

Aviation Activity Demand Forecast

Introduction

Forecasting is a key element in the master planning process. The forecasts are essential for analyzing existing airport facilities and identifying future needs and requirements of the facilities. Forecasting, by its very nature, is not exact, but it does establish some general parameters for development and, when soundly established, provides a defined rationale for various development activities in relation to anticipated demand. The purpose here is to provide a summary of the 1994 base data forecast information (presented in *Aviation Demand Forecasts Draft Technical Paper*, December 1996, by TRA-BV) that was previously accepted by King County and the FAA and to update those forecasts as required in consideration of activity through the end of calendar year 1997.

Previous Forecast Summary

A summary of the unconstrained aviation activity forecasts as published by TRA-BV in December 1996 is presented in the following table, entitled *SUMMARY OF TRA-BV UNCONSTRAINED FORECAST SUMMARY*. As can be seen, this set of forecasts was prepared with 1994 base year data (the most recent full year prior to the commencement of the planning effort in 1995).

Unconstrained forecasts of activity are normally used as the basis in airport planning documents because they provide a theoretical estimate of demand for aviation facilities that will be placed on a certain airport within a defined planning period. In turn this then provides the airport sponsor with the information needed to understand what facilities will be required to meet the unconstrained forecast demand and make determinations whether or not those facilities can be provided.

Table B1
SUMMARY OF TRA-BV UNCONSTRAINED FORECASTS, 1994-2015
King County International Airport Master Plan

Operations	1994 ¹	2000	2005	2010	2015
General Aviation	377,450	392,200	404,900	418,000	431,787
Military	3,076	3,000	3,000	3,000	3,000
Air Cargo	16,386	20,000	23,000	25,500	28,100
Aerospace	2,657	3,300	3,900	4,600	5,500
Passenger	2,000	5,000	7,200	9,000	10,200
Air Taxi	21,235	25,400	29,400	34,100	39,500
TOTAL OPERATIONS	422,804	448,900	471,400	494,200	518,100
Passenger Enplanements					
TOTAL ENPLANEMENTS	2,300	13,000	38,200	77,000	89,300
Based GA Aircraft					
TOTAL BASED GA AIRCRAFT	436	451	463	476	489

Source: TRA/BV, Aviation Demand Forecasts Draft Technical Paper, December 1996.

¹ Actual.

Revised Forecast Summary

As with all forecasts, those prepared by TRA-BV become flawed as time passes and actual operation counts become available for years that were at one time a part of the forecast period. Utilizing TRA/BV's forecast assumptions, the forecasts for this airport master plan have been updated using 1997 base year data, and are presented in the following table entitled, *REVISED UNCONSTRAINED FORECAST SUMMARY 1997-2015*. Following the table an explanation of the revised forecast components is provided.

Table B2
SUMMARY OF REVISED UNCONSTRAINED FORECASTS, 1997-2015
King County International Airport Master Plan

Operations	1997¹	2000	2005	2010	2015
General Aviation	311,313	323,274	339,608	356,600	374,275
Military	2,243	3,000	3,000	3,000	3,000
Air Cargo	23,750	25,658	29,387	33,904	38,184
Aerospace	2,950	3,300	3,900	4,600	5,500
Passenger	2,000	5,000	7,200	9,000	10,200
Air Taxi	28,812	31,484	36,498	42,311	49,051
TOTAL OPERATIONS	371,068	391,716	419,593	449,415	480,210
Passenger Enplanements					
TOTAL ENPLANEMENTS	2,300	13,000	38,200	77,000	89,300
Based GA Aircraft					
TOTAL BASED GA AIRCRAFT	443	451	463	476	489

Source: BARNARD DUNKELBERG & COMPANY.
¹ Actual.

To the extent reasonable, the forecasts of aviation activity produced by TRA/BV remain unchanged. Where revisions have been made, they have been driven by the historical operational activity documented in 1995, 1996, and 1997. By category, the revised forecast numbers are described below.

For reference purposes, it should be noted that actual total aircraft operations in calendar year 2000 totaled 363,838.

General Aviation Forecasts

Based Aircraft. The forecast trends identified by TRA/BV related to based general aviation aircraft have shown to be reasonable during the past several years. The based aircraft forecast numbers have not been changed from those produced in 1996.

Aircraft Operations. The basis for the forecasting of general aviation aircraft operations is most often determined by establishing a ratio of Operations Per Based Aircraft (OPBA). An aircraft operation is either a landing or a takeoff. A reexamination of the 1994 OPBA statistics at Boeing Field indicates that it was unusually high (the OPBA in 1994 was 866, 1995 was 659, 1996 was 639, and 1997 was 703), this resulted in an unusually high forecast for general aviation aircraft operations. In the revised forecasts presented above, a new growth trend has been projected using OPBA statistics over the past decade as a basis. The revised forecast starts with an OPBA of 703 in 1997 and increases to 765 in 2015.

Military Activity

Aircraft Operations. The number of military aircraft operations is expected to remain a relatively small percentage of total aircraft operations at the airport. The revised forecast for military aircraft operations is unchanged from the original 1996 TRA/BV projection.

Air Cargo

The quantity of air cargo passing through the airport and the number of air cargo aircraft operations has increased significantly since 1994. These increases dictate the need to re-evaluate the projections made by TRA-BV in 1996.

Air Cargo Quantities. In 1994, approximately 40,000 tons of air freight passed through the airport. That quantity increased to approximately 142,000 tons in 1997. Using 1997 air cargo statistics as a basis and assuming a 4.6% growth rate for the remainder of the planning period (per the TRA/BV forecast update memorandum dated June 2, 1997) air cargo quantities are expected to increase to approximately 305,000 tons by the year 2015 in the unconstrained forecast.

Air Cargo Aircraft Operations. According to the airport's FAA documentation, in 1994, there were approximately 18,218 air cargo aircraft operations at the airport (TRA/BV documented 16,386 operations of cargo aircraft in the 1996 Forecasts Technical Paper). The number of air cargo aircraft operations at the airport increased to 23,750 in 1997. As the quantity of air cargo passing through the airport has increased, the tons of cargo carried per aircraft operation has also increased. This is a trend that is expected to continue in the future. In 1997, each air cargo aircraft landing or taking off at the airport carried an average of almost six tons of air cargo. The average tons per aircraft operation is expected to increase by approximately two tons by the year 2015 (TRA-BV forecast update memorandum dated June 2, 1997). The number of annual air cargo aircraft operations is expected to increase to approximately 38,000 by the year 2015.

It should be noted that there are two types of air cargo carriers operating at KCLIA. The majority of air cargo aircraft operations at the airport are conducted using small aircraft (less than sixty-thousand pound). These small air cargo aircraft range in size from single-engine piston aircraft up to business jet aircraft. The other type of air cargo carrier at the airport use transport type jet aircraft ranging in size from small commercial airliners (e.g., DC-9, B-727, etc.) to large wide-body aircraft (e.g., B-767, B-747, etc.). The forecast of future activity presented in the following table, entitled *UNCONSTRAINED OPERATIONS FORECAST BY AIRCRAFT TYPE, 1997-2015*, is broken down to provide an operations projection for both of these types of air cargo carriers.

Aerospace Activity

Aircraft Operations. The projection of number of aerospace aircraft operations is unchanged from the original 1996 TRA/BV forecast.

Passenger Activity

Enplaned Passengers and Aircraft Operations. The projections for number of enplaned passengers and the number of commercial passenger aircraft operations in the latter years of the planning period are unchanged from the 1996 TRA/BV forecast. FAA records for 1999, indicate that annual passenger enplanements totaled 12,692; therefore, the forecast of enplanements for the year 2000 was increased to 13,000. Presently, the aircraft types associated with the scheduled commercial passenger operations at the airport are small (under 20 passenger) fixed wing and helicopters.

The forecast of unconstrained demand for commercial passenger activity at the airport recognizes that in consideration of the airport's central location within Seattle Metropolitan area, there is certainly demand for passenger services. It must also be taken into consideration that at the present time, no airline is proposing a significant commercial passenger operation at the airport, and that no new facilities are programmed for construction to accommodate such growth.

Air Taxi Activity

Aircraft Operations. The number of aircraft operations attributed to the air taxi category increased from 21,235 in 1994 to 28,812 in 1997. Using the 1997 activity as a base year, the TRA/BV projection of a 3% compound annual growth rate was used to forecast air taxi aircraft operations for the remainder of the forecast period.

Operations Forecast By Aircraft Type

The following table, entitled *OPERATIONS FORECAST BY AIRCRAFT TYPE, 1997-2015*, depicts the approximate level of use by aircraft types that are projected to use KCIA. This table reflects the growing percentage of turbine-powered aircraft anticipated to operate at the airport, and the decreasing percentage of piston-powered aircraft. This is indicative of the type of facility the airport is expected to become, the prevailing local economic conditions, and national trends.

Table B3
UNCONSTRAINED OPERATIONS FORECAST BY AIRCRAFT TYPE, 1997-2015
King County Airport Master Plan

Operations By Type	1997(a)	2000	2005	2010	2015
<i>General Aviation</i>	311,313	323,274	339,608	356,600	374,275
Single Engine	217,919	223,059	227,537	235,356	239,536
Multi-Engine	31,131	32,327	33,961	35,660	37,428
Turboprop	15,566	16,164	16,980	17,830	18,714
Business Jet	31,131	35,560	42,451	46,358	56,141
Helicopter	15,566	16,164	18,678	21,396	22,457
<i>Military</i>	2,243	3,000	3,000	3,000	3,000
Variety of Types	2,243	3,000	3,000	3,000	3,000
<i>Air Cargo</i>	23,750	25,658	29,387	33,904	38,184
<60,000 pounds	17,462	18,730	21,159	24,072	26,729
>60,000 pounds	6,288	6,928	8,228	9,832	11,455
<i>Aerospace¹</i>	2,950	3,300	3,900	4,600	5,500
B-707 (AWACS)	148	148	148	148	148
B-737	1,800	2,392	2,837	3,432	4,177
B-747	10	10	10	10	10
B-757	600	700	850	950	1,100
B-767 (AWACS)	30	40	45	50	55
B-777	362	10	10	10	10
<i>Passenger</i>	2,000	5,000	7,200	9,000	10,200
Single-Engine	1,840	3,500	3,600	2,997	2,581
Multi-Engine	460	1,500	2,880	4,500	6,120
Turbojet ²	0	0	720	1,503	1,499
<i>Air Taxi</i>	28,812	31,484	36,498	42,311	49,051
Single Engine	20,168	21,724	24,454	27,925	31,393
Multi-Engine	2,881	3,148	3,650	4,231	4,905
Turboprop	1,441	1,574	1,825	2,116	2,453
Business Jet	2,881	3,463	4,562	5,500	7,358
Helicopter	1,441	1,574	2,007	2,539	2,943
TOTAL ANNUAL OPERATIONS	371,068	391,716	419,593	449,415	480,210

(a) Actual

1 Boeing Company Estimates

2 Turbojet passenger aircraft demand forecast; however, no airline is proposing this type of service for Boeing Field.

Source: BARNARD DUNKELBERG & COMPANY.

Peak Period Forecast

An additional element in assessing airport use and determining various capacity and demand considerations is to ascertain peak period activities. Actual air traffic records for 1997, together with FAA statistics and assumptions from airports with similar activity and operational characteristics, have been applied to formulate peak period forecasts for King County International Airport. The peak period operational activities are depicted in the following table, entitled *PEAK PERIOD AIRCRAFT OPERATIONS FORECAST, 1997-2015*. The data provided in this table provide a theoretical estimate on the number of aircraft operations that might be expected in consideration of the forecast demand of annual aircraft operations. These numbers are compared to the theoretical capacity of the airport's runway system to help determine the need for improvements to efficiently accommodate demand.

Table B4
PEAK PERIOD AIRCRAFT OPERATIONS FORECAST, 1997-2015
King County International Airport Master Plan

Year	Annual	Peak Month	Average Day of Peak Month	Peak Hour/ Average Day Ratio	Peak Hour
1997	371,068	39,083	1,261	9.0%	113
2000	391,716	41,257	1,331	8.7%	116
2005	419,593	44,194	1,426	8.5%	121
2010	449,415	47,334	1,526	8.2%	125
2015	480,210	50,578	1,631	8.0%	130

Source: BARNARD DUNKELBERG & COMPANY from methodology contained in FAA AC 150/5070-6A *Airport Master Plans* and FAA AC 150/5060-5 *Airport Capacity and Delay*.

Airport Reference Code (ARC)/Critical Aircraft Analysis

The types of aircraft presently utilizing an airport and those projected to utilize the facility in the future are important considerations for planning airport facilities. An airport should be designed in accordance with the Airport Reference Code (ARC) standards that are described in *AC 150/5300-13 Airport Design*. The ARC is a coding system used to relate and compare airport design criteria to the operational and physical characteristics of the aircraft currently operating, along with those forecast to operate, at the airport. The ARC has two components that relate to the airport's "Design Aircraft". The first component, depicted by a letter (i.e., A, B, C, D, or E), is

the aircraft approach category and relates to aircraft approach speed based upon operational characteristics. The second component, depicted by a roman numeral (i.e., I, II, III, IV, V or VI), is the aircraft design group and relates to aircraft wingspan (physical characteristic). Generally speaking, aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan is primarily related to separation criteria associated with taxiways and taxilanes.

At King County International Airport, the most critical aircraft that regularly utilizes the airport with regard to wingspan and approach speed is the Boeing 747-200, which has a wingspan of 195.7 feet and an approach speed of 152 knots. In consideration of this critical aircraft, the main runway at the airport (Runway 13R/31L), along with its associated taxiway and apron systems, should be designed using ARC D-V dimensional criteria (the next chapter will present a more detailed discussion).

ATCT and airport operations staff operate Runway 13L/31R as a general aviation facility. The largest aircraft that regularly utilize this runway are twin-engine general aviation aircraft such as the Beech Super King Air B200. This indicates that Runway 13L/31R and its associated taxiway system should be designed using ARC B-II criteria.

Summary

The information contained in the *Aviation Activity Demand Forecast* chapter is used in the following chapters to analyze the capacity of the airport, develop facility requirements and to determine future noise impacts and exposure. In other words, the aviation activity forecasts are the foundation from which future plans are developed and implementation decisions are made.

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