CHAPTER B

Forecasts of Aviation Activity:

Forecasting is a key element in any airport master planning process. The forecast process is essential for analyzing existing airport facilities and identifying further needs and requirements of the facilities that may arise over the next 20 years. The relationship between aviation activity and projected demand is an indicator as to the type, timing, and allocation of future airport infrastructure, equipment, and service needs.

For the purposes of this Airport Master Plan, the most important element of the forecasts chapter is the documentation of existing aircraft operations by type and size of aircraft as well as the future projections of operations by type and size of aircraft. One of the assumed outcomes of this planning process was that the type and size of aircraft using the Airport on a regular basis are larger than what RNT was originally designed for. The trend of more operations by larger design aircraft is forecast to continue and warrants a design standard change for RNT. This change in design standards is further discussed starting on Page B.37 with the conclusion being that the Airport is, in fact, in need of a design standards upgrade in accordance with FAA guidance.

Introduction.

The RNT aviation activity forecasts in this chapter are developed for a 20-year planning period and are based on historic activity, industry trends, local socioeconomic data, and changes at RNT since the completion of previous planning studies. The forecasts utilize FY2015 (October 2014 through September 2015) as the base year and project future activity through 2035, identified in 5-year increments. The FY2015 base year was chosen because it is the most recent year for which RNT Airport Traffic Control Tower (ATCT) data is available. This chapter is organized to first define the Airport's service area, followed by a documentation of current and historic activity levels. The chapter also reviews and summarizes previous planning efforts and forecasts and includes an industry and regional socioeconomic overview prior to forecasting future activity levels for RNT. This chapter is organized into the following eleven sections:

1. Airport Service Area
2. Existing and Historic Airport Activity
3. Forecast Documentation Review
4. Industry Trends and Regional Socioeconomic Overview
5. Aviation Activity Forecast
6. General Aviation (GA) Based Aircraft Forecast
7. Forecast Approach and Methodology
8. Critical (Design) Aircraft Analysis and Forecasts of Operations By Runway Design Code
9. Forecasts Summary

10. Key Forecasts of Aviation Activity Chapter Points
11. Resources and Links

Airport Service Area

Service areas, or catchment areas, at commercial airports are primarily tabulated by reviewing commercial airline ticket purchases and then determining what zip codes those ticket purchases originated from. Since RNT is a general aviation airport with no traditional air carrier activity, an alternative method to define RNT's service area must be used. Use of zip codes is still an appropriate way to answer the question, but instead of analyzing airline ticket purchases an analysis has to be done on RNT's different user groups. The following are the broad categories of RNT users:

1. People who come to RNT because they have their personal or corporate aircraft based at the Airport;
2. People who come to RNT for air taxi services;
3. People who come to RNT for flight training services;
4. People who come to RNT for aircraft maintenance services; and
5. People who come to RNT on transient aircraft.

Based aircraft users. There are 276 based aircraft at RNT. As shown in Figure B1, proximity to the Airport has an effect on the decision of an aircraft owner to base at Renton. There are 19 aircraft from the two Renton zip codes, 98057 and 98055. Other based aircraft owners live primarily north of the Airport in the zip codes surrounding Lake Washington and Mercer Island.

Air taxi users. Airport management reached out to Northwest Seaplanes, the primary air taxi operator to obtain information about what zip codes their customers originate from. Northwest Seaplanes responded that they don't collect the information in a way that would be easily retrievable. Northwest Seaplanes indicated they were unable at this time to dedicate the resources to collecting and tabulating this information.

Flight training users. There are four businesses on the Airport that provide flight training services: Boeing Employees Flying Association (BEFA), Rainier Flight Service, ProFlight Aviation, and Aviation Training Center. Airport management reached out to each of these businesses for information on their customer base. Rainier Flight Service responded with a list of zip codes of their customer base. The majority of the Rainier Flight Service customers are from Seattle, Bellevue, and Renton zip codes. In total, Rainier provided Flight Service had customers coming from 190 different zip codes. Aviation Training Center also responded to this request for information. Aviation Training Center has logged customers from 415 different zip codes, however, similar to Rainier Flight Service, the majority of the zip codes were either Seattle, Bellevue or Renton. BEFA responded and like Rainier, the majority of their customers are from Seattle, Bellevue and Renton zip codes. ProFlight Aviation responded with only a list of zip codes but not a count of users in each zip code making it impossible to determine the location of the majority of their customers. The RNT users total for each zip code is shown in blue text in Figure B1.

Aircraft maintenance service users. RNT has three maintenance businesses on the airport: Northwest Seaplanes, ProFlight Aviation, and Ace Aviation. Airport management reached out to each of these businesses in an attempt to gather information on the zip codes of their customer base. None of the three responded to that request.

Transient users. Transient operators are difficult to quantify at RNT. RNT has a policy that transient aircraft may stay on the Airport, free of charge, for up to three days. There is no requirement for transient operators to check in at the airport office. Since aircraft are not required to check in at the airport office upon arrival, information on transient aircraft is incomplete.

In addition to city operated transient tie down space, Aerodyne, a leaseholder on the Airport, is also required by lease provision to offer three transient parking places. Airport management reached out to Aerodyne to collect information on their transient aircraft activity. Similar to how the city operated transient tie-downs, Aerodyne does not regularly collect information on their transient traffic. Not enough information is available to provide meaningful information on transient aircraft using RNT.

Conclusion on service area. It can be reasonably concluded from the information provided, as well as the data illustrated on Figure B1, that the service area for the Renton Municipal Airport includes the entire Seattle metropolitan statistical area. However, the service area specifically for based aircraft is more focused on the close in zip codes in Renton, Mercer Island, and cities surrounding Lake Washington including Bellevue, Kirkland, Seattle and Tukwila.

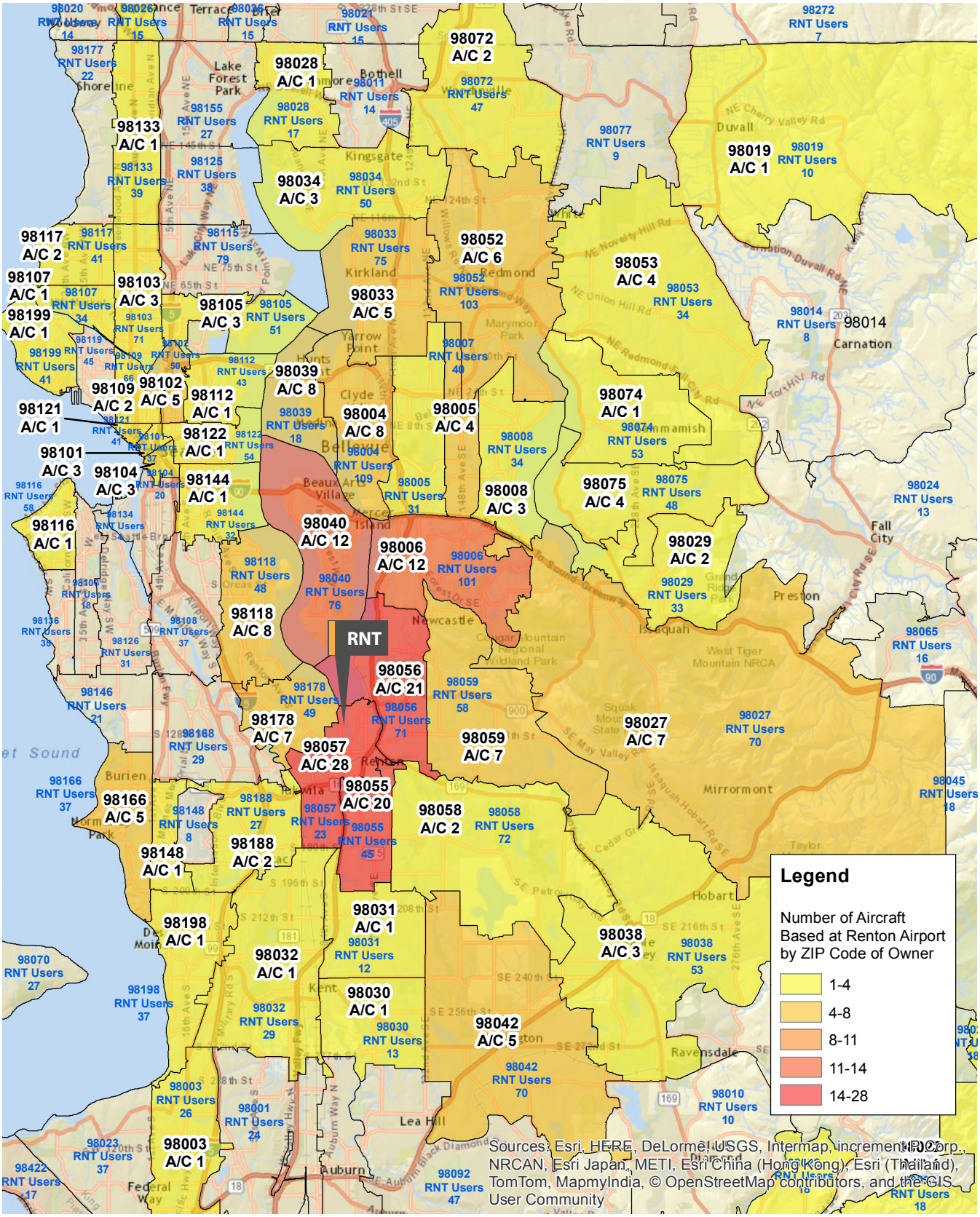


FIGURE B1 **Renton Airport Service Area**

Renton Municipal Airport/ Clayton Scott Field

Existing and Historical Airport Activity

To understand what future aviation demands will be placed on RNT, we must first understand the existing and historic activity at the Airport. A tabulation of RNT existing and historic aviation activity is presented in Table B1 below.

Table B1 **HISTORIC AVIATION ACTIVITY, 1996-2015**

Year	Itinerant					Local			Total
	Air Carrier	Air Taxi	General Aviation	Military	Subtotal	General Aviation	Military	Subtotal	
1996	87	875	43,962	55	44,979	69,643	12	69,655	**114,634**
1997	154	1,102	34,808	35	36,099	61,179	22	61,201	**97,300**
1998	299	967	37,392	91	38,749	62,810	16	62,826	**101,575**
1999	378	672	39,358	143	40,551	65,952	6	65,958	**106,509**
2000	363	683	49,037	105	50,188	81,054	32	81,086	**131,274**
2001	406	2,375	41,353	261	44,395	65,810	16	65,826	**110,221**
2002	438	1,268	41,681	74	43,461	69,779	20	69,799	**113,260**
2003	189	638	37,138	38	38,003	58,332	2	58,334	**96,337**
2004	203	939	35,669	40	36,851	50,375	0	50,375	**87,226**
2005	239	1,028	32,833	36	34,136	46,603	4	46,607	**80,743**
2006	337	1,269	34,053	58	35,717	47,046	0	47,046	**82,763**
2007	335	1,290	40,192	451	42,268	52,320	2	52,322	**94,590**
2008	346	1,093	39,468	12	40,889	60,039	6	60,045	**100,934**
2009	343	727	36,188	5	37,263	45,861	154	46,015	**83,278**
2010	400	1,337	34,457	130	36,446	43,833	427	44,260	**80,584**
2011	430	780	33,160	76	34,446	45,353	206	45,559	**80,005**
2012	394	929	39,350	128	40,810	51,970	236	52,206	**93,007**
2013	438	973	38,133	103	39,647	53,854	334	54,188	**93,835**
2014	482	1,034	41,126	129	42,771	55,915	130	56,045	**98,816**
2015	498	1,148	45,138	36	46,820	65,655	154	65,809	**112,629**
5-Year CAGR	2.98%	8.04%	6.36%	-13.88%	6.33%	7.68%	5.65%	7.63%	**7.08%**
20-Year CAGR	9.12%	1.37%	0.13%	-2.10%	0.20%	-0.29%	13.61%	-0.28%	**-0.09%**

SOURCE: Fiscal Year 2015 RNT ATCT Records derived from FAA's The Operations Network

Airport activity captured above was sourced from the FAA's The Operations Network. RNT has a part-time, contract Air Traffic Control Tower (ATCT) that records and categorizes these operations. The ATCT is open from 7:00 a.m. to 8:00 p.m. from October 1 to April 30, and 7:00 a.m. to 9:00 p.m. from May 1 to September 30 each year. While most of the Airport's activity takes place while the Tower is open, operations have also been observed to continue after hours and are therefore not counted. In essence, the table above reflects the minimum amount of air traffic using the Airport.

Operations are recorded by the ATCT, classified as either Itinerant or Local, and then tallied in a variety of categories. These categories and their explanations are as follows.

Air Carrier. RNT is a general aviation airport and does not have traditional air carrier activity. RNT has no scheduled service. Recorded air carrier operations at RNT only come from new Boeing 737 departures and, on occasion, arrivals.

Air Taxi. Air Taxi operations at RNT are charter aircraft operations. According to the ATCT Air Traffic Manager, the vast majority of these operations are seaplane arrivals and departures from Lake Washington using the Will Rogers and Wiley Post Memorial Seaplane Base (W36). RNT is unique in that it is collocated with a public seaplane base. Air Taxi operations also come from turbo prop and small jets. The corporate style jets are operated by fractional jet companies. Some examples of jet charter companies that have visited RNT include Netjets, Flexjet, and Flight Options.

General Aviation. The vast majority of operations fall under the general aviation category. General aviation captures everything from flight training operations to news helicopter departures and arrivals. As table B1 reflects, between 1996 and 2016 general aviation traffic contributes between 97 and 99 percent of all operations.

Military. From 18 total operations in 2008 to 557 total operations in 2010, military activity has ranged widely over the past 20 years. According to the ATCT staff, 100 percent of these operations over the past decade have come from helicopter operations. Typical military helicopters that visit RNT include the Bell OH-58 Kiowa, the Sikorsky UH-60, and the Boeing CH-47 Chinook.

It is important to note that ATCT staff only record air traffic information as they pertain to the categories shown in Table B1. ATCT staff do not collect information on the types of aircraft that would be placed into these broader categories.

General Operations Discussion

Two significant events have shaped the total operations numbers at RNT over the past 20 years. The first was the terrorist attacks of September 11, 2001 (9/11). The second was the severe economic recession in 2009 resulting from the sub-prime mortgage crisis. The year before 9/11 RNT recorded its highest operations year in this data set at 131,274 total operations. The fallout from that day and from the economic slowdown in the wake of that event contributed to depressed operations numbers year over year for the next five years.

The year 2005 showed the first low point in operations over the past 20 years, bottoming out at 80,743. Operations numbers began to rebound in 2006, up almost 2,000 from the year before. The upward trend continued for only the next two years topping out at 100,934. The sub-prime mortgage crisis and economic fallout starting in 2009 dealt a second blow to RNT's operations numbers. Operations dropped by over 17 percent in one year from 2008 to 2009, and then continued to drop in 2010 and 2011. The year 2012 started the next operations rebound trend – one that is continuing through 2015 and now into 2016. From the low of 80,005 operations in 2011, operations have been increasing year over year by over seven percent. The year 2015 had operations numbers back into the six figures since the start of the recession in 2009.

More interesting than the recently increasing total operations trend are the trends in the constituent categories that comprise the total operations numbers. These category trends for General Aviation, Air Taxi, Air Carrier, and Military are discussed in the following sections.

General Aviation Operations. General aviation numbers are the largest category of operations and, like all operations, are recorded as either Itinerant or Local. Added together, the total Itinerant and Local operations have accounted for no less than 97 percent of all operations at RNT over the past 20 years. In two of the years shown previously in Table B1, general aviation has accounted for over 99 percent of all operations. Itinerant operations as a percentage of total operations have remained in a range of 37 to 43 percent over the reporting period. Local operations have remained in a range of 54 to 63 percent of total operations over the reporting period. This data is consistent with airport management and ATCT staff observations of general aviation traffic using the airport. The credit for higher Local operations comes from robust civil pilot training at the Airport.

Currently, there are four flight schools located on the Airport: Rainier Flight Service, ProFlight Aviation, Boeing Employees Flying Association (BEFA), and Aviation Training Center. In addition to these businesses, there are also a number of solo flight instructors providing instruction for hire. The presence of these flight training outlets has helped to increase the Local operations over the past five years. More flight training has contributed to more touch and goes to the Runway, and more local area flight training. From the operations low in 2011 until 2015 Local operations have been increasing every year.

Airport management expects this trend to continue for at least the next decade for a few specific reasons. First, Rainier Flight Service, a full fixed base operator (FBO), has recently signed a long term lease for a second parcel on the Airport that they intend to develop over the next few years. This added space will help them expand both their flight training and maintenance operation. In talking with Rainier Flight Service staff, they are currently experiencing heavy demand for flight training services. Demand is so robust that Rainier Flight Service has recently established a waiting list for new students. ProFlight Aviation and BEFA have also been adding flight training operations. Both have long term leases for their parcels. BEFA's lease does not expire for another 13 years, and ProFlight's lease still has over 20 years before it expires. Aviation Training Center is new to the Airport as of 2015. As Aviation Training Center begins building on their customer base, airport management expects them to add to both Local and Itinerant operations from flight school activities. Based only on these local conditions, airport management and ATCT staff expect Local operations to continue an upward trend, year over year for at least the next decade.

Air Taxi Operations. Air taxi operations are the second largest category of operations at RNT. Air taxi represents between a half percent and two percent of total operations over the past 20 years. According to ATCT staff, air taxi operations are primarily float plane departures and arrivals from Lake Washington. Second to float plane operations are charter jet and turboprop operations. Fractional ownership companies like Netjets, Flight Options, and Flexjet have all visited RNT over the years.

Air Taxi operations from float planes primarily come from Northwest Seaplanes, a company located on the airport near Lake Washington. Northwest Seaplanes has a fleet of DeHavilland Beavers on floats and, as of 2016, one DeHavilland Otter on floats. The majority of Northwest Seaplanes' business occurs during the spring and summer months. The float planes are stored on paved leased area on RNT airport property and are repositioned via a float truck to the float docks that serve W36 when needed (the float docks are also on RNT airport property). Passengers board the float planes at the docks of the seaplane base and then depart from the water. Passengers who are inbound will exit the float planes after landing at the docks and return to their vehicles or other transportation to leave the airport.

Northwest Seaplanes has more than 10 years left on their lease for airport property. As of this year Northwest Seaplanes has expanded their aircraft fleet, and has also starting offering scheduled flights during the summer months.

No float planes are permanently docked at W36. W36 has no based aircraft. The seaplane base is only used for transient float plane activity. There is a wooden launch ramp that Northwest Seaplanes and others use to place float planes into the water. For float planes with wheels in the pontoons (known as "amphibs" or amphibians) operators can taxi under power up or down the launch ramp. Other than the docks, there are no other distinguishing features for W36 (no buoys, navigational lighting, et cetera).

Chartered jet and turboprop operators primarily use ProFlight Aviation when they arrive. ProFlight Aviation is the Airport's other full service FBO that provides jet services and JetA fuel sales. While ProFlight Aviation will not disclose their precise numbers of charter jet and turboprop customers, they have provided airport management with more general information on overall charter operations. That information is provided later in this chapter. ProFlight Aviation has over 20 years left on their lease and has been consistently building their FBO capabilities since moving to their new airport parcel in 2011.

Based the local conditions as noted above, airport management expects the percentage of air taxi operations to remain within its historic percentage range relative to total operations for at least the next 10 years.

Air Carrier Operations. The third largest category of operations at RNT is air carrier. RNT is a general aviation airport and does not have traditional air carrier operations. There is no scheduled service at RNT. The numbers in the Air Carrier column represent Boeing 737 and Boeing P8A Poseidon (a military version of the 737) departures and, on occasion, arrivals. The number of air carrier operations have been dramatically increasing over the past 20 years as shown in Table B1. From a low of 87 operations in 1996 to a high of 498 operations in 2015, Boeing departures and arrivals at RNT represent a compounded annual growth rate of over nine percent.

The Boeing Company has a large manufacturing facility located on private property on the east side of the Cedar River from the airport. From this facility, Boeing manufactures the 737-700, -800, and -900 commercial jets and the P8A Poseidon (based on the -700 model) military jet. Boeing has also recently unveiled their newest 737 model, the 737 MAX. The MAX will eventually replace the "Next Generation" 737 jets that are currently in production. The most popular aircraft Boeing has ever built based on orders, the 737, is only manufactured in Renton.

According to a *USA Today* article citing Boeing sources (2016), the company is currently producing 42 aircraft per month from its Renton facility. That equates to 504 737 aircraft produced per year. From the same article, Boeing is reportedly looking to substantially increase the production in the coming years. In 2017, production will be increased to 47 airplanes per month. In 2018, production will be increased to 52 airplanes per month. In 2019, production will be increased to 57 airplanes per month. The *Seattle Times* has recently reported that at maximum production, the new Boeing 737 MAX assembly line could produce up to 63 aircraft per month, or 756 aircraft per year. The increase in production is a direct response to market demand for this jet.

According to Boeing's website (2016), the company has already logged 326 orders for the 737 in 2016. Putting that into perspective, Boeing has only logged 380 total orders in 2016 so far. The 737 therefore represents 86 percent of all new jet orders.

New orders are good, but Boeing is also facing a very large backlog. Also from Boeing's website, as of the end of September 2016 the 737 has 10,362 total orders since its inception. Out of the 10,362 total orders Boeing has only been able to fill 6,012 of those orders to date. This leaves 4,350 orders left unfilled.

Backlogs help promote top line revenue stability and overall company stability but are also problematic. From a *Bloomberg* article (2014) on this very problem, "If the wait for an airplane stretches out over too many years, a customer's business can change dramatically, leading to cancelations or shifts to a different model." Boeing's basic business interest is to fulfill each of the orders placed for its 737 aircraft in lieu of receiving cancellations. This is especially true since the 737 represents such a high percentage of all Boeing aircraft being produced. The production rate increases help to minimize these long lead times from airplane order to airplane delivery.

Increasing production of the 737 will also help Boeing stave off pressure from its competitors. The Airbus A320 has been in production for years now as Boeing's chief competitor. But as the popularity of the single aisle commercial jet continues, other companies are looking to bring their products to market. For example, Delta recently ordered 75 of the new Bombardier C series jet. While neither Boeing nor Airbus has a direct competitor for the Bombardier C100 that Delta purchased, both of them do compete with Bombardier's larger C300 jet. With this sale, Bombardier is becoming a more relevant competitor to the two giant aircraft manufacturers.

But even the production rate increases won't immediately solve the backorder problem. As Table B2 below shows, even if Boeing were to meet their announced future production rate today, it would still take over six years to fill the existing backlog.

Table B2 **BOEING PRODUCTION RATE INCREASES AFFECT ON EXISTING BACKLOG**

Monthly Production Rate	Yearly Production Rate	Total Backlog Orders	Time to Fill Backlog Orders (years)
42	504	4,350	8.6
47	564	4,350	7.7
57	684	4,350	6.4

SOURCE: The Boeing Company

The chart above provides a snap shot in time of the current backlog but does not take into account future incoming orders for the 737. To get a sense of what the future orders could be we must first look at the context of Boeing's historic orders Table B3 below shows what the historic orders for the 737 have been over the past ten years.

Table B3 **BOEING 737 HISTORIC ORDERS**

Year	737 Gross Orders	Total Gross Commercial Jet Orders	Percent of 737 Gross Orders to Total Gross Commercial Jet Orders
2016 (to date)	326	380	86%
2015	666	878	76%
2014	1196	1550	77%
2013	1208	1531	79%
2012	1184	1339	88%
2011	625	921	68%
2010	508	625	81%
2009	197	263	75%
2008	488	669	73%
2007	850	1423	60%
10 YR AVERAGE	**724**	**958**	**76%**

SOURCE: The Boeing Company

Over the past ten years Boeing has averaged 958 orders per year. Over the past 10 years the 737 has represented 76 percent of all orders. By these numbers the 737 has been the outright most popular commercial jet Boeing has ever manufactured. Save for 2016 which hasn't concluded as of this writing, the total gross orders of the 737 in all but two of the years listed above has outpaced Boeing's current production rate of 42 airplanes per month or 504 airplanes each year. Even at Boeing's published production rate of 57 airplanes per month or 684 airplanes per year, new orders for the 737 would have outpaced production in four of those years adding more jets to the existing backlog.

If we extrapolate these numbers into the future, it would be reasonable to assume based on this data that the standing backlog of 737 jets to be built and delivered will either remain constant or increase for the foreseeable future.

Boeing 737 order backlog is robust indicator of Boeing's continued long-term presence in Renton, but it is not the only indicator. Boeing Company has been investing in projects to meet an increased production schedule and continues making significant investments into their facilities. Plant and apron construction projects to assist a higher production rate would need to be implemented to meet the sustained production growth. Furthermore, Boeing provides significant workforce employment and the state of Washington continues to strongly indicate support for keeping aerospace manufacturing in Washington.

Boeing has completed several large construction projects on their leased aprons around the airport in 2016 alone to boost their ability to produce and deliver airplanes. All of this work is funded by Boeing on leased area that will remain in Boeing's possession until at least 2030. Boeing's lease with the City also has two 10-year extension provisions that could extend the end date of the lease to 2050.

On Boeing's apron B leased area on the west side of the airport, new blast fences and crew shelters have been installed. With these improvements, Boeing now has five fully functioning aircraft production stalls on Apron B. This represents a two-stall net increase.

Apron A work on the east side of the airport is also complete. The project involved turning one oversized aircraft production stall into two standard sized aircraft production stalls. Work also included adding crew shelters and other facilities for Boeing pre-flight employees. With the work on Apron A, Boeing has netted one new production stall for a total of nine production stalls on the east side of the airport.

Boeing currently has a shorter term lease for land on Apron C north of the ATCT on the west side of the airport. Construction recently concluded on Apron C that will permit the short term parking of seven 737-MAX airplanes. Apron C does not have fully functioning production stalls as are found on Aprons A and B, rather this is static parking for unfueled MAX aircraft as they await FAA certification.

Work on Apron R is also in progress. Apron R is located on Boeing's private property near Lake Washington. This apron will provide additional ramp parking for 737's fresh out of the factory. These are not fully functioning production stalls but will provide additional short-term parking as production rates increase. All of these apron projects total multiple tens of millions of dollars in airport and private property investment.

Military Operations. Military operations is the smallest category of operations at RNT and has ranged widely over the past 20 years. Military operations for the past decade have been exclusively from helicopters. Itinerant military operations are those that occasionally perform full stops often associated with fuel sales, while local military operations are primarily operations training operations (practice instrument approaches, touch and goes, and general pattern work). According to airport management, the spike in military operations since 2009 is largely attributed to increased awareness by military helicopter operators from the ATCT staff that RNT is available for practice work and refueling. Military operations have ranged widely over the years. There is no reliable data to predict what rate these operations will be in the years ahead.

Summary of Operations Discussion. RNT is unique. RNT is a general aviation reliever airport, but is also home of the Boeing 737. RNT is collocated with W36 making it one of a few airports in the country that has a public seaplane base adjacent to a public airport. These factors contribute to the mix of operations as outlined above. While total operations numbers have varied over the past 20 years in response to external events, the mix of operations has remained constant. Over the past 20 years, general aviation has dominated the total operations, air carrier operations as a percent of total operations have always been less than one percent, air taxi operations have consistently ranged between one and two percent of total operations, and military operations have ranged widely.

The relative health of this Airport in terms of revenue and operations is buttressed by the number and variety of users. RNT via its long term leases with the companies that create these operations. Northwest Seaplanes has seven years left on their long term lease. Boeing has fourteen years left in their initial lease term with a maximum lease term going until 2050. Rainier Flight Service has two long term leases for airport parcels that won't expire until 2024 and 2050. ProFlight Aviation is in the middle of their long term lease that won't expire until 2046. The Airport in recent years has executed these leases to stabilize its cash flow and provide for the variety of operations that make for a successful general aviation airport. Based on these local factors, airport management's assumption is for continued high operations numbers for the foreseeable future.

While Table B1 does show interesting trends in the different general categories of airport operations, it would be helpful to understand what type and model of aircraft are being counted in those categories. That information is covered in the next section.

Fleet Mix/Aircraft Type Operations

To better refine the data that is collected by ATCT staff and shown in Table B1, we need to estimate what aircraft are being recorded in the different categories. Since the ATCT staff do not collect information on specific aircraft types, and because historically airport management has not independently recorded aircraft types, we must turn to other sources to collect and estimate this information. One of the best sources of this information is the FAA's Traffic Flow Management System Counts (TFMSC) database that contains a mix of FAA radar data and FAA instrument flight plan information for RNT traffic and includes aircraft type and model information.

FAA Records. The fiscal year 2015 TFMSC for RNT included 4,668 IFR operations, which equates to about 4 percent of the total 112,629 operations. For FY2015, the operations from the TFMSC database for RNT are listed in Table B4.

Table B4 **EXISTING FY2015 TFMSC OPERATIONS BY AIRCRAFT TYPE**

FAA Records (Aircraft Type)	Operations (Normalized)	Percentage
Single Engine Piston	3,263	57.4%
Multi-Engine Piston	265	4.7%
Turboprop	916	16.1%
Jet	1,228	21.6%
Helicopter	4	0.1%
Unknown	4	0.1%
Total	*5,680*	*100%*

SOURCE: **FAA's Traffic Flow Management System Counts (TFMSC)**

While the TFMSC data above only reflects operations that are on an Instrument Flight Rules (IFR) flight plan which is about 4 percent of the total operations into RNT for 2015, it does provide a solid breakdown of the types of aircraft that make up the total IFR operations into RNT. From the TFMSC information, airport management can determine each type of aircraft's percentage of total TFMSC operations. Those percentages are shown in the chart above and can then be used as a starting point to determine how the airport's total operations might break down into different aircraft types.

Boeing Records. It has already been established that the only air carrier operations into or out of RNT come from Boeing airplanes. For the air carrier category of operations, we need to understand what models of Boeing jets make up the overall air carrier operations numbers. That breakdown is found below in Table B5.

Table B5 **BOEING 737 OPERATIONS AT RNT**

Year	737-700s[1] (ARC C-III)	737-800s[1] (ARC D-III)	737-900s[1] (ARC D-III)	Total 737s[1]	Average 737s Per Month
2009	62	315	30	407	34
2010	45	425	21	491	41
2011	76	415	28	519	43
2012	15	365	39	419	35
2013	21	383	54	458	38
2014	13	403	69	485	40
2015	10	422	66	498	42

SOURCE: **FAA's Traffic Flow Management System Counts (TFMSC)**

Each of the aircraft models in the table above also has an associated Airport Reference Code (ARC) identifier. The 700 model has an ARC of C-III while the 800 and 900 models have an ARC code of D-III. More information on ARC comes later in this chapter.

The TFMSC database gives airport management a good starting place to estimate how the total operations might break down into different aircraft types. The Boeing operations totals remove one unknown as we know how the air carrier total operations numbers break down in aircraft type. The next method for determining aircraft types comes from information captured from the airport's FBO tenants, airport management observations, and ATCT staff observations.

RNT Businesses, Industry, Airport Management, and ATCT Staff Observations and Data. Table B6 provides a breakdown of operations conducted by aircraft type based on 2015 traffic levels, including the percent of operations. This fleet mix information was assembled from various reputable RNT sources (listed at the bottom of each table) and observations. The italicized numbers in the table below are actual ATCT recorded operations.

The breakdown of the 111,941 general aviation operations and percent of fleet mix was carefully estimated based on the following factors:

1. Extrapolating aircraft type estimates from information collected from the TFMSC database;
2. Advice from airport management, ATCT staff, and airport business tenants; and
3. Industry fleet mix data published by the FAA, National Business Aircraft Association (NBAA), and General Aviation Manufacturing Association (GAMA).

All of these data points in aggregate will help to estimate the proportion of traffic conducted by major user and aircraft type. Overall, RNT's total traffic is 99.39 percent general aviation, 0.44 percent Boeing and 0.17 percent military. Also, RNT's breakdown of operations conducted by fixed wing aircraft vs. helicopters is about 97 percent to 3 percent. Although the Boeing 737 is the largest aircraft operating at RNT, it constitutes less than 0.5 percent of the total airport operations. Similarly, military operations only account for 0.17 percent of the RNT operations.

Table B6 **FY2015 OPERATIONS ESTIMATE BY AIRCRAFT TYPE**

RNT User Groups (Aircraft Type)	Operations	Percentage of Category	Percentage of Total
Boeing 737 Production	*498*[1]	*100%*	*0.44%*
-700 Series	10	2.0%	--
-800 Series	412	82.7%	--
-900 Series	66	13.2%	--
P-8 Poseidon	10	2.0%	--
General Aviation	*111,941*[1]	*100%*	*99.39%*
Single Engine Piston	101,866[2]	91.0%	--
Multi-Engine Piston	2,127[2]	1.9%	--
Turboprop	3,022[2]	2.7%	--
Business Jet	1,344[2]	1.2%	--
Helicopter	3,582[2]	3.2%	--
Military	*190*[1]	*100%*	*0.17%*
Total	*112,629*[1]		*100%*

SOURCE:

[1] ATCT Records, FY2015 (Oct. 1, 2014 through Sept. 30, 2015)

[2] Mead & Hunt, Airport Management, RNT ATCT, and RNT FBO estimates

The table above describes what aircraft types have been using the Airport in FY2015 based on the information airport staff have collected and estimated. More information is needed. Specifically, we need to understand how the aircraft types as listed above fit into an ARC classification. This becomes important as part of this master planning process is determining what the critical aircraft should be. Classifying existing and future traffic into ARC categories will help make that determination.

FAA Aircraft Classification. Table B7 further identifies a fleet mix breakdown of RNT aircraft traffic by FAA category based on 2015 operations. The FAA Airport Reference Code (ARC) is a classification by aircraft category determined by the Aircraft Approach Category (defined by the aircraft approach speed and expressed by letter A through D) and the Airplane Design Group (defined by the wingspan and tail height and expressed by Roman numeral I through III).

Based on all of the information as presented above, the table below is airport management's best estimate at determining the breakdown of 2015 airport operations in ARC categories. As in the table above, the italicized numbers in the table below are actual ATCT recorded operations.

Table B7 **FY2015 OPERATIONS ESTIMATE BY ARC**

FAA ARC Category (Aircraft Type)	Operations	Percentage
General Aviation/Boeing Fixed Wing	*108,857*[1]	*96.65%*
A-I (single engine piston)	74,990[2]	68.89%
A-II (single and multi-engine piston)	8,636[2]	7.67%
B-I (multi-engine piston, singe engine turboprop and small jet)	20,300[2]	18.65%
B-II (multi-engine turboprop and small jet)	4,083[2]	3.36%
B-III (multi-engine turboprop)	30[2]	0.03%
C-I (small business jet)	107[2]	0.10%
C-II (medium business jet)	106[2]	0.10%
C-III (Boeing 737-700)	10[2]	0.01%
C-III (large business jet)	27[2]	0.02%
D-I (medium business jet)	40[2]	0.04%
D-II (large business jet)	26[2]	0.02%
D-III (Boeing 737-800, -900)	488[2]	0.45%
D-III (large business jet)	14[2]	0.01%
Helicopter	*3,583*[1]	*3.18%*
Military	*190*[1]	*0.17%*
Total	*112,629*[1]	*100%*

SOURCE:

[1] FAA TFMSC data and Airport Management estimates.

[2] Mead & Hunt, Airport Management, RNT ATCT, and RNT FBO estimates

The Boeing and jet numbers are based on normalized TFMSC data. The remaining data were estimated by airport management who confirmed these estimates with both the ATCT and the FBOs.

RNT Based Aircraft Mix

In addition to analyzing the types of aircraft that are using RNT, we must also understand the fleet mix of airplanes that are based on the airport to help estimate future operations. RNT has historically based between 270 and 370 aircraft, with 276 based aircraft currently, as documented by airport staff and recorded in the National Based Aircraft Inventory Program. Table B8 provides a historic breakdown of the type, number, and percent of aircraft based at RNT. Overall, as consistent with national general aviation fleet and utilization trends documented by the FAA, there has been proportional increases in the turbine business-class aircraft (turboprop, business jet, and helicopters) at RNT, with declines in the piston fleet. The based turboprop aircraft consist of Pilatus PC-12s, Beechcraft King Airs, and Aero Twin Commanders. The based business jets include an Embraer Phenom, a Learjet 36, and a Cessna Citation series aircraft.

Table B8 **BASED AIRCRAFT AT RENTON MUNICIPAL AIRPORT, 2015**

Year	Total	Single Engine Piston (SEP)	Multi Engine Piston (MEP)	Turboprop (TP)	Jet	Helicopter
2005	290[1]	269 (92.8%)	12 (4.1%)	1 (0.3%)	1 (0.3%)	7 (2.4%)
2008	310[2]	278 (89.7%)	20 (6.5%)	---	2 (0.6%)	10 (3.2%)
2009	319[2]	290 (90.9%)	16 (5.0%)	---	0 (0.0%)	13 (4.1%)
2010	311[2]	282 (90.7%)	14 (4.5%)	---	1 (0.3%)	14 (4.5%)
2011	322[2]	293 (91.0%)	14 4.3%)	---	1 (0.3%)	14 (4.3%)
2012	335[2]	302 (90.1%)	16 (4.8%)	---	2 (0.6%)	15 (4.5%)
2013	367[2]	329 (89.6%)	21 (5.7%)	---	2 (0.5%)	15 (4.1%)
2014	256[2]	228 (89.1%)	15 (5.9%)	---	5 (2.0%)	8 (3.1%)
2015	276[3]	244[3] (88.0%)	11[3] (4.0%)	11[3] (4%)	3[3] (1.1%)	7[3] (3.6%)

NOTE: **FAA Terminal Area Forecast (TAF) not reflective of actual 2015 based aircraft levels.**

SOURCE: **[1] 2009 Renton ALP Update (2005 base year for forecasts).**
[2] Airport Records
[3] FAA National Based Aircraft Inventory Program (NBAIP).
--- Data Not Available

As projected by the FAA (FAA Aerospace Forecasts Fiscal Years 2015-2035), this higher concentration of turbine business-class aircraft is expected to continue, and potentially increase throughout the 20-year planning period. In terms of RNT based aircraft demand, the Airport has maintained a waiting list for T-hangars for over 25 years. The waiting list for T-hangars currently includes 72 names. For tie-downs, the Airport has only a few spots left and has had to maintain a waiting list at times during the year. With all but one airside parcel of land leased as of this writing, it seems demand will continue to outpace supply in the years to come.

Forecast Documentation Review

So far, analysis and documentation has been done on the airport's existing and historical activity in an attempt to identify trends and help anticipate what future demand for RNT might look like. In addition to that effort, a documentation review was also conducted to ascertain and assess available forecast-related data pertinent to the RNT forecasts, including published industry analysis and statistical studies, and approved airport and community studies.

Prior to forecasting future activity levels for the Airport, it is important to examine existing projections for both the region and the Airport made by other independent organizations for the purposes of context. The following list of reports, studies, and publications and their associated projections were reviewed, and their relevance the Renton Municipal Airport is discussed:

- 1997 Renton Airport Master Plan (Page B.17)
- 2009 Renton Airport Layout Plan (ALP) Update (Page B.17)
- FAA's Terminal Area Forecast (TAF) (Page B.17)
- FAA Aerospace Forecasts Fiscal Years 2015-2035 (Page B.19)
- Aircraft Manufacturer Marketing Outlooks (Page B.19)
- Pilot Registration Records (Page B.20)
- Washington Aviation System Plan, 2009 (Page B.20)
- Washington State Long-term Air Transportation Study (LATS) (Page B.20)

1997 Renton Airport Master Plan. The 1997 Renton Airport Master Plan has a base year of 1993 and forecasted aviation activity through the year 2013. The 1997 plan forecasted total operations to increase from 113,875 in 1993 to 163,270 by 2013 based on a forecasting method known as Operations per Based Aircraft (OPBA). Using a historical OPBA figure of 536, a forecast of future operations was derived. A number of methodologies were employed to forecast based aircraft in the 1997 plan including market share, time series, and regression analysis. The average market share projection was chosen as the preferred based aircraft forecast, projecting based aircraft to grow from 255 in 1993 to 290 in 2013. A comparison of the 1997 forecasts to actual activity levels show from 1993 to 2013 operations and based aircraft grew at slower rates than anticipated.

2009 Renton Airport Layout Plan (ALP) Update. The 2009 Renton ALP Update has a base year of 2004 and forecasted aviation activity through the year 2025. The 2009 ALP Update forecasted total operations to increase from 87,226 in 2004 to 116,212 in 2025, an average annual growth rate of 1.4 percent. This projection was also based on an OPBA method with the OPBA figure growing over the planning period from 303 to 339. A number of based aircraft projections were developed based on various growth rates. The growth rate of 0.7 percent, based on the 2001 Regional Airport System Plan by PSRC, was chosen as the preferred based aircraft forecast which projected based aircraft to growth from 290 in 2005 to 335 by 2025. A comparison of the 2009 ALP Update forecasts to actual activity levels show from 2004 to 2015 operations grew at a slightly faster rate than anticipated, while based aircraft numbers have declined since 2005.

FAA's Terminal Area Forecast (TAF). The TAF is the official forecast of aviation activity for airports in the National Plan of Integrated Airport Systems (NPIAS), which includes RNT. The NPIAS is the FAA system plan for all airports eligible for federal funding from the FAA's Airport Improvement Program. The TAF is prepared annually to assist FAA in meeting budgeting, planning, and staffing needs, and to provide information for use

by state and local authorities, the aviation industry, and the public. The TAF contains historical data and forecasts for aircraft operations and based aircraft. The 2015 TAF projects 99,434 operations and 363 based aircraft for RNT by 2035. Table B9 includes TAF forecast distributions of based aircraft and operations for airports in the Puget Sound Region. The increase or decrease of future aircraft operations and based aircraft at airports near RNT are considered factors for the Airport's potential growth in operations and based aircraft. Nine area airports are considered: Sea-Tac (SEA), Boeing Field (BFI), Paine Field (PAE), Harvey Field (S43), Auburn (S50), Pierce County –Thun Field (PLU), Tacoma Narrows (TIW), and Bremerton National (PWT). Similar to RNT, these area airports are predominately GA airports, with the exception being SEA which is a commercial service airport. The distribution of based aircraft at these airports is shown in Table B10.

Table B9 **OPERATIONS DISTRIBUTION AT PUGET SOUND AIRPORTS (2015-2035)**

Year	RNT Renton[1]	SEA Sea-Tac	BFI Boeing Field	PAE Paine Field	S43 Harvey Field	S50 Auburn	PLU Thun Field	TIW Tacoma Narrows	PWT Bremer-ton National	Puget Sound Region Total
2015	7.3% (112,629)	27.9%	13.4%	8.2%	10.6%	12.4%	7.6%	4.0%	8.4%	1,361,663
2020	6.8% (123,192)	29.5%	13.0%	7.7%	10.0%	12.4%	7.7%	3.7%	9.1%	1,471,479
2025	6.3% (125,031)	30.4%	12.7%	7.3%	9.5%	12.4%	7.9%	3.6%	10.0%	1,579,752
2030	5.9% (126,897)	31.1%	12.4%	6.9%	9.1%	12.4%	8 0%	3.4%	10.8%	1,696,185
2035	5.4% (128,792)	31.7%	12.1%	6.5%	8.6%	12.5%	8 2%	3.2%	11.8%	1,824,974
Compound Annual Growth Rate (CAGR) 2015-2035										
	0.00%	1.41%	0.62%	0.17%	0.28%	0.98%	1 23%	0.26%	2.11%	

SOURCE: [1] FAA TAF

[1] **RNT's total operations are forecast in the FAA TAF to increase from 112,629 in 2035 to 128,792 by 2015 even though, as a percentage share of Puget Sound operations, RNT's share decreases during the same time frame.**

Table B10 **BASED AIRCRAFT DISTRIBUTION AT PUGET SOUND AIRPORTS (2015-2035)**

Year	RNT Renton[1]	SEA Sea-Tac	BFI Boeing Field	PAE Paine Field	S43 Harvey Field	S50 Auburn	PLU Thun Field	TIW Tacoma Narrows	PWT Bremer-ton National	Puget Sound Region Total
2015	15.7% (266)	0.1%	18.1%	24.4%	10.7%	9.6%	8.5%	5.8%	7.1%	2,280
2020	14.9% (268)	0.1%	18.0%	23.7%	10.7%	10.3%	9.2%	5.5%	7.5%	2,401
2025	13.0% (271)	0.1%	18.1%	23.4%	10.7%	11.4%	10.1%	5.3%	8.0%	2,494
2030	13.0% (271)	0.1%	17.8%	22.6%	10.5%	12.3%	10.5%	5.0%	8.3%	2,650
2035	13.0% (271)	0.1%	17.4%	21.8%	10.2%	13.2%	11.0%	4.7%	8.8%	2,821
Compound Annual Growth Rate (CAGR) 2015-2035										
	0.09%	0.00%	0.88%	0.50%	0.79%	2.71%	2.38%	0.00%	2.13%	

SOURCE: [1] FAA TAF

[1] **RNT's total based aircraft are forecast in the FAA TAF to increase from 266 in 2015 to 271 by 2035 even though, as a percentage share of Puget Sound based aircraft, RNT's share decreases during the same time frame.**

According to the FAA projections, these tables show the RNT market share of both operations and based aircraft in the area are projected to decrease over the next 20 years. The majority of operations growth is expected to be accommodated at Sea-Tac, Bremerton, and Thun Field; while the majority of based aircraft growth is expected to take place at Auburn, Thun Field, and Bremerton. This is important information relative to Renton and must be considered when forecasting future activity levels. The FAA TAF assumes an unconstrained demand for aviation services (i.e. an airport's forecast is developed independent of the ability of the airport, and the air traffic control system to supply the capacity required to meet demand).

FAA Aerospace Forecasts Fiscal Years 2015-2035. The FAA Aerospace Forecast outlines aeronautical activity projections and rationale for the purpose of understanding future demands on the national airport and airspace system, including the general aviation industry sectors. The FAA Aerospace Forecasts are used for the RNT forecasts to correlate with past activity trends, understand the basis for the forecast reasoning and assembling methodology, and to quantify growth patterns relative to projected industry rates of change. These projections are important to Renton given that the Airport's fleet mix is currently dominated by single engine piston activity, and the transition to increased business-class based aircraft and utilization. An overview of the FAA Aerospace Forecasts is presented in Table B11.

Table B11 **OVERVIEW OF 20-YEAR FAA AEROSPACE FORECAST GROWTH RATES**

Activity Sector (2015-2035)	Total	Single Engine Piston (SEP)	Multi-Engine Piston (MEP)	Sport/Experimental	Turboprop	Business Jet	Rotor
GA Fleet Size	0.36%	-0.6%	-0.4%	2.9%	1.5%	2.8%	2.5%
GA Fleet Utilization	1.36%	-0.5%	-0.4%	3.8%	1.7%	3.6%	3.0%

SOURCE: [1] **FAA Aerospace Forecasts Fiscal Years 2015-2035**

Aircraft Manufacturer Marketing Outlooks. Demand for aviation services is often driven by changes in economic activity. The aviation industry declined with the economy during the 2008 recession and has been slowly recovering ever since. Aircraft manufacturers have increased production to supply commercial airline fleet renewal programs, and general aviation operators have sought more fuel efficient and technologically capable aircraft. The FAA Aerospace Forecast expects U.S. scheduled domestic airline passengers to increase by an average of 1.7 percent through 2035.

In 2016, Boeing published Current Market Outlook 2016-2035 (2016) which stated the fastest growing and most dynamic market segment was single-aisle jet. The report went on to say that between 2016, and 2035, Boeing plans to deliver 28,140 single-aisle airplanes. This estimate is in line with market outlooks from Airbus, Bombardier, and Embraer which predict the world's aircraft fleet to double in size over the next 20 years. Virtually every major aircraft manufacturer has revised its forecasts upwards (Radical Departure, Vol. 12/No. 1, the publication from Makino for Advanced Techniques in Aerospace Manufacturing, 2014).

Based on figures released by the General Aviation Manufactures Association (GAMA), U.S. manufacturers of general aviation aircraft manufacturers delivered 1,631 aircraft in 2014, one percent more than 2013. Overall piston deliveries increased by 4.5 percent, with single-engine deliveries up 6.2 percent, and the much smaller multi-engine category down 10 percent. In the turbine categories, turbojet deliveries were up 12.3 percent. Turboprop deliveries were down 11.2 percent in 2014.

Overall, forecasts from the FAA, GAMA, and the commercial airline manufacturers show the long-term outlook for the aviation industry is one of growth.

Pilot Registration Records. The FAA Aerospace Forecast projects 448,400 active general aviation pilots in the U.S. in 2035, an increase of 0.1 percent annually. A key reason behind this projected growth is additional student plots on their way to becoming commercial and airline transport pilots. U.S. commercial and airline pilots are expected to increase at 0.6 percent annually through 2035, and these new pilots will need flight instruction. Airport Management estimates that 67 percent of aircraft operations in 2015 at RNT were flight training operations and future training demand may influence based aircraft and aircraft operations.

Licensed student pilots in the U.S. have been declining for the past 10 years. The FAA is forecasting the number of student pilots to decrease at an average annual rate of 0.2 percent through 2035, which is contrary to GAMA and Boeing projections that show the demand for student pilots increasing. Despite FAA projections, airlines and aircraft manufacturers see their industries growing, and mandatory pilot retirement ages will require the airlines to train new pilots to fill the vacancies.

Washington Department of Transportation (WSDOT) Aviation System Plan, 2009. The WSDOT Aviation Division's state system plan is currently being updated. The previous plan was completed in 2009. The 2009 plan covers the 138 public-use airports that make up the state system and provide critical support to the state economy. The 2009 plan does not include individual airport projections, but did project a 1.44 percent annual growth in based aircraft for the Puget Sound Region and 1.7 percent annual growth in operations for the region through 2030. This is important to RNT as it serves as a critical component in the state system of airports.

Washington State Long-term Air Transportation Study (LATS). In 2005, a study known as the Washington State Long-Term Air Transportation Study (LATS) was conducted. This study assessed existing statewide aviation capacity and recommended a plan to address Washington's future air transportation needs. This study estimated that based aircraft demand for the Puget Sound Region would increase from 3,527 in 2005, to 29,994 by 2030, and that aircraft operations would increase from approximately 1.8 million in 2005, to over 2.7 million by 2030. This study is important to RNT as it estimated that within the 20-year planning period, both Sea-Tac and Boeing Field would exceed 100 percent of their operating capacity. The study also stated that Renton Municipal Airport could potentially absorb some of that general aviation demand. In fact, this is Renton's role in the local and state airport system and why it has been designated as a Reliever airport by the FAA.

The LATS study also concluded hangar demand at Renton Municipal Airport would exceed the Airport's hangar storage capacity by approximately 150 percent by 2030 (the Airport is currently at 100 percent hangar storage capacity with an estimated 157 aircraft stored in hangars and 77 aircraft on a hangar waitlist).

For comparison purposes, some of the growth rates from the previously listed studies and organizations are listed in the following table entitled *SUMMARY OF INDUSTRY PROJECTED GROWTH RATES*.

Table B12 **SUMMARY OF INDUSTRY PROJECTED GROWTH RATES**

Study/Organization	Growth Rate
1997 Renton Airport Master Plan (operations)	2.17%
2009 Renton Airport Layout Plan (ALP) Update (operations)	1.66%
FAA Terminal Area Forecast (TAF) (operations for Puget Sound Airports)	1.70%
FAA Aerospace Forecasts Fiscal Years 2015-2035 (GA fleet utilization)	1.36%
Active General Aviation Fleet (FAA Aerospace Forecasts)	0.40%
General Aviation Pilots (FAA Aerospace Forecasts)	0.10%
Washington Aviation System Plan, 2009 (for Puget Sound Region)	1.44%
Washington State LATS (aircraft operations in Puget Sound Region)	2.00%

Conclusion on documentation review. The information presented in the Forecast Documentation Review provides a summary of potential industry growth indicators based on published industry analysis, statistical studies and approved airport and community studies. This information provides a baseline that will be considered in the following sections of this chapter which seek to forecast future activity levels for RNT. As described in the previous section and as illustrated in Table B12, general industry growth in the area of one to two percent is considered reasonable.

Industry Data and Regional Socioeconomic Overview

The following sections include industry data, socioeconomic conditions, community support, and other factors that may have either upward or downward influences on the amount of aviation activity and utilization at RNT over the next 20 years. Mead & Hunt relied on Airport Management and key RNT users to understand the airport's general aviation preferences, aircraft utilization, and other factors which could reasonably influence the airport's general aviation activity projections.

National Data and Projections. As discussed in the previous study summaries like the FAA TAF and Aerospace document, the long term national outlook for general aviation is considered favorable, particularly for the turbine and jet sectors. The growth in business aviation demand over the long term continues, driven by a growing U. S. and world economy, especially in the turbojet (Cessna Citation type), turboprop (Beechcraft King Air type), and turbine rotorcraft (Bell 206 helicopter type) markets. General aviation operations at combined FAA and contract towers decreased by 1.1 percent in 2014, with a 1.4 percent decline in itinerant operations and a 0.6 percent decline in local operations. General aviation activity at consolidated traffic facilities fell 0.2 percent, while the number of general aviation aircraft handled at FAA en-route centers increased by 4.7 percent.

Regional Socioeconomic Conditions and Projections. As mentioned previously, the Renton Municipal Airport accommodates a variety of aviation related activity within the Puget Sound region. As such, the existing socioeconomic conditions are important and have historically impacted aviation activity levels. The three primary socioeconomic indicators, which are typically analyzed in the forecast of aviation activity, are population, income, and employment statistics.

As reported in the Puget Sound Regional Council (PSRC) long-range regional economic forecast through 2013, factors expected to contribute to economic growth in the Seattle Primary Area include: (1) the diversity in the economic base, which lessens its vulnerability to weaknesses in particular industry sectors, (2) growth in the existing and emerging Seattle industry sectors described earlier, (3) an educated labor force able to support the development of knowledge-based and service industries, and (4) continued reinvestment to support the development of tourism, conventions, and other businesses. Overall, population in the region is forecast to grow at one percent annually, non-agriculture employment at 1.4 percent, and per capita income growth at 2.5 percent. Comparatively, the State of Washington forecast population growth rate is 1.3 percent per year and one percent per year in the nation, for 2013 to 2034. The majority of economic indicators point to growth in Renton and the Seattle metropolitan area in general.

City/County Population Data and Projections. Per the State of Washington, the City of Renton grew from 90,927 people in 2010 to 98,470 in 2015, an 8.3 percent change in population. Over the same period, King County population grew at a rate of 5.92 percent. Other municipalities within the Airport's service area have also grown as indicated in Table B13. Surrounding communities also experienced positive growth rates; notably the City of Kirkland which grew 71 percent from 48,787 to 83,460 people from 2010-2015.

The City of Renton's population is projected to grow to 101,600 in 2017, a 1.4 percent annual growth rate. The King County population is projected to grow to 2,350,576 in 2035, a 0.6 percent annual growth rate (U. S. Census, American Community Survey). This information points to a sustained population growth expected in both the City of Renton and the County-wide region.

Table B13 **REGIONAL POPULATION GROWTH WITHIN THE AIRPORT SERVICE AREA**

Municipality	2010 Population	2015 Population	Numeric Population Change	% Change Population
Renton	90,927	98,470	7,543	8.3
Kirkland	48,787	83,460	34,673	71.07
Issaquah	30,434	33,330	2,896	9.52
Mercer Island	22,699	23,480	781	3.44
Bellevue	122,363	135,000	12,637	10.33
Newcastle	10,380	10,940	560	5.39

SOURCE: State of Washington, Office of Financial Management, *Population Change and Rank for Cities and Towns*, April 1, 2015-April 1, 2015

City/County Income and Employment Data and Projections. Median household income for the City of Renton has been rising at an annual rate of 0.3 percent from 1990 to 2013 and at an average annual rate of 1.33 percent between 2010 and 2014. The median household income for the City of Renton in 2014 was $65,223. In comparison the median household income for the State of Washington in 2014 was $60,294. King County had a median household income level of $73,035 in 2014, with an average annual growth rate of 2.97 percent between 1990 and 2013 (U. S. Census, American Community Survey). Newcastle had a median income increase of 15.1 percent from $95,926 to $110,456. Other municipalities in the Airport's service area have also experienced income growth as indicated in Table B14. This information indicates an increase in income levels which translates to more disposable income and, potentially, more recreational flying. Between 2000 and 2013, employment within the City of Renton increased at an average annual rate of 1.3 percent, while King County's employment increased at an average annual rate of 0.8 percent during the same time period. The unemployment rate for the City of Renton was 8.6 percent in 2013, and 7.7 percent in King County (U. S. Census, American Community Survey).

Table B14 **REGIONAL INCOME GROWTH WITHIN THE AIRPORT SERVICE AREA**

Municipality	2010 Median Household Income	2014 Median Household Income	Income Change	% Income Change
Renton	$61,592	$65,223	$3,631	5.89
Kirkland	$84,955	$90,611	$5,656	6.6
Issaquah	$84,001	$88,770	$4,769	5.7
Mercer Island	$120,994	$125,651	$4,657	3.8
Bellevue	$81,912	$92,524	$10,612	12.9
Newcastle	$95,926	$110,456	$14,530	15.1

SOURCE: US Census, American Community Survey (ACS) 2010-2014

Community Support. The Renton Municipal Airport benefits from having the support of the local community. In 2001, the City of Renton established the Renton Airport Advisory Committee (RAAC). The RAAC convenes on a quarterly basis with the intent of facilitating communication and collaboration between RNT neighbors,

tenants, and other stakeholders. The voluntary noise abatement procedures in place at Renton Municipal Airport are an example of a direct result of this communicative, collaborative process.

The Airport is recognized as a vital city asset, which contributes to the stability and future of the area's economy. The City of Renton has had a proud partnership with the Boeing Company for more than 70 years. Boeing's Renton 737 sales account for nearly $7 billion (2.7 percent) of Washington's Gross State Product, 10.7 percent of the State's exports abroad and over 45,000 direct and indirect jobs. According to the Renton City Council, "Renton's highest economic development priority is to make every effort at the local, regional, state and federal levels to ensure the current 737 NG production ramp-up and the production of the 737 MAX re-engined airplane are successful" (*City of Renton 2012 State Legislative Agenda*).

Additional Growth Indicators. According to the *Demographic Summary Profile, City of Renton (2013)*, the median home value will increase from $283,102 in 2012 to $310,850 by 2017, an almost nine percent increase. The *City of Renton Economic Forecast 2012-2016*, projects total taxable sales for the City of Renton to increase at an average rate per year of six percent from $22.2 million in 2013 to $26.3 million by 2016. The report also projects an increase in employment in the City of Renton from a total of 48,144 people in 2013, to 49,865 people in 2016. In the City of Seattle, housing units are projected to increase by 86,000 in the next 25 years while King County projects a countywide sales tax/tax base increase from 57.6 Billion in 2015 to $88.3 Billion by 2025. The majority of economic indicators point to growth in Renton and the Seattle metropolitan area in general.

Summary of Industry and Socioeconomic Data and Projections. The majority of the industry trends, socioeconomic conditions and other factors presented in the following sections point to positive upward influences on the amount of aviation activity and utilization at the Renton Municipal Airport for the next 20 years. This information was presented to provide the reader an understanding of the Airport's general aviation preferences, aircraft utilization, and other factors which could reasonably influence the Airport's general aviation activity projections.

Forecast Approach and Methodology

Up to this point in the chapter, we have reviewed existing and historical airport activity and trends, we have reviewed forecast documentation by others, we have identified industry trends and socioeconomic data and their relevance to RNT and we have developed realistic forecasts of future demand (both aircraft operations and based aircraft). The Renton Municipal Airport aviation demand forecasts were developed for a 20-year planning period, from 2015 until 2035, indexed in 5-year increments. Airport activity forecasts are largely influenced by local airport factors, aviation industry trends, and overarching regional socio-economic market conditions. Overall, the aviation activity forecasts are developed to meet the following objectives:

1. Realistic and sustainable
2. Based on the latest available data
3. Reflective of current conditions at the Airport
4. Supported by information in the plan
5. Providing adequate justification for airport planning and development

From this, general aviation activity is forecast on a year-by-year basis to reflect a reasonable demand scenario for the Airport. Various forecast statistical methods (trend, market share, regression) were contemplated and assessed in developing a range of reasonable forecast scenarios. While the forecast methods provide a means for developing quantifiable aviation demand, the confidence and correlations for each forecast method is susceptible to some level of uncertainty. Therefore, the forecast scenarios are documented and substantiated by historic RNT activity trends, FAA statistical industry-related projections, and other applicable national, local, and industry-related data sources. Although activity levels during individual years might vary above or below the forecast projections, the Airport's future developments should conform to the tracking of actual activity. For this reason, the forecasts do not necessarily coincide to a specific year, and are considered 'unconstrained', which assumes facilities and services are, or will be, sufficiently available to accommodate user demands when the demand arises.

From this, a single preferred forecast is determined from qualified research and professional industry knowledge, as found acceptable upon Airport Management and the Study Committee review. The preferred forecast is then compared with the FAA Terminal Area Forecast (TAF) for consistency (Table B33), then submitted to the FAA for review and formal written approval. The following is the FAA forecast approval guidance:

For all classes of airports, forecasts for total enplanements, based aircraft, and total operations are considered consistent with the TAF if the forecasts differ by less than 10 percent in the 5-year forecast period, and 15 percent in the 10-year forecast period.

Forecasts that require FAA headquarters (APP-400, APO-110) review are those inconsistent with the TAF, except as noted in the "exception" section below, or forecasts for projects that are expected to require an EIS and/or BCA, even if such forecasts are consistent with the TAF.

FAA headquarters review is not required for forecasts at non-towered general aviation and reliever airports where five and ten year forecasts do not exceed 200 based aircraft or 200,000 total annual operations, and the related development is not expected to require an EIS and/or BCA.

Aviation Activity Forecasts

Projections of aviation demand at Renton Municipal Airport for the next 20-year planning period, based on the information presented previously, are included in the following sections, along with a description of the various forecast methodologies considered. The forecast results of these different methodologies are then compared and a preferred recommendation is made for each projection. The methodologies utilize socioeconomic data, regional trends, market share, and the future projection of historical trends.

General Aviation (GA) Aircraft Operations Forecast

Many different factors impact the number of general aviation operations at an airport including, but not limited to:

1. The total based aircraft;
2. Area demographics;
3. Activity and policies of neighboring airports; and
4. National trends.

It is also important to note that these projections do not include Boeing operations or military operations. Projections for these operations were developed separately and are presented in later sections. Even though RNT's historical activity shows only moderate correlation to socioeconomic data these methodologies were still considered for comparison purposes.

The following FAA-accepted forecast methodologies were considered in the development of the general aviation operations forecast:

1. Socioeconomic Analysis – Income Variable (Page B.25)
2. Socioeconomic Analysis – Multivariate (Page B.26)
3. Linear Trend Analysis (Page B.27)
4. Market Share Analysis (Page B.27)

Socioeconomic – Income Variable. This methodology uses linear regression to examine the historic relationship between GA operations at the Airport and local income from 2005 - 2015. It then uses that relationship to project future operations. Income is considered to be a strong driver of GA activity as the expense related to owning and operating an aircraft is often dependent on a level of financial flexibility. Initially, the average income of the Renton Airport Service Area was calculated and compared to historical airport operations and the equation resulting from this analysis is shown below. Unfortunately, average income in the Service Area was shown to have only a 0.018 R^2 value (correlation coefficient) meaning that statistically speaking, there is almost zero correlation between historical income levels in the Service Area and operations at the Airport.

$$(Operations = 68{,}755 + (0.252 * Income)$$

Another attempt was made to compare historic income levels in the City of Renton with historic airport operations. These two variables have a R^2 value of 0.33. This is still not considered close to a preferred correlation (an R^2 showing statistical correlation is considered 0.9 or above). GA operations forecasts utilizing this methodology are shown below in Table B15 with the associated equation. This methodology forecast

growth of 1.54 percent CAGR to 151,842 by the end of the planning period and again, the R^2 value is 0.33 and the income coefficient is 3.31. In short, this model predicts 3.31 operations per dollar of average income for Renton residents. This also explains the initial dip in the forecast as the 2015 annual operations exceeded the average relationship between variables.

$$(Operations = 96{,}922 - (3.31 * Income)$$

Table B15 **GA OPERATIONS FORECAST, SOCIOECONOMIC – INCOME VARIABLE**

Year	Renton GA Operations[1]	Average Income[2]
2005	79,440	$53,995
2006	81,099	$57,682
2007	92,514	$59,460
2008	99,513	$58,591
2009	82,203	$53,933
2010	78,717	$54,033
2011	78,719	$55,566
2012	91,556	$55,819
2013	92,321	$56,205
2014	97,171	$56,678
2015	111,941	$57,215
Projected		
2020	103,752	$60,570
2025	117,685	$64,774
2030	133,749	$69,621
2035	151,842	$75,080
CARG	*1.54%*	*1.37%*

SOURCE: **Mead & Hunt**

[1] **ATCT Records, FY2015 (Total RNT operations minus military and Boeing 737 operations)**
[2] **Woods and Poole, Inc.**

Income variable conclusion. The income based variable projects a moderate growth rate over the forecasting period. However, the R^2 value for this forecast is only 0.33. The correlation coefficient or R^2 is a measure of correlation in which 1 equals a perfect relationship, and 0 equals no relationship. A value of 0.33 is considered a weak predictor of future operations as a value of near 0.90 is preferred. For this reason, this forecast is considered unreliable.

Socioeconomic – Multivariate. Similar to the income variable, this methodology uses the relationship of variables from the past ten years to estimate future operations at RNT. Selected variables include the projected average income and the projected population of King County. While individual variables are useful, projecting growth using multiple predictor variables often results in a more accurate forecast, even for variables that have already been considered independently. The formula for this method is shown below and growth is forecasted at 205,733 operations by the end of the planning period with a R^2 value of 0.69. This analysis shows a moderately strong statistical association between income and airport operations. With an increased income coefficient of 3.46, this is the predominant factor in the estimated growth shown below in Table B16.

$$(Operations = -232543 + (3.46 * Income) + (0.07 * Population)$$

Table B16 **GA OPERATIONS FORECAST, SOCIOECONOMIC – MULTIVARIATE**

Year	Renton GA Operations	King County Average Income[2]	King County Population[2]
2005	79,440	$53,995	1,795,268
2006	81,099	$57,682	1,822,967
2007	92,514	$59,460	1,847,986
2008	99,513	$58,591	1,875,020
2009	82,203	$53,933	1,912,012
2010	78,717	$54,033	1,937,157
2011	78,719	$55,566	1,969,722
2012	91,556	$55,819	1,997,864
2013	92,321	$56,205	2,026,564
2014	97,171	$56,678	2,055,762
2015	111,941[1]	$57,215	2,085,264
Projected			
2020	123,986	$60,570	2,237,093
2025	148,866	$64,774	2,394,414
2030	176,166	$69,621	2,554,714
2035	205,733	$75,080	2,717,298
CARG	3.09%	*1.37%*	1.33%

SOURCE: **Mead & Hunt**

[1] **ATCT Records, FY2015, Total operations minus military and Boeing 737 operations**

[2] **Woods and Poole, Inc.**

Multivariate conclusion. The multivariate forecast, also a linear regression method, has an R^2 value of 0.62. While this is a moderate predictor, it is not acceptably close to the 0.90 benchmark desired. For this reason, the multivariate methodology is not considered a viable methodology due to low predictive reliability.

Linear Trend. This methodology projects historical growth trends into the future. This is often useful to forecast short term growth. This forecast, presented in Table B17, GA OPERATIONS FORECAST – LINEAR TREND, utilizes both the 10-year historical trend and the 20-year historical trend. As discussed earlier in this chapter, the 20-year trend is actually negative or decreasing at RNT and results in a growth rate of -2.60 percent. However, the 10-year trend is positive and it results in an operations projection of 135,459 and a growth rate of just under one percent. The 10-year and 20-year linear trends are illustrated in Figure B2.

Figure B2 **RENTON GA HISTORICAL OPERATIONS 10-YEAR and 20-YEAR TRENDS**

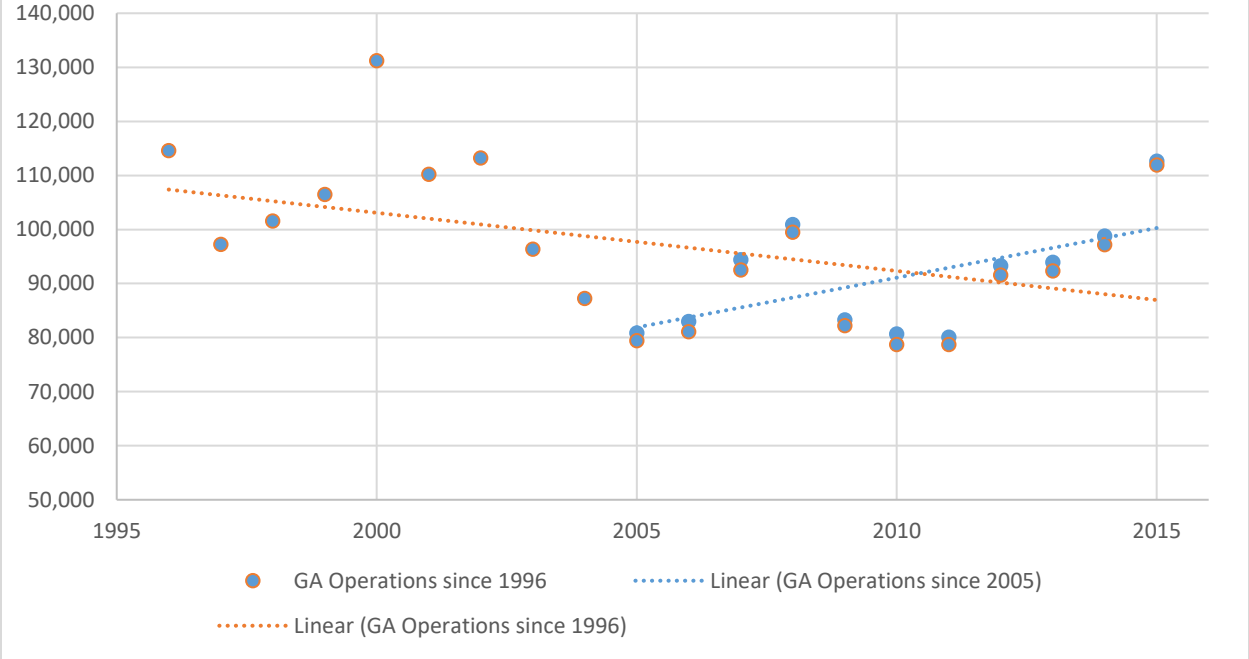


Table B17 **GA OPERATIONS FORECAST – LINEAR TREND**

Year	Renton GA Operations based on 10-Year Trend	Renton GA Operations based on 20-year Trend
2015	111,941[1]	111,941[1]
Projected		
2020	107,979	81,788
2025	117,139	76,542
2030	126,299	71,296
2035	135,459	66,049
CARG	*0.96%*	*-2.60%*

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015, Total operations minus military and Boeing 737 operations

Linear trend conclusion. The linear growth rate methodology is usually a good measure to predict short term growth. For the purposes of this analysis, it also provides a good comparison based on historical data.

Market Share. This methodology estimates future operations at RNT as a function of the total operations in the Puget Sound region (see associated data provided in Tables B1 and B9). The following airports were used to determine total operations in the region and the subsequent RNT market share.

- Seattle-Tacoma International Airport (SEA)
- Boeing Field/King County International Airport (BFI)

- Snohomish County Airport – Paine Field (PAE)
- Harvey Field airport (S43)
- Auburn Municipal Airport (S50)
- Pierce County – Thun Field Airport (PLU)
- Tacoma Narrows Airport (TIW)
- Bremerton National Airport (PWT)

The total GA operations in the region totaled 812,770 operations in 2015 with RNT's market share accounting for 13.77 percent of those operations. The market share has grown steadily in the past 10 years. However, in order to provide a conservative forecast, this method uses the average of the past three years, 12.64 percent, to forecast future growth. This is not demonstrating a historic market share trend, rather just assuming that it's reasonable to expect RNT's market share to at least remain similar to the past few years. Essentially, this method estimates that RNT will maintain a share very close to its current share of the GA operations market in the Puget Sound region according to the FAA TAF. This can be seen in Table B18 and estimates growth to 132,824 GA operations by 2035.

Table B18 **GA OPERATIONS FORECAST – MARKET SHARE**

Year	Renton GA Operations	Market Share	Total Region GA Operations[2]
2006	81,099	9.24%	877,650
2007	92,514	10.51%	879,012
2008	99,513	10.60%	939,036
2009	82,203	9.64%	852,501
2010	78,717	9.29%	847,449
2011	78,719	9.56%	823,642
2012	91,556	11.46%	798,610
2013	92,321	12.01%	768,714
2014	97,171	12.15%	799,859
2015	111,941[1]	13.77%	812,770
Projected			
2020	109,143	12.64%	863,221
2025	116,214	12.64%	919,146
2030	124,071	12.64%	987,291
2035	132,824	12.64%	1,050,512
CARG	*0. 86%*	*N/A*	*1. 29%*

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015, Total operations minus military and Boeing 737 operations

[2] FAA TAF

Market share conclusion. Given that the role of RNT is not expected to change dramatically through the course of the 20-year planning period, it is reasonable to expect that the Airport will at least maintain its current market share of regional operations. Therefore, the market share methodology was selected as the preferred forecast for this Airport Master Plan. It is also important to note that all the growth rates in this section are very similar to those included in previous studies and presented previously in Table B12.

A comparison of these projections is presented in Table B19 and Figure B3.

Table B19 **GENERAL AVIATION AIRCRAFT OPERATIONS PROJECTIONS, 2015-2035**

Year	2016 FAA TAF[2]	Income[3]	Multivariate[3]	Market Share (Preferred)	Linear Trend since 2006	Linear Trend since 1996
2015	111,941	111,941	111,941	**111,941**[1]	111,941	111,941
2020	114,917	103,752	123,986	**109,143**	107,979	81,788
2025	116,650	117,685	148,866	**116,214**	117,139	76,542
2030	118,407	133,749	176,166	**124,071**	126,299	71,296
2035	120,189	151,842	205,733	**132,824**	135,459	66,049
CAGR	*0.36%*	*1.54%*	*3.09%*	***0.86%***	*0.96%*	*-2.60%*

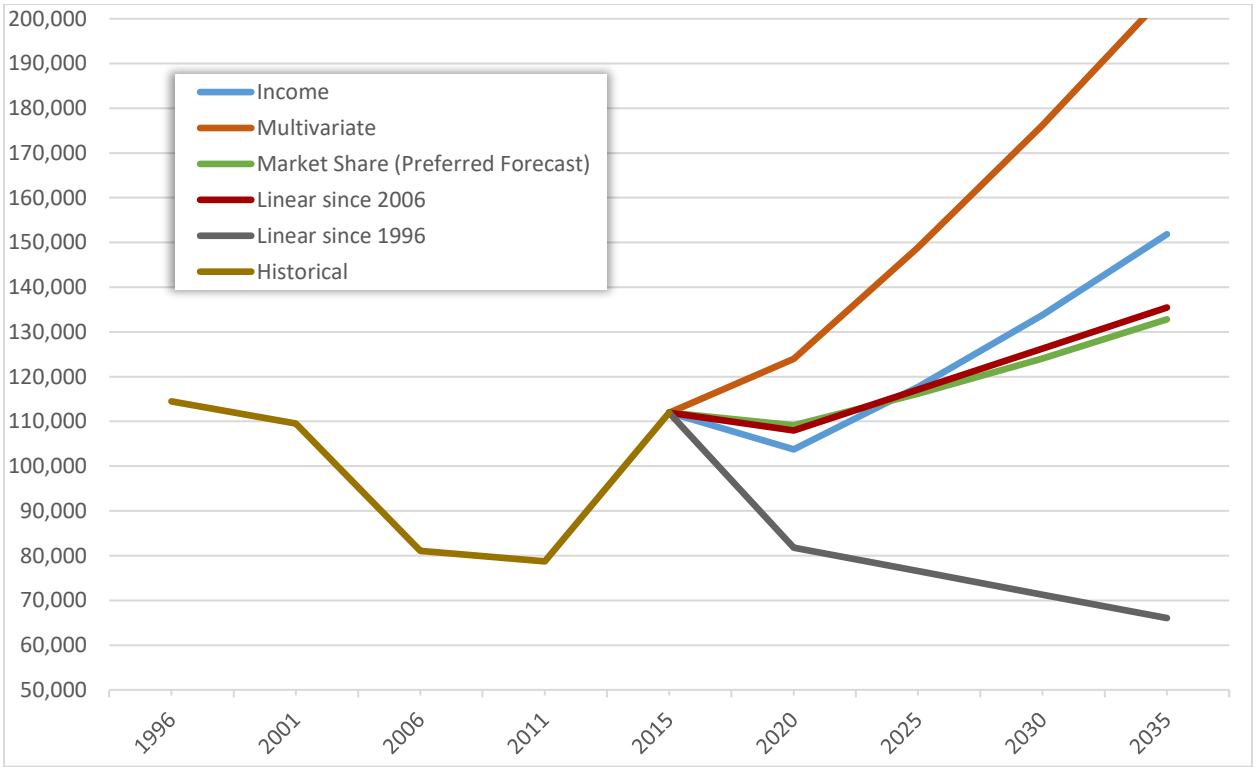
SOURCE: Mead & Hunt

[1] ATCT Records, FY2015, Total operations minus military and Boeing 737 operations

[2] 2016 FAA TAF

[3] Woods and Poole, Inc.

Figure B3 **GENERAL AVIATION AIRCRAFT OPERATIONS PROJECTIONS, 2015-2035**



SOURCE: Historical = ATCT Records, FY2015, Total operations minus military and Boeing 737 operations
Future = Mead & Hunt

Military Aircraft Operations Forecast. As a percentage of annual aircraft operations, the number of military operations at the Airport has historically been relatively insignificant. No factors have been identified that would significantly increase the number of military operations in the future; therefore, the military aircraft operations of about 190 annual operations is projected to remain through the end of the planning period.

Boeing Operations Forecast. As a percentage of the Airport's total annual aircraft operations, the number of Boeing operations has historically been relatively small (0.44 percent in 2015). Projections of Boeing operations are identified on the basis of published Boeing productions rates in consideration of the third final B-737 assembly line that Boeing is in the process of adding to its Renton plant.

Operations Forecast by Aircraft Type. A further assessment of the forecast involves the individual and collective use of the Airport by various types of aircraft. Knowing the types of aircraft expected to use the Airport assists in determining the amount and type of facilities needed to meet the aviation demand. Table B20 depicts the approximate level of use by aircraft types that are projected to use Renton Municipal Airport.

Table B20 **SUMMARY OF TOTAL OPERATIONS FORECAST BY AIRCRAFT TYPE, 2015-2035**

Aircraft Type	2015	2020	2025	2030	2035
Boeing 737s	*498*	*684*	*684*	*684*	*684*
Aircraft per Month[2]	42	57[2]	57	57	57
General Aviation	*111,941*	*109,143*	*116,214*	*124,072*	*132,824*
Single Engine Piston	101,866	99,320	105,755	112,906	120,870
Multi-Engine Piston	2,127	2,074	2,208	2,357	2,524
Turboprop	3,022	2,947	3,138	3,350	3,586
Business Jet	1,343	1,310	1,395	1,489	1,594
Helicopter	3,582	3,493	3,719	3,970	4,250
Military	190	*190*	*190*	*190*	*190*
Total	*112,629[1]*	*110,017*	*117,088*	*124,946*	*133,698*
CAGR	-	*-0.47%*	*0.39%*	*0.69%*	*0.86%*

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015

[2] The Seattle Times, January 2016

Local and Itinerant Operations Forecast. Forecast of operations have also been categorized accordingly into local and itinerant operations. The FAA's Operations Network (OPSNET) glossary defines a local operation as any operation performed by an aircraft operating in the local traffic pattern or within sight of the airport, by aircraft known to be departing or arriving from flight operations in the local practice area located within a 20-mile radius of the airport, or aircraft executing practice instrument approaches at the airport. Itinerant operations are defined as operations performed by an aircraft, either operating under Instrument Flight Rules (IFR), Special Visual Flight Rules (SVFR), or Visual Flight Rules (VFR), that lands at an airport, arriving from outside the airport area, or departs an airport and leaves the airport area.

Local operations at Renton Municipal Airport according to the ATCT records, accounted for approximately 58 percent of all airport operations in fiscal year 2015. This percentage is expected to remain relatively consistent through the end of the planning period. Forecasts of local and itinerant operations are shown in Table B21.

Table B21 **SUMMARY OF LOCAL AND ITINERANT OPERATIONS FORECAST, 2015-2035**

Year	Local	Itinerant	Total

2015	63,693	48,936	112,629[1]
2020	59,557	44,929	110,017
2025	62,888	47,441	117,088
2030	66,406	50,096	124,946
2035	70,123	52,899	133,698

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015

Peak Period Forecast. An additional element in assessing airport use and determining various capacity and demand considerations is to ascertain peak period activities. Data was obtained from the ATCT, and analyzed for peak month operations. August was found to be the peak month for operations at Renton Municipal Airport, with an average of 11.8 percent of the total operation over the last five years. In addition to air traffic records, FAA statistics and assumptions from airport with similar activity and operational characteristics have been applied to Renton Municipal Airport. These included: a 31-day peak month is assumed, and existing peak hour operations are 10 percent of the average day of the peak month. Over time, operations during the peak hour are assumed to increase as flight training activity increases at the Airport. The peak period operational activities are illustrated in Table B22.

Table B22 **PEAK PERIOD AIRCRAFT OPERATIONS FORECAST, 2015-2035**

Year	Annual	Peak Month	Average Day of Peak Month	Peak Hour/ Average Day Ratio	Average Peak Hour
2015	112,629[1]	13,290	429	10%	43
2020	110,017	12,982	419	11%	46
2025	117,088	13,816	446	12%	53
2030	124,946	14,744	476	13%	62
2035	133,698	15,776	509	14%	71

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015

Overall conclusion. For the purposes of this Airport Master Plan the Market Share forecast is the recommended forecast. Airport Management has indicated that the growth rate of just under one percent is reasonable given current local conditions. This forecast is also based on an industry accepted forecasting technique. The growth rate reflects positive growth and increased activity levels through the 20-year planning period. Finally, this growth rate results in a forecast consistent with the 2016 FAA Terminal Area Forecast (TAF). Tables comparing the master plan forecast to the FAA TAF are included at the end of this chapter.

General Aviation (GA) Based Aircraft Forecast

The number of general aviation aircraft which can be expected to be based at an airport facility is dependent on several factors such as: available facilities, airport operator services, airport proximity and access. General aviation operators are particularly sensitive to both the quality and location of their basing facilities, with proximity of home and work often being identified as the primary consideration in the selection of an aircraft basing location.

Based aircraft are those that are permanently stored at an airport. Estimating the based aircraft demand over the next 20 years impacts the planning for future facility and infrastructure requirements. However, it is again important to note the constrained nature of based aircraft demand at RNT. The airport maintains a paid deposit waiting list with 72 names of individuals and organizations desiring indoor aircraft storage and currently has no developable property for the construction of additional hangars.

1. Socioeconomic Analysis – Income Ratio (Page B.32)
2. Socioeconomic Analysis – Population Ratio (Page B.33)
3. Market Share Analysis (Page B.33)

Socioeconomic – Income Ratio. For this method the ratio of based aircraft per $100 of King County income was determined and then applied through the forecast period. The results of this methodology are presented in Table B23, which shows a projection of 360 aircraft by the end of the planning period.

Table B23 **BASED AIRCRAFT FORECAST, SOCIOECONOMIC – INCOME RATIO**

Year	RNT Based Aircraft	King County Income (hundreds of dollars)[2]	Aircraft per $100 of Income
2015	276[1]	$572.15	0.48
2020	291	$605.70	0.48
2025	311	$647.74	0.48
2030	334	$696.21	0.48
2035	360	$750.80	0.48

SOURCE: Mead & Hunt
[1] National Based Aircraft Inventory
[2] Woods and Poole, Inc.

Socioeconomic – income ratio conclusion. At most general aviation airports, the socioeconomic income ratio is typically a reasonable index of future based aircraft trends, due to the fact that it is premised on local demographic factors. However, no known coloration exists between historic based aircraft and income so the income ratio scenario was not considered further.

Socioeconomic – population ratio. Similar to the income variable, experience has shown that the population ratio is also typically a reasonable index of future based aircraft trends This forecast methodology determines the ratio of based aircraft to population and projects this throughout the planning period. It was determined based on the year 2015 that 0.28 aircraft exist per 100 people within with City of Renton. The City of Renton was chosen for the population ratio due the significant amount of redevelopment currently occurring in Renton and the potential for this redevelopment to result in population increases which could potentially mean more pilots/aircraft owners moving to the area and an associated increased demand for basing aircraft

at the local airport. The results of this method are presented in Table B24, which shows a projection of 321 aircraft by the end of the planning period.

Table B24 **BASED AIRCRAFT FORECAST – POPULATION RATIO**

Year	RNT Based Aircraft (Population Ratio)	City of Renton Population[2]	Aircraft per 100 People
2015	276[1]	98,470	0.28
2020	288	103,332	0.28
2025	299	107,614	0.28
2030	311	111,571	0.28
2035	321	115,178	0.28

SOURCE: Mead & Hunt
[1] National Based Aircraft Inventory
[2] US Census Bureau

Socioeconomic – population ratio conclusion. The socioeconomic population ratio is also a reasonable index of future based aircraft trends, due to the fact that it is premised on local demographic factors. However, given that Renton does not have available land to grow in the future, this method is not considered a reasonable method to project future based aircraft. For these reasons, the population ratio scenario not considered further.

Market share analysis. This methodology projects future based aircraft at Renton as a percentage of total aircraft in the region. The Puget Sound airports listed previously were again used to determine a future regional total. Renton's current market share of based aircraft in the region is approximately 14 percent and has increased from 12 percent in 2006. This method conservatively implies that RNT will maintain its current share throughout the 20-year planning period. RNT's actual market share may increase or decrease in the next 20 years, but if it remains in the 14 percent range, future based aircraft totals would be similar to what's shown in Table B25. This methodology results in a projection of 345 aircraft at RNT by the end of the planning period.

Table B25 **BASED AIRCRAFT FORECAST – MARKET SHARE**

Year	RNT Based Aircraft	Market Share Percentage	Puget Sound Region Based Aircraft
2006	310[1]	12%	2,630
2007	310[1]	12%	2,668
2008	310[1]	13%	2,342
2009	319[1]	13%	2,433
2010	311[1]	13%	2,394
2011	322[1]	15%	2,150
2012	335[1]	15%	2,160
2013	367[1]	16%	2,236
2014	256[1]	11%	2,256
2015	276[2]	14%	1,928
2020	287	14%	2,051
2025	305	14%	2,179
2030	324	14%	2,314
2035	345	14%	2,463

SOURCE: **Mead & Hunt**

[1] **Airport Records**
[2] **National Based Aircraft Inventory**

Market share analysis conclusion. As shown in the previous table, RNT's market share of region based aircraft has increased from 12 to 14 percent over the past 10 years. This forecast predicts that RNT's share will conservatively remain constant over the planning period with modest growth as a function of projected regional growth. For comparison purposes, all three methods and associated projections are shown Table B26 with the market share method being the preferred.

Table B26 **GENERAL AVIATION BASED AIRCRAFT FORECAST, 2015-2035**

Year	2016 FAA TAF	Market Share (Preferred)	Socioeconomic –Income	Socioeconomic - Population
2015	247	**276[1]**	276[1]	276[1]
2020	249	**287**	291	288
2025	252	**305**	311	299
2030	252	**324**	334	311
2035	252	**345**	360	321
CAGR	*0.10%*	***1.12%***	*1.34%*	*0.76%*

SOURCE: **Mead & Hunt**

[1] **National Based Aircraft Inventory**

General Aviation Based Aircraft by Type Forecast. The projected demand for based aircraft at RNT is expected to be an additional 69 aircraft by 2035. The mix of based aircraft by type is shown in Table B27. The future mix is expected to remain proportionally similar to the current based aircraft mix, largely comprised of single piston-engine aircraft.

Table B27 **GENERAL AVIATION BASED AIRCRAFT BY TYPE, 2015-2035**

Aircraft Type	2015	2020	2025	2030	2035
Single Engine Piston	244	255	270	286	304
Multi-Engine Piston	11	11	12	13	14
Turboprop (Single/Multi-)	11	11	12	13	14
Business Jet	3	3	3	4	4
Helicopter	7	7	8	8	9
Total	276[1]	287	305	324	345

SOURCE: **Mead & Hunt**
[1] **National Based Aircraft Inventory**

Overall conclusion on general aviation based aircraft forecasts. The previous sections forecast general aviation based aircraft by size and type of aircraft. The market share forecast was selected as the preferred forecast for a number of reasons. Most notably, this forecast predicts modest growth as a function of projected regional growth. The projection of 345 based aircraft at a CAGR of 1.12 percent is considered reasonable given the existing based aircraft waitlist and the socioeconomic projections for the region. The growth rate assumes RNT maintains its current share of 14 percent of the based aircraft market and is also similar to the projected operations growth rate. For these reasons, the market share forecast is recommended as the preferred forecast for based aircraft at RNT.

Critical (Design) Aircraft Analysis and Forecasts of Operations by Runway Design Code

As stated in the introduction to this chapter, the information presented in this section is perhaps, the most important information for planning for the future of RNT. The types of aircraft presently utilizing RNT and those projected to utilize the Airport in the future have a significant impact on the planning and design of airport facilities. These standards are based on the "critical aircraft," often referred to as the design aircraft that currently utilizes the Airport on a regular basis (regular use). A number of FAA guidance documents (including, FAA Advisory Circular 150/5070-6B, *Airport Master Plans*, FAA Order 5090. 3C, F*ield Formulation of the National Plan of Integrated Airport Systems,* and FAA Advisory Circular 150/5325-4B, *Runway Length Requirements for Airport Design*) define regular use as 500 or more annual operations (landings and takeoffs are considered as separate operations). In June of 2017, FAA published an AC entitled *Critical Aircraft and Regular Use Determination*. This document defines "critical aircraft" as the most demanding aircraft type, or grouping of aircraft with similar characteristics, that make regular use of the airport. Regular use is 500 annual operations, including itinerant and local, excluding touch-and-go operations. An operation is defined as either a takeoff or landing.

It is also important to note that the 500 annual operations regular use threshold is not a cap or limit on aircraft operations, but rather a planning metric for consideration of the potential need to upgrade airport facilities. The design aircraft can also be only one aircraft or a composite of more than one aircraft representing the highest Aircraft Approach Category (AAC) and Airplane Design Group (ADG).

The selected AAC and ADG are combined to form the Runway Design Code (RDC) of a particular runway. The RDC provides the information needed to determine the dimensional criteria standards that apply to that runway. The first component, depicted by a letter, is the AAC and relates to the aircraft approach speed. The second component, depicted by a roman numeral, is the ADG and relates to the aircraft wingspan, and tail height. The AAC and ADG are presented in the following tables.

Table B28 **AIRCRAFT APPROACH CATEGORY (AAC)**

AAC	V_{REF}/Approach Speed
A	Approach speed less than 91 knots
B	Approach speed 91 knots or more but less than 121 knots
C	Approach speed 121 knots or more but less than 141 knots
D	Approach speed 141 knots or more but less than 166 knots
E	Approach speed 166 knots or more

SOURCE: **FAA AC 150/530-13A, Airport Design, Change 1, February 2014**

Table B29 **AIRPLANE DESIGN GROUP (ADG)**

ADG	Tail Height	Wing Span
I	Less than 20 Feet	Less than 49 Feet
II	Greater than 20, but less than 30 Feet	Greater than 49, but less than 79 Feet
III	Greater than 30, but less than 45 Feet	Greater than 79, but less than 118 Feet
IV	Greater than 45, but less than 60 Feet	Greater than 118, but less than 171 Feet
V	Greater than 60, but less than 66 Feet	Greater than 171, but less than 214 Feet
VI	Greater than 66, but less than 80 Feet	Greater than 214, but less than 262 Feet

SOURCE: **FAA AC 150/530-13A, Airport Design, Change 1, February 2014**

While the Renton Municipal Airport has historically served as the initial flight location for the majority of the Boeing Company's narrow body aircraft, the number of aircraft produced annually (and associated number of annual aircraft operations) has always been less than 500. Because of this fact, previous planning documents have designated the Airport's critical aircraft (or design aircraft) as the Beechcraft King Air 200 which has an RDC of B-II. However, this Airport has historically been used and will continue to be used by a number of aircraft with approach speeds greater than 121 knots (C and D Approach Speed aircraft) and wingspans greater than 79 feet (Design Group III aircraft). Given that systems or databases to quantify the number of operations by aircraft exceeding the B-II RDC were not available at the time of previous planning studies, and given that Boeing operations were always documented as less than 500 annually, this previous designation of B-II made sense at the time of those previous planning studies. However, it has been confirmed and documented in Table B30, in each of the past 10 years and also in FY2015, the total number of operations by both Boeing aircraft and a number of private and corporate aircraft that exceed B-II specifications exceeds 500 annual operations.

Table B30 **RNT HISTORIC TFMSC DATA ANALYSIS – LARGE C/D BUSINESS JET OPERATIONS AND BOEING OPERATIONS**

Year	Large C/D Business Jet Operations	Boeing Operations	Total Large Aircraft Operations
2006	799	179	978
2007	465	211	676
2008	499	267	766
2009	316	300	616
2010	334	425	759
2011	358	474	832
2012	303	400	703
2013	281	433	714
2014	345	480	825
2015	248	501	749

SOURCE: **FAA TRAFFIC FLOW MANAGEMENT SYSTEM COUNTS (TFMSC) – not normalized**

In other words, the combined total of Boeing operations and other large Category C/D operations for each of the past 10 years has exceeded the 500 operations threshold each and every year. All indications are that this trend of aircraft operations at RNT exceeding the 500-annual operations threshold will continue throughout the 20-year planning period and it is our professional recommendation that development alternatives that upgrade the airfield to meet RDC D-III standard should be considered. So the recommended

existing and future critical aircraft are the same, the combination of the B-737 and the Lear 36. Table B31 presents our forecast of future operations by RDC.

Table B31 **SUMMARY OF OPERATIONS FORECAST BY RDC, 2015-2035**

FAA RDC Category (Aircraft Type)	2015	2020	2025	2030	2035
A-I (single engine piston)	74,990[2]	73,053	77,791	83,056	88,924
A-II (single and multi-engine piston)	8,636[2]	8,436	8,978	9,581	10,251
B-I (multi-engine piston, single engine turboprop and small jet)	20,300[2]	19,829	21,104	22,520	24,097
B-II (multi-engine turboprop and small jet)	4,083[2]	3,988	4,245	4,530	4,847
B-III (multi-engine turboprop)	30[2]	29	31	33	36
C-I (small business jet)	107[2]	105	111	119	127
C-II (medium business jet)	106[2]	104	110	118	126
C-III (Boeing 737-700)	10[2]	0	0	0	0
C-III (large business jet)	27[2]	26	28	30	32
D-I (medium business jet)	40[2]	39	42	44	47
D-II (large business jet)	26[2]	25	27	29	31
D-III (Boeing 737-800, -900)	488[2]	684	684	684	684
D-III (large business jet)	14[2]	14	15	16	17
Helicopter	3,773[2]	3,686	3,922	4,186	4,479
Total	*112,629[1]*	*110,018*	*117,088*	*124,946*	*133,698*

SOURCE: [1] **ATCT Records, FY2015**

[2] **Mead & Hunt, Airport Management, RNT ATCT, and RNT FBO estimates**

Forecasts Summary

A summary of the aviation forecasts prepared for this Airport Master Plan is presented in Table B32. To reiterate, these forecasts were prepared based on an initial examination of the service area for the Airport. The service area primarily consists of the communities on the south and east sides of Lake Washington. This service area examination was followed by a comprehensive examination of historic airport activity, current and projected aviation industry trends, current and projected socioeconomic data and changes at RNT since the completion of previous planning studies.

Various forecast statistical methods (trend, market share, regression) were then contemplated and assessed in developing a range of reasonable forecast scenarios. While the forecast methods provide a means for developing quantifiable aviation demand, the confidence and correlations for each forecast method is susceptible to some level of uncertainty. Therefore, the forecast scenarios are documented and substantiated by historic RNT activity trends, FAA statistical industry-related projections, and other applicable national, local, and industry-related data sources. Although activity levels during individual years might vary above or below the forecast projections, the Airport's future developments should conform to the tracking of actual activity. For this reason the forecasts do not necessarily coincide to a specific year, and are considered 'unconstrained', which assumes facilities and services are, or will be, sufficiently available to accommodate user demands when the demand arises.

Following the aviation operations and based aircraft forecasts, an assessment of the current and future critical aircraft was conducted. The critical aircraft determination is a very important outcome of this chapter as this information is used as a background to develop the remaining portions of the report (analyze facility requirements, to aid development of alternatives and to guide the preparation of the plan and program of future airport facilities). In other words, the aviation activity forecasts (and critical aircraft determination) are the foundation from which plans will be developed and implementation decisions will be made.

In addition, a comparison of total operations with the FAA TAF is summarized in Table B33. As can be seen in the table, the Airport's forecasts for total operations are consistent with the FAA TAF.

Table B32 **SUMMARY OF AVIATION ACTIVITY FORECASTS, 2015-2035**

Operations	2015	2020	2025	2030	2035
Boeing 737	498	684	684	684	684
Aircraft Per Month	42	57	57	57	57
General Aviation	*111,941*	*109,413*	*116,214*	*124,072*	*132,824*
Single Engine Piston	101,866	99,320	105,755	112,905	120,870
Multi-Engine Piston	2,127	2,074	2,080	2,358	2,524
Turboprop	3,022	2,946	2,955	3,349	3,586
Business Jet	1,342	1,310	1,395	1,489	1,594
Helicopter	3,582	3,492	3,502	3,970	4,250
Military	*190*	*190*	*190*	*190*	*190*
Total Operations	112,629[1]	110,017	117,088	124,946	133,698
Local Operations	63,693	62,710	66,740	71,219	76,208
Itinerant Operations	48,936	47,307	50,347	53,727	57,490
Based Aircraft By Type					
Single Engine Piston	244	255	270	286	304
Multi-Engine Piston	11	11	12	13	14
Turboprop (Single/Multi-	11	11	12	13	14
Business Jet	3	3	3	4	4
Helicopter	7	7	8	8	9
Total	276[2]	287	305	324	345

SOURCE: **Mead & Hunt**
[1] **ATCT Records, FY2015**
[2] **National Based Aircraft Inventory**

Table B33 **COMPARISON OF MASTER PLAN FORECASTS AND TAF FORECASTS, 2015-2030 (FAA FORMAT)**

	Airport Forecast	Jan 2017 FAA TAF	AF/TAF % Difference
PASSENGER ENPLANEMENTS			
Base Year (2015)	0	434	-100.0%
2020	0	434	-100.0%
2025	0	434	-100.0%
2030	0	434	-100.0%
COMMERCIAL OPERATIONS			
Base Year (2015)	498[1]	495	0.6%
2020	684	624	9.6%
2025	684	624	9.6%
2030	694	624	9.63%
TOTAL OPERATIONS			
Base Year (2015)	112,629[1]	112,629	0.0%
2020	110,017	123,192	-10.7%
2025	117,088	125,031	-6.4%
2030	124,946	126,897	-1.5%

SOURCE: Mead & Hunt

[1] ATCT Records, FY2015

Resources and Links

The Boeing Company

Boeing Delivery Statistics:
http://www.boeing.com/commercial/#/orders-deliveries

Boeing Current Market Outlook 2016-2035:
http://www.boeing.com/resources/boeingdotcom/commercial/about-our-market/assets/downloads/cmo_print_2016_final_updated.pdf

Boeing to Increase 737 Production Rate to 52 per Month in 2018, October 2, 2014:
http://boeing. mediaroom. com/2014-10-02-Boeing-to-Increase-737-Production-Rate-to-52-per-Month-in-2018

Bloomberg

With epic backlogs at Boeing and Airbus, can business be too good?
https://www.bloomberg.com/news/articles/2014-01-29/with-epic-backlogs-at-boeing-and-airbus-can-business-be-too-good

City of Renton

City of Renton 2012 State Legislative Agenda
https://rentonwa.gov/uploadedFiles/Business/EDNSP/2012%20State%20Legislative%20Agenda_4pages. pdf?n=2430

Community & Economic Development. Demographics Summary Profile, City of Renton:
http://www.rentonwa.gov/uploadedFiles/Business/EDNSP/about/demographics/1Renton%20Summary%20Demographics%20Overview%20June%202010. pdf

Department of Finance and Information Technology. City of Renton Economic Forecast 2012-2016:
http://www. rentonwa. gov/uploadedFiles/Business/EDNSP/rentonrep0712. pdf

Federal Aviation Administration (FAA)

FAA Advisory Circular 150/5000-17: Critical Aircraft and Regular Use Determination:
http://www. faa. gov/documentLibrary/media/Advisory_Circular/draft-150-5000-17. pdf

FAA Advisory Circular 150/5070-6B: Airport Master Plans:
http://www. faa. gov/documentLibrary/media/Advisory_Circular/150-5070-6B-Change-2-Consolidated. pdf

FAA Advisory Circular 150/5300-13A: Airport Design, Change 1:
http://www. faa. gov/documentLibrary/media/Advisory_Circular/150-5300-13A-chg1-interactive. pdf

FAA Advisory Circular 150/5325-4B: Runway Length Requirements for Airport Design:

http://www. faa. gov/documentLibrary/media/advisory_circular/150-5325-4B/150_5325_4b. pdf

FAA Aerospace Forecast Fiscal Years 2015-2035:
https://www.faa.gov/data_research/aviation/aerospace_forecasts/

FAA Form 5010, Airport Master Record:
http://www. gcr1. com/5010web/REPORTS/AFD01082015RNT. pdf

FAA National Based Aircraft Inventory Program:
https://basedaircraft. com/bacounts/state_counts. asp

FAA Operations Network (OPSNET):
https://aspm. faa. gov/opsnet/sys/main. asp

FAA Operations Network (OPSNET) Glossary:
https://aspm. faa. gov/atads/gloss. htm

FAA Order 5090. 3C Field Formulation of the National Plan of Integrated Airport Systems (NPIAS):
http://www. faa. gov/airports/resources/publications/orders/media/planning_5090_3C. pdf

FAA Traffic Flow Management System Counts (TFMSC):
https://aspm. faa. gov/tfms/sys/main. asp

FAA Terminal Area Forecast (TAF):
http://aspm. faa. gov/main/taf. asp

National Oceanic and Atmospheric Administration (NOAA)

National Climatic Data Center. Data Access, Land-Based Station Data, Automated Weather Observing System (AWOS):
http://www. ncdc. noaa. gov/data-access/land-based-station-data/land-based-datasets/automated-weather-observing-system-awos

Puget Sound Regional Council (PSRC)

Preparing Busy General Aviation Airports for Next Generation Technologies
http://www. psrc. org/assets/7340/NextGen. pdf

Renton Municipal Airport

2009 Airport Layout Plan
http://rentonwa. gov/living/default. aspx?id=7560

Airport Master Plan Update
http://rentonwa. gov/living/default. aspx?id=30679

Seattle Times

Boeing races to keep up with Airbus on single-aisle jet production

http://www.seattletimes.com/business/boeing-aerospace/boeing-races-to-keep-up-with-airbus-on-single-aisle-jet-production/

Boeing's 737 MAX takes wing with new engines, high hopes
http://www. seattletimes. com/business/boeing-aerospace/boeings-737-max-takes-off-on-first-flight/

State of Washington

Washington State Department of Transportation. Washington Aviation System Plan, Long-Term Air Transportation Study (LATS):
http://www. wsdot. wa. gov/aviation/SystemPlan/default. htm

Washington State Office of Financial Management. Washington State Growth Management Population Projections for Counties 2010 to 2040:
http://www. ofm. wa. gov/POP/gma/projections12/projections12. asp

United States Census Bureau

American Community Survey
http://factfinder. census. gov/faces/nav/jsf/pages/programs. xhtml?program=acs

American Fact Finder
http://factfinder. census. gov/faces/nav/jsf/pages/index. xhtml

USA Today

Boeing will boost 737 production, slow 777 rates
http://www.usatoday.com/story/travel/flights/todayinthesky/2016/01/28/boeing-boost-737-production-but-slow-777-rates/79450198/

Woods and Poole Economics, Inc.

Long-term county forecasts
http://woodsandpoole. com