3 AVIATION DEMAND FORECASTS

AIRPORT FORECAST METHODOLOGY

Aviation demand forecasts are prepared to estimate future airport facility and equipment needs. The preferred forecasts are used to identify the type, extent, and timing of aviation development, along with an estimate of the financial feasibility of airport development alternatives, and evaluating potential environmental effects. Aviation demand forecasts have been prepared for the following:

- Based aircraft by category
- Aircraft operations (landings & takeoffs)
- Critical aircraft (family of aircraft)
- Military and air taxi operations
- Fleet mix by aircraft type
- Actual instrument approaches (AIA’s)

Development of aviation forecasts involves analytical and judgmental assumptions to realize the highest level of forecast confidence. The general aviation demand forecasts are developed in accordance with national trends, and in context with the inventory findings, including local population, per capita income, and employment trends. The forecasts are time-based projections which provide a schedule for expecting demand levels, in which the forecasts ultimately serves a guide for development – as demand and facilities warrant. National general aviation trends and forecasts, used to provide a baseline of growth rates, are provided by the FAA Aviation Forecast (FY 2000-2011).

NATIONAL GENERAL AVIATION TRENDS

Several national trends have been identified as an influence to the forecast analysis for the Bowers Field Airport. During the past several years, industry and legislative reforms have been initiated which are poised to bring rather significant change and growth to all aspects of the general aviation industry.¹

In conjunction with this, the growing national economy has induced a greater reliance of business aircraft utilization, but also a resurgence in recreational flying, as demonstrated by new pilots starts. These factors have resulted in a new-found optimism for long-term growth of the general aviation industry.

¹ Aviation activity is often influenced by the types of airport services offered for transient and based aircraft, and by the general business environment. In addition, factors such as vigorous local airport marketing, gains in sales and services, increased industrialization, changes in transportation mode preferences, or fluctuations in the national or local economy all influence aviation demand.
Overall, the general aviation segment of the industry is expected to experience moderate annual growth (1.5% to 2.2%) during the next 10 years, and within the 3 to 5 year period, is projected to sustain activity levels experienced prior to the mid-1980’s general aviation downturn.

As examples, the single-engine general aviation fleet is becoming more sophisticated, with a gradual increase in the fleet size and pilot training. The recent infusion of new aircraft technology into general aviation has resulted in improved performance, more reliable, and cost-effective single-engine airplanes, as evidence of the manufacturing proliferation of new production airplanes and various experimental aircraft models.

More vibrant business utilization, combined with increasingly complex pilot and airspace regulations have greatly contributed to a more sophisticated pilot population flying more advanced and demanding aircraft fleet. Associated with this, the recent cost escalation associated with recreational flying, coupled with higher liability and taxes for those who own, rent, and operate general aviation aircraft has contributed to an increase in business and itinerant aircraft operations relative to pilot training and recreational activity. This trend is becoming more evident at smaller, highly active general aviation airports such as Bowers Field.

The higher-value twin piston and turbo-propeller engine aircraft are being manufactured slightly in advance of normal attrition, and continue to gain market share popularity. Due to new airframe and engine technology and cost–sharing arrangements, jet aircraft also have become an economical substitute for a number of the larger twin-turbine propeller aircraft. In addition, the pre-owned general aviation aircraft market has remained strong. Also, national legislation passed in 1994 established an 18-year liability horizon for the design of general aviation aircraft and components, allowing more affordable design and navigational technologies in the mainstream marketplace, as well as a proliferation of experimental aircraft production under revised FAA certification guidelines. The above-mentioned, as well as numerous other reasons cast a positive light on the possible continued prosperity of general aviation.

**LOCAL-AREA BASED AIRCRAFT FORECAST FACTORS AND ASSUMPTIONS**

Based on information obtained in the inventory analysis, the following factors and assumptions have incorporated into the forecasts of based aircraft and annual operations at Bowers Field Airport:

- A net increase in based aircraft would likely be influenced by the timing and availability of future hangar expansion by airports within the Columbia Valley region. Several existing based aircraft owners are expected to upgrade to a higher performance and more complex aircraft in the next 5 years. The demand for future based aircraft would likely arise from recreation and business interests.

- Expansion of the CWU Flight Training Program, in terms of fleet composition, flight training enrollment, or curriculum expansion would likely result in increased airport activity.
Improved instrument approach procedures including additional approaches with lower minimums to increase the reliability and allow the safe and effective use of the airport by higher performance aircraft.

Expansion of the Bowers Field Industrial Park would potentially attract a core industry with airport usage. Growth of external industries would be the most likely to influence the expansion of Bowers Field.

Airport reliance from the Trend West Resort development is anticipated, with further expansion of services and promotion of the Bowers Field, due to the lack of adequate full-service airport facilities within the region.

GENERAL AVIATION DEMAND FORECASTS

The Bowers Field aviation demand forecasts have been developed using statistical techniques; including regression analysis, market-share and trend-line series. A judgmental analysis of the various forecasts culminates in the selection of a preferred forecast as a reasonable indicator of future general aviation demand at the airport. The following provides a summary of the preferred forecasts.

FORECAST OF BASED AIRCRAFT

Table 3.1 summarizes the various forecasts of based aircraft prepared for the Bowers Field Airport throughout the 20-year planning period. Forecast of based aircraft was developed using multiple methodologies such as regression, linear trend line/trend extension, market share, time-series, as well as FAA annual growth rates per the FAA Aerospace Forecasts (2000-2011). Judgmental or professional analysis was utilized in formulating the preferred forecasts as well.

Overall, the forecast methods resulted in a range of 56 to 82 based aircraft by the end of the planning period (2020), representing a 1.0% to 2.6% annual growth rate, respectively.

Because no one method produced a statistically acceptable confidence factor (95% significance), the “preferred” forecast was developed by averaging each of the forecast methods. The “preferred” forecast of based airplanes represents a reasonably conservative projection, and is consistent with recent past airport trends, the anticipated growth of the general aviation fleet, and is realistic with respect to market factors and socio-economic conditions identified in the airport service area.
### Table 3.1
Summary of Based Aircraft Forecasts – Total Aircraft
Bowers Field Airport

<table>
<thead>
<tr>
<th>Year</th>
<th>Regression Analysis</th>
<th>Time-Series Analysis</th>
<th>Kittitas County Market Share Analysis</th>
<th>Averaged (Local Demand) “Preferred”</th>
<th>FAA Annual Growth (National Average)</th>
<th>Linear Trend Line Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
<td>49</td>
</tr>
<tr>
<td>2005</td>
<td>58</td>
<td>55</td>
<td>51</td>
<td>54</td>
<td>54</td>
<td>51</td>
</tr>
<tr>
<td>2010</td>
<td>66</td>
<td>61</td>
<td>52</td>
<td>58</td>
<td>59</td>
<td>54</td>
</tr>
<tr>
<td>2015</td>
<td>74</td>
<td>66</td>
<td>54</td>
<td>63</td>
<td>63</td>
<td>56</td>
</tr>
<tr>
<td>2020</td>
<td>82</td>
<td>72</td>
<td>56</td>
<td>67</td>
<td>68</td>
<td>59</td>
</tr>
</tbody>
</table>

Note 1: No forecasts were prepared for ultralights, rotorcraft, balloons, or sailplanes/giders.

Note 2: The FAA fleet size rate of increase varies with the type of aircraft. The overall general aviation fleet is expected to grow at 1.2% annually (2000-2011). The single-engine aircraft fleet is expected to grow at an annual rate of 0.9% to 1.4%, multi-engine at 0.9%, twin turbine-engine aircraft at 3.2%, and jet turbine at 4.9%. Growth rates per category of aircraft were applied to the number of based aircraft starting in 2000.

**Source:** BWR, Summary Forecast of Based Aircraft, January 2001.
BASED AIRCRAFT FORECAST (PREFERRED)

Table 3.2 provides a detailed breakdown, by category, of the “preferred” mix forecast of based aircraft. The projected mix of airplanes was developed in reference to survey responses regarding upgrade to aircraft and to national trends in aircraft production. For this, the baseline number of aircraft identified at Bowers Field in 2001 was incrementally adjusted during the planning period based on the survey and interview information collected with regard to the hangar waiting list demand, expected aircraft purchases, and anticipated aircraft upgrades. Details regarding the forecast of based aircraft can be referenced in the appendix.

<table>
<thead>
<tr>
<th>Year</th>
<th>Single-Engine Aircraft (A-I)</th>
<th>Multi-Engine Piston (A-I to B-I)</th>
<th>Multi-Engine Turbine (B-II)</th>
<th>Business Jets (B-I to B-II)</th>
<th>Helicopters</th>
<th>Total Based Fixed-Wing Aircraft</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>45</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>49</td>
</tr>
<tr>
<td>2005</td>
<td>48</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>54</td>
</tr>
<tr>
<td>2010</td>
<td>51</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2 – 3</td>
<td>58</td>
</tr>
<tr>
<td>2015</td>
<td>56</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2 – 4</td>
<td>63</td>
</tr>
<tr>
<td>2020</td>
<td>58</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2 – 4</td>
<td>67</td>
</tr>
</tbody>
</table>

Note 1: Forecasts have not been prepared for other aircraft; ultralights, rotorcraft, balloons, or sailplanes/ gliders.

The significant aspect of the forecast indicates a realistic expectation for a small-cabin business jet to be based at Bowers Field by the end of the planning period, most likely as an upgrade from an existing based business twin-turbine aircraft similar to the existing critical aircraft. This could likely occur as a shared general aviation interest amongst a group or consortium of local-area business interests. The arrangement of such a partnership could introduce similar aircraft through mechanisms initially provided by the FBO. Such arrangements, similar to fractional aircraft ownership, is the fastest growing component of the general aviation industry.

Additional twin piston and turbine based aircraft are shown to be based, which corresponds with the potential for significant production expansion of single and twin-engine turboprops in the near future. Additional single-engine aircraft would likely be based at the airfield upon availability of hangar space. The addition of based helicopters is a planning consideration, as the DNR has indicated a potential for more activity at Bowers Field sometime in the future. For this reason, a total of up to 4 helicopters are included in the forecast of based aircraft.

**AIRCRAFT OPERATIONS FORECAST (PREFERRED)**

Table 3.3 summarizes the forecast of annual aircraft operations at the Bowers Field for each forecast phase. The forecast of operations was projected in reference to the forecast of based aircraft and the airport's utilization rate\(^2\). The utilization rate, as specific to individual airports, is a common means to extrapolate future total traffic levels in using based aircraft figures.

For planning purposes the Bowers Field utilization rate of 1,122 is expected to remain relatively constant throughout the planning period, a rate which is consistent with utilization experienced at the airport during the past 10 years. The relatively high utilization rate at Bowers Field is realized, which is more than most general aviation community-service airports due to the extensive flight training based at the airport. However, this rate is consistent with similar airport facilities with certified flight training programs. With operations established by this methodology, itinerant and local operations were determined by application of the current relationship of local (55%) and itinerant (45%) operations. The details regarding the forecast of annual operations can be referenced in the appendix.

The forecasts of operations, similar based aircraft forecast, is a moderately conservative estimate of activity throughout the planning period. The additional 20,200 annual operations represents a 1.6 percent growth per year, an increase consistent with state and national projections for rural general aviation airports.

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\(^2\) **Utilization Rate** - Ratio of annual operations to the number of based aircraft, providing a consistent gauge of total activity relative to the number of based aircraft.
It should be noted, that although accounted in terms of an “unconstrained” forecast, levels of activity could fluctuate due to the success of flight training programs, FBO fuel and hangar pricing, active airport marketing initiatives, the introduction of an established Part 135 air charter/taxi service, or the timing of additional commercial business at the airport.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Based Aircraft</th>
<th>Utilization Rate</th>
<th>Total Local Operations</th>
<th>Total Itinerant Operations</th>
<th>Other Itinerant</th>
<th>Total Forecast Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>49</td>
<td>1,122</td>
<td>30,250</td>
<td>100</td>
<td>1,800</td>
<td>22,850</td>
</tr>
<tr>
<td>2005</td>
<td>54</td>
<td>1,122</td>
<td>33,300</td>
<td>100</td>
<td>2,000</td>
<td>25,200</td>
</tr>
<tr>
<td>2010</td>
<td>58</td>
<td>1,122</td>
<td>35,800</td>
<td>100</td>
<td>2,200</td>
<td>27,000</td>
</tr>
<tr>
<td>2015</td>
<td>63</td>
<td>1,122</td>
<td>38,900</td>
<td>100</td>
<td>2,400</td>
<td>29,300</td>
</tr>
<tr>
<td>2020</td>
<td>67</td>
<td>1,122</td>
<td>41,400</td>
<td>100</td>
<td>2,600</td>
<td>31,100</td>
</tr>
</tbody>
</table>

Note: Other itinerant operations include transient general aviation operations.
Note: Forecast operations were rounded to the nearest hundred for simplicity and planning purposes.

Forecasts for itinerant and local traffic were calculated as follows:
- Military Activity: Expected to remain constant
- Air Taxi Operations: Projected to increase at about 2% annually
- Total Operations = Local Operations + Itinerant Operations

**Source:** BWR, Preferred Aircraft Operational Forecast, January 2001.

The following provides additional details regarding forecast considerations:

**CWU Aviation Program Fleet Activity:** As a key component and major airport user, CWU flight training was forecasted separately based on future factors which might substantially influence the total forecast of operations at Bowers Field. As a prudent planning consideration, various assumptions were applied to the CWU flight training program, as currently arranged with Midstate Aviation, Inc. Although the “preferred” forecast of annual operations included flight training by means of the utilization rate, further analysis was conducted to specifically address growth potential by the FAR Part 141 flight school. This was accomplished by generating three scenarios for future growth, including; 1) a status quo of existing flight training enrollment and aircraft fleet, 2) a moderate growth of flight training consistent with national general aviation trends, and; 3) a high level of growth spurred by an external influence to the flight training program.
Table 3.4 depicts the estimated activity of the CWU Flight Program aircraft fleet given a current, moderate, and high level of growth or activity. This scenario indicates that the CWU flight activity could reasonably increase to nearly 50,000 annual operations, and as high as 60,000 annual operations during the 20-year planning period.

At present, the dedicated CWU fleet consists of 14 single engine and 1 multi-engine aircraft. According to Midstate Aviation maintenance records the combined fleet logs approximately 11,000 annual hours (733 hours per aircraft). Application of this use to the number of enrolled flight students and, or operations assigned per flight training program (FAA flight certificates/ratings – primary, commercial, instrument, ATP) generates a minimum of 35,000 to 40,000 annual operations, if not higher.

<table>
<thead>
<tr>
<th>CWU Fleet Information</th>
<th>Status Quo/ Existing</th>
<th>Moderate Level of Growth/ Activity</th>
<th>High Level of Growth/ Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>CWU Single-Engine Aircraft Fleet</td>
<td>14</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>CWU Multi-Engine Aircraft Fleet</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>CWU Total Fleet</td>
<td>15</td>
<td>18</td>
<td>21</td>
</tr>
<tr>
<td>CWU Fleet Total Hours of Operation</td>
<td>10,995</td>
<td>13,190</td>
<td>15,390</td>
</tr>
<tr>
<td>CWU Total Annual Operations</td>
<td>44,000</td>
<td>52,760</td>
<td>61,560</td>
</tr>
</tbody>
</table>

**Note:** Additional aircraft added to current fleet will be assigned the existing utilization rate of 733 operations per hour for purposes of projecting activity; number of operations per hour is assumed to be four (4); activity figures rounded to the nearest tenth.

**Source:** BWR, CWU Flight Program Outlook of Activity, January 2001.

**Air Taxi Operational Forecast:** Air-taxi operations, which are generally linked to business rather than leisure travel, include on-demand passenger and freight operations for non-published (nonscheduled) routes. The demand for air taxi (charter) service is largely determined by the types of based aircraft, the general business climate of the airport service area and the cost effectiveness of flying rather than driving. Even with the proximity of Bowers Field in relation to Yakima Air Terminals (YKM), as well as Wenatchee/Pangborn Memorial (EAT) and Moses Lake, Grant County International (MWH), corporate/business interests will continue, an a limited basis, to utilize the convenience and flexibility that air taxi service offers.
Air taxi operations, which have proven to be successful ventures at other airports in the surrounding region, would be expected to mainly support those industries located in the City of Ellensburg. It is anticipated that air taxi activity at Bowers Field would expand slightly over the long-term planning period, and would constitute a small portion of the overall itinerant activity and passenger levels. Overall, the air taxi growth (less than 2% annually) assumes continued success in local economic development efforts, growth and expansion of profitable business enterprises in the region and the availability of a certified FAR Part 135 operation on Bowers Field.

**ANNUAL INSTRUMENT APPROACH (AIA) FORECAST**

Table 3.5 summarizes the forecast of annual civilian instrument approaches for the Bowers Field airport during the 20-year planning period. The forecast of annual instrument approaches (AIA’s) provides further guidance in determining requirements for the type, extent, and timing of future navigational (NAVAID) equipment.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Itinerant Operations-Transient/Flight Training</th>
<th>Air-Taxi Operations</th>
<th>Percent IFR Rated Pilots</th>
<th>Percent IMC</th>
<th>Itinerant AIA Operations</th>
<th>Actual Itinerant AIA Operations (% of Total Operations)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>24,750</td>
<td>1,800</td>
<td>46.1%</td>
<td>6.5%</td>
<td>742</td>
<td>429 (0.78%)</td>
</tr>
<tr>
<td>2005</td>
<td>27,300</td>
<td>2,000</td>
<td>44.3%</td>
<td>6.5%</td>
<td>786</td>
<td>458 (0.75%)</td>
</tr>
<tr>
<td>2010</td>
<td>29,300</td>
<td>2,200</td>
<td>44.5%</td>
<td>6.5%</td>
<td>848</td>
<td>495 (0.76%)</td>
</tr>
<tr>
<td>2015</td>
<td>31,800</td>
<td>2,400</td>
<td>44.5%</td>
<td>6.5%</td>
<td>920</td>
<td>538 (0.76%)</td>
</tr>
<tr>
<td>2020</td>
<td>33,800</td>
<td>2,600</td>
<td>44.5%</td>
<td>6.5%</td>
<td>978</td>
<td>573 (0.76%)</td>
</tr>
</tbody>
</table>

**Actual Itinerant AIA Operations** = Total “other” itinerant operations x percent IFR rated pilots x percent IMC + (Air-taxi operations x percent IMC)/2

Note 1: The percent of IFR Rated Pilots is based on FAA Forecasts (2000-2011), and trend line (2010-2020). The increase in the percent of IFR-rated pilots is extrapolated from FAA forecasts, indicating 1.3 percent growth in IFR training during the next 12 years. The percent of IFR Rated Pilots is based on FAA Forecasts (2000-2011), and linear trend line (2010-2020).

Note 2: Forecast based on unconstrained condition – IFR flight plans are completed and canceled after executing the full approach. Military operations are not included in the AIA forecast.

Note 3: An instrument approach is defined as an approach to an airport, with intent to land in accordance with an instrument flight rule (IFR), when visibility is less than three nautical miles and/or the cloud ceiling is at or below the minimum initial approach altitude.

AIRCRAFT MIX FORECAST

Table 3.6 presents the aircraft fleet mix forecast at the Bowers Field Airport for each phase throughout the 20-year planning period. The mix forecast is used to determine future airport design, structural and material needs, and was developed by applying the forecast of activity to future aircraft use patterns and trends obtained during the inventory analysis.

### Table 3.6
**Forecast Aircraft Mix by FAA Design Groups**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Category A (Less 91 Knots)</td>
<td>51,130 (93%)</td>
<td>55,650 (91.8%)</td>
<td>59,760 (91.7%)</td>
<td>68,650 (91.25%)</td>
</tr>
<tr>
<td>Category B (92 to 120 Knots)</td>
<td>3,850 (7%)</td>
<td>4,850 (8.2%)</td>
<td>5,210 (8.3%)</td>
<td>6,390 (8.75%)</td>
</tr>
<tr>
<td>Category C (121 to 141 Knots)</td>
<td>80 (&lt;1%)</td>
<td>105 (&lt;1%)</td>
<td>130 (&lt;1%)</td>
<td>160 (&lt;1%)</td>
</tr>
<tr>
<td>Category D (142 to 166 knots)</td>
<td>6 (&lt;0%)</td>
<td>6 (&lt;0%)</td>
<td>6 (&lt;0%)</td>
<td>6 (&lt;0%)</td>
</tr>
</tbody>
</table>

### Airplane Design Group (ADG) - A grouping of aircraft based on wingspan dimension (feet).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I (Less than 49’)</td>
<td>54,180 (98.5%)</td>
<td>59,690 (98.5%)</td>
<td>63,800 (98%)</td>
<td>72,940 (97%)</td>
</tr>
<tr>
<td>Group II (49’ to 78’)</td>
<td>825 (1.5%)</td>
<td>910 (1.5%)</td>
<td>1,300 (2%)</td>
<td>2,250 (3%)</td>
</tr>
</tbody>
</table>

Note 1: The aircraft approach category (AAC) is classified from A to E, and the airplane design group (ADG) is classified from I to IV. Combined, the two classifications produce an Airport Reference Code (ARC) which yields specific characteristics about the type of airplane that the airport is designed to accommodate.

Note 2: Fleet mix estimates are rounded to the nearest tenth (10); fleet mix estimates indicating 0% denotes total operations for the period are less than one (1) percent of total annual operations.


Ultimately, three (3) categories of general aviation aircraft are forecast to use the Bowers Field: 1) light single-engine aircraft weighing less than 12,500 pounds; and 2) light and medium twin-piston engine aircraft weighing less than 12,500 pounds, 3) small to medium-cabin turbine aircraft, including business jets, typically weighing less than 25,000 to 30,000 pounds.
Table 3.7 lists common ARC B-I to C-II business aircraft currently using the Bowers Field Airport. Business jets are also noted by cabin size (small and medium).

<table>
<thead>
<tr>
<th>Airport Reference Code (B-I)</th>
<th>Airplane Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin-Engine (Piston)</td>
<td>Beech Baron Series</td>
</tr>
<tr>
<td></td>
<td>Beech Cessna 404 (Tifan)</td>
</tr>
<tr>
<td></td>
<td>Beech Cessna 414 (Chancellor)</td>
</tr>
<tr>
<td></td>
<td>Cessna 402 (Businessliner)</td>
</tr>
<tr>
<td></td>
<td>Cessna 421 (Golden Eagle)</td>
</tr>
<tr>
<td></td>
<td>Piper PA30-310 (Navajo)</td>
</tr>
<tr>
<td></td>
<td>Piper PA60-602P (Aerostar)</td>
</tr>
<tr>
<td>Small Cabin Business Jets</td>
<td>Lear (Various)</td>
</tr>
<tr>
<td></td>
<td>Dassault (Falcon 10)</td>
</tr>
<tr>
<td></td>
<td>Rockwell (Sabre 40/60)</td>
</tr>
<tr>
<td></td>
<td>Beechjet</td>
</tr>
<tr>
<td></td>
<td>Vantage Jet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Airport Reference Code (B-II)</th>
<th>Airplane Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twin-Engine (Piston/Turbine)</td>
<td>Piper (Cheyenne)</td>
</tr>
<tr>
<td></td>
<td>Beech (King Air C-90 Series)</td>
</tr>
<tr>
<td></td>
<td>Beech (King Air F90)</td>
</tr>
<tr>
<td></td>
<td>Beech (Duke)</td>
</tr>
<tr>
<td></td>
<td>Beech (Queen Air)</td>
</tr>
<tr>
<td>ARC B-II+10</td>
<td>Cessna 441 (Conquest II)</td>
</tr>
<tr>
<td></td>
<td>Beech (King Air B200)</td>
</tr>
<tr>
<td></td>
<td>Beech (King Air Super - 350)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Airport Reference Code (C-I / C-II)</th>
<th>Airplane Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Cabin Business Jets (ARC C-I)</td>
<td>Lear 20, 40 and 50 Series</td>
</tr>
<tr>
<td></td>
<td>Hawker-Siddley 600/700</td>
</tr>
<tr>
<td></td>
<td>IAI Westwind I/II</td>
</tr>
<tr>
<td></td>
<td>IAI Jet Commander</td>
</tr>
<tr>
<td>Medium Cabin Business Jets (ARC C-II)</td>
<td>Cessna Citation VII (650 Series)</td>
</tr>
<tr>
<td></td>
<td>Cessna Citation X (750 Series)</td>
</tr>
<tr>
<td></td>
<td>Canadair Challenger 600/604</td>
</tr>
<tr>
<td></td>
<td>Raytheon/Hawker 800XP/1000</td>
</tr>
<tr>
<td></td>
<td>Gulfstream Aerospace G-III</td>
</tr>
<tr>
<td></td>
<td>IAI Galaxy</td>
</tr>
<tr>
<td></td>
<td>Lear 30 and 60 Series</td>
</tr>
</tbody>
</table>

| Source: | BWR Aircraft Performance Files; FAA Advisory Circular 150/5300-13, Change #6, Airport Design. |

**Small Aircraft Activity:** Small aircraft will assume the majority of based aircraft and operations. However, it is anticipated that a large percentage of the based single-engine aircraft, and annual operations, will increasingly be comprised of more high performance/complex aircraft, including a slight to moderate proliferation of single-engine experimental and single and twin-piston personal business aircraft. Operations by ARC B-I and B-II aircraft, which are typically used for personal business travel command greater (more frequent) utilization. These aircraft are expected to increase beyond current activity levels as a percentage of total activity as operators might upgrade from their existing single-engine aircraft. The ARC B-I category generally includes unpressurized twin-piston engine aircraft used for regional business travel, while the ARC B-II category includes small and large cabin class aircraft used for regional “corporate” travel with up to 10 passenger seats (weigh in excess of 12,500 pounds).
Large Aircraft Activity: The forecast outlook of large aircraft use at Bowers Field is not expected to increase significantly as a percentage of the total annual operations. Some frequency of large aircraft at Bowers Field (turbo-propeller and turbine jet) is a reasonable expectation, including some ARC Category C aircraft. Advanced turbine cabin-class business aircraft have moderately comparable seating capacity to turbo-propeller aircraft, but significantly improved performance capabilities in comparison. It is recognized the small to medium-cabin business jet demands a greater regional/national marketing capability, and service area exposure through quicker and more convenient point-to-point travel. However, this category of general aviation aircraft has not been based at Bowers Field in the past, and is not readily identified as an immediate future prospect. With technological innovations currently being made to airframes and powerplants, it is possible future single-engine aircraft would incorporate the high-end components which would demand similar runway facilities than existing business and corporate aircraft, including use in commercial-related capacities.

Rotorcraft: Given its strategic location in the Columbia Valley and the geographical location in the Washington, future expansion of the Washington State DNR is reasonable expectation, including additional based helicopters, and possible fixed-wing aircraft. The type of aircraft associated with the Washington State DNR would typically be small to medium-cabin turbine aircraft.
ULTIMATE CRITICAL AIRCRAFT/FAMILY OF AIRCRAFT

Table 3.8 provides information about the ultimate critical aircraft for Bowers Field. The critical aircraft is the largest airplane within a composite family or category of aircraft conducting at least 500 annual itinerant operations (combination of 250 takeoffs and landings) per year at the Bowers Field Airport. The future critical aircraft is evaluated with respect to size, speed and weight, and is important for determining airport design, structural, and equipment needs for the airfield and terminal area facilities.

The future critical aircraft for Bowers Field, identified by application of the forecast of fleet mix (executive travel, fuel, personal-use) and itinerant activity, is a small to medium-sized cabin business jet aircraft in the ARC B-II/B-II+10 family of aircraft. This category of aircraft was selected based on current airport usage, and forecast assumptions for activity by large aircraft. A common business jet representative of the ARC B-II/B-II+10 fleet is a Cessna Citation Ultra (560), a new generation eight to eleven passenger pressurized cabin plane commonly used for executive travel and limited cargo-transport.

<table>
<thead>
<tr>
<th>Aircraft Type &amp; (ARC)</th>
<th>Wing Span</th>
<th>Aircraft Length</th>
<th>Aircraft Height</th>
<th>Seating</th>
<th>Max. Gross Takeoff Weight</th>
<th>Ground Roll Distance</th>
<th>Approach Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cessna/ Textron Citation Ultra (ARC B-II / B-II+10)</td>
<td>52.2'</td>
<td>48.1'</td>
<td>15.0'</td>
<td>8-11</td>
<td>16,300 lbs.</td>
<td>3,180 ft.</td>
<td>106 KIAS</td>
</tr>
</tbody>
</table>

Note 1: Takeoff weight indicates maximum takeoff and ramp weight, respectively.
Note 2: Takeoff distance computed for Bowers Field using pressure altitude, and the following operating Conditions: 59°F & 89.6°F - no wind - normal aircraft operating takeoff conditions (no flaps, no runway grade).

FORECAST SUMMARY

Table 3.9 summarizes various forecast elements. The forecasts, combined with the inventory data, will be used to identify and develop the facility requirements for Bowers Field. The next chapter, Facility Requirements, identifies the types and extent of facilities required to adequately accommodate the demand levels identified in this chapter.

<table>
<thead>
<tr>
<th>Table 3.9 Aviation Forecast Summary</th>
<th>Bowers Field Airport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Existing (2000)</td>
</tr>
<tr>
<td>Total Based Aircraft</td>
<td></td>
</tr>
<tr>
<td>Single-Engine Aircraft (A-I &amp; B-I)</td>
<td>45</td>
</tr>
<tr>
<td>Piston Multi-Engine Aircraft (B-I)</td>
<td>3</td>
</tr>
<tr>
<td>Turbine Multi-Engine Aircraft (B-II)</td>
<td>1</td>
</tr>
<tr>
<td>Business Jet Aircraft (B-II to C-I)</td>
<td>0</td>
</tr>
<tr>
<td>Helicopters/Rotorcraft</td>
<td>2</td>
</tr>
<tr>
<td>Total Based Aircraft</td>
<td>49</td>
</tr>
<tr>
<td>Total Annual Aircraft Operations</td>
<td></td>
</tr>
<tr>
<td>Local Operations</td>
<td>30,250</td>
</tr>
<tr>
<td>Other Itinerant Operations</td>
<td>22,850</td>
</tr>
<tr>
<td>Air Taxi Operations</td>
<td>1,800</td>
</tr>
<tr>
<td>Military Operations</td>
<td>100</td>
</tr>
<tr>
<td>Total Annual Operations</td>
<td>55,000</td>
</tr>
<tr>
<td>Annual Instrument Approaches</td>
<td>429</td>
</tr>
</tbody>
</table>

Note: Annual instrument operations are counted as part of total annual operations; instrument operations include local and itinerant operations, but not military operations. The AIAs include only a projection of actual instrument approaches during IMC.

AIRPORT ANNUAL SERVICE VOLUME (ASV)/ CAPACITY ANALYSIS

The annual service volume (ASV) is one measure of estimated airport capacity and delay. The ASV, as defined in FAA Advisory Circular 150/5060-5, Airport Capacity and Delay, is a reasonable estimate of an airport’s annual operational capacity. The ratio between demand and capacity is one factor used to establish a strategic time-frame for airfield capacity improvements. The ASV is calculated from the following airfield factors and assumptions:

- Runway and taxiway geometry
- Percent of runway use (VFR/IFR/T&G)
- Existing and future aircraft mix categories
- Weather conditions/airport closed
- Runway lighting
- Empirical factors/weighting scale

The ASV for Bowers Field Airport, applying current airfield/taxiway layout, is about 198,700 annual operations. The specific calculations used to estimate the ASV can be referenced in the appendix. The demand/capacity is the ratio between the total annual operations divided by the ASV, which is expressed as percent. Given the ASV, and existing and forecast operational levels, the demand/capacity ratio for the Bowers Field Airport is as follows:

Existing Capacity => 55,000 Annual Operations * 100 = 23% (demand/capacity ratio)  
246,600 ASV

Ultimate Capacity => 75,200 Annual Operations * 100 = 30% (demand/capacity ratio)  
246,600 ASV

As described in FAA Order 5090.3B, Field Formation of the National Plan of Integrated Airport Systems (NPIAS), airports are recommended by the FAA to proceed with a planning process to preserve and enhance capacity when 60 percent of the ASV has been reached. This level of activity will not be reached at the Bowers Field Airport within the 20-year planning period. The following are existing and future peak hour activity levels:

- Year 2001: Average peak hour airport operations = 23 operations per hour
- Year 2020: Average peak hour airport operations = 32 operations per hour

The existing demand/capacity indicates the average delay would average 10 to 15 seconds per aircraft, and 20 to 25 seconds per aircraft by the year 2020. Assuming the current airfield layout (runway and taxiway systems), without improvements, the average annual delay for Bowers Field, given the year 2000 and 2020 operational forecast levels, is as follows:

- Year 2001: Average delay of 12.5 seconds x 22,850 annual itinerant operations = 79 hours of delay per year
- Year 2020: Average delay of 22.5 seconds x 31,100 annual operations = 193 hours of delay per year
The analysis of the ASV and demand/capacity has revealed the following findings at the Bowers Field Airport:

- Individually, Runways 11-29 and 7-25 provide enough capacity to accommodate future demand without significant delay, even during average day peak hour periods.

- A partial to full-length parallel taxiway system with entrance taxiways serving Runway 11-29 would increase the runway capacity to nearly 120 operations per hour.

- The current runway and taxiway system is capable of accommodating peak hour operations. The practical peak hourly capacity for Runway 11-29 is 80 operations per hour, and 118 operations for Runway 7-25. The capacity for Runway 7-25 is significantly higher due to the full-length parallel taxiway system.

- Runways 11-29 and 7-25 could currently accommodate the peak hour instrument operational level with significant delay.

- Based on the current runway and taxiway layout, there might be instances when during peak operating periods when departing traffic on Runway 29 is delayed due landing traffic (or touch & go traffic) taxing on Runway 11-29 to the connecting Taxiway “F” (Foxtrot). Similarly, there would be a similar delay for departing traffic on Runway 25 when Runway 11-29 is in use, again, particularly during peak flight training periods – pattern touch & go activity.

- Landing traffic on Runway 29 by large aircraft would typically use more stopping distance than available before the Taxiway “F” turnoff. Large aircraft require wider turning radius, in which the 150-foot runway width might not provide sufficient area, particularly during wet or snowy conditions. This is a capacity and safety issue which can be resolved with taxiway or turnaround improvements.

- No instrument flight rules (IMC/IFR) capacity or delay problems are expected at Bowers Field.