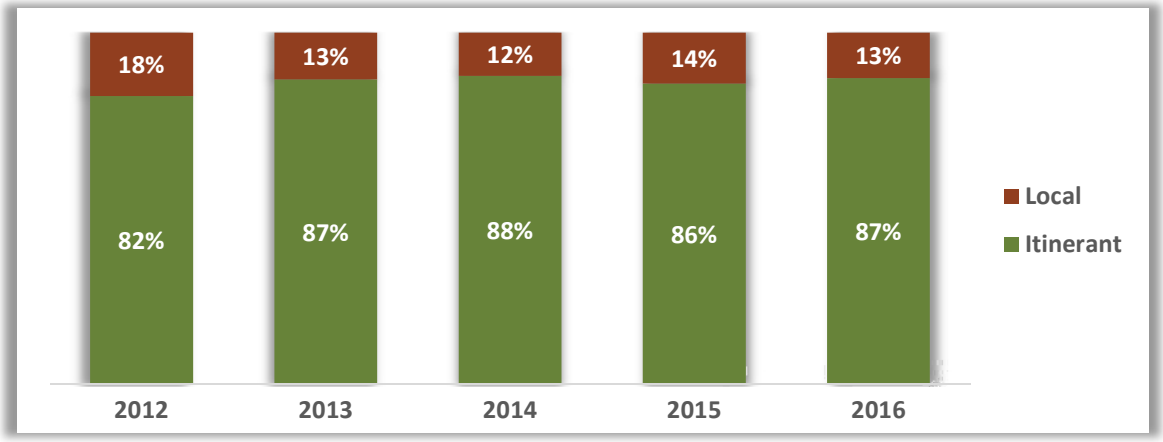
Figure 2-39 shows the trends in GA operations at RNO from 2000 and the breakdown between itinerant and local operations. **Figure 2-40** shows the distribution of GA operations between local and itinerant operations in the last five years. Itinerant operations accounted for as much as 88 percent in 2014. Although their share decreased slightly in 2015, they appear to be bouncing back with an 87 percent share in 2016.

Figure 2-39: General Aviation Operations at RNO, 2000-2016



Source: FAA and Unison Consulting, Inc.

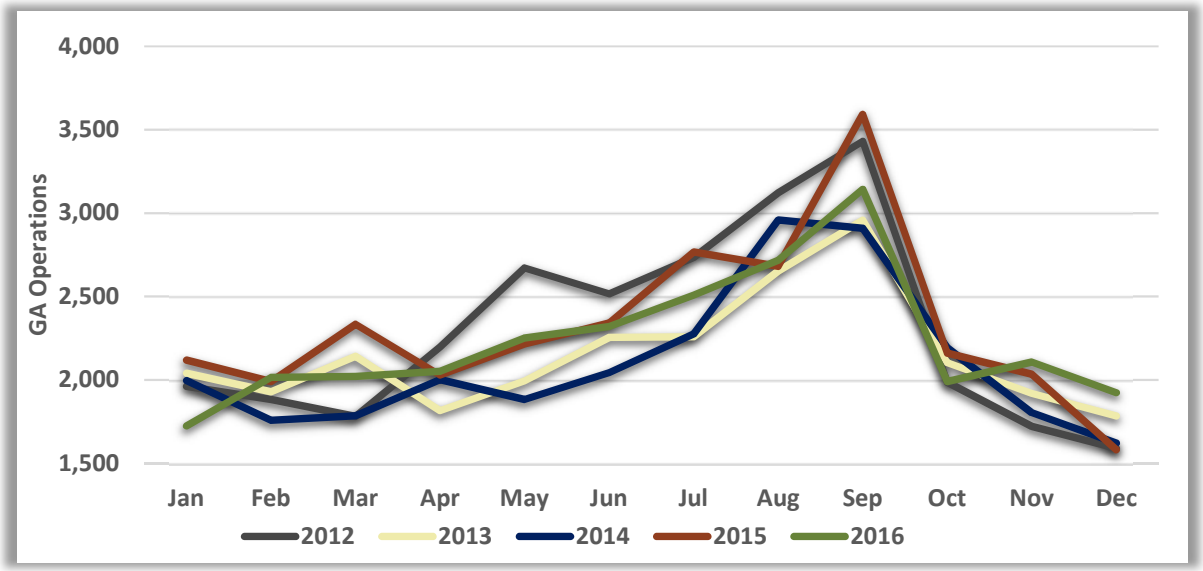
Figure 2-40: Local and Itinerant GA Operations – Percentage Distribution



Source: FAA ATADS and Unison Consulting, Inc.

As shown in **Figure 2-41**, GA operations exhibit a seasonal pattern. They are highest during the month of September. On average, 12 percent of GA operations take place during this month, based on data in the last five years. September is a peak month for GA traffic, specifically itinerant GA, primarily due to local events that are held in August and September. Since the early 1990s, Burning Man has taken place in the Black Rock Desert in Nevada, north of Reno. This event has attracted more than 50,000 participants annually since 2010. Approximately one-third of these visitors use RNO for both commercial and GA services. The National Championship Air Races also takes place every September just north of Reno. Various types of GA aircraft from the region fly to RNO for the event. Over the past 10 years, this event has brought more than 150,000 spectators to the region, contributing to an increase in itinerant traffic at RNO.

Figure 2-41: Local and Itinerant GA Operations – Distribution by Month

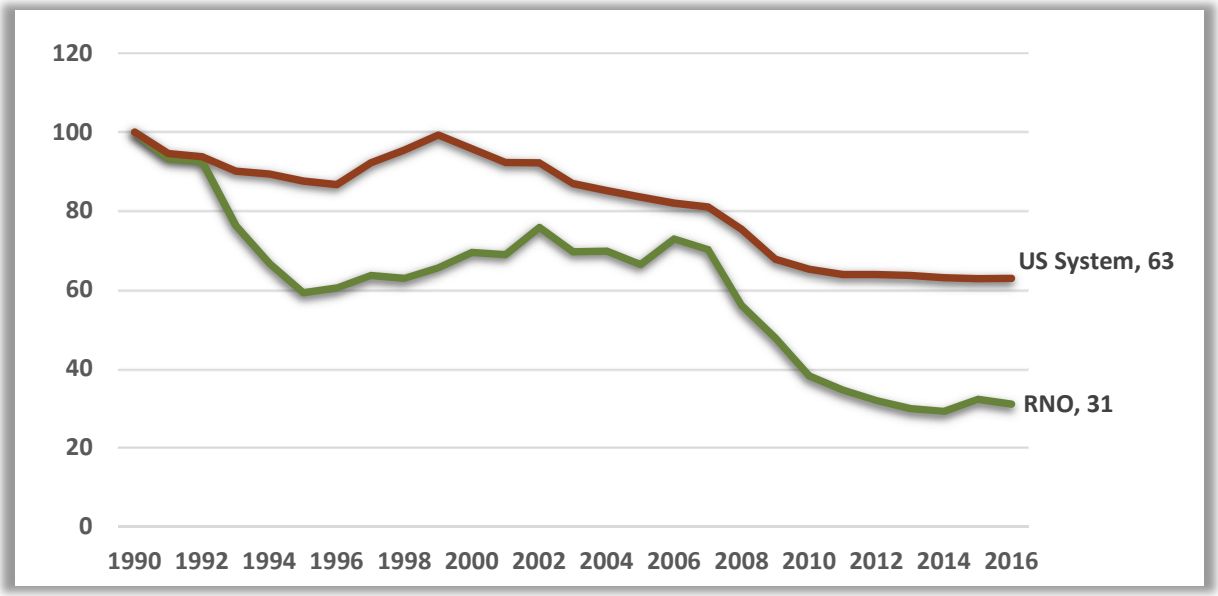


Source: FAA ATADS and Unison Consulting, Inc.

National Trends

The decrease in GA activity at RNO follows the national trend that began four decades ago. **Figure 2-42** exhibits RNO's trends in GA operations alongside national trends since 1990. Clearly the U.S. economic recessions, especially the Great Recession in 2008-2009 and the subsequent slow economic recovery depressed GA activity, but other factors also contributed to the fall in traffic. The pilot population has declined since reaching its peak in the 1980s. The production and deliveries of GA aircraft have also decreased amid the aging of the existing fleet. Finally, aviation fuel prices rose to record high levels until their recent decline.[3]

Figure 2-42: General Aviation Total Operations Index (1990 level=100)



Source: Federal Aviation Administration Air Traffic Activity Data System and Unison Consulting, Inc.

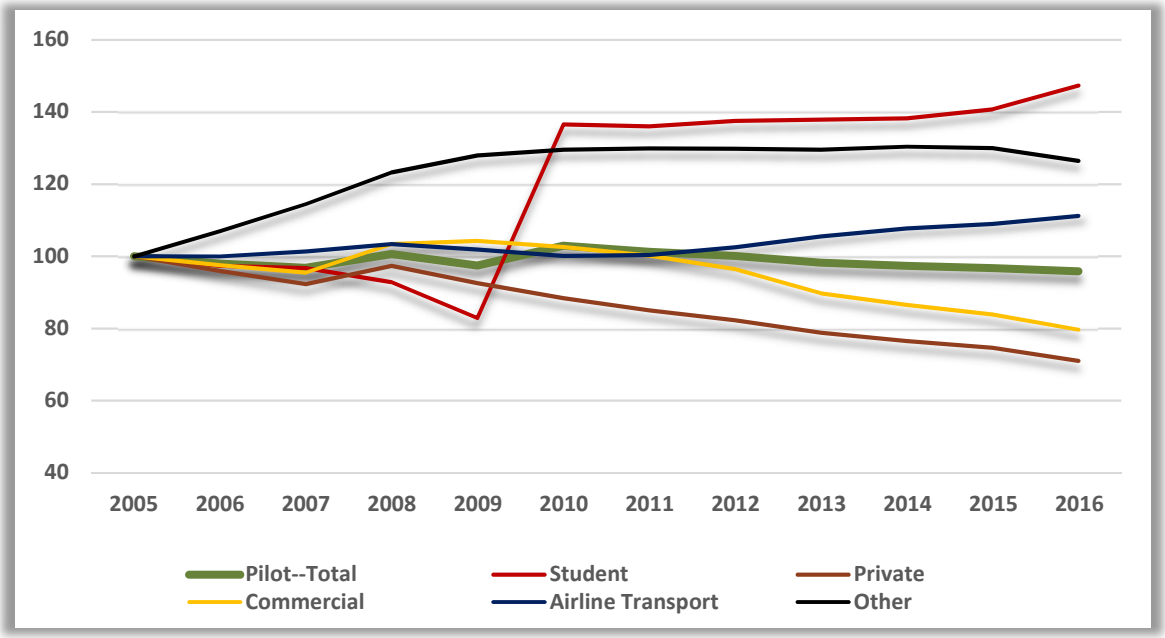
Pilot Population

The number of active pilots in the U.S. has continued to decrease in recent years, from a high of over 827,000 pilots in 1980. The FAA's U.S. Civil Airmen statistics show that the population of active pilots was 584,362 in 2016, down from 590,039 in 2015 and 593,499 in 2014. This statistic includes pilots ranging from student pilots, to pilots with recreational, sports, rotorcraft, glider, private, commercial, and air transport licenses. While the sum of these pilot categories has declined gradually over the past decade, there are some differences in their individual trends (**Figure 2-43**).

[3] Kamala I. Shetty and R. John Hansman, "Current and Historical Trends in General Aviation in the United States," *Report No. ICAT-2012-6*, MIT International Center for Air Transportation, August 2012.

The number of airline transport pilots (ATP) has increased since the end of the 2008-2009 economic recession, approaching its 1990 levels in 2016. On the other hand, the pilot population with commercial and private licenses has declined since the recession. The decrease in commercial pilot licenses, with a nearly proportional increase in ATP certificates, is primarily driven by the Airline Safety and Federal Aviation Administration Extension Act of 2010. This legislative change mandated that all flight crew members of scheduled airlines (part 121 carriers) would hold an ATP certificate by August 2013. Grouped in the other category, pilots with recreational, sport, rotorcraft, and glider active licenses exhibited growth through the recession, but their growth appears to have levelled off afterwards and even decreased in 2016. Finally, although the number of active student pilots has increased in recent years, new certifications appear to have not grown fast enough to offset the number of retiring pilots.[4] Certificate statistics, however, cannot be used to accurately determine the number of GA pilots or, more broadly, the number of full-time pilots. Pilots who fly for personal and/or business purposes may hold higher FAA certificates or ratings.

Figure 2-43: Active Pilots (2005 level=100)



[4] The student pilot population significantly increased in 2010, increasing the total number of active pilots. However, this increase may be partly due to the FAA's decision that year to extend the validity period of student certificates from 36 to 60 months for pilots under the age of 40.

Aircraft Production

GA aircraft deliveries by U.S. manufacturers declined significantly in the 1980s and early 1990s before the passage of the General Aviation Revitalization Act (GARA) in 1994. By lessening the liability burden of aircraft and parts manufacturers, GARA helped manufacturers increase aircraft production and meet the growing demand for aircraft during this period. By 2007, aircraft deliveries had increased to 3,279 units, up from their lowest level of 929 in 1994.[5] Other factors, including growth in the economy, entrance by new manufacturing companies, and the spread of fractional aircraft ownership programs played a role in the increase of GA aircraft deliveries. However, shipments decreased sharply to 1,334 units in 2010 due to the recession. While yearly shipments increased slightly to 1,631 units between 2010 and 2014, GAMA's General Aviation Aircraft Shipment Report shows declines in more recent years, down to 1,592 in 2015 and 1,525 in 2016. The share of exported aircraft shipments has decreased from its peak of 51.6 percent to 29.7 percent in 2010. Therefore, while recent years saw a decline of U.S. GA aircraft production, the share of delivered aircraft staying in the country has increased.

Fuel Costs

The rise and volatility in the cost of fuel significantly affected GA operating costs. Towered GA operations across airports in the U.S. declined during periods of fuel price surges. Although the nominal cost of fuel rose to its highest levels in 2012, recent years saw a substantial decrease. Fuel prices fell by more than 40 percent in 2015, and the U.S. Energy Information Administration does not anticipate they will rise in the short run. While GA aircraft operators and owners may enjoy lower fuel costs for now, the unpredictable nature of fuel prices makes it difficult to project future costs. In addition to volatile fuel prices, there is greater uncertainty in the GA community due to potential barriers to the supply of aviation gasoline used by piston-engine aircraft.

Other Costs

The GA activity decline also relates to higher aircraft ownership costs. Total billings for aircraft manufactured in the U.S. increased through the recent economic recession. However, since there were also cuts in aircraft production during that period, this suggests that aircraft acquisition costs were growing significantly.[6] With the exception of 2016, increases in total billings continued since 2009, while shipment remained relatively flat and even decreased in the last two years. Thus, aircraft purchase costs are still relatively high, and the slow introduction of new aircraft leaves the GA market dominated by older fleets, which are more expensive to maintain.

[5] While this growth in shipments is impressive, the number of aircraft delivered annually was still far below the historic peak in the late 1970s with the delivery of nearly 18,000 units.
[6] Kamala I. Shetty and R. John Hansman (*ibid*.)

Noncommercial Aviation Activity Forecasts

Analyzing monthly traffic trends at RNO together with demand-side drivers of air traffic forms the basis for forecasting GA operations. Multivariate time series regression analysis is used to link changes in GA operations to trends in local demand drivers. This approach combines elements of multiple regression and time series regression analysis, providing the ability to incorporate many explanatory variables while quantifying their unique contributions to GA activity trends. Using the least squares method, the model estimation process is designed to minimize forecast errors. GA operations are strongly seasonal at RNO, and the modeling approach accounts for seasonality, while controlling for serial correlation and common trends over time between operations and explanatory variables.

GA services satisfy local demands for air transport, including business travel, emergency transportation, flight training, and tourism. In view of these local drivers, variables that capture regional economic trends are incorporated into the forecast model. Considering potential differences in their drivers and in their historic trends at RNO, itinerant and local GA operations were modeled separately.

The regression model for RNO's GA operations is specified to measure the contribution of economic factors that drive GA activity, while controlling for both seasonal and sustained traffic trends. Regression coefficients measure contributions of demand drivers (explanatory variables) to RNO's GA activity growth trends. These coefficients are estimated using monthly data from 1995.[7] Period-specific dummy variables in the regression control for the seasonal nature of RNO's GA activity, and a time index controls for inherent trends over time. The estimated regression coefficients are then used to generate forecasts of GA activity at RNO based on projected trends for the model's explanatory variables.

The model specification for itinerant GA operations includes the following explanatory variables: real per-capita GDP of the Reno CSA , real jet fuel price,[8] dummy variables to capture the impacts of the 9/11 terrorist attacks, a linear trend variable to control for common trends over time between operations and explanatory variables, and indicator variables for the months of the year to capture seasonal effects.[9] The model specification also includes corrections for autocorrelation (correlation of current and prior values of the dependent variable). The model specification for local GA operations is similar in construction. However, the Reno CSA's population was used instead of real per-capita GDP to indicate regional trends, because population proved to be a stronger predictor of local GA operations.

[7] The beginning of the sample period was chosen to avoid the years of stagnation in the GA industry before the passing of the General Aviation Revitalization Act (GARA) in 1994.

[8] Jet fuel prices track closely with aviation gasoline prices. Aviation gasoline price was not used since the data were sparse for recent years and projections were not available for forecast years.

[9] Real per-capita GDP for the Reno CSA proved to be a better predictor of RNO's itinerant GA activity than the other economic indicators tested, namely: aggregate and per capita personal income in the Reno CSA; nonfarm employment in the Reno CSA; and U.S. nonfarm employment.

The estimated regression coefficient for real per-capita GDP confirms the variable's expected influence on RNO's itinerant GA trends. Holding all other factors constant, growth in regional real GDP, which indicates overall regional economic growth, stimulates growth in RNO's itinerant GA operations. Conversely, downturns in the region's economy decrease itinerant GA operations at RNO. Population also has the expected positive effect on local GA traffic, reaffirming the expectation that a larger traffic base for RNO stimulates traffic. The estimation results for the remaining variables are statistically significant, and they also confirm their expected effects on both itinerant and local GA traffic.

Table 2-17 presents the resulting forecast of GA operations, along with forecasts of military operations and based aircraft. Military operations are held constant at their level in 2016, while the number of based aircraft is expected to increase with the projected growth in GA operations.

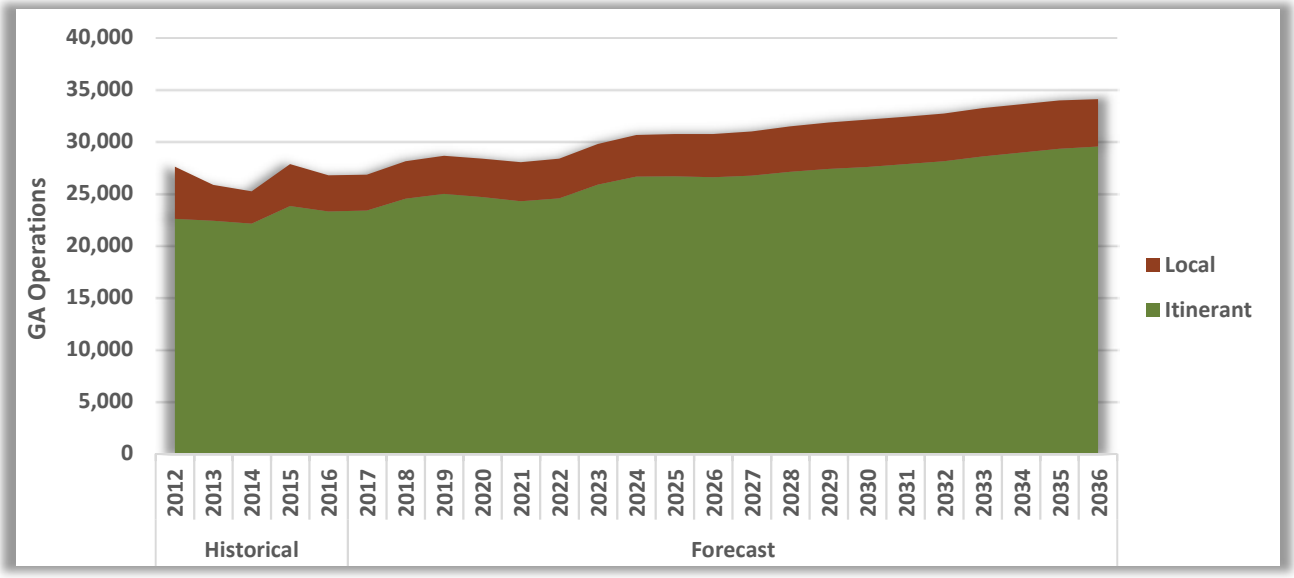
Table 2-17: Forecast Noncommercial Aviation Activity

Operations	Levels				Compound Annual Growth Rate		
	Actual	Forecast			Forecast		
	2016	2021	2026	2036	2016-2021	2021-2026	2026-2036
GA	26,775	28,034	30,746	34,129	0.9%	1.9%	1.0%
Itinerant GA	23,292	24,266	26,594	29,544	0.8%	1.8%	1.1%
Local GA	3,483	3,769	4,152	4,585	1.6%	2.0%	1.0%
Military	2,220	2,220	2,220	2,220	0.0%	0.0%	0.0%
Based Aircraft	122	126	135	142	0.6%	1.3%	0.5%

Source: FAA and Unison Consulting, Inc.

Figure 2-44 shows the forecast growth in GA operations, broken down between itinerant and local operations. The forecast shows that itinerant operations will continue to account for around 87 percent of total GA operations.

Figure 2-44: Forecast GA Operations – Breakdown between Local and Itinerant Operations



Source: FAA and Unison Consulting, Inc.

Overall, forecasts indicate that both itinerant and local operations are expected to grow between 2017 and 2036. The decreases in itinerant operations in 2020, 2021, and the modest decrease in 2026, correspond to projected declines in the Reno CSA's real GDP for those years, ending the current economic expansion and marking the beginning of another economic cycle. These declines are not offset by positive effects from contemporary changes in real fuel price or population. Local operations decrease slightly in the first forecast year, continuing the downward trend observed in 2016, before increasing annually thereafter until 2034. The projected decreases in 2034 and 2036 are due to the projected increases in fuel prices during those years. While population, which is the other driver of local GA traffic, is expected to continue growing during these forecast years, the pace of population growth is projected to slow over time.

The next sections put the forecasts of GA activity in the context of forecast national growth, and the following section compares the Master Plan forecasts with the TAF for RNO.

FAA Aerospace Forecasts

Each year, the FAA publishes high-level forecasts for national aviation activity, including forecasts on GA operations. Based on economic drivers of GA activity, the FAA provides forecasts of aircraft fleet mix, hours of operation by category of aircraft, and the number of active pilots. The main findings from the 2016-2036 fiscal year forecasts are summarized below, and **Table 2-18** provides the forecast annual average growth rates for Active GA fleet and Hours Flown:

- The long-run outlook for GA is of positive growth.
- The active GA fleet is expected to grow at an average rate of 0.2 percent a year.
- The largest category of the current fleet, fixed wing piston aircraft, is projected to decline by 0.6 percent annually.
- Turbine powered aircraft are forecast to increase by an average annual rate of 2.1 percent, driving the projected growth of the GA aircraft population.
- The number of GA hours flown is expected to grow by 1.2 percent per year.
- The number of active air transport pilots is expected to grow by 13,600, while the number of active GA pilots is projected to decline to around 5,000 by 2036 (0.1 percent annual decrease).
- Active private and commercial pilot populations are also forecast to shrink annually by 0.6 percent. However, student and sport pilot certificates are expected to increase by an annual average rate of 0.3 percent and 4.8 percent, respectively.

Table 2-18: Forecast Growth in U.S. GA Activity (Average Annual Growth Rates)

Active GA Fleet	2015-2016	2016-2021	2021-2026	2026-2036
Fixed Wing, Single-Engine Piston	-0.8%	-0.7%	-0.8%	-0.7%
Fixed Wing, Multi-Engine Piston	-0.5%	-0.4%	-0.4%	-0.6%
Fixed Wing, Turbo-Prop	-1.6%	-0.4%	1.2%	2.6%
Fixed Wing, Turbo-Jet	1.3%	2.0%	2.4%	2.8%
Rotorcraft, Piston	2.9%	2.5%	2.0%	1.8%
Rotorcraft, Turbine	2.9%	2.7%	2.3%	2.0%
Other*	0.9%	1.1%	1.1%	1.1%
Total GA Fleet	-0.2%	-0.02%	0.1%	0.3%
Hours Flown	**2015-2016**	**2016-2021**	**2021-2026**	**2026-2036**
Fixed Wing, Single-Engine Piston	-0.8%	-0.7%	-0.7%	-0.4%
Fixed Wing, Multi-Engine Piston	-0.9%	-0.6%	-0.1%	0.1%
Fixed Wing, Turbo-Prop	-0.7%	0.2%	1.3%	2.6%
Fixed Wing, Turbo-Jet	2.6%	3.5%	3.1%	3.0%
Rotorcraft, Piston	-1.2%	2.2%	2.7%	2.0%
Rotorcraft, Turbine	3.7%	3.4%	2.6%	2.1%
Other*	2.2%	2.4%	2.3%	2.1%
Total GA Fleet	0.4%	1.0%	1.1%	1.4%

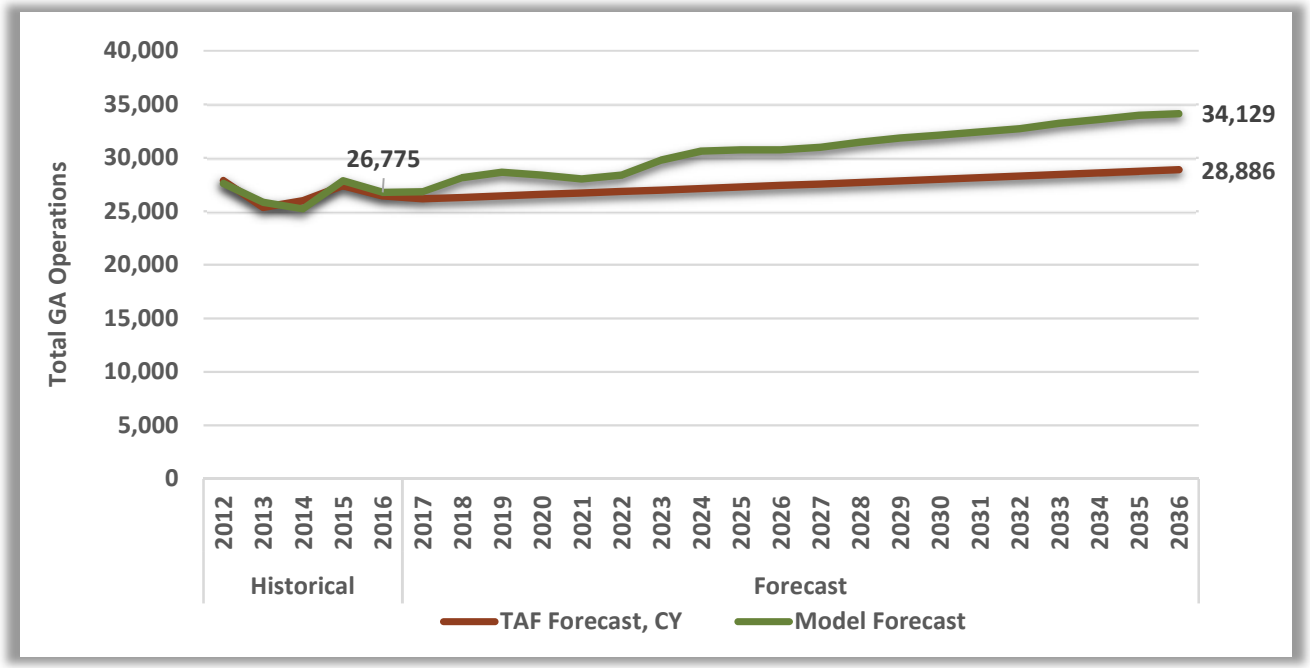
Source: FAA Aerospace Forecast 2016-2036
*Other aircraft include experimental, sport aircraft, airships, balloons, and gliders.

FAA Terminal Area Forecast for RNO

The FAA also provides airport-level aviation activity forecasts through its TAF program for active airports in the National Plan of Integrated Airport Systems (NPIAS). These forecasts are prepared to meet the budget and planning needs of the FAA and provide information for use by state and local authorities, the aviation industry, and the public. As such, the TAF represents the FAA's policy benchmark for federal review and approval of airport master plan forecasts. TAF projections are updated annually using federal fiscal year activity values.

Figure 2-45 and **Table 2-19** compares forecast GA operations with those published for RNO in the FAA TAF. They differ by slightly less than 5 percent over the first five years and by not much more than 12 and 18 percent over the following five and ten years, respectively. For comparison with the Master Plan's calendar year forecasts, the TAF projections are also presented on calendar year basis. The TAF's estimated levels for the base year 2016 are lower than observed levels for the same year. This difference of about 1.3 percent accounts for some of the difference between the TAF and the Master Plan forecast levels over the remaining forecast period.

Figure 2-45: Master Plan Forecast General Aviation Operations Compared with the TAF



Sources: FAA and Unison Consulting, Inc.

Table 2-19: Forecast General Aviation Operations

General Aviation Operations	Levels				Compound Annual Growth Rate		
	Actual	Forecast			Forecast		
	2016	2021	2026	2036	2016-2021	2021-2026	2026-2036
Total	26,775	28,034	30,746	34,129	0.92%	1.86%	1.05%
Itinerant	23,292	24,266	26,594	29,544	0.82%	1.85%	1.06%
Local	3,483	3,769	4,152	4,585	1.59%	1.96%	1.00%
TAF, CY, as of Jan. 2017	26,432	26,718	27,419	28,886	0.21%	0.52%	0.52%
Ratio of Total to TAF	1.01	1.05	1.12	1.18			

Sources: RTAA for actual data, FAA for TAF, and Unison Consulting, Inc. for the forecasts.

General Aviation Market Assessment

The forecast consultant screened airports within a 60- to 80-mile radius of RNO to compare their GA services to the services provided by RNO. The evaluation of facilities and services offered at selected airports provided the opportunity to make some cursory determinations about competition and potential traffic leakages from RNO. The airports that met preliminary selection criteria are listed below. **Table 2-20** provides some more information on their characteristics, traffic levels, and services offered.[10]

- Carson Airport (CXP)
- Minden-Tahoe Airport (MEV)
- Reno/Stead Airport (RTS)
- Truckee Tahoe Airport (TRK)
- Nevada County Air Park (GOO)
- Lake Tahoe Airport (TVL)
- Nervino Airport (O02)
- Silver Springs Airport (SPZ)

Compared to the proximate airports listed above, RNO is the only towered airport and the only airport that offers commercial services as a small hub. However, CXP and MEV handle similar levels of GA traffic while also accommodating air taxi flights. These airports, along with RTS and TRK, offer several ancillary services that may be attractive to GA operators. As would be expected, the busier GA airports have higher market shares of based aircraft. Most notably, MEV has the highest share of based aircraft and the highest level of GA activity. However, nearly a third of MEV's based aircraft are gliders, suggesting that the airport potentially serves a niche market. The number and diversity of based aircraft are useful measures of an airport's aircraft storage capacity, as well as its proximity to population centers. While airports may provide sufficient hangar and tie-down services for transient operations, aircraft storage capacity is an important determinant of the based aircraft population.

[10] For a more comprehensive analysis of GA competition between these airports, see *Truckee Tahoe Airport District. Demand Drivers Study*, Mead & Hunt. November 2015.

The column showing markets segments served by the airports in **Table 2-20** is a strong indicator of an airport's role in the broader system of airports it belongs to. While RNO serves as the only airport with commercial services in this system, both RNO and RTS accommodate Air National Guard operations. RTS also serves as a reliever airport with CXP, while the remaining airports in the system focus on GA operations. Each airport in the system makes important facilities and services available to its markets, and the private sector or airport operator provide key inputs and supplements to these services. These areas of airport services can be investigated further to examine competition for GA traffic within RNO's system of airports.

Table 2-20: Potential General Aviation Competitors

Airport	Category[1]	Based Aircraft		Market Share of Based Aircraft	GA Ops (2015)	Market Segment Served	Acres
		Fixed Wing	Other				
Minden-Tahoe (MEV)	GA	255	109	33.1%	77,000	GA/CORP	993
Carson City (CXP)	Reliever	164	22	16.9%	76,000	GA/CORP	632
Reno-Stead (RTS)	Reliever	92	16	9.8%	61,000	MIL/GA	5,000
Truckee-Tahoe (TRK)	GA	117	5	11.1%	33,976	MIL/GA/CORP	2,280
RNO	**Small Hub**	**113**	**14**	**11.5%**	**27,687**	**AC/MIL/GA/CORP**	**1,450**
Nevada County (GOO)	GA	137	0	12.4%	26,750	GA/CORP	117
South Lake Tahoe (TVL)	GA	24	4	2.5%	21,965	GA/CORP	348
Nervino (O02)	GA	15	0	1.3%	12,000	GA	99
Silver Springs (SPZ)	GA	13	1	1.3%	5,000	MIL/GA	400

Sources: Unison Consulting, Inc., Airport IQ 5010, and FAA Terminal Area Forecast (TAF), 2015.
1. Categorization from FAA's National Plan of Integrated Airport Systems (NPIAS).
AC = Air Carrier
MIL = Military
GA = General Aviation
CORP = Corporate Aircraft and Charters

Summary of Forecasts

Table 2-21 presents a summary of the forecasts of commercial and non-commercial aviation activity at RNO for 2021, 2026, and 2036, along with the baseline actual data for 2016. Commercial activity consists of passenger carrier and all-cargo carrier activity. Forecasts for passenger and all-cargo carrier activity are provided under three scenarios. Noncommercial activity consists of GA and military operations. Forecasts for GA and military operations are provided under one scenario. Estimates of air taxi operations are added to the Master Plan forecasts of commercial passenger and all-cargo aircraft operations to compare with the subtotal of air carrier and commuter/air taxi operations under the FAA TAF.

Table 2-21: Summary of RNO Aviation Activity Forecasts

Measure/Scenario		Levels				Compound Annual Growth Rate		
		Actual	Forecast			Forecast		
		2016	2021	2026	2036	2016-2021	2021-2026	2026-2036
Commercial Aviation Activity - Passenger Carriers								
Enplanements (Thousand)	Master Plan Forecast	1,824	2,178	2,417	2,839	3.6%	2.1%	1.6%
	Low Growth (25 Percentile)	1,824	1,949	2,063	2,333	1.3%	1.1%	1.2%
	High Growth (75 Percentile)	1,824	2,315	2,622	3,168	4.9%	2.5%	1.9%
	TAF, CY, as of Jan. 2017	1,810	2,185	2,393	2,893	3.8%	1.8%	1.9%
	Ratio of MP to TAF	1.01	1.00	1.01	0.98	N/A	N/A	N/A
	Ratio of Low to TAF	1.01	0.89	0.86	0.81	N/A	N/A	N/A
	Ratio of High to TAF	1.01	1.06	1.10	1.09	N/A	N/A	N/A
Aircraft Landings (Thousand)	Master Plan Forecast	19.5	23.0	24.7	27.7	3.3%	1.4%	1.1%
	Low Growth (25 Percentile)	19.5	20.6	21.1	22.5	1.1%	0.4%	0.6%
	High Growth (75 Percentile)	19.5	24.3	26.6	30.2	4.5%	1.8%	1.3%
Landed Weight (Million Pounds)	Master Plan Forecast	2,095	2,504	2,767	3,237	3.6%	2.0%	1.6%
	Low Growth (25 Percentile)	2,095	2,241	2,362	2,628	1.4%	1.1%	1.1%
	High Growth (75 Percentile)	2,095	2,646	2,986	3,536	4.8%	2.4%	1.7%
All-Cargo Carriers - Enplaned and Deplaned Air Cargo (Million Pounds)								
Master Plan Forecast		156.4	178.9	200.5	242.3	2.7%	2.3%	1.9%
All-cargo		151.8	173.7	194.7	235.2	2.7%	2.3%	1.9%
Belly cargo		4.6	5.2	5.9	7.1	2.7%	2.3%	1.9%
Low Growth		156.4	171.5	185.4	211.0	1.9%	1.6%	1.3%
All-cargo		151.8	166.5	180.0	204.9	1.9%	1.6%	1.3%
Belly cargo		4.6	5.0	5.4	6.2	1.9%	1.6%	1.3%
High Growth		156.4	187.1	218.0	281.0	3.7%	3.1%	2.6%
All-cargo		151.8	181.7	211.7	272.8	3.7%	3.1%	2.6%
Belly cargo		4.6	5.5	6.4	8.2	3.7%	3.1%	2.6%
All-Cargo Aircraft Operations (Thousand)	Master Plan Forecast	5.0	5.2	5.4	5.8	0.7%	0.7%	0.7%
	Low Growth	5.0	5.0	5.0	5.0	0.0%	0.0%	0.0%
	High Growth	5.0	5.4	5.8	6.7	1.5%	1.5%	1.5%
All-Cargo Aircraft Landed Weight (Million Pounds)	Master Plan Forecast	611.4	579.7	600.4	644.0	-1.1%	0.7%	0.7%
	Low Growth	611.4	559.8	559.8	559.8	-1.8%	0.0%	0.0%
	High Growth	611.4	601.9	647.2	748.4	-0.3%	1.5%	1.5%
Subtotal Commercial and Air Taxi								
Aircraft Operations (Thousand)		52.8	61.4	65.5	73.1	3.0%	1.3%	1.1%
Noncommercial Aviation Activity Aircraft Operations (Thousand)								
General Aviation		**26.8**	**28.0**	**30.7**	**34.1**	**0.9%**	**1.9%**	**1.0%**
Military		**2.2**	**2.2**	**2.2**	**2.2**	**0.0%**	**0.0%**	**0.0%**
Based Aircraft								
Number of Based Aircraft		122	126	135	142	0.6%	1.3%	0.5%

Source: Unison

Comparison of Master Plan Forecast with the FAA TAF

Table 2-22 compares the Master Plan forecast with the FAA TAF. Forecast enplanements are within 2 percent of the TAF through 2036. Forecast commercial aircraft operations are within 9 percent of the TAF through 2036. Forecast noncommercial aircraft operations are within 10 percent of the TAF through 2023, within 15 percent through 2035, and within 17 percent in 2036. Forecast based aircraft are within 10 percent of the TAF through 2022, within 15 percent through 2031, and within 18 percent through 2036.

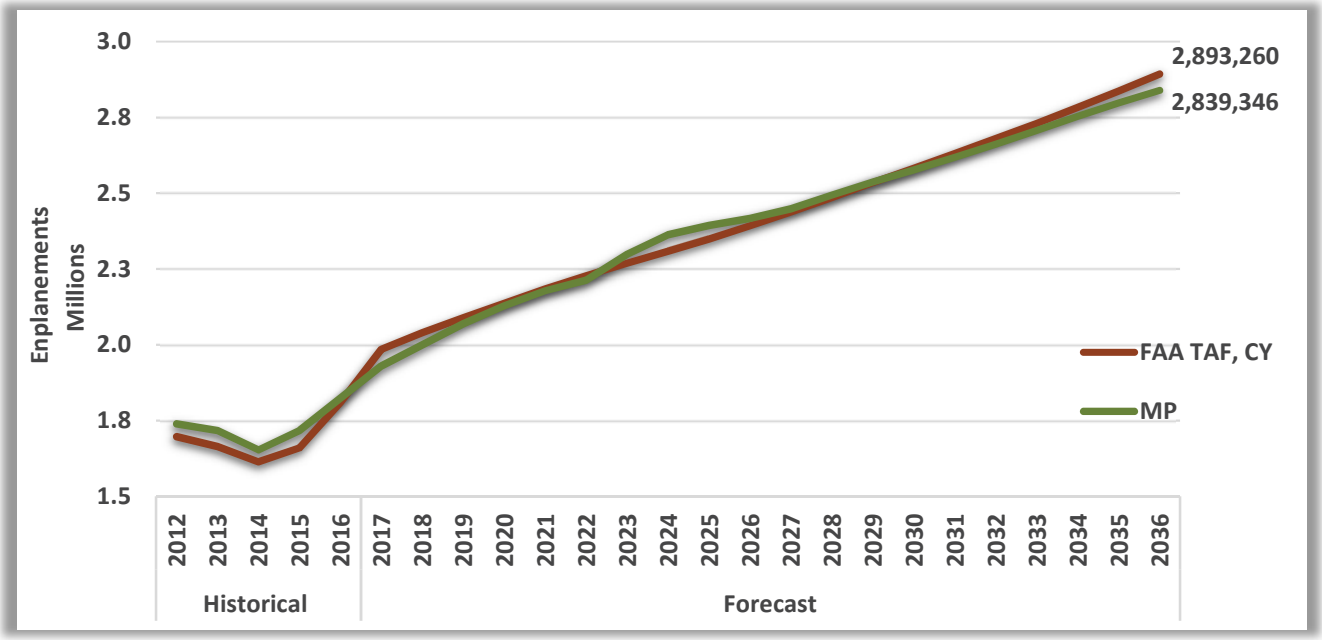
Table 2-22: Comparison of Master Plan Forecast with the FAA TAF for RNO

	Actual	Forecast		
Enplanements (Thousand)	**2016**	**2021**	**2026**	**2036**
Master Plan Forecast	1,824	2,178	2,417	2,839
FAA TAF, CY	1,810	2,185	2,393	2,893
Ratio of MP to TAF	**1.01**	**1.00**	**1.01**	**0.98**
Commercial Aircraft Operations (Air Carrier, Commuter & Air Taxi)				
Master Plan Forecast	52,814	61,366	65,543	73,116
FAA TAF, CY	52,814	62,360	67,604	80,055
Ratio of MP to TAF	**1.00**	**0.98**	**0.97**	**0.91**
Noncommercial Aircraft Operations (GA and Military)				
Master Plan Forecast	28,995	30,254	32,966	36,349
FAA TAF, CY	28,594	28,880	29,581	31,048
Ratio of MP to TAF	**1.01**	**1.05**	**1.11**	**1.17**
Based Aircraft				
Master Plan Forecast	122	126	135	142
FAA TAF, CY	120	120	120	120
Ratio of MP to TAF	**1.02**	**1.05**	**1.12**	**1.18**

Sources: FAA TAF converted to calendar year (CY) basis and Unison Consulting, Inc.

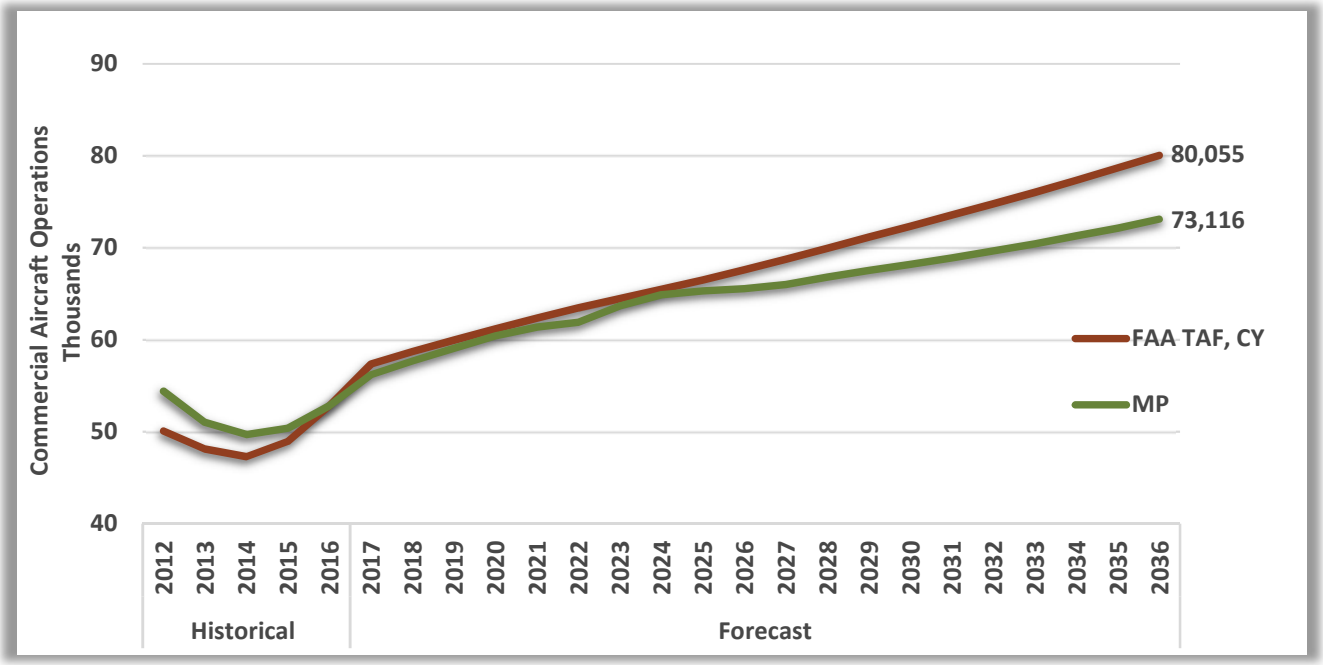
Figures 2-46, 2-47, and 2-48 compare the Master Plan forecasts of enplanements, commercial aircraft operations, and noncommercial operations with the TAF.

Figure 2-46: Master Plan Forecast Enplanements Compared with the TAF



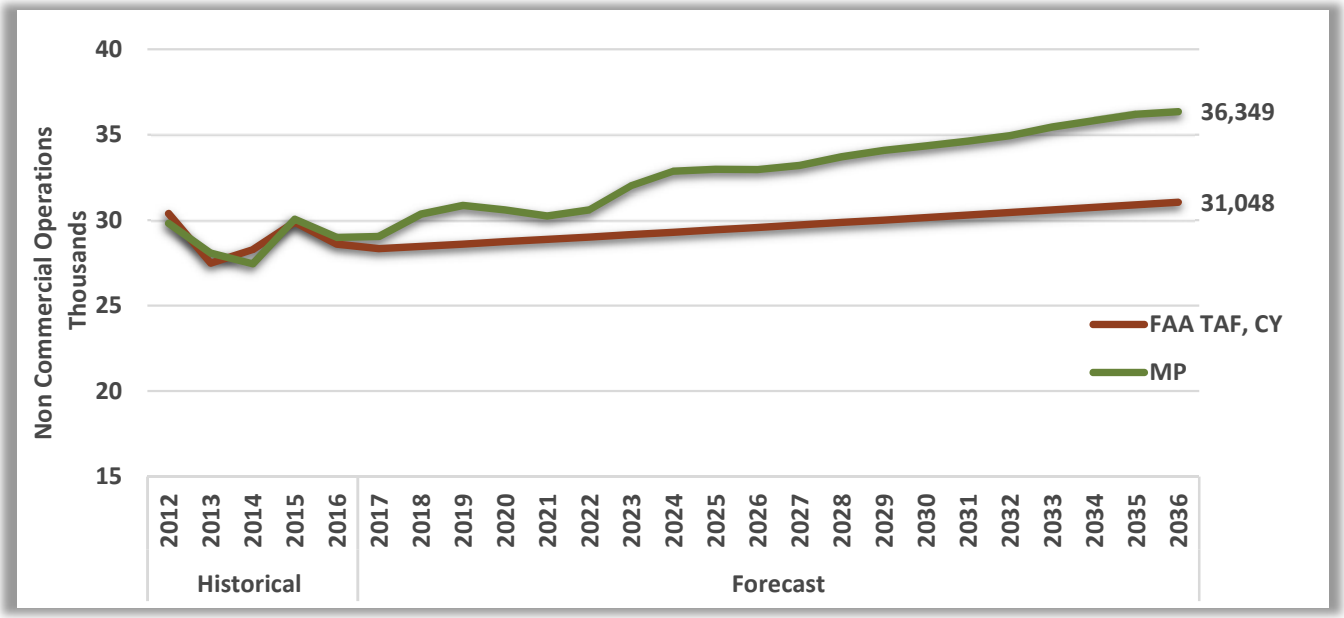
Source: Unison Consulting, Inc.

Figure 2-47: Master Plan Forecast Commercial Aircraft Operations Compared with the TAF



Source: Unison Consulting, Inc.

Figure 2-48: Master Plan Forecast Noncommercial Aircraft Operations Compared with the TAF



Source: Unison Consulting, Inc.

Sources of Forecast Risk and Uncertainty

The Master Plan forecasts of aviation activity are based on information available at the time of analysis, measurable factors that drive air travel demand, and assumptions about the availability and characteristics of airline service at RNO. While forecast development took a comprehensive approach and incorporated the best available information at the time of the study, broader factors affecting the aviation industry and RNO can cause RNO's actual performance to deviate from the forecasts. Some of these factors are discussed below.

Regional Economic Conditions

Regional economic conditions drive trends in both passenger and cargo traffic at RNO, and the regional economy has shown vulnerability to recessions. In the past recession, the tourism-dependent regional economy suffered deeper losses and stayed in recession much longer than the rest of the nation, as shown in **Figure 2-8** and **Figure 2-9** earlier in this Chapter. The regional economy is recovering (see the discussion in **Chapter 1 – Inventory of Existing Conditions**). The Master Plan forecasts of RNO aviation activity are based on projections of growth in the regional economy. Actual performance could fall short of these forecasts if the regional economy were to go into another deep recession or grow at a much slower pace than the projections.

National Economic Conditions

National economic conditions affect airport traffic trends. While the national economy is a major driver of Nevada's statewide economy, it also is important in determining air travel demand at RNO. Airport activity is closely tied to regional and national trends in the economy. Economic expansions increase income, boost consumer confidence, stimulate business activity, and increase demand. In contrast, economic recessions reduce income, diminish consumer confidence, dampen business activity, and weaken demand. Generally, national and regional air traffic decline during economic recessions and grow during economic recoveries and expansions.

Trends in Oil Prices

Oil prices affect one of the largest components of airline costs. The sharp increase in oil prices in the past decade resulted in huge financial losses in the U.S. airline industry, pushing many airlines into bankruptcy and prompting significant changes in airline operations and business practices.

World oil prices have been declining since mid-2014. From a June 2014 peak near $106 per barrel, West Texas Intermediate (WTI) spot oil prices fell to their lowest level of around $30 per barrel in February 2016, before climbing to just under $47 in October 2016 (see **Figure 2-49**). Oil prices have recovered to over $52 as of January 2017, and the U.S. Energy Information Administration projected oil prices will average $52 per barrel this year. The U.S. Energy Information Administration does not anticipate oil prices to rise in 2017; however, upward price pressures are expected to emerge in 2018 as inventories are decreased to more closely align with demand. Ultimately, there is considerable ambiguity surrounding oil prices for the next few years. Geopolitical events and production cuts, particularly the Organization of the Petroleum Exporting Countries' (OPEC's) adherence or non-adherence to recent production cut agreements, can push oil prices in either direction.

Figure 2-49: Monthly Crude Oil Prices: West Texas Intermediate (WTI) – Cushing, Oklahoma

Sources: U.S. Energy Information Administration and Unison Consulting, Inc.

Performance of RNO's Largest Carriers[11]

The market performance of major airlines operating at RNO can affect future Airport traffic. Southwest and American Airlines are the two largest carriers at RNO, respectively accounting for 43 percent and 21 percent of RNO's enplanements in 2016. United and Alaska Airlines each accounted for 12 percent of enplanements that year, followed by Delta Airlines (seven percent) and the other carriers operating at RNO (six percent).

Southwest Airlines

Southwest is the second largest scheduled domestic market U.S. carrier, based on its share of U.S. system revenue passenger miles, which were 18.3 percent for the 12-month period ending in October 2016. In 2015, Southwest reported its 43rd consecutive annual profit of $2.18 billion, nearly doubling its $1.14 billion profit in 2014 and maintaining its record as the only major U.S. airline that remained profitable through all the downturns in the airline industry. The carrier earned a net income of $1.72 billion through the third quarter of 2016, and it served 101 markets with 1,296,000 flights for the 12-month period ending in October 2016. Southwest's top markets include Chicago, Las Vegas, Denver, Baltimore and Phoenix.

Southwest acquired AirTran Airways, Inc., in May 2011 and completed the process of integrating AirTran's operations by the end of 2014. In 2013, Southwest broke ground on its five-gate, international facility at Houston's William P. Hobby Airport. This international facility was completed in late 2015 to serve destinations in the Caribbean, Mexico, Central America, and the northern cities of South America. Since the Great Recession, Southwest has been re-allocating capacity among airports, moving flights from less profitable to more profitable markets, and reducing flight frequencies at certain airports to increase load factors. With the removal of Wright Amendment restrictions on nonstop service at Dallas Love Field in October 2014, Southwest has been expanding service at Dallas Love Field. Although Southwest's enplanement share has been slowly shrinking, flight schedules published in January 2017 indicate that the airline plans to grow seat capacity at RNO. Through June 2017, Southwest plans to increase scheduled seat capacity at RNO by around 17 percent over 2016 levels. Southwest accounted for nearly 45 percent of all scheduled seats at RNO for 2016.

American Airlines

American is the largest scheduled domestic market U.S. passenger carrier, based on its 19.3 percent share of U.S. system revenue passenger miles in the 12-month period ending in October 2016. The airline's top domestic markets are Dallas, Charlotte, Chicago, Phoenix, and Miami. The airline served 106 markets and had 917,000 flights for the 12-month period ending in October 2016.

American has maintained just over 20 percent of RNO's enplanements since 2013. However, reported scheduled seats indicate that the carrier expects to reduce capacity at RNO through mid-2017. This capacity reduction continues the trend observed in the decline of the carrier's enplanements and scheduled seats between 2015 and 2016.

[11] The discussion is based on information and reports contained in the airlines' websites, financial data from the NASDAQ website, and operating data from the Bureau of Transportation Statistics.