RASP2

Puget Sound Regional Council

PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

PUGET SOUND REGIONAL COUNCIL

REGIONAL AIRPORT SYSTEM PLAN

TECHNICAL ADVISORY COMMITTEE
1998 - 2001

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- 2001 Regional Airport System Plan Refinement Draft, March 20, 2001

Puget Sound Regional Council

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REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Thursday, December 3, 1998
2:00 - 4:00 p.m.

Puget Sound Regional Council
6th Floor Board Room
1011 Western Avenue
Seattle, Washington

9:00 a.m.	1.	Welcome and Introductions - *King Cushman*
9:15 a.m.	2.	Discuss Roles, Expectations, and Project Purpose/Scope - *Steve Kiehl*
9:45 a.m.	3.	Establish Committee Ground Rules -*King Cushman*
10:00 a.m.	4.	Discuss Existing Airport System Inventory - *Steve Kiehl*
10:20 a.m.	5.	Discuss Issues/Trends Affecting the Future of Aviation - *Steve Kiehl*
10:45 a.m.	6.	Future Meeting Schedule – Preferred day of week and time? • Next meeting – April 1999
10:55 a.m.	7.	Other Business
11:00 a.m.	8.	Adjourn

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling (206) 464-7090. TDD/TTY: (206) 464-5409

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Presentation Materials
used at
RASP Advisory Committee Meeting
December 3, 1998

Contents:

- Roles & Expectation
- Work Scope
- Regional Airport System Plan Schedule
- MTP Components
- 1988 RASP
- Total U.S. Public Use Airports
- New Authority
- Regional Airport System
- System Airports
- System Inventory
- Airport Ownership
- System Summary
- Condition of Runway Pavement
- Runway Length by Airport Role
- Top Ten Airports (annual operations)
- Top Ten Airports (based aircraft)
- Aircraft Owners by County
- Aircraft Pilots by County
- Based Aircraft by County
- Based Aircraft per 100,000 Population and Employment
- Regional Based Aircraft by Type
- Total Based Aircraft by County
- Airfield Operations vs. Capacity (Top 10)
- Key Issues

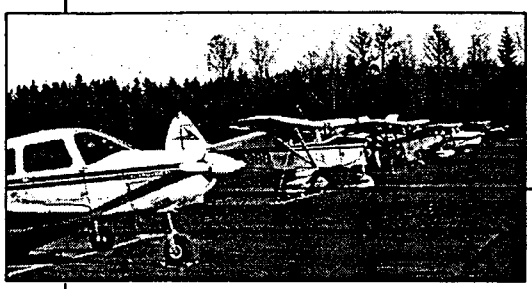
1011 Western Avenue, Suite 500 • Seattle, Washington 98104-1035 • (206) 464-7090 • FAX 587-4825

Puget Sound Regional Council

Regional Airport System Plan

Roles & Expectations

- ☐ **Bring your experience**
- ☐ **Share your concerns**
- ☐ **Provide input and comments**
- ☐ **Accurate information**
- ☐ **Balanced perspective**
- ☐ **Advise staff**



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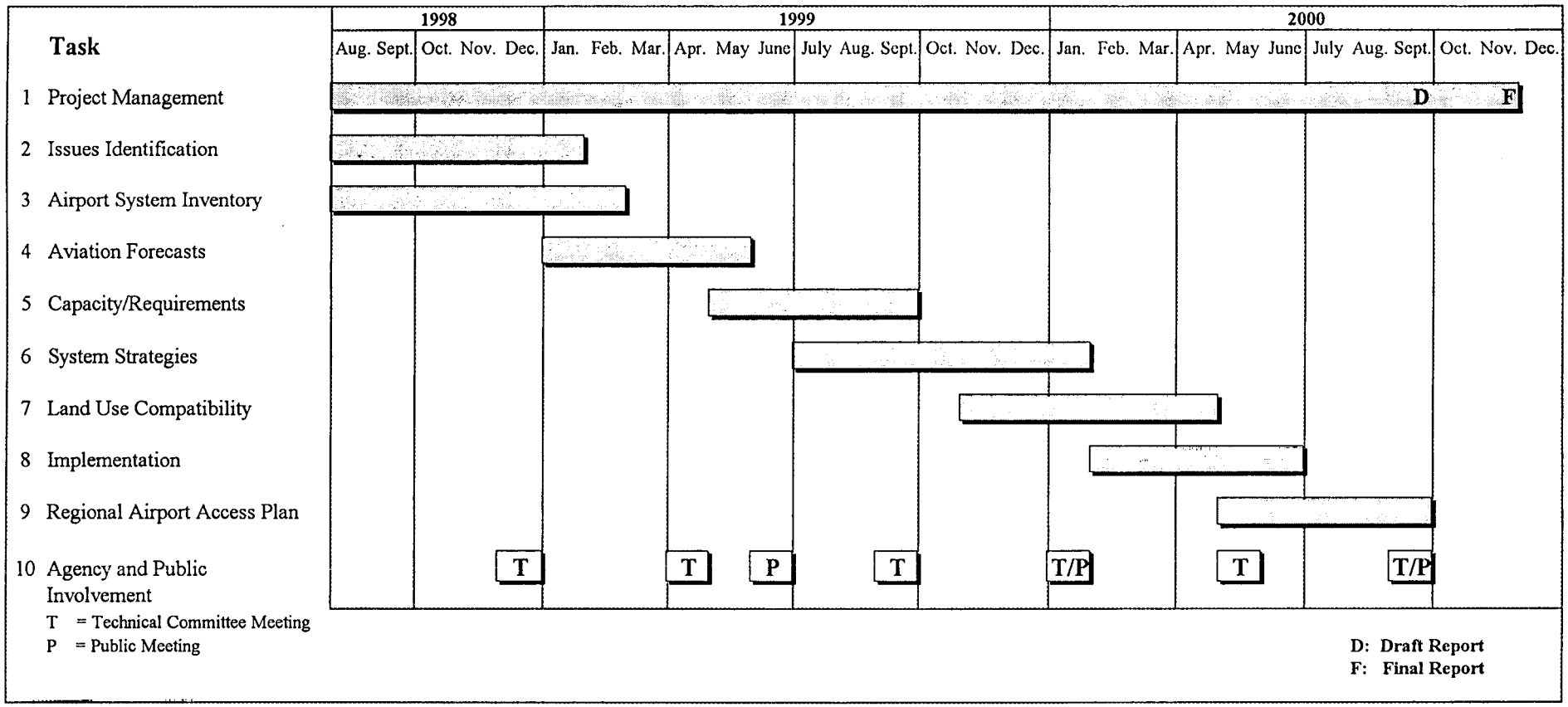
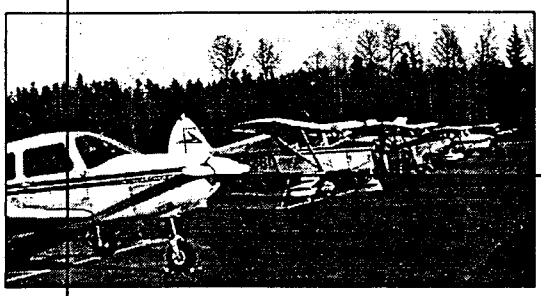
Regional Airport System Plan

Work Scope

- ☐ **Project Administration**
- ☐ **Issues and Trends**
- ☐ **Inventory of Existing Airport System**
- ☐ **Aviation Forecasts**
- ☐ **Capacity Analysis & System Req'ts**
- ☐ **System Alternatives and Strategies**
- ☐ **Land Use Compatibility Planning**
- ☐ **Implementation Plan / CIP**
- ☐ **Intermodal Airport Access Plan**
- ☐ **Agency and Public Involvement**

Regional Airport System Plan Schedule





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Regional Airport System Plan

MTP Components

- **Transit**
- **Ferries**
- **Freight and Goods**
- **Highways**
- **Aviation**
- **TDM/TSM**
- **Financial**

→ **Metropolitan Transportation Plan**

Adoption - May 2001

Puget Sound Regional Council

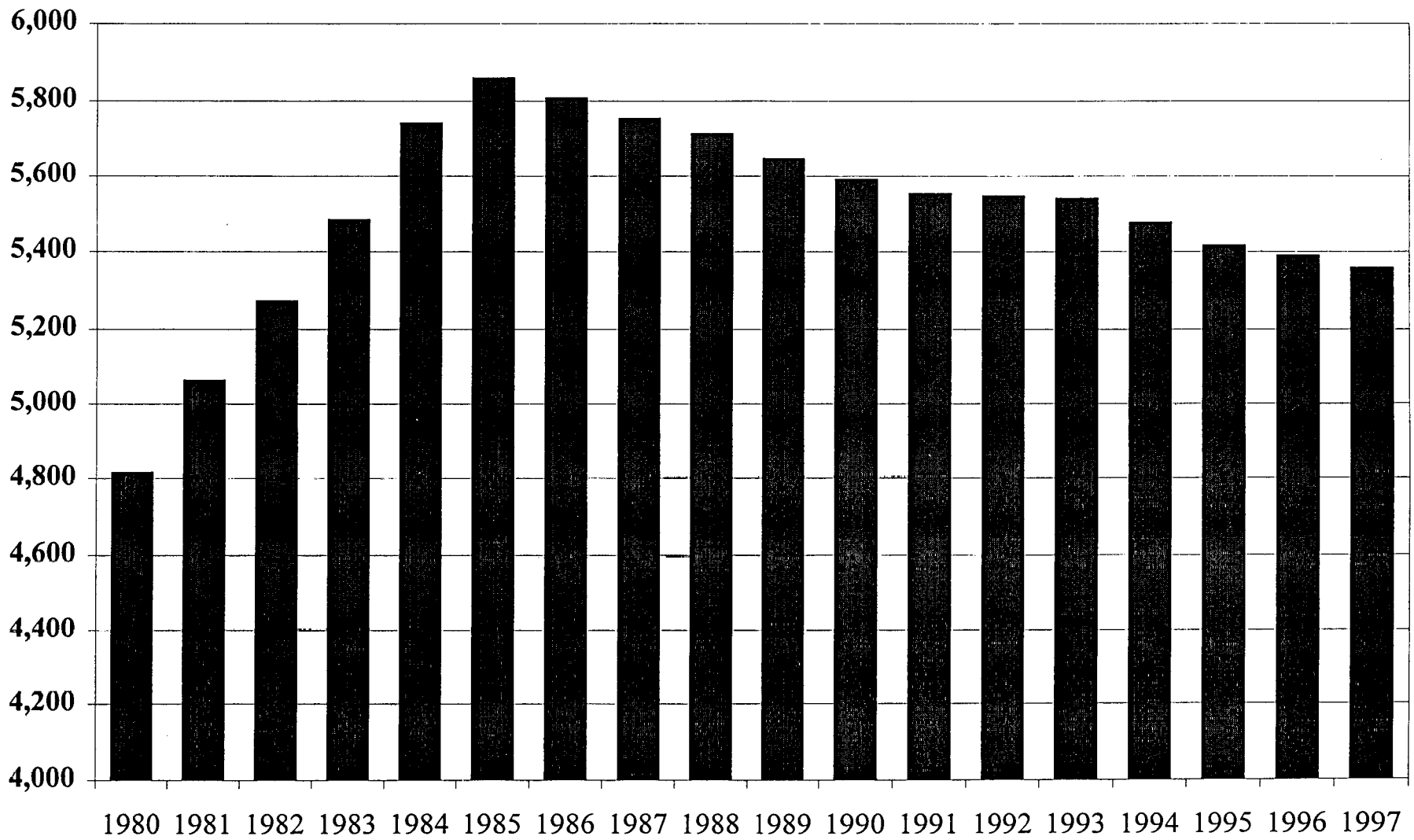
Regional Airport System Plan

1988 RASP

- [ ] **Expand Sea-Tac**
- [ ] **Develop New Air Carrier Airport**
- [ ] **Preserve / Improve GA Airports**
- [ ] **Build New GA Airports (King Co.)**
- [ ] **Tax Incentives for Private Airports**
- [ ] **Compatible Land Use Planning**

Total U.S. Public Use Airports

Source: FAA



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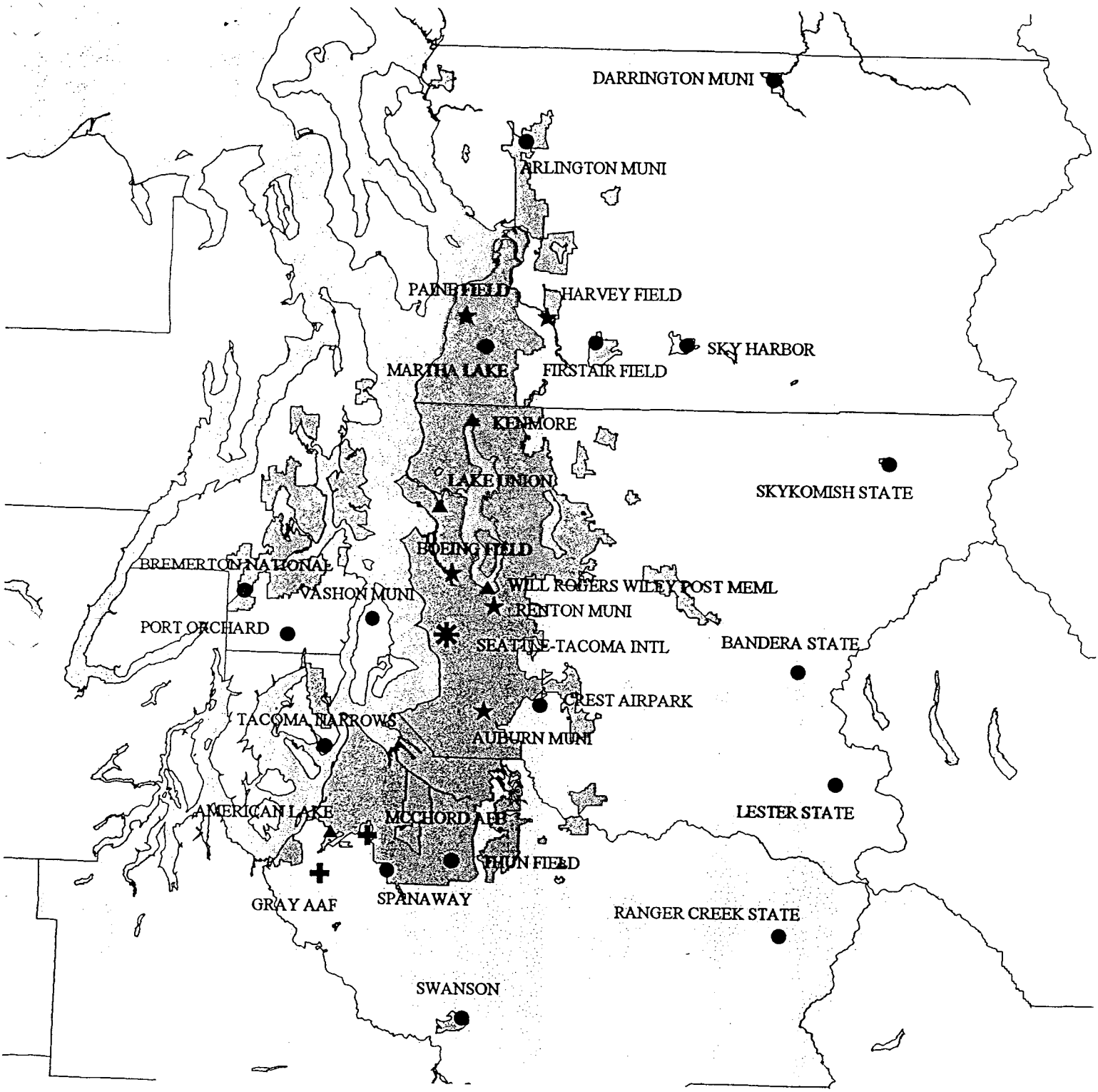
Regional Airport System Plan

New Authority

- ☐ **RTPO Legislation**
  - * **Regional Transportation Plan**
  - * **6-Year TIP**
  - * **TEA-21**
- ☐ **Growth Management**
  - * **Certify Comprehensive Plans**
  - * **Compatible Land Use (SSB-6422)**
  - * **Essential Public Facilities**

Regional Airport System



Airport Service Levels

- Primary Service
- Reliever
- General Aviation
- Military
- Seaplane Base
- Incorporated Cities
- Urban Growth Area

N
W E
S

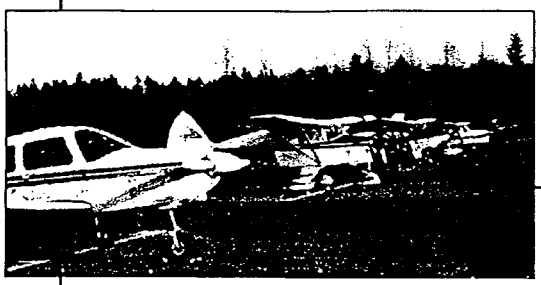
System Airports

27 Public Use Airports

* 1 Primary Service (Sea-Tac)
* 5 Relievers
* 17 General Aviation
* 4 Seaplane Bases

2 Military Airfields

* McChord AFB
* Gray Field (Ft. Lewis)



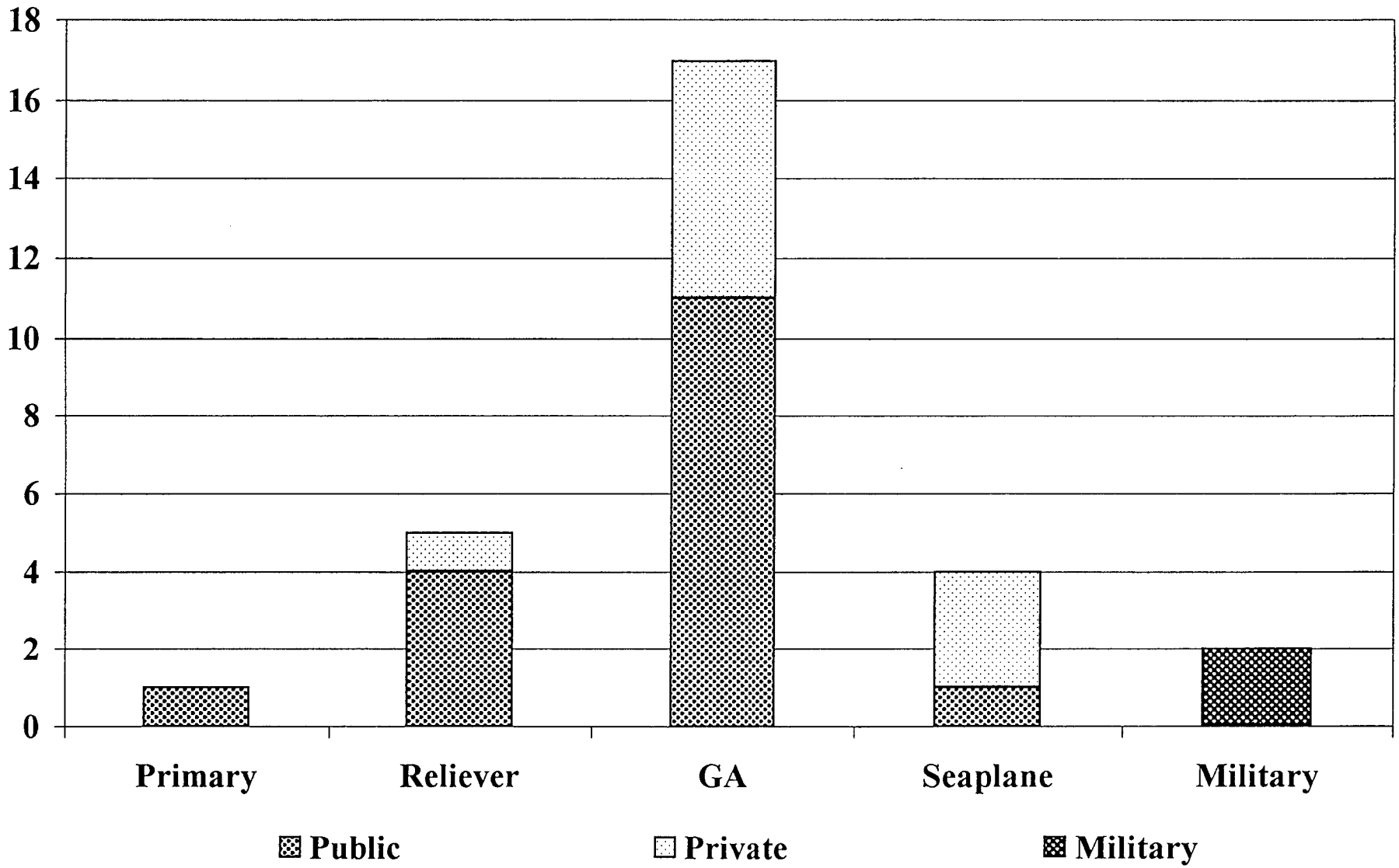
Puget Sound Regional Council

Regional Airport System Plan

System Inventory

- ☐ **Database (System and Airports)**
- ☐ **Airports**
- ☐ **Owners and Pilots**
- ☐ **Based Aircraft / Fleet Mix**
- ☐ **Aircraft Operations**
- ☐ **Airport Facilities**
  - * Airfield (runways, lighting, navaids, etc.)
  - * Aircraft parking (tie-downs and hangars)
  - * Landside / support facilities
  - * Pavements
- ☐ **Airport Access**
- ☐ **Compatible Land Use**

Airport Ownership



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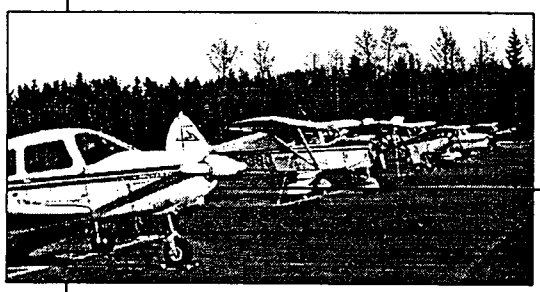


Puget Sound Regional Council

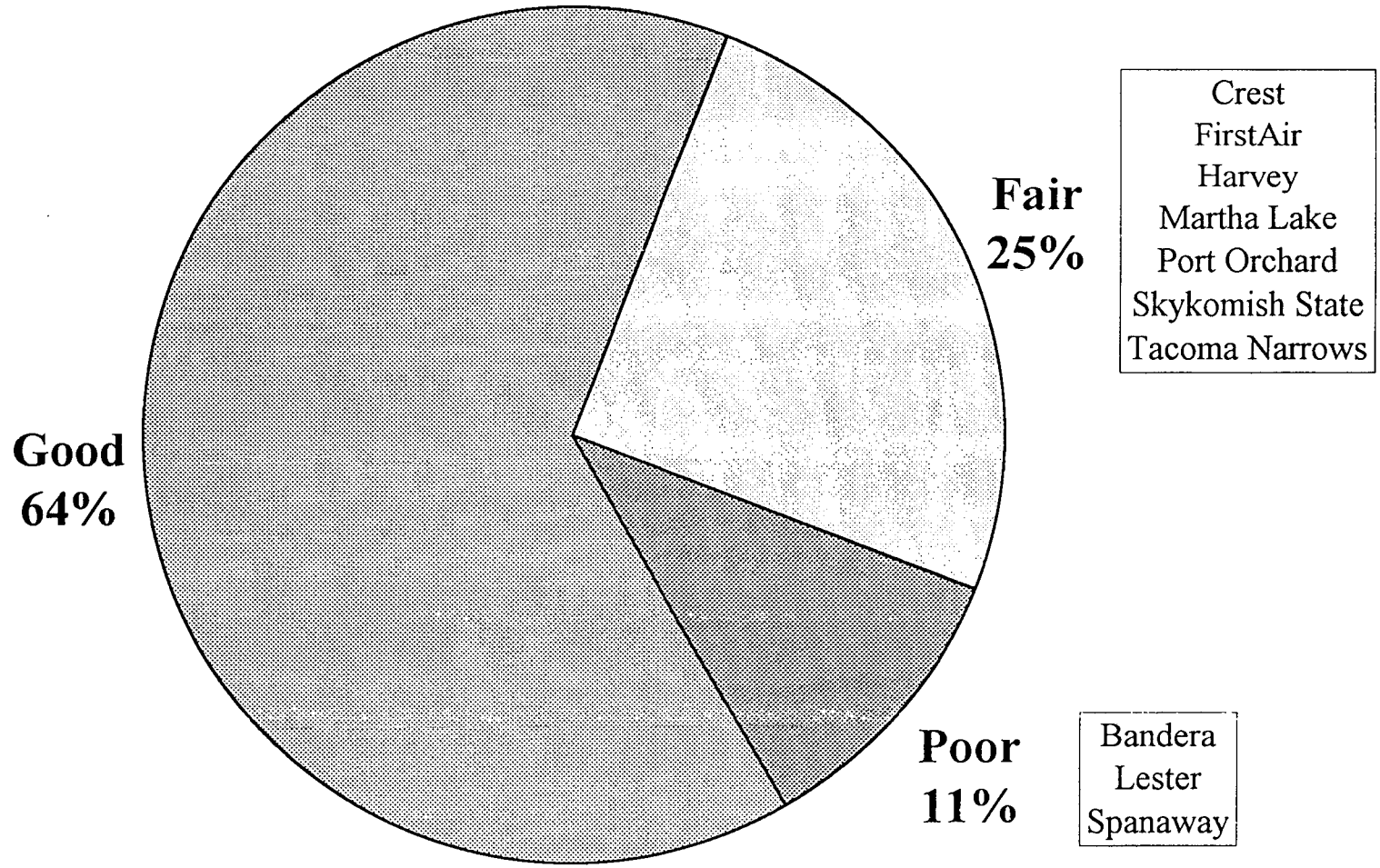
Regional Airport System Plan

System Summary

- **3,578 Based Aircraft**
- **2 Million Annual Operations**
  - * 470,000 Air Carrier / Commuter
  - * 30,000 Air Taxi
  - * 654,000 Local GA
  - * 828,000 Itinerant GA
- **29 Airports / 36 Runways**
  - * 5 Water (4 seaplane bases)
  - * 6 Turf/gravel
  - * 25 Asphalt/concrete
  - * Longest - 11,900' (Sea-Tac)
  - * Shortest - 1,680' (Martha Lake)

Condition of Runway Pavement

(1998 data based on visual inspection)



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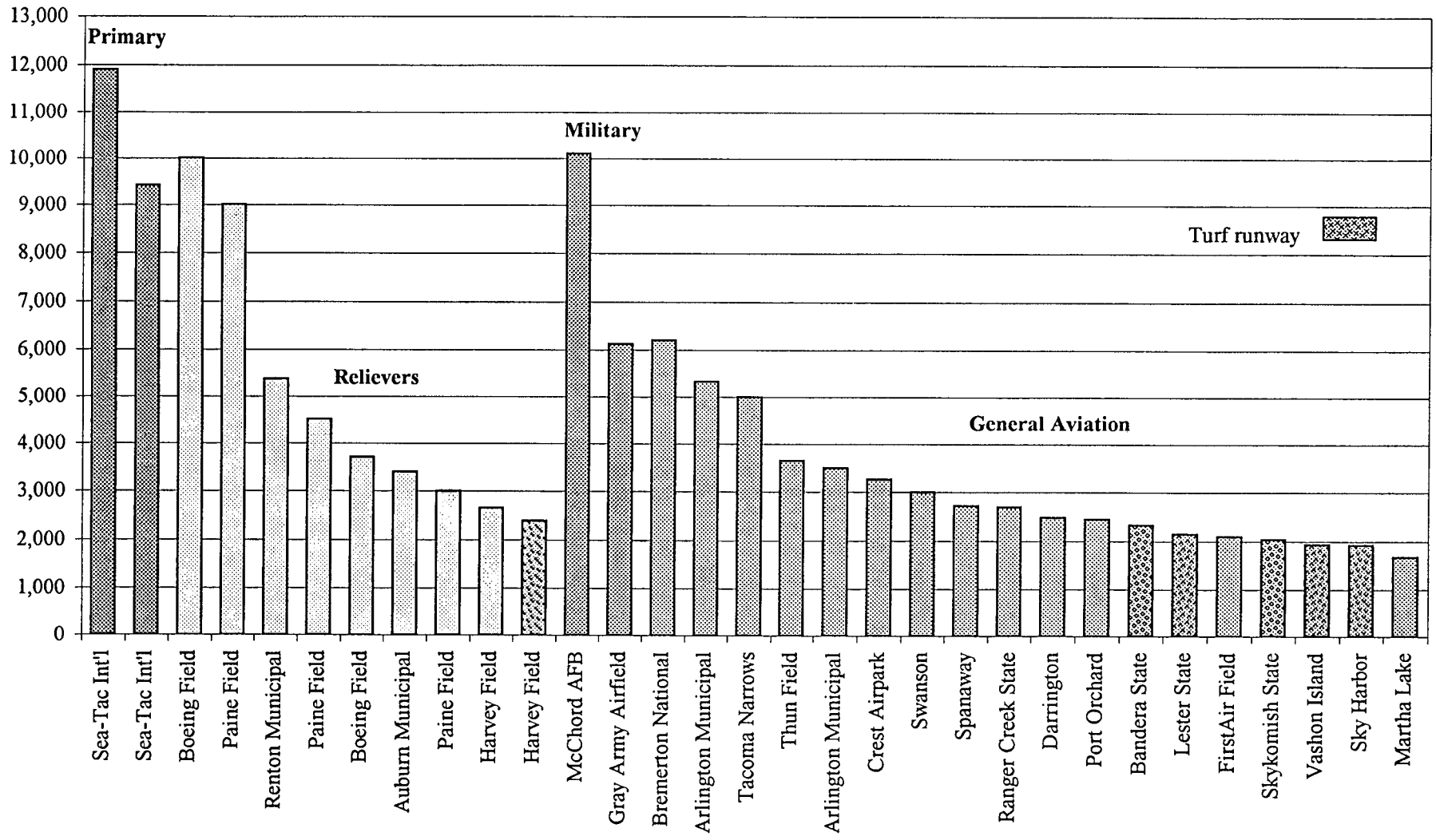
Runway Length by Airport Role



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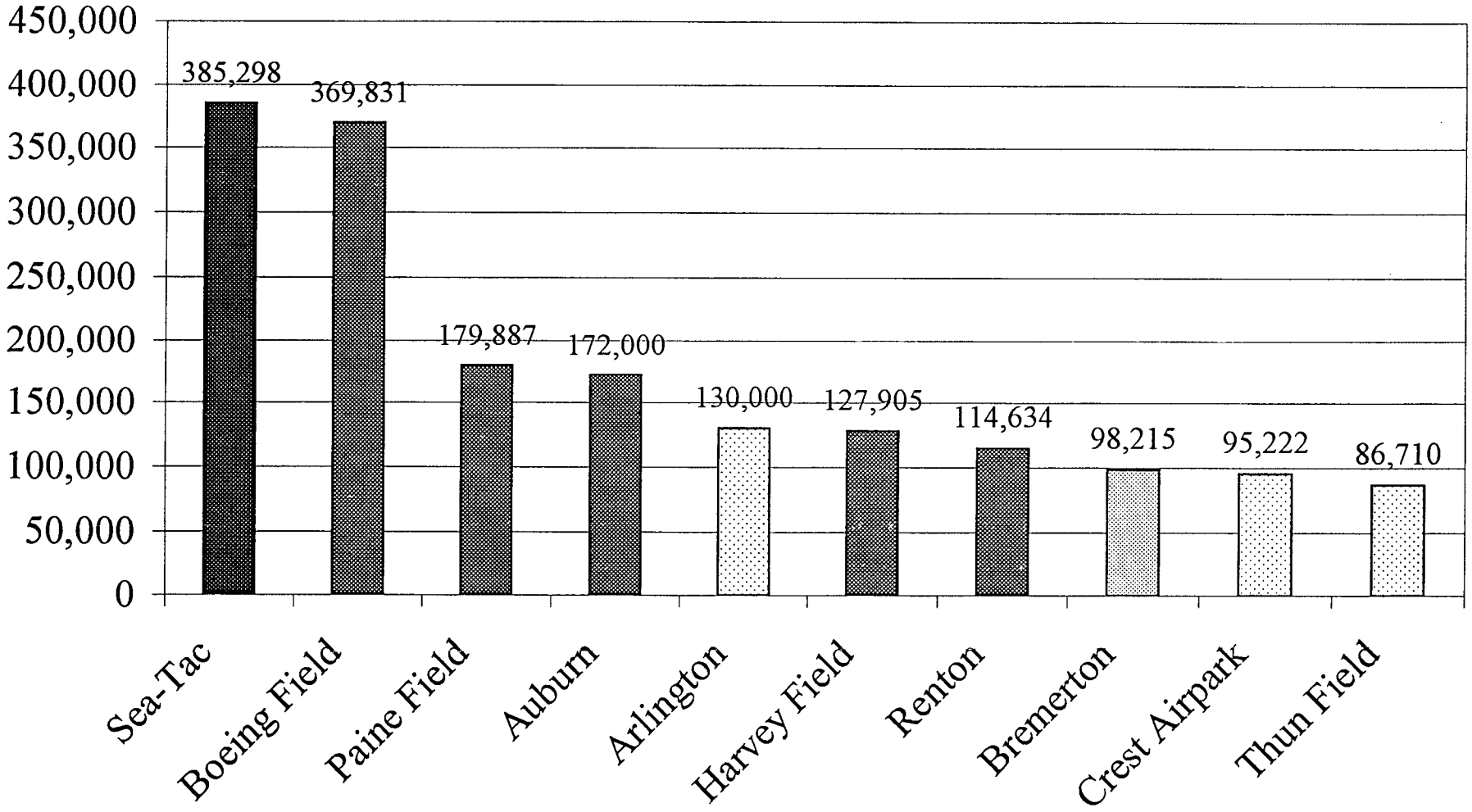
Top Ten Airports (annual operations)

(1995-1997 data / FAA 5010 Forms)



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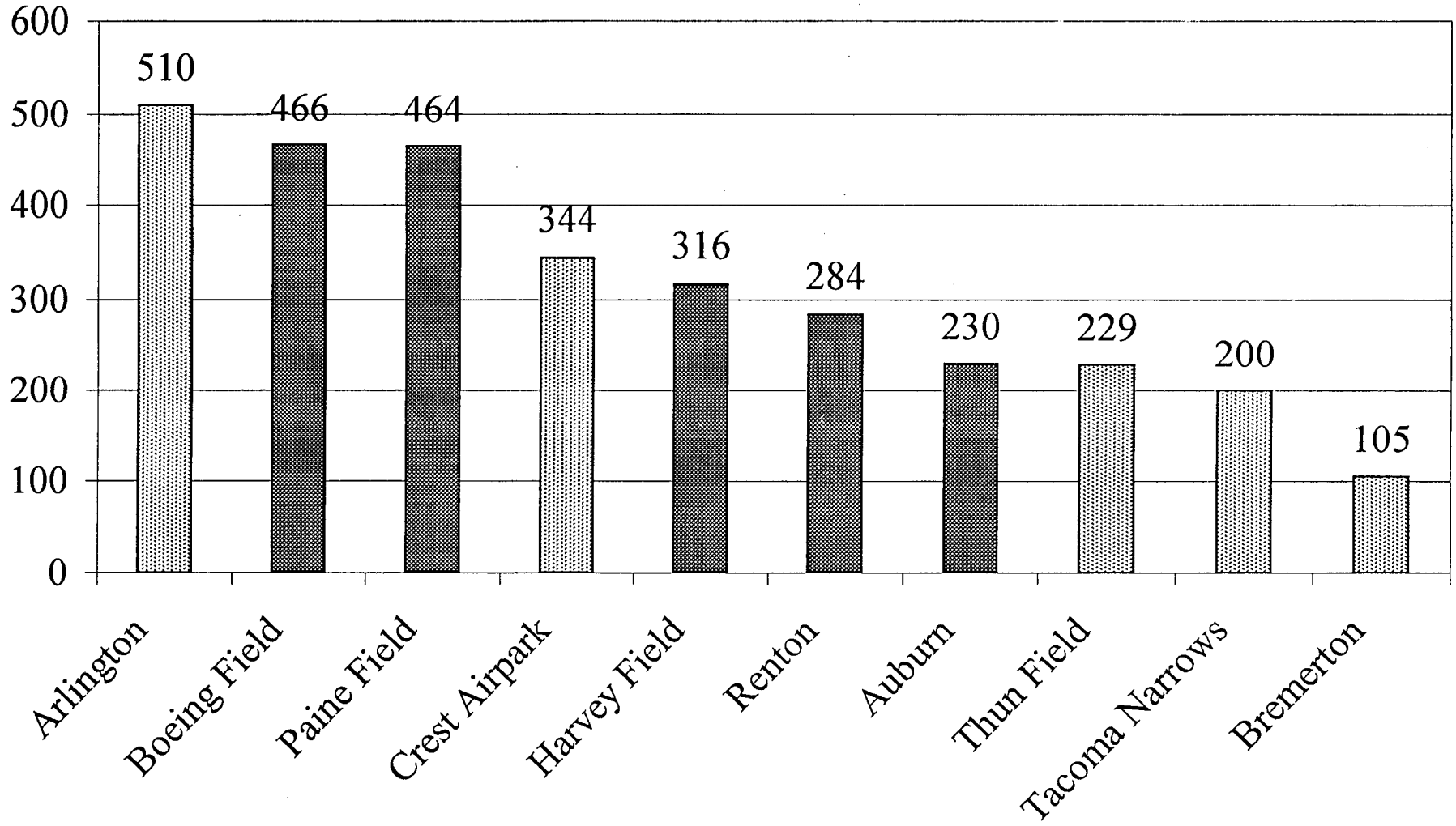
Top Ten Airports (based aircraft)

(1997 data / FAA 5010 Forms)



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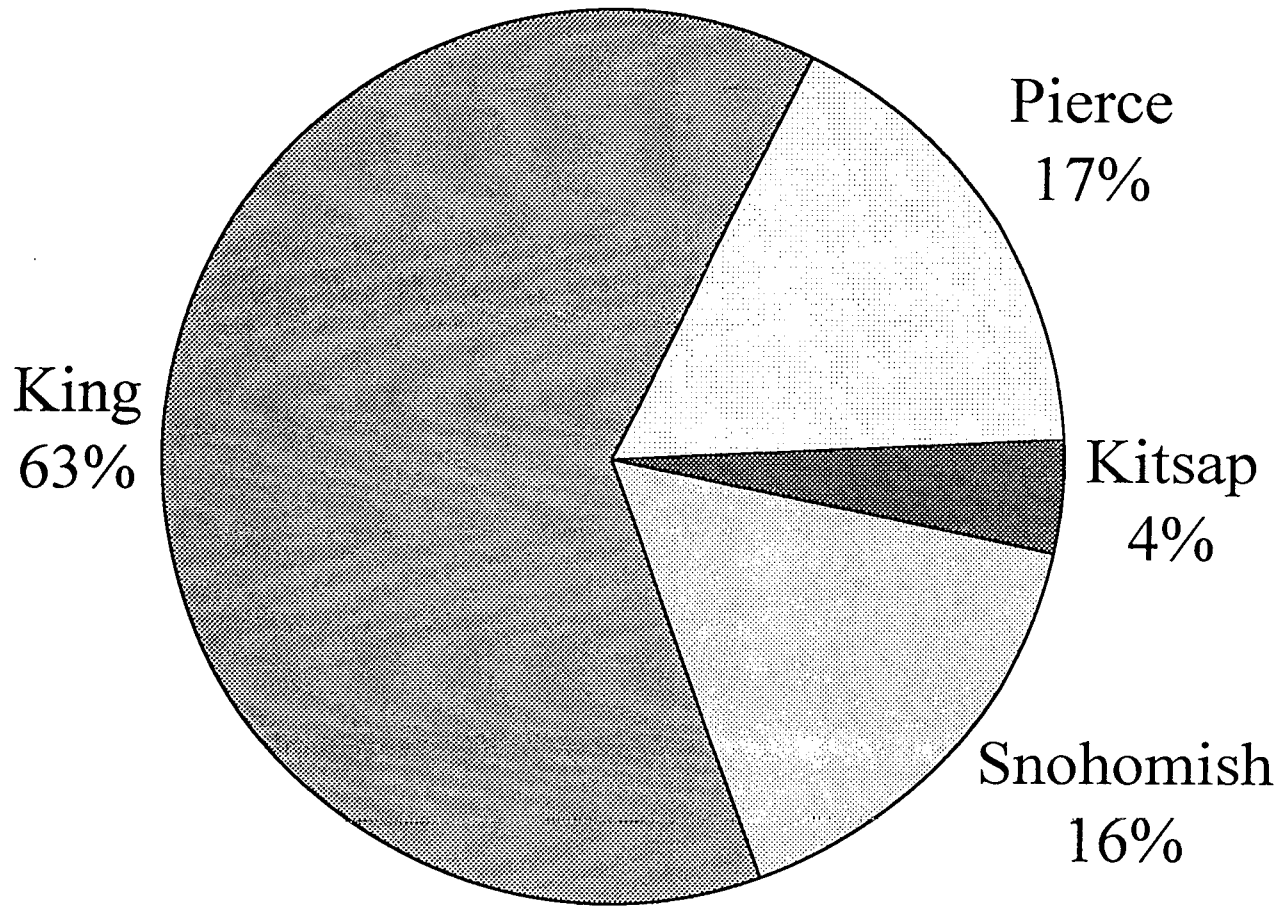
Aircraft Owners by County



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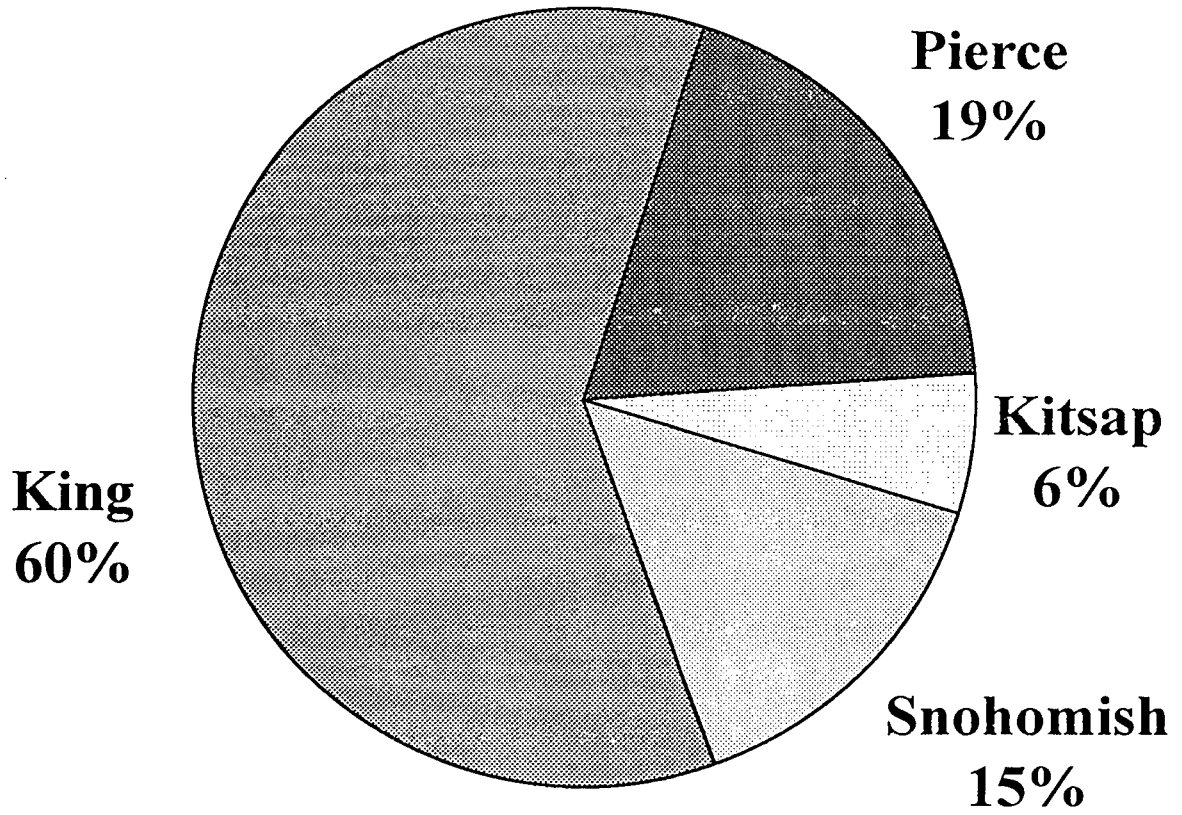
Aircraft Pilots by County



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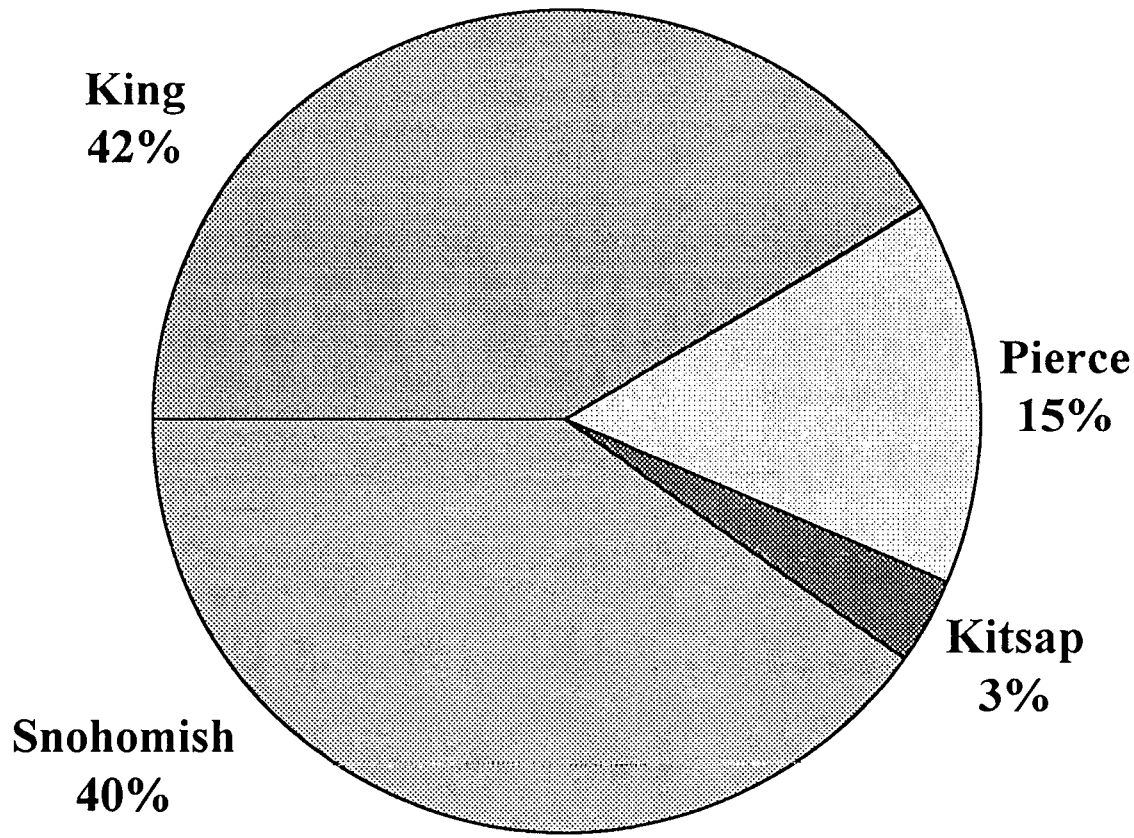
Based Aircraft by County



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Based Aircraft per 100,000 Population and Employment

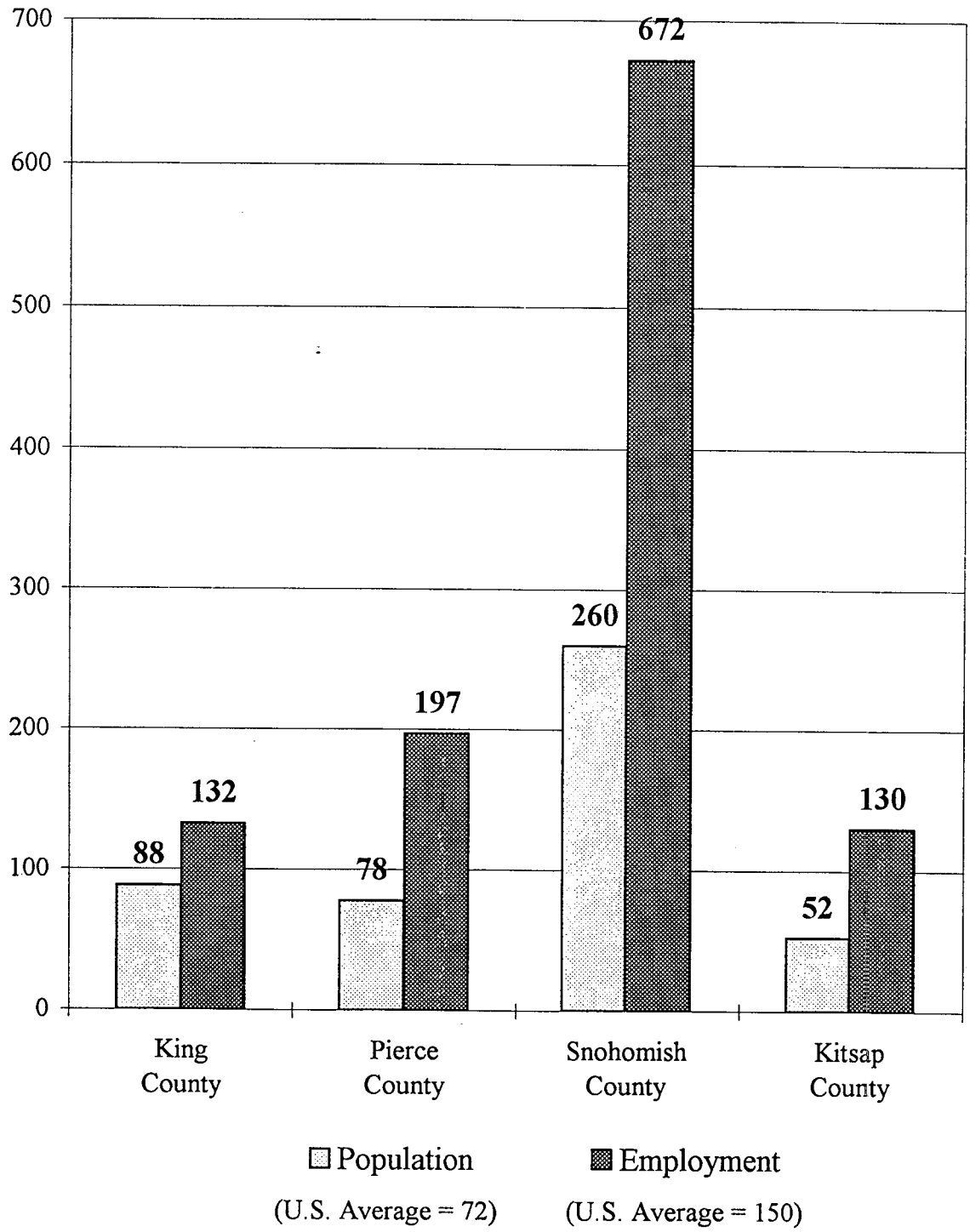
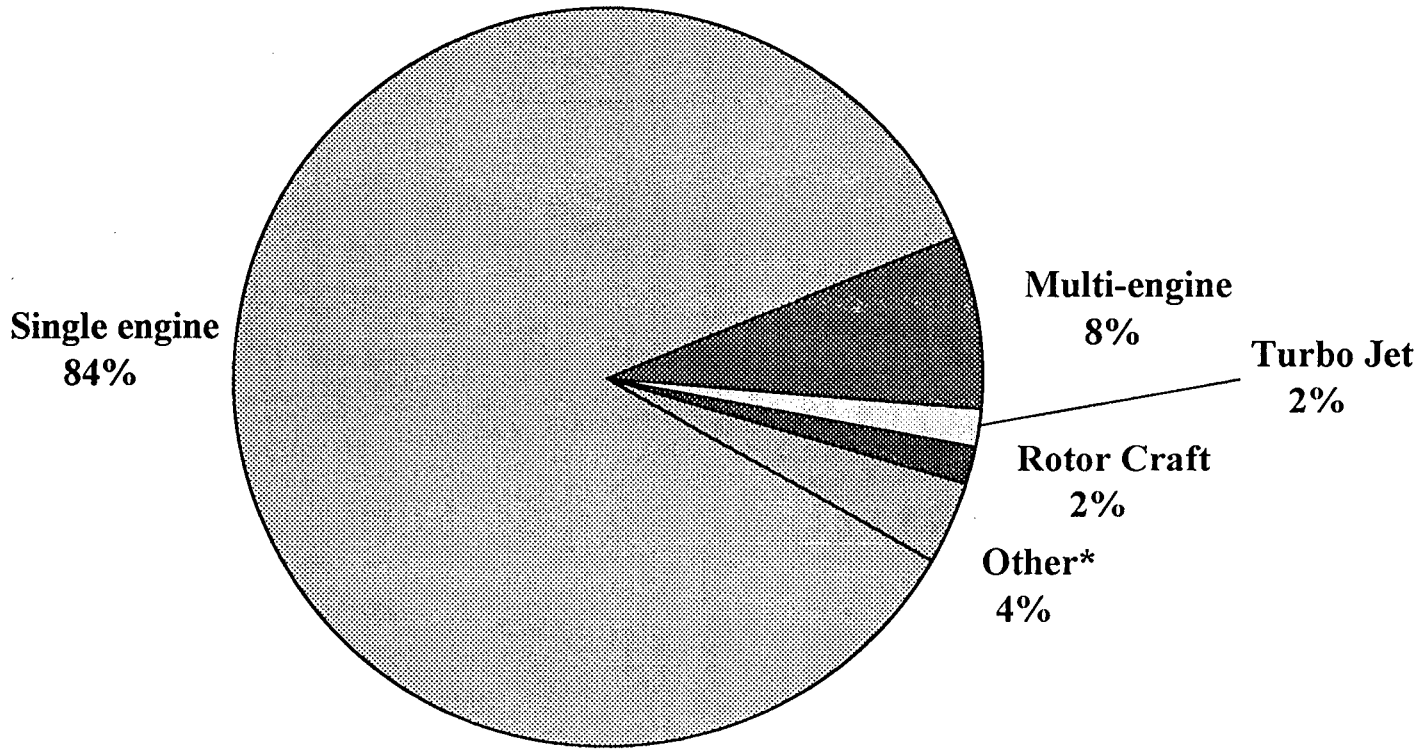
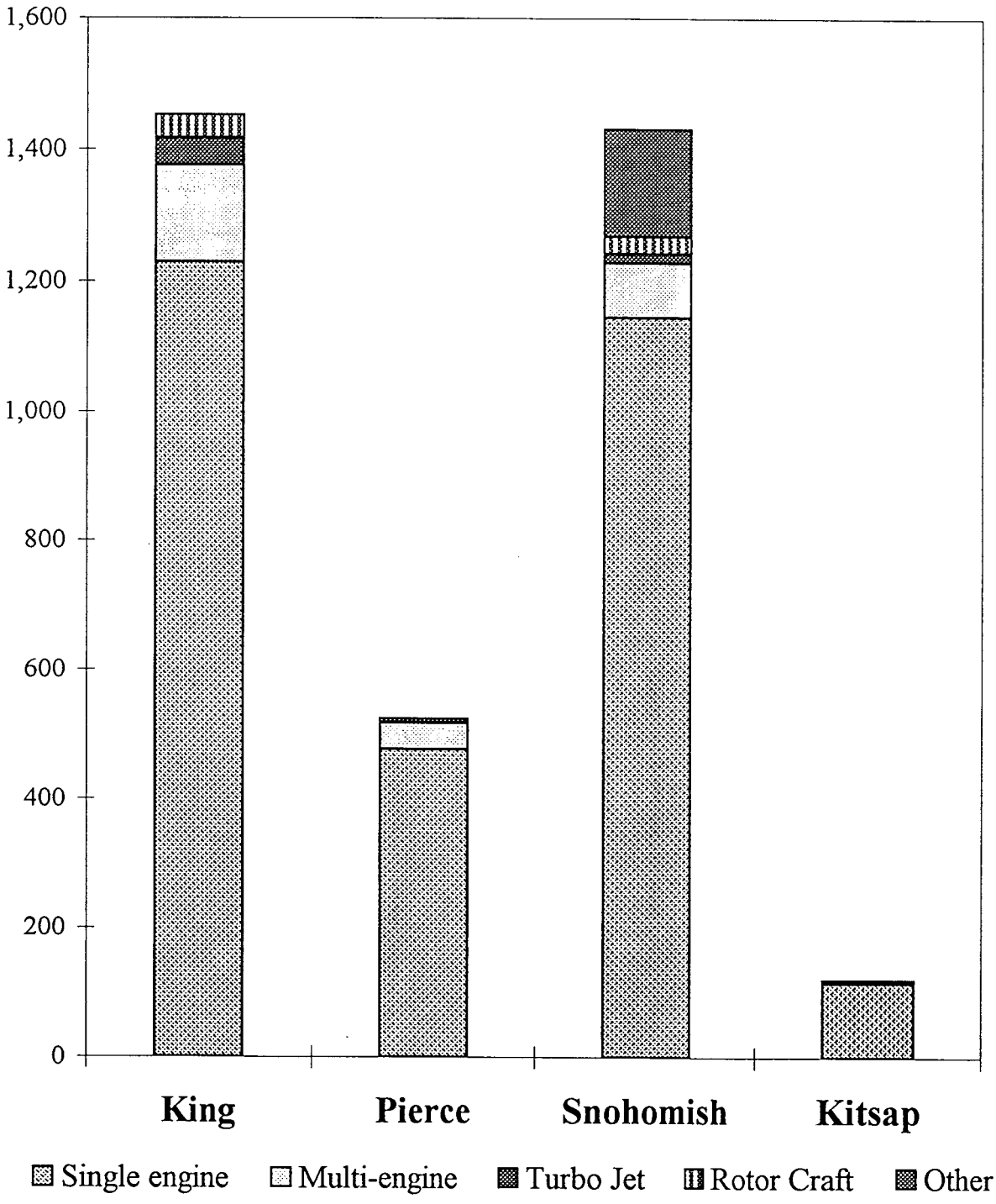


Exhibit 7 Regional Based Aircraft by Type



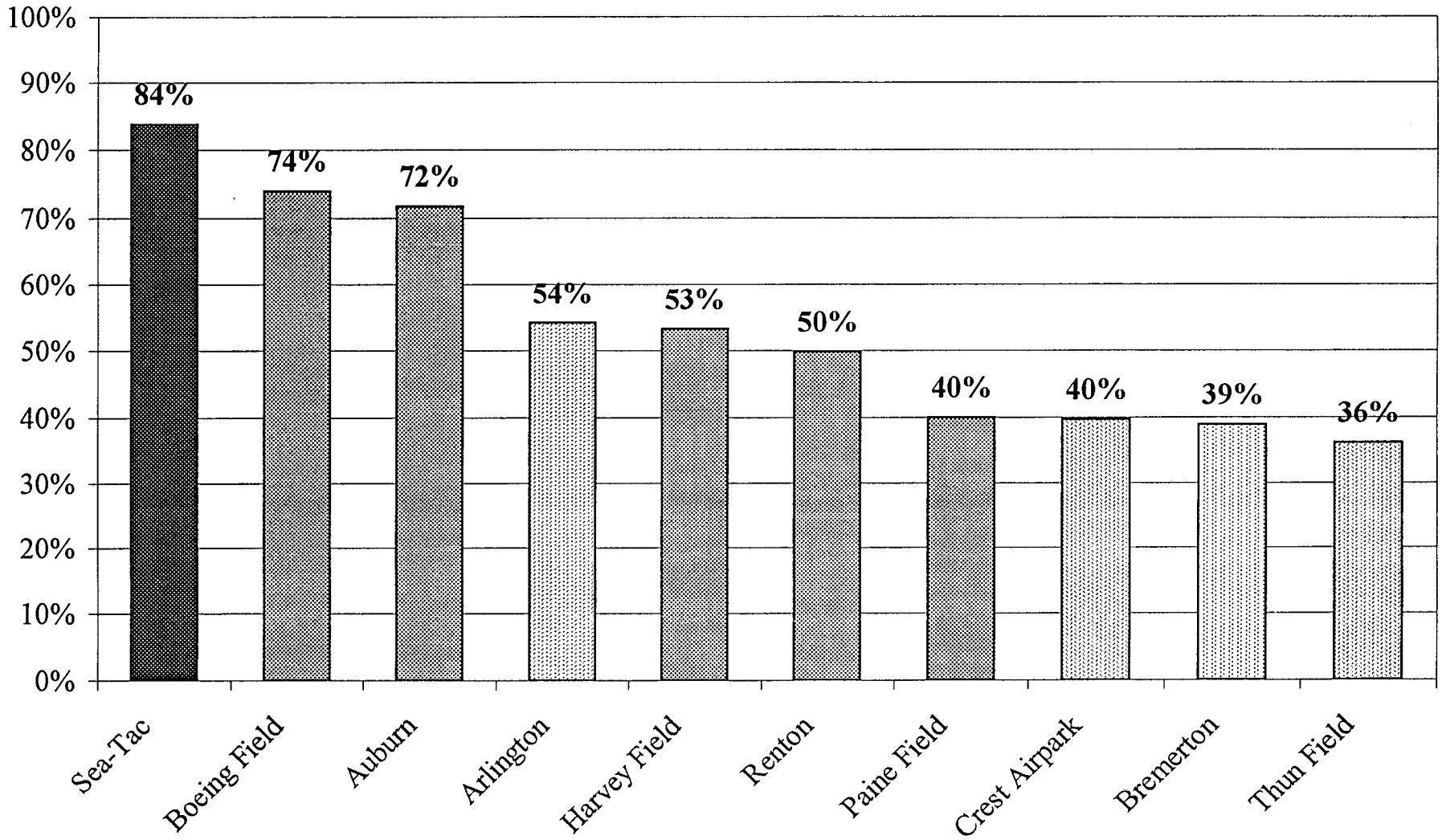
* Includes Ultra-light, Experimental, Glider, and Other Aircraft

Exhibit 8 Total Based Aircraft by County



Airfield Operations vs Capacity (top 10)

(Sea-Tac based on max. theoretical capacity; others based on "Annual Service Volume")



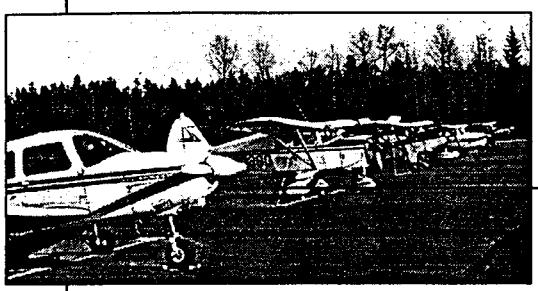
C:\airport\RASP\Raspdata.xls\Airfield D-C Ratio Chart

Puget Sound Regional Council

Regional Airport System Plan

Key Issues

- **Funding**
- **Airport Pavements**
- **Capacity**
- **Airport Roles**
- **Safety / Security**
- **Standards (RPZs, safety areas, etc.)**
- **Air Cargo**
- **Ground Access**



Puget Sound Regional Council

Regional Airport System Plan

Key Issues

☐ Environmental Issues

* Noise
* Air Quality
* Water Quality
* Hazardous Materials / Fuel Storage

☐ Encroachment / Compatible Land Use

☐ Airspace Protection / Obstructions

☐ Land Acquisition

☐ Emergency Response

☐ Economic Development

Puget Sound Regional Council
PSRC

Regional Airport System Plan (RASP)
Technical Advisory Committee

Meeting Notice

Thursday April 1, 1999
1:00 - 4:00 P.M.

Puget Sound Regional Council - 6th Floor Board Room
1011 Western Avenue
Seattle, WA 98104

Our second RASP Advisory Committee meeting is scheduled for Thursday, April 1, 1999. For those of you who attended our first meeting on December 3, 1998, your participation and input was much appreciated. For those who were not able to attend, we hope you'll review the enclosed materials and we'll see you on April 1.

Included with this notice are: 1) minutes of the December 3 meeting; and 2) copies of the viewfoils that staff used in the presentation to provide an overview of the existing airport system inventory and issues and trends affecting future aviation system needs. Based on discussion at the December 3 meeting, several corrections and updates have been made to the information in the viewfoils. Please review these materials, and if you have any questions, comments or additional corrections, please contact Steve Kiehl, PSRC Aviation Planner, at (206) 464-6715, FAX at (206) 587-4825, or e-mail at skiehl@psrc.org. Prior to the April 1 meeting you will receive an agenda package with additional information for review, including preliminary draft technical material covering system plan issues, trends and the airport system inventory. We'll discuss these materials at our meeting before introducing the approach to aviation forecasts.

Your assistance in developing information that is current and accurate is critical in our effort to update the Regional Airport System Plan. As we continue work on the airport system inventory, you may hear from our staff to verify or confirm information we've collected from a variety of sources.

Thanks again for your support and participation in this planning effort.

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Puget Sound Regional Council
PSRC

RASP TECHNICAL ADVISORY COMMITTEE

December 3, 1998
2:00-4:00 p.m.
Puget Sound Regional Council - 6th Floor Boardroom

Members and Alternates in Attendance

King Cushman, Puget Sound Regional Council, Acting Chair
Stan Allison, WSDOT-Aviation Division
John Anderson, Auburn Airport
Tom Ballard, Pierce County/Thun Field
Rikki Birge, Crest Airpark
Jess Browning, University of Washington-GTTL Studies
Steve Butler, City of SeaTac
Dan Cardwell, Pierce County Planning & Land Services
Jim Combs, Washington Pilots Association (Alt.)
Ray Costello, Aircraft Owners & Pilots Association
John Current, Federal Aviation Administration
Rod DeVol, Snohomish County Airport/Paine Field
Cory Duskin, Arlington Municipal Airport
Clare Impett, King County International Airport/Boeing Field
Nancy Jensen, 99s
Steve Lancaster, City of Tukwila
Ralph Lawson, Spanaway Airport
Jack McGoldrick, Washington Pilots Association
Jeff Robb, Port of Bremerton
Julie Rodwell, City of SeaTac (Alt.)
Theresa Smith, WSDOT-Aviation Division

Others in Attendance

Bill Brubaker, WSDOT-Aviation Division
Steve Kiehl, PSRC
Ron Seymour, Port of Seattle--Sea-Tac International Airport

MEETING SUMMARY
December 3, 1998

[This was the kick-off meeting for the Regional Airport System Plan (RASP) Technical Advisory Committee. The committee, comprised of representatives from transportation agencies, land use planning agencies, airports, pilot and user groups, and the academic sector, was established to provide technical input and direction to the Puget Sound Regional Council on updating the RASP, last updated in 1988. The RASP update is to be completed in the year 2000 for incorporation into the updated Metropolitan Transportation Plan (MTP - the region's long-range transportation plan), scheduled for adoption in March 2001.]

Introduction

King Cushman, PSRC Director of Transportation Planning, opened the meeting, followed by self introductions by members of the Committee.

Roles, Expectations and Project Purpose

Steve Kiehl, PSRC project manager for the Regional Airport System Plan (RASP), described roles and expectations for the RASP Technical Advisory Committee. He encouraged members to provide comments and advice throughout the update process, and to let the Regional Council know what is important to their area of representation. Members will be asked to review and comment on draft chapters of the RASP and to ensure that information in the plan is current and correct. It is also hoped that when the update has been completed, members will advocate the plan.

Steve also discussed the purpose and scope of the RASP update project. The RASP will not specify how airports should spend their money, nor will it replace existing master plans or advocate new policies at any particular airport. The plan will not revisit the issues related to Sea-Tac. Lastly, the RASP will not address heliport facilities.

The RASP update will:

- Document issues and trends related to airport system infrastructure
- Develop new general aviation system forecasts
- Identify system needs and priorities
- Evaluate airport roles
- Develop a regional airport capital improvement program (CIP)
- Establish a regional airport pavement program
- Identify airport access needs
- Identify land use compatibility issues and potential actions

The RASP update is anticipated to be completed late in the year 2000 and will become one of the components of the Metropolitan Transportation Plan (MTP) Update, which is scheduled for adoption in March 2001.

Steve provided background information about previous RASP updates, and described what is new and different this time. New considerations include the state Growth Management Act; new authority and responsibilities for the Regional Council under state Regional Transportation Planning Organization (RTPO) legislation; the new State Aviation Policy; the Washington State Department of Transportation (WSDOT) land use encroachment program; and the new federal Transportation Equity Act for the 21st Century (TEA-21) program..

Committee Ground Rules

King reminded members that the RASP Committee was established to advise the Regional Council in developing a coordinated aviation plan element of the Metropolitan Transportation Plan (MTP). It is estimated that the Committee will meet about six times over the next 24 months to accomplish the following.

- Take an in-depth look at issues and focus on the airport system inventory that the Regional Council is undertaking in cooperation with the state.
- Identify forecast needs and capacity deficiencies and develop potential strategies to address them.
- Recommend implementation ideas and strategies.

King asked for a volunteer to chair the Committee, and agreed to serve as Acting Chair to facilitate the meetings until a Chair is found.

Existing Airport System Inventory

Steve briefed the Committee on the existing airport system inventory, noting that state, local and Federal Aviation Administration data sources were used. He reviewed the wide range of information that is being looked at in order to understand what is going on at the system level, including data about the following:

- Airports / airport roles
- Distribution of airports by county
- Airport ownership - public vs. private
- Regional summary of aircraft and runways
- Runway pavement condition
- Runway length by airport role
- Top 10 airports (operations and based aircraft)
- Number of aircraft owners by county
- Number of registered pilots
- Based aircraft by county
- Based aircraft per 100,000 population and employment

- Regional based aircraft by type
- Aircraft operations and capacity
- Airport facilities
- Compatible land use

Copies of the viewfoils that Steve used in his presentation will be mailed to members of the Committee. Several members noted corrections to some of the existing data and said they would like to have more current data where possible. Staff will update the data to reflect the most current and correct information for distribution to members prior to the next meeting. Several members also pointed out the importance of looking at both runway capacity and landside capacity at general aviation airports as regional issues.

Issues and Trends Affecting the Future of Aviation

A handout was provided which summarized the following 13 key issues affecting the future of aviation, and Steve reviewed the reasons why these issues are important.

- Funding
- Airport pavements
- Capacity
- Airport roles
- Safety and security
- Standards
- Ground access
- Environmental
- Encroachment / compatible land use / protecting private airports
- Airspace protection / obstructions
- Land acquisition
- Emergency response
- Economic development

As these issues are explored, it will be important to balance the needs of airports with the wants and needs of the adjoining communities, and to balance the related economic, social and environmental issues.

Theresa Smith, WSDOT Aviation Division, provided information about the new State Aviation Policy (copy included in agenda packets) which was recently adopted by the Washington State Transportation Commission. Four areas of state interest were identified: preservation (including land use compatibility), safety, capacity and environmental protection.

Committee members raised the following issues for consideration during the RASP update:

- Growth in air cargo and the need for additional data
- Air carrier capacity
- Economic development

- Land use compatibility and preserving airports against encroachment (importance of implementing the provisions of SB 6422)
- Ground access and a road network to support freight mobility
- Air traffic control
- Heliports
- Need to clarify the difference between air carrier and general aviation flights at airports such as Boeing Field
- Need to clarify airport operations data source (actual counts at towered airports, some acoustical counts, some estimates)

Julie Rodwell, City of SeaTac, encouraged members not to forget to consider the impacts on the communities surrounding Sea-Tac Airport.

Future Meeting Schedule

Members agreed that meetings should be lengthened to three hours, from 1:00-4:00 p.m.. It was agreed that the meetings will be held approximately once each quarter, on Thursday afternoons. The next meeting of the RASP Technical Advisory Committee was tentatively scheduled for Thursday, April 1, 1999, 1:00-4:00 p.m.

Other Business

Bill Brubaker suggested that the RASP Committee be expanded to include representatives of seaplane and vertical (heliport oriented) aircraft organizations.

King reminded the Committee out that this RASP update isn't a "one time" event, as it is required to be revisited every two to three years because of the constant flux in urban development, population and economic activity.

Puget Sound Regional Council
PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Thursday, April 1, 1999
1:00 - 4:00 p.m.

Puget Sound Regional Council
6th Floor Board Room
1011 Western Avenue
Seattle, Washington

1:00 p.m.	1.	Welcome and Introductions - *King Cushman*
1:10 p.m.	2.	Overview of Report Format for Updated Regional Airport System Plan (RASP) - *King Cushman and Steve Kiehl*
1:25 p.m.	3.	Comments on Draft RASP Work-In-Progress - *Committee* • Chapter 2: Goals, Issues and Trends • Chapter 3: Airport System Planning Background • Chapter 4: System Inventory • Appendix A: Glossary of Terms
2:00 p.m.	4.	Background and Approach to Forecast Data - *Steve Kiehl*
2:30 p.m.	5.	Discussion of Aviation Forecast Issues and Methodology- *Committee*
3:55 p.m.	6.	Other Business
4:00 p.m.	7.	Next Meeting: Thursday, September 2, 1999, 1:00-4:00 p.m. • Finalize forecasts and needs • Review/discuss capacity requirements Adjourn

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling (206) 464-7090. TDD/TTY: (206) 464-5409

Puget Sound Regional Council

PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Thursday, September 30, 1999
1:00 - 4:00 p.m.

Puget Sound Regional Council
***5th Floor* Board Room**
1011 Western Avenue
Seattle, Washington

NOTE NEW LOCATION:
5TH FLOOR

1:00 p.m.	Review Agenda and Introduce Co-Chair David Waggoner - *King Cushman*
1:10 p.m.	Summary of *FAA's 11th International Workshop on Future Aviation Activities* - *Steve Kiehl*
1:25 p.m.	Presentation and Discussion of Draft Chapter 5: Aviation Forecasts* - *Steve Kiehl*
2:30 p.m.	Discussion of Approach to Capacity Analysis - *Steve Kiehl / Committee*
3:15 p.m.	Discussion of System Requirements and Strategies - *Committee*
3:55 p.m.	Other Business
4:00 p.m.	Next Meeting: Thursday, January 27, 2000, 1:00-4:00 p.m. • System Requirements and Strategies Adjourn

*Supporting material enclosed

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling Grace Foster at (206) 464-7090. TDD/TTY: (206) 464-5409

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Puget Sound Regional Council
PSRC

RASP TECHNICAL ADVISORY COMMITTEE

April 1, 1999
1:00-4:00 p.m.
Puget Sound Regional Council - 6th Floor Boardroom

Members and Alternates in Attendance

King Cushman, Puget Sound Regional Council, Acting Chair
Stan Allison, WSDOT-Aviation Division
John Anderson, Auburn Airport
Tom Ballard, Pierce County/Thun Field
Rikki Birge, Crest Airpark
Jess Browning, University of Washington-GTTL Studies
Jim Combs, Washington Pilots Association (Alt.)
John Current, Federal Aviation Administration
Rod DeVol, Snohomish County Airport/Paine Field
Frank Figg, Boeing Commercial Airplane Company
Clare Impett, King County International Airport/Boeing Field
Jonathan Morrow, Air Force Representative-FAA Northwest Mountain Region
Theresa Smith, WSDOT-Aviation Division
Dave Waggoner, Snohomish County/Paine Field

Others in Attendance

Pete Beaulieu, PSRC
Bill Brubaker, WSDOT-Aviation Division
Steve Kiehl, PSRC
Mike Lunenschloss, Washington Seaplane Pilots Association
Kevin Murphy, PSRC

1011 Western Avenue, Suite 500 • Seattle, Washington 98104-1035 • (206) 464-7090 • FAX 587-4825

MEETING SUMMARY
April 1, 1999

Introduction

King Cushman, PSRC Director of Transportation Planning, opened the meeting. Self introductions by Committee members were followed by birthday wishes for Bill Brubaker.

Overview of Report Format for Updated Regional Airport System Plan (RASP)

Three-ring binders were provided to members in attendance for RASP-related materials. Referring to draft chapters 2, 3 and 4 included in the agenda packet, King noted that the RASP refinement is a "work in progress" and reminded members that their review and input is important to help ensure that the final document will be as accurate and up-to-date as possible.

Comments on Initial Draft Chapters in RASP: "Work-In-Progress"

Stephen Kiehl provided an overview of the materials and asked members for their comments on the draft chapters to date (Chapter 2, Goals, Issues and Trends; Chapter 3, Airport System Planning Background; Chapter 4, System Inventory; and Appendix A, Glossary of Terms). The following input was provided:

- Stan Allison noted that Bandera Airfield is not paved and that the runway at Lester Airport was washed out last winter and is now closed. Bill Brubacker also pointed out that the Lester Airport now has only a helipad with restricted access due to being in a closed watershed area.
- Stan Allison pointed out that some of the airports listed as having control towers do not actually have towers, and suggested checking the status.
- Frank Figg suggested that Boeing Field should be referred to by its legal name: King County International Airport/Boeing Field. The group also agreed to refer to Paine Field as Snohomish County Airport/Paine Field.

Additional comments and input should be directed to Stephen Kiehl, via phone (206) 464-6715), FAX (206) 587-4825, or e-mail skiehl@psrc.org.

Background and Approach to Forecast Data

King Cushman noted that background and trends are being looked at with an eye toward identifying the variables and key issues in making forecasts for the future. The forecast approach will consider national trends, regional trends, FAA national forecasts, previous regional forecasts, forecast issues and methodology.

Stephen Kiehl showed a series of overhead transparencies on trends and forecasts. Members discussed the information and made the following comments.

- Dave Waggoner also said it would be interesting to compare the aircraft shipment figures with the number of general aviation airports and the price of fuel over time.

- Dave Waggoner suggested including data for the state of Washington in the graphic showing the comparison of 1998 aviation activity measures (the graphic showed only the PSRC region, the Northwest Mountain FAA region, and the nation). Staff will add Washington data to the graphic.

- The group discussed the source of new pilots. Stephen Kiehl said the latest Federal Aviation Administration (FAA) forecasts of pilots show the "student" pilot group growing very slowly over time while the "other" pilot groups (airline transport, commercial, private) are growing more rapidly. He explained this is because pilots in the "student" category remain there only a relatively short time before graduating up into the "other" pilot categories.

- Jon Morrow suggested using data on Air Force pilot retention rates and pilot training bases in the forecasts analysis. He said the military is a primary source of civilian airline pilots, and that should be considered in the forecasts.

- Jon Morrow and Jim Combs offered their opinion about the cause of the steep decline in aircraft production in the late 1970's and early 1980's. They said they believe it was because of the rapidly increasing liability costs and several important court cases regarding general aviation aircraft accidents and liability.

- The group suggested looking at existing aircraft storage waiting lists at the region's airports to assess the level of latent demand for storage and identify which areas are in need of storage. Many airports have vacant tie-down spaces while their hangars are full; Stan Allison explained that most business and corporate users with expensive aircraft want quality hangers for their aircraft.

- Members discussed some of the factors affecting shifts in demand within the region, and Jim Combs said that regional aircraft tie-down and hanger costs should be looked at. He also suggested that "backcasts" could help assess whether the right factors are being used in the forecasts.

Aviation Forecast Issues and Methodology

Discussion focused on the following questions:

What are the key factors that should be looked at?
Where are there "holes" in existing data/information?
Where are we now?
What direction should we be going in?
What are some of the factors of change?

- Bill Brubaker said he believes there are regulatory forces that strongly affect aviation, including the federal initiative for user fees, land use issues, and the new liability reform, and that these need to be considered in the forecasting effort.

- Jim Combs suggested there is a relationship between the level of activity at an airport and how long it takes to get there on the region's roadways, and that this issue should be looked at. Stephen Kiehl noted that an airport access element is included in the RASP. Later in the discussion this issue was raised again, and it was pointed out that we need to consider the effects of higher speed ground transportation on air travel - whether such improved ground transportation would put more demand on air transportation, or diminish the demand.

- Jim Combs pointed out that there are now many more competing forms of recreation, such as hiking, camping and skiing, that draw demand away from aviation.

- The group discussed some of the changing trends in aviation, including the growing trend toward fractional ownership of aircraft. They agreed that increasing purchase prices are forcing more pilots into partial ownership. Also, costs are behind some pilots selling their aircraft and then renting or chartering planes when needed. This lowers their overall costs and reduces their liability and maintenance concerns.

- Bill Brubaker stressed that vertical aviation should be included in the report. Clare Impett agreed that seaplanes, vertical aircraft and non-fixed-wing aircraft need to be folded into the planning picture and addressed in the report.

- Dave Waggoner asked whether the study is being done to effect a change, or simply to observe and provide facts with no plan to impact the regional airport system. King Cushman said that if a relationship can be established between the facts, trends and potential economic benefits to the region of preservation and expansion of general aviation facilities, then the aviation element of the Metropolitan Transportation Plan could become like the freight and goods or other modal elements, with a link between the system plan and needed investments. Funding issues could be brought into the picture. We could look at funding options for aviation. How are we pricing the market now? We could look at strategies for financing and explore how to better connect aviation-related revenues to use and improvements.

- Theresa Smith said that the impact of aging aircraft fleet should be taken into account in the forecast.

- Clare Impett stressed the importance of quantifying the benefits of general aviation.

- It was agreed that several alternative scenarios will be developed in response to the forecasts and capacity analysis:
  - No Action - status quo
  - Maintenance / Preservation - maintain and preserve the existing system

- Growth Potential and Associated Needs - what if? (Improvements in technology, etc. - what does it mean, what are the costs, what are the impacts)

Members agreed that a subcommittee should be formed to work on these issues - either in a meeting or through one-on-one interviews - before the next full committee meeting in September. *[This meeting was held on April 14, 1999, at the FAA office in Renton, and was attended by John Current, Jim Combs, Stan Allison, Theresa Smith and Stephen Kiehl.]*

Dave Waggoner volunteered to assist with the RASP update effort by co-chairing the RASP Technical Advisory Committee with King Cushman.

Adjournment

The meeting adjourned at 4:20 p.m.

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Puget Sound Regional Council

Regional Airport System Plan Refinement

– Work in Progress –

September 24, 1999

- Chapter 5: Aviation Forecasts
- Chapter 6: System Capacity and Future Facility Requirements (methodology and first cut numbers)

For discussion by the
Regional Airport System Plan (RASP) Technical Advisory Committee
September 30, 1999

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Chapter 5 - Aviation Forecasts

Forecast Approach

The general approach used to prepare these regional airport system forecasts included analysis of historical aviation trends data for the nation, the state, the region, and the airports; a review of previous forecasts prepared for the region and the state; a review of the most recent FAA National Aerospace Forecasts; a summary of regional socio-economic forecasts; selection of a forecast methodology; and preparation of the selected forecast methodology.

Historical Aviation Trends

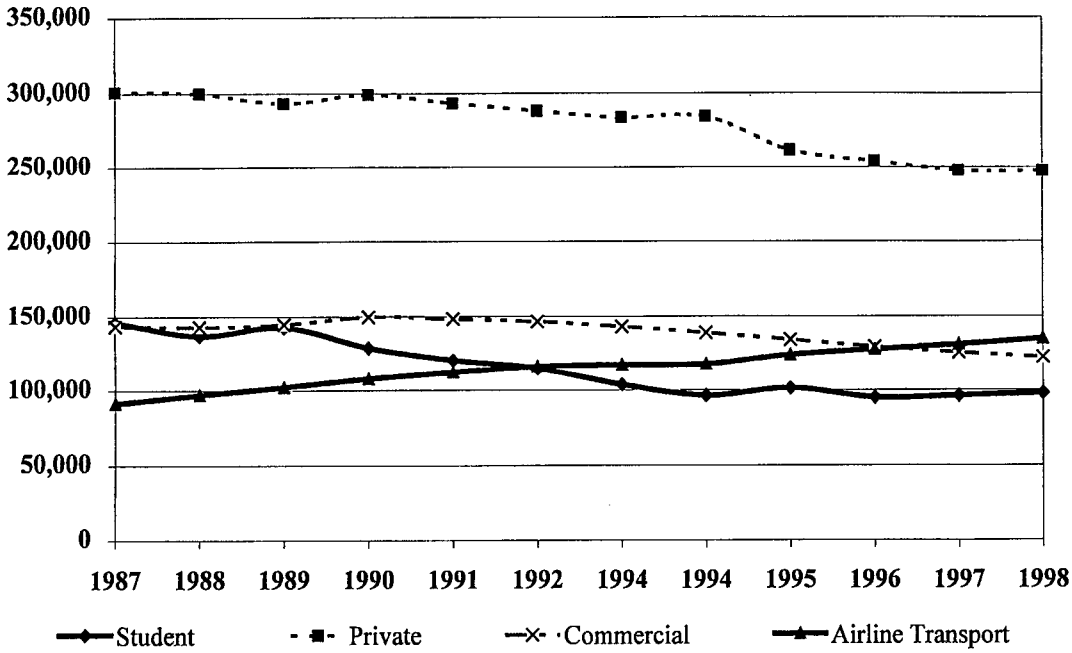
Analysis of historical trends provided a base of information useful in preparing future aviation activity forecasts. A wide range of aviation data from numerous sources was reviewed in documenting historical trends. These data included information about the number, type, and age of active pilots; total based aircraft and aircraft fleet mix; aircraft operations by type and operations per based aircraft ("OPBA"); fuel consumption; aircraft hours flown; and new aircraft production/shipments. In addition, related historical population, employment, and income data for the Puget Sound region was reviewed and documented. Major data sources included the FAA, General Aviation Manufacturers Association ("GAMA"), the Regional Council, the State DOT Aviation Division, and the individual airports.

Most of the historical data from the FAA was taken from the most recent *Aerospace Forecast* for 1999 through 2010 (March 1999); *Long Range Aerospace Forecasts* for 2015, 2020, and 2025 (June 1999); *Statistical Handbook of Aviation*; *Census of Civil Aircraft*; *General Aviation and Air Taxi Activity and Avionics Survey*; and *General Aviation Pilot and Aircraft Activity Survey.* Most of the historical data analysis was based on the years 1987 through 1998, for which common data were available. This provided a reasonable data string for analysis of historical trends. The FAA's 1999 *Aerospace Forecast* (previously called Aviation Forecast) shows a base period of 1993-1998 plus its 12-year forecast for the years 1999 through 2010. Other FAA data (Airport Master Records) were also collected for the period 1987 through 1998 to provide for comparable analysis. Aircraft shipment data from GAMA are displayed for the years 1970 through 1998. PSRC historical data on population, employment, and income are shown for the years 1985-1998. Where additional historical data for earlier years were available and useful to the analysis, those data were used and are shown here.

Pilots

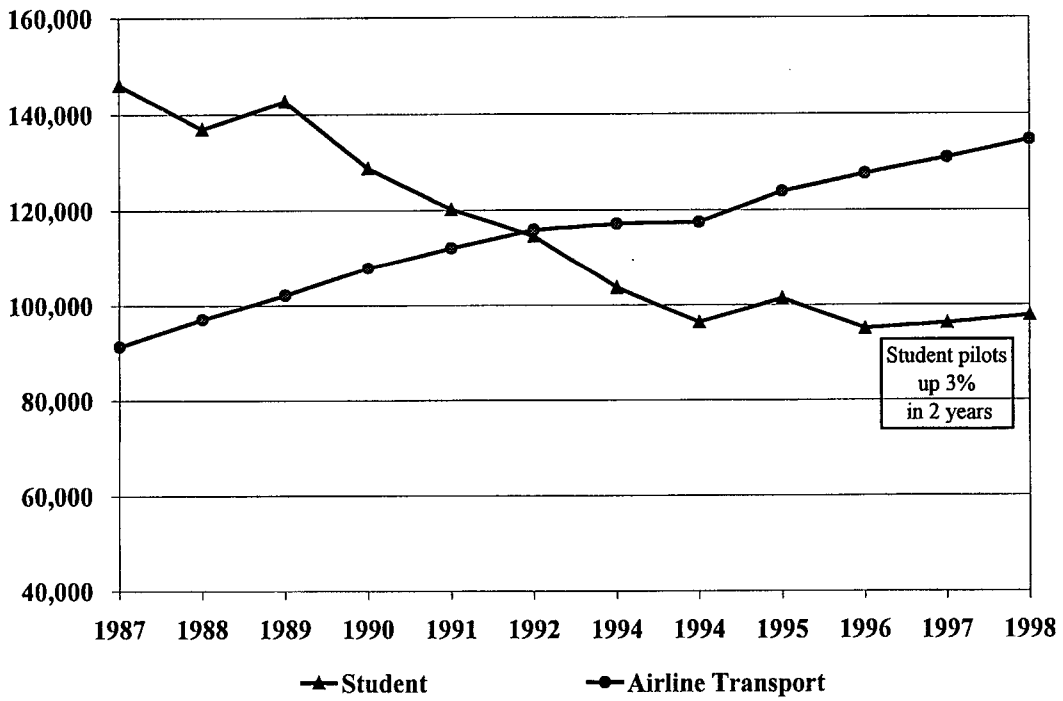
The number and type of aircraft pilots is a fundamental component of the aviation industry. Drawing primarily from nationwide FAA information, historical trend data on the number, type, and age of active pilots were collected and analyzed. These trends are displayed in Exhibits 5-1 through 5-3. For the years 1987 through 1998 the total number of U.S. active pilots by certificate type is shown in Exhibit 5-1. The data show 5 basic types of pilot certificates: student, private, commercial, airline transport, and flight instructor. Private pilots is by far the largest group. Between 1987 and 1998 this pilot group has declined from 300,000 to 247,000 (18%). This continues a longer term historical trend which began in the 1980's after the termination of the "GI Bill."

Exhibit 5-1 U.S. Pilot Trends



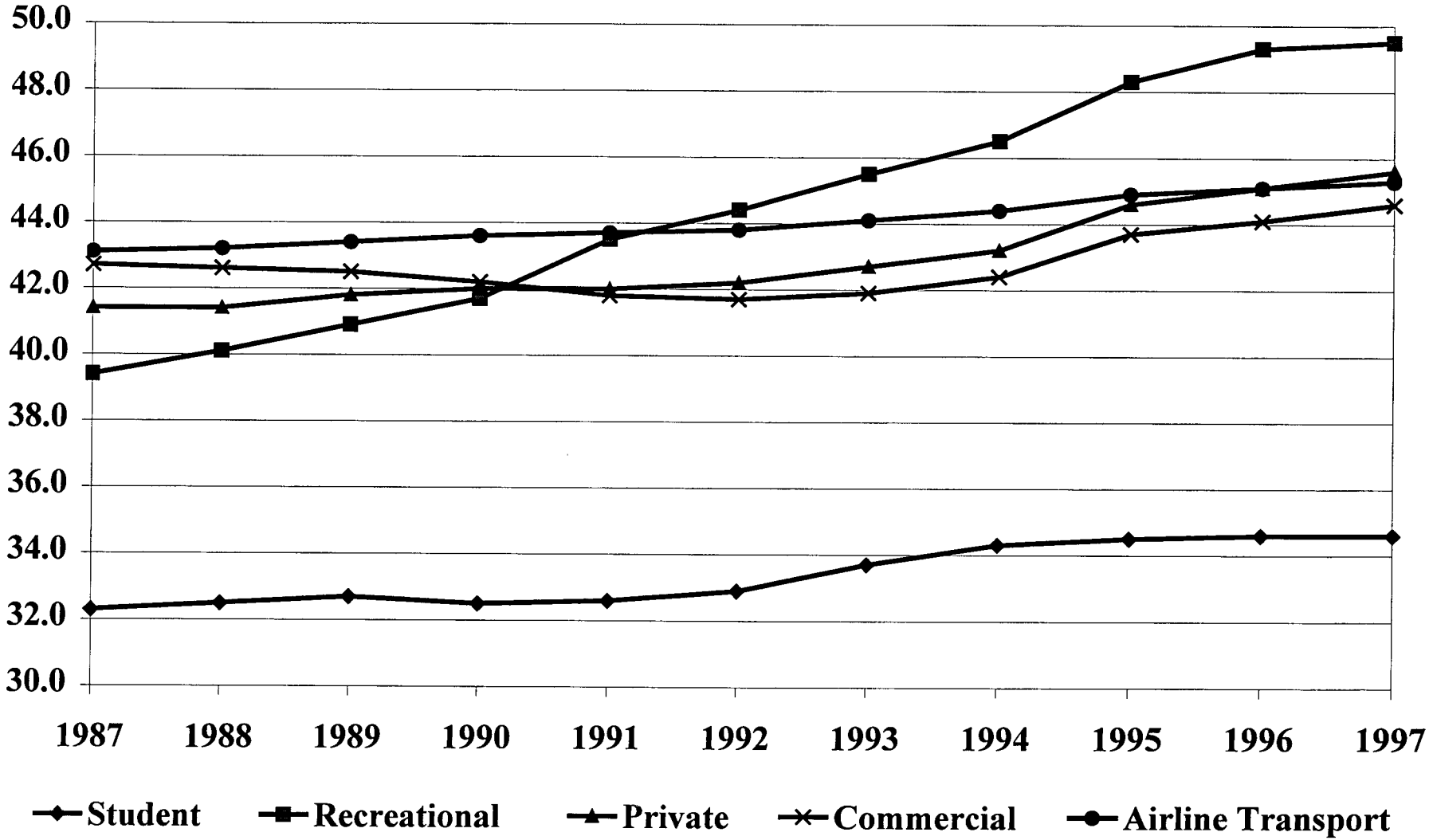
Active Airmen 1987-1996.xls / Pilot Trends Chart

Exhibit 5-2 U.S. Growing Pilot Sectors



Active Airmen 1987-1996.xls / Growing Pilot Segments

Exhibit 5-3 Trend in U.S. Pilot Age



Pilot Age.xls / Pilot Age Trend Chart

Other pilot groups that have also declined in the past several years include student pilots, which dropped from 146,000 to 98,000 (33%); and commercial pilots, which declined 15% from 144,000 in 1987 to 122,000 in 1997. In total, these three pilot groups declined from 590,000 to 469,000 (20.5%) in the last decade. Upon more detailed analysis, these data show that while all three pilots groups declined over the decade, the commercial pilot sector declined the least, and the student pilot market sector appears to have bottomed out in 1994. The student population has remained somewhat stable, with a growth trend in 1997 and 1998. During these past two years, the student pilot population increased by nearly 3%. The stabilized pilot population may be attributable in part to the general aviation product liability reform in 1994, favorable economics in recent years, and the continued strong market for air transport pilots.

One component of the pilot population has shown growth in recent years (see Exhibit 5-2). Among all U.S. pilots, the strongest growth continues to occur among airline transport pilots. In the decade from 1987 to 1998 this group increased from 91,000 to 135,000 (48%), or a growth rate of nearly 4% per year. The airline transport pilot group is clearly fueled by the strong airline passenger and air cargo markets. As demand grows, there appears to be a continuing strong market for new pilots in the airline transport sector.

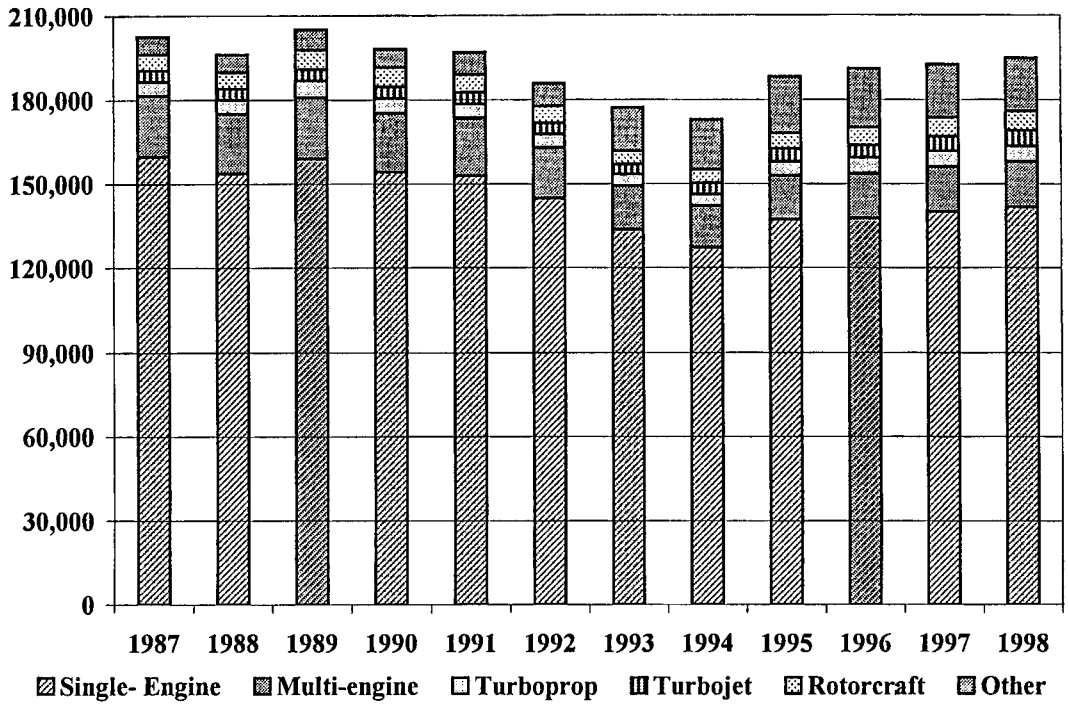
In addition to the number and type of pilots, trends in pilot age affect the aviation industry, and need to be considered in preparing aviation forecasts. Exhibit 5-3 displays average age for these same five pilot groups over the period 1987 through 1997. Two important trends are apparent in the chart. First, between 1987 and 1997 the age of recreational pilots increased almost exactly 10 years, from 39 to 49 years. These data seem to represent recreational pilots as a static demographic group that is simply aging, with no significant influx of new members. Second, all other pilot groups are aging at significantly lower rates. Over the 10 year period, the average age of student pilots increased from 32 to 34; private pilots aged from 41 to 45; commercial pilots aged from 43 to 44; and airline transport pilots aged by only 2 years, from 43 to 45. Two factors could explain these trends: (1) older pilots retiring or simply choosing not to renew their certificates; or (2) younger pilots are entering the pilot population.

U.S. Active Aircraft / Aircraft Fleet Mix

Historical data on numbers of U.S. active aircraft and fleet mix were obtained from FAA Airport Master Records (5010 forms), FAA Aerospace Forecasts, FAA Statistical Handbook of Aviation, FAA Census of Civil Aircraft, airport master plans, directly from airport sponsors, from other FAA sources, and from other regional and state resources. At the national level annual data are available, and are displayed in Exhibit 5-4. Between 1987 and 1994 the historic downward trend in active general aviation aircraft continued. Hardest hit were the single and multi-engine piston powered aircraft, both of which declined in numbers until 1994. Turboprop, turbojet, and rotorcraft numbers have remained relatively constant throughout the period from 1987 to 1998. In recent years, two categories of aircraft have grown. Single engine aircraft increased from 127,000 to nearly 142,000 between 1994 and 1998. The "other" category, which includes gliders, ultra-light, and experimental aircraft, grew steadily throughout the 10-year period, from 6,300 in 1987 to over 19,000 aircraft in 1998.

The U.S. GA aircraft fleet mix has shown modest shifts over the past decade. In general, single engine piston aircraft have declined both in numbers and as a percentage (from 78% in 1987 to 73% in 1998) of total GA aircraft. Multi-engine piston powered aircraft also declined in absolute numbers and in their share of the fleet. This group declined from 21,800 (11% of the total fleet) in 1987 to 16,065 (8%) in 1997. Turboprop (5,700 aircraft) and turbojet aircraft (about 5,500) both declined until 1993-1994, and

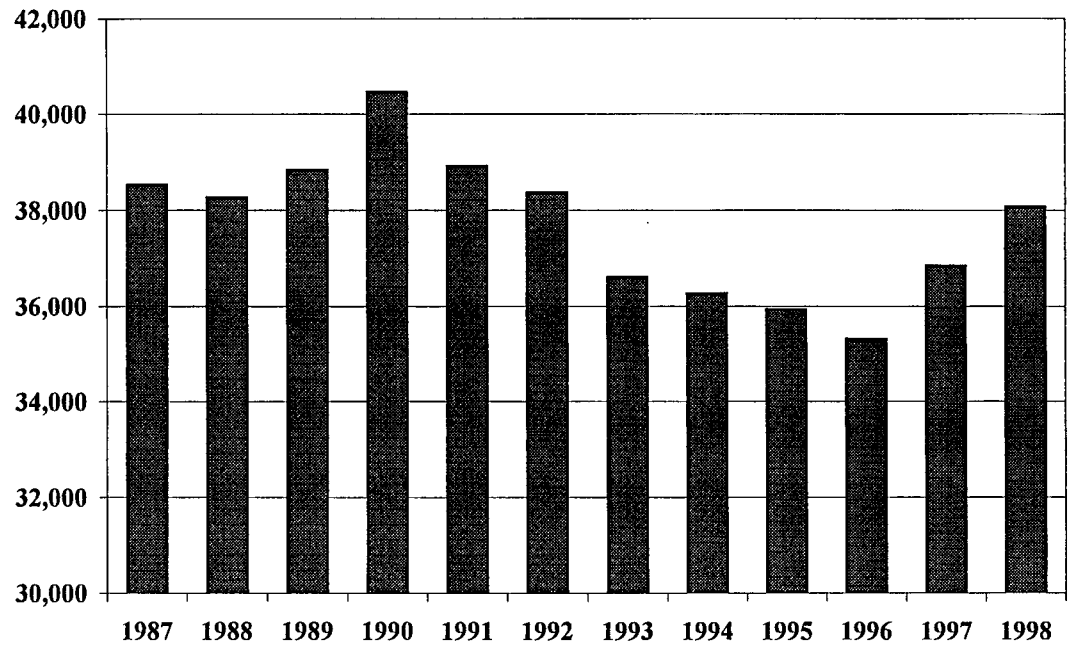
Exhibit 5-4 Active U.S. General Aviation Aircraft



Active GA Fleet 1987-1996.xls / GA Aircraft Chart

Exhibit 5-5 GA Aircraft Operations at U.S. Airports with Air Traffic Control Service

(in thousands)



FAA Forecasts 1998-2009 (Appendices).xls / GA Ops at FAA Towered Airports

have increased in the last 4-5 years. Between 1987 and 1998 these combined aircraft types increased their share of the total GA fleet from 4 to 6%. Perhaps the most remarkable shifts in the GA fleet in the past decade relate to the glider, ultra-light, and experimental aircraft category. Together, these three aircraft types increased from 6,300 in 1987 to over 19,000 aircraft in 1998. The group's share of the total fleet grew accordingly, from 3% to 10%. A portion of this shift is due to the changing definition of experimental aircraft. As an example, prior to 1993, single engine experimental aircraft were combined with all single engine aircraft. After 1993 these were placed in the separate "experimental" category. As a result, some of the apparent drop in fixed wing and rotorcraft aircraft in 1993 can be explained by the aircraft re-classification.

At the regional level, the four-county PSRC airport system was more concentrated toward single engine piston aircraft than the nation as a whole, with this category comprising 84% of the based aircraft. Multi engine piston and turboprop aircraft comprised 8% of the regional fleet; Turbojet comprised 2%; rotorcraft 2%; and other (gliders, ultralights, and experimental) comprised 4%.

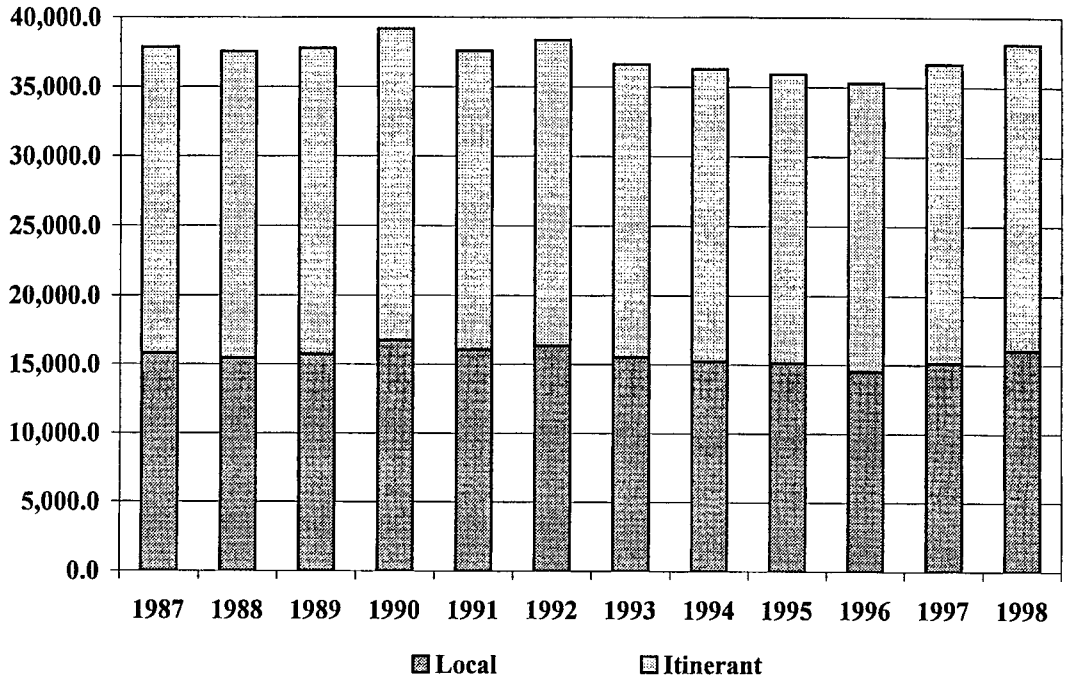
Aircraft Operations

National aircraft operations data were obtained from the FAA. Regional data were obtained from airport records, from FAA Airport Master Records (Form 5010), and from the WSDOT Aviation Division. At the national level, operations data are available for airports with either FAA or contract air traffic control services. At the region's smaller airports historical operations data are sketchy, and are available only where airport management undertook a counting program and where the State DOT Aviation Division deployed its acoustical counters. At regional airports with control towers operations data are consistently available. Because aircraft operations data are not regularly collected at all airports, the historical string of operations data for the region's airports is incomplete. There is a need for more consistent data collection at the region's small airports.

While the FAA's national operations data excludes many of the nation's small general aviation airports, it does include larger airports with control towers, and is useful in tracking national trends. Exhibits 5-5 through 5-7 display FAA national aircraft operations data. Exhibit 5-5 shows the national trend in total GA aircraft operations at airports with air traffic control services (either FAA or contract towers). Between 1987 and 1998 total U.S. GA operations peaked in 1990 at over 40 million, then declined to 35.3 million in 1996. This trend shifted in 1997, when operations showed a 4.2% increase to 36.8 million, and again in 1998, when total GA operations grew another 3.3%. Exhibit 5-6 displays the same data as Exhibit 5-5 showing the split between local and itinerant GA operations. After growing from 1987 to 1990, both local and itinerant GA operations declined from 1991 through 1996, when operations reached its low point for the decade. From 1996 to 1998 both local and itinerant GA operations increased: local operations grew from 14,475,000 to 15,976,700, while itinerant operations increased from 20,823,000 22,086,400. Among the measures of GA aircraft activity, the largest area of recent growth has been in the number of instrument operations, shown in Exhibit 5-7. Similar to total GA operations, instrument operations grew strongly from 1987 until 1989, then declined sharply for four years to a low point in 1993. Since then, instrument operations have increased four of the past five years. Between 1993 and 1998 total U.S. GA instrument operations grew by nearly 121%.

Exhibit 5-6 Total U.S. Local and Itinerant GA Operations at Airports with Air Traffic Control Service

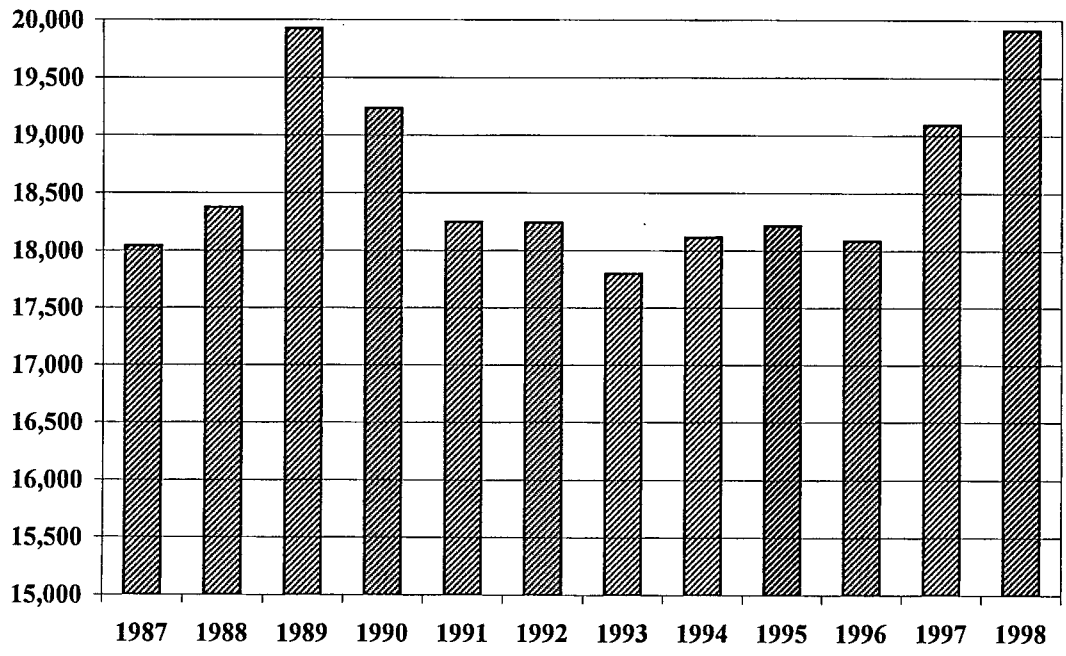
(in thousands)



FAA Forecasts 1998-2009 (Appendices).xls / Local & Itin GA Ops

Exhibit 5-7 GA Aircraft Instrument Operations at Airports with FAA Air Traffic Control Service

(in thousands)



FAA Forecasts 1998-2009 (Appendices).xls / GA Instrument Ops

Aircraft Hours Flown

In addition to the number of aircraft operations, FAA data show historical trends in aircraft fuel consumption. These data are displayed in Exhibits 5-8 and 5-9. GA aircraft hours flown held steady at between 33 and 34 million from 1987 through 1991. Total annual hours flown then fell for three years, and reached a low point of 24 million hours in 1994. Since then the number of total GA aircraft hours flown has increased each year through 1998. These trends were experienced equally among the various aircraft types. Exhibit 5-10 shows the 12-year trend in average annual fuel consumption by aircraft type. Turboprop, turbojet, and rotorcraft consistently show the highest level of use, with total average flight hours per aircraft between 250 to 500 per year. Piston engine and other aircraft (gliders, ultralight, and experimental) show a much lower level of annual use: piston engine aircraft hovered near 140 hours per year through the period, while "other" aircraft were flown between 50 and 75 hours per year. Among the higher-use aircraft types, turboprops have generally declined, from a peak of nearly 500 hours per year in 1989 to 300 hours in 1996. After declining for three prior years, turbojet aircraft use has increased steadily for the past 5 years, growing from 260 hours in 1991 to 340 hours in 1996.

Aircraft Fuel Consumption

Aircraft fuel consumption is another measure of aviation activity which takes into account the number of aircraft operations, aircraft type, and length of flight. While the number of operations is most critical for determining airport needs, the amount of fuel consumed is a more complete measure of total aviation activity. The FAA collects information on the amount of general aircraft fuel consumed by aircraft type. Historical national trends in GA fuel consumption for the years 1987 through 1998 are displayed on Exhibit 5-10. Fuel consumption held fairly steady between 1987 and 1991, then dropped significantly (31%) from 1991 to 1993. Since 1993 the industry has seen steady growth each year, from 703 million gallons in 1993 to 965 million gallons in 1998. This represents a 37% increase in 6 years. This trend is a direct reflection of the number of hours flown, as discussed above.

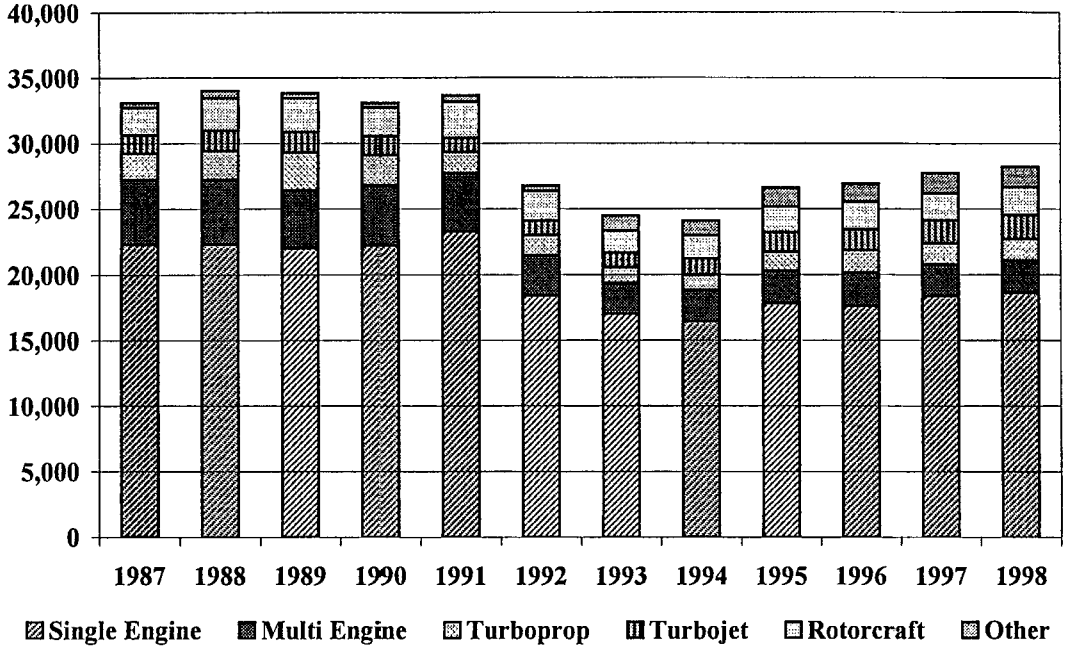
While the other types of aircraft have not shown significant change in fuel consumption (most have been stable or declined slightly), the turbojet category has seen major growth in the past 5 years. Between 1992 and 1997 fuel consumed by GA turbojet aircraft has increased from 287,800,000 gallons to 481,800,000 gallons. This represents an annual growth rate of 8.8%, and a total 6-year increase of 67%. This is one of the strongest measures of growth in the General Aviation sector. Another trend noticeable in Exhibit 5-10 is the reduction in fuel use by multi-engine piston and turboprop aircraft, which corresponds with 1993. Since that time both multi-engine piston and turboprop aircraft fuel use has been intermittently up and down.

New Aircraft Production/Shipments and Aircraft Billings

Information on the historical trend in new aircraft production / shipments and billings is shown in Exhibits 5-11 through 5-13. These data were obtained from the *1998 General Aviation Statistical Databook*, published by the General Aviation Manufacturers Association (GAMA). Data for 1998 were obtained from information presented at GAMA's *Annual Industry Review and Outlook Briefing* held on February 10, 1999. The information collected from GAMA goes back to 1970, and shows the unprecedented growth trend until the year 1978 followed by the steep decline from 1978 until 1983. This decline continued at a lesser rate from 1983 until about 1987, when the industry seemed to reach bottom. Total new aircraft shipments grew from 7,292 in 1970 to 17,811 in 1978, then declined to 1,085 in 1987. After

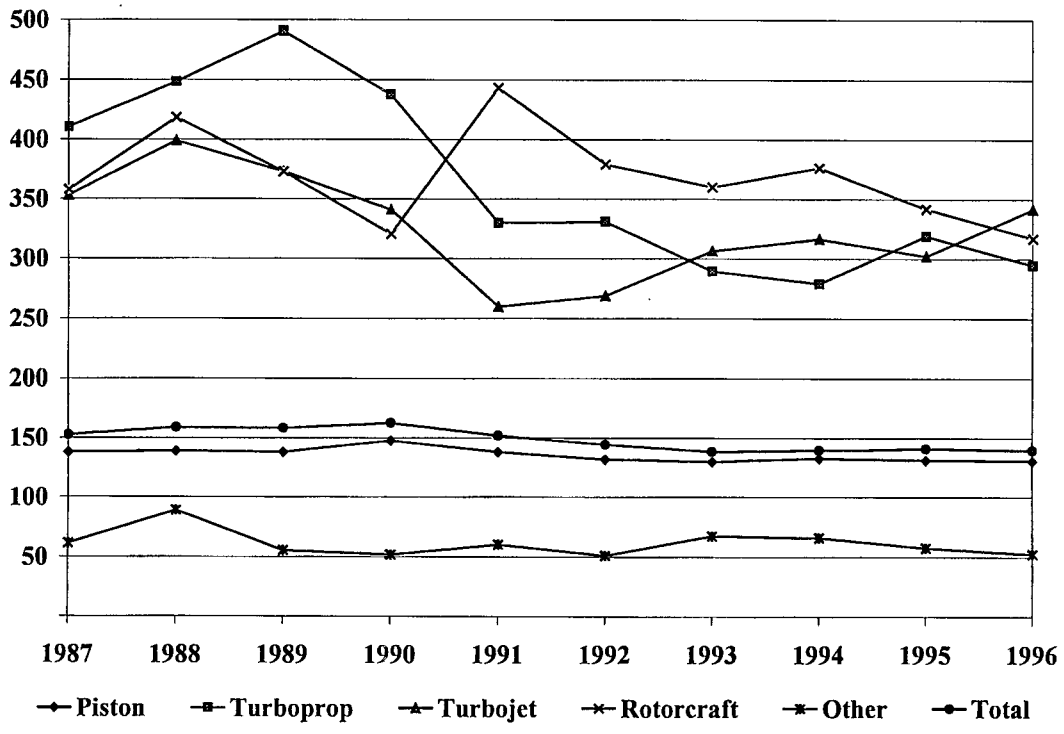
Exhibit 5-8 U.S. GA Aircraft Hours Flown

(in thousands)



FAA Forecasts 1998-2009.xls / GA Aircraft Hours Flown Chart

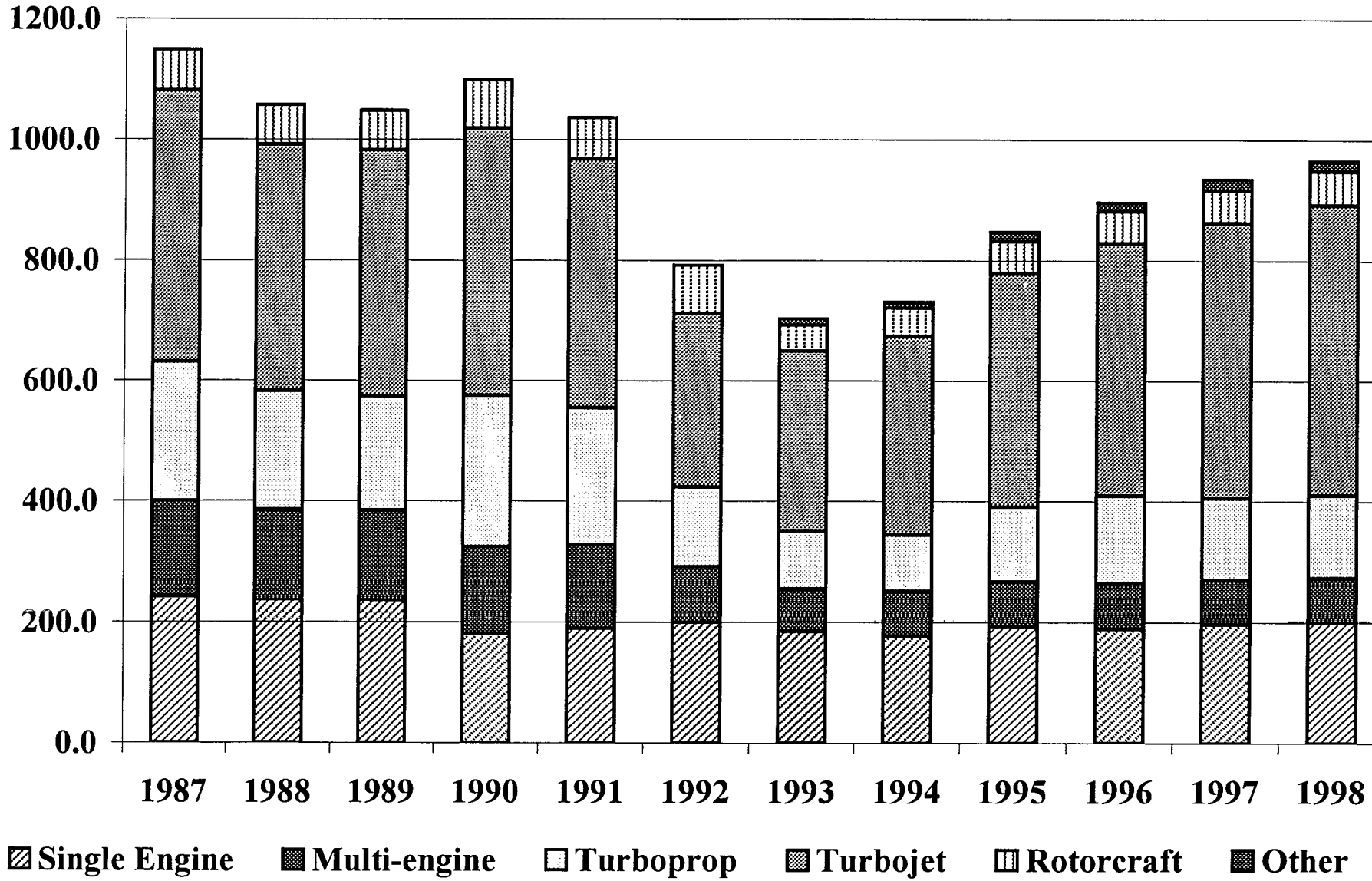
Exhibit 5-9 Active U.S. GA Aircraft Average Hours Flown



GA Average Hours Flown.xls / Ave Hrs Flown Chart

Exhibit 5-10 U.S. GA Aircraft Fuel Consumed

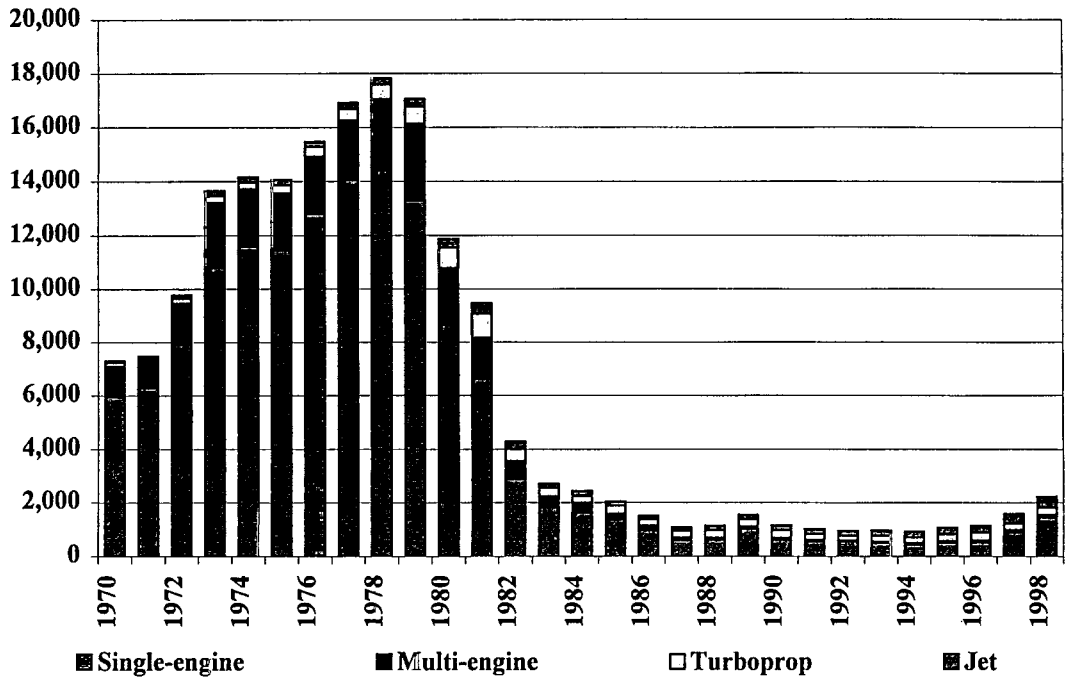
(millions of gallons)



FAA Forecasts 1998-2009.xls / GA Fuel Consumed Chart

Exhibit 5-11 Annual New U.S. Manufactured GA Aircraft Shipments

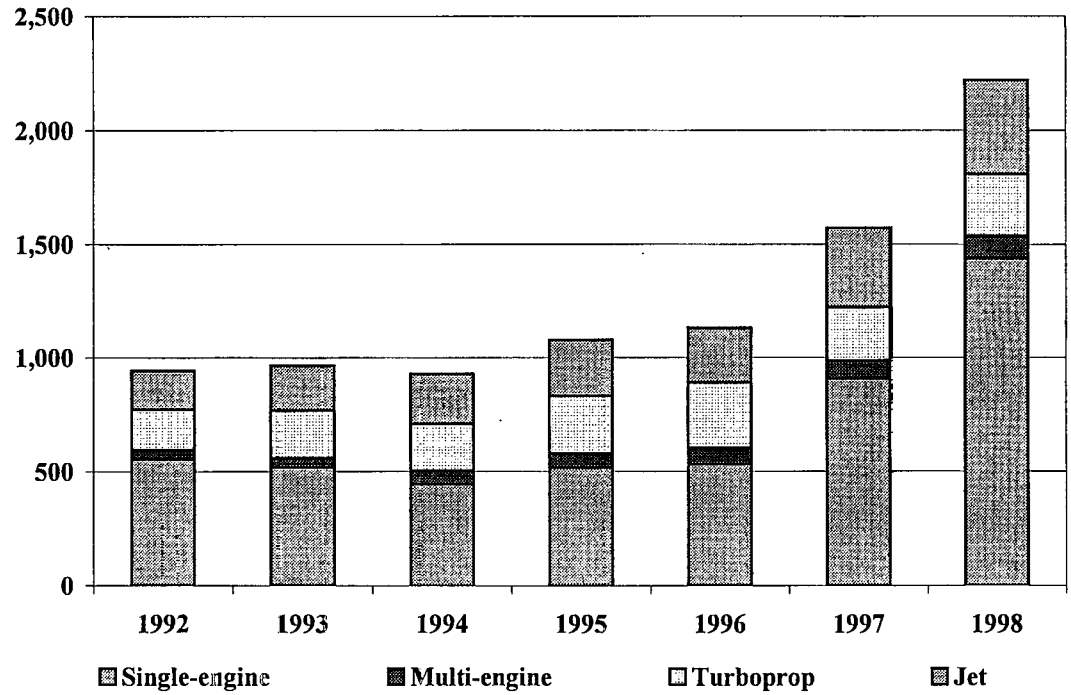
(source: GAMA 1998 Statistical Databook)



GAMA Aircraft Shipments.xls / Annual New Aircraft Shipments

Exhibit 5-12 Recent Trends in New U.S. GA Aircraft Shipments

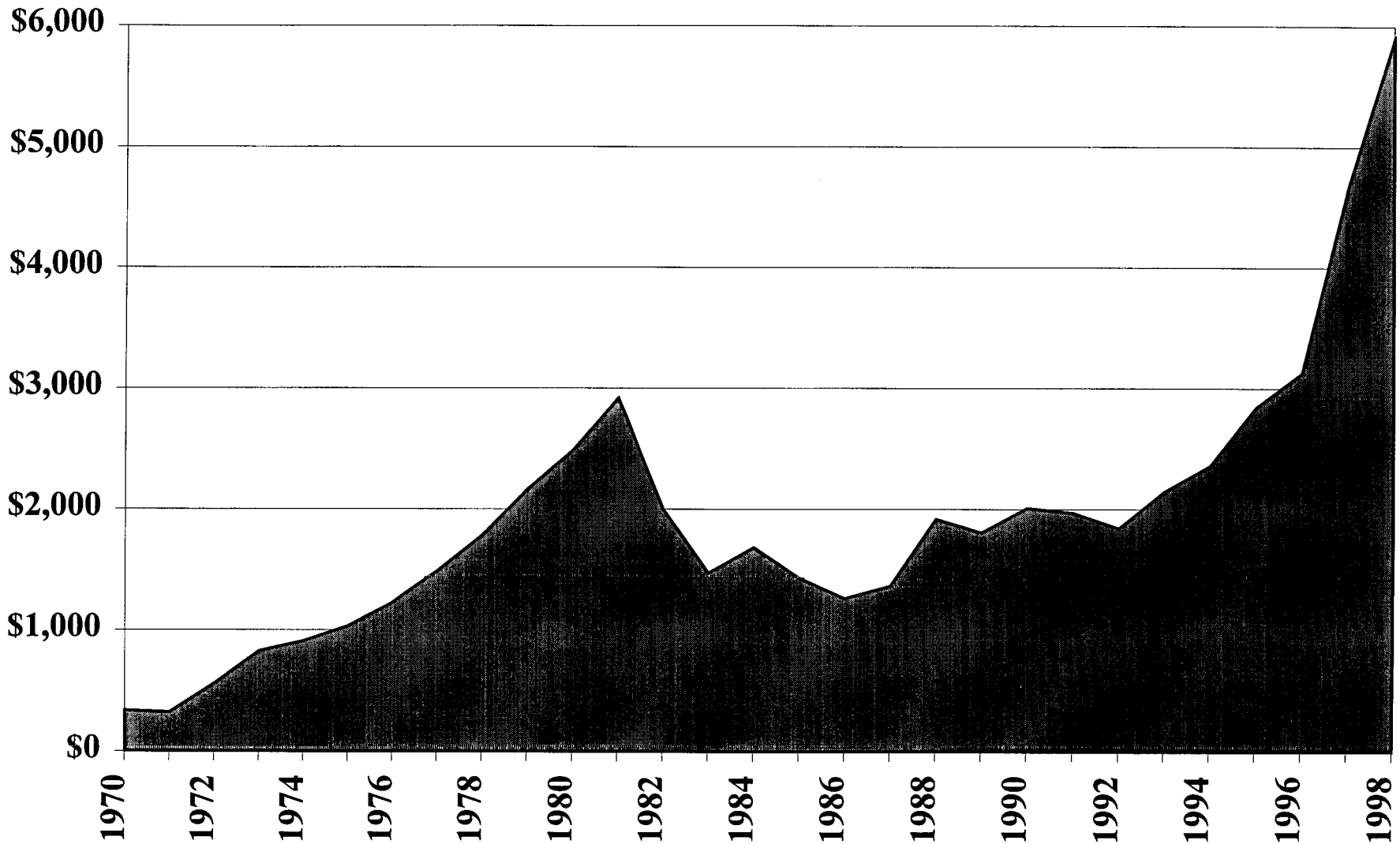
(source: GAMA 1998 Statistical Data Book)



GAMA Aircraft Shipments.xls / Recent Trends in AC Shipments

Exhibit 5-13 Total GA Aircraft Billings (in millions)

(source: GAMA 1998 Statistical Databook)



GAMA Aircraft Shipments.xls / Total Billings

Ph-5 page 39d.

several years of stagnation, the industry has seen a resurgence, growing from a low of 928 new units in 1994 to 2,220 in 1998, a 139% increase in just 4 years. The 1998 figure is the highest level of new aircraft shipments since 1984. Historically, the strong growth in aircraft shipments which peaked in 1987, the succeeding decline until the early 1980's, and the recent growth trend, affected all four major aircraft types (single-engine, multi-engine, turboprop, and jet) about equally.

Exhibit 5-12 shows the recent upward trend in aircraft production between 1992 and 1998. While growth was moderate through 1996, total shipments jumped significantly in 1997, when total new GA aircraft shipments grew by 39% in a single year, and again in 1998, when units shipped increased by 42% over 1997. Taken together, the growth in GA aircraft shipments in 1997 and 1998 represent a virtual doubling of shipments in the last two years. The most recent 2-year growth spurt in aircraft production was not felt equally among the four major aircraft types. Shipments of single engine piston aircraft showed the most growth, increasing from 530 units in 1996 to 1,436 units in 1998, a 2-year increase of 171%. Jet aircraft shipments increased by 72% for the 2-year period; multi-engine piston aircraft shipments grew by 40%; and turboprops, after having grown for several years, dropped by 18% in 1997, then rebounded in 1998, increasing by 15% for the year.

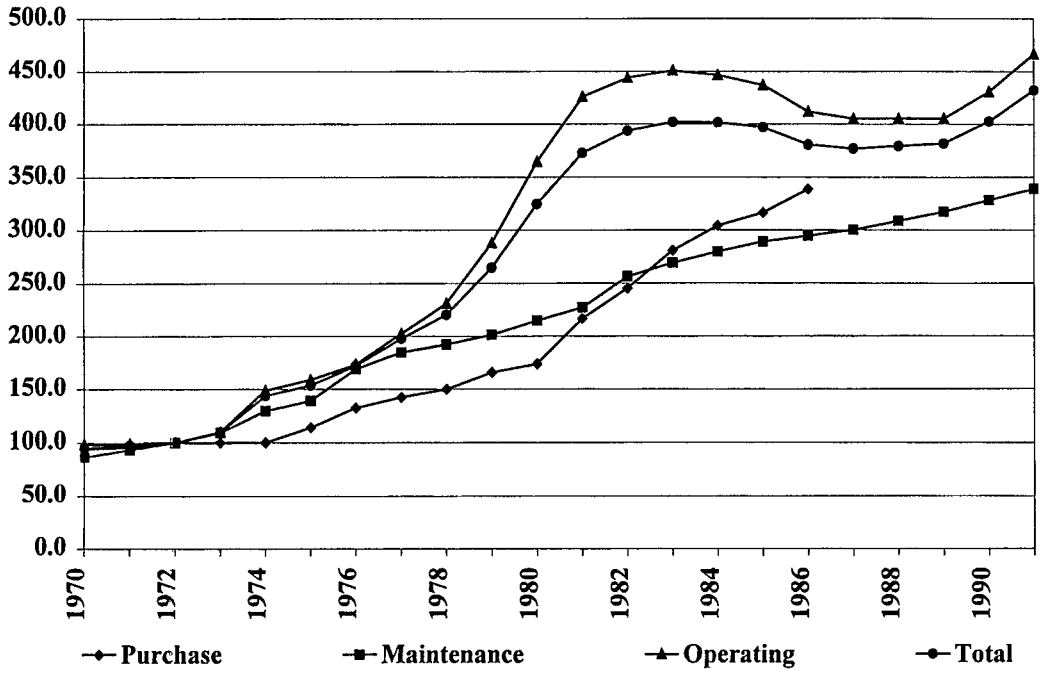
Exhibit 5-13 displays the historical trend in new billings for GA aircraft manufacturers for the period 1970 through 1998. Though the exhibit displays similar trends to those seen in Exhibits 5-11 and 5-12, the affect of inflation on the price of aircraft softened the decline in total billings for the years between 1981 and 1986. Whereas total new aircraft shipments declined by 95% in the period from 1978 to 1986, total billings declined by only 57% during its decline (1981-1986). Since that time, GA aircraft manufacturers' total annual billings related to new aircraft production have increased at a very robust average annual growth rate of nearly 14%. Total growth in billings for the period 1986-1998 was 368%, much of which occurred in the two most recent years. In the last two years both aircraft manufacturing and total billings have grown at unprecedented rates. From 1996 to 1997 total billings grew 49%, while 1998 billings exceeded 1997 figures by some 25%.

The consistent upward trend in new GA aircraft production / shipments and manufacturers' billings over the past 5 to 6 years is an encouraging sign that the aviation industry may have "turned the corner," and may possibly be entering a new era of growth and stability.

General Aviation Aircraft Cost Indices

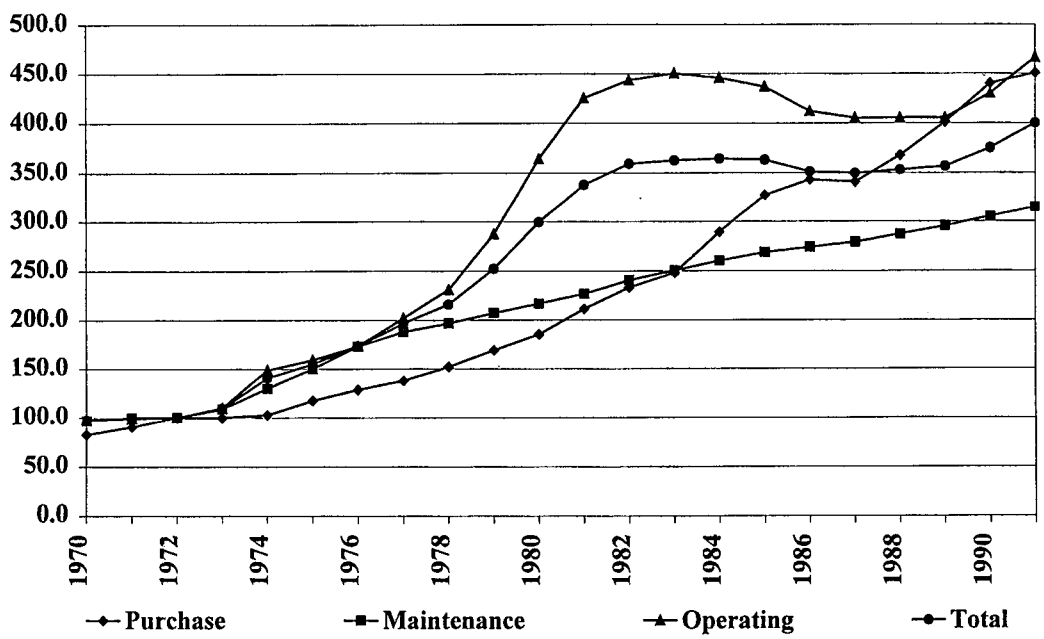
Historical cost index data for general aviation aircraft are available from the FAA. Exhibits 5-14 through 5-19 show these trends divided into the various cost components for various aircraft types. The cost index data use 1972 as a base year, setting the indices at 100 for that year. Single-engine piston aircraft costs are shown in Exhibit 5-14. The data for purchase cost end in the year 1986 because aircraft production for the aircraft models in the index ceased that year. Overall, the patterns shown in all five aircraft cost index charts are similar: costs have risen consistently over time, and by 1991 had quadrupled their 1972 levels. While all cost components have increased, operating costs have grown more than other costs. Among other items, these costs include fuel and insurance. Historically, the operating cost for any general aviation aircraft grew very rapidly between the mid-1970's and the early 1980's, then leveled off and, dropped in the mid-1980's, and began growing again in 1989.

Exhibit 5-14 General Aviation Aircraft Cost Indices
Single Engine Piston Aircraft
(1972 = 100)



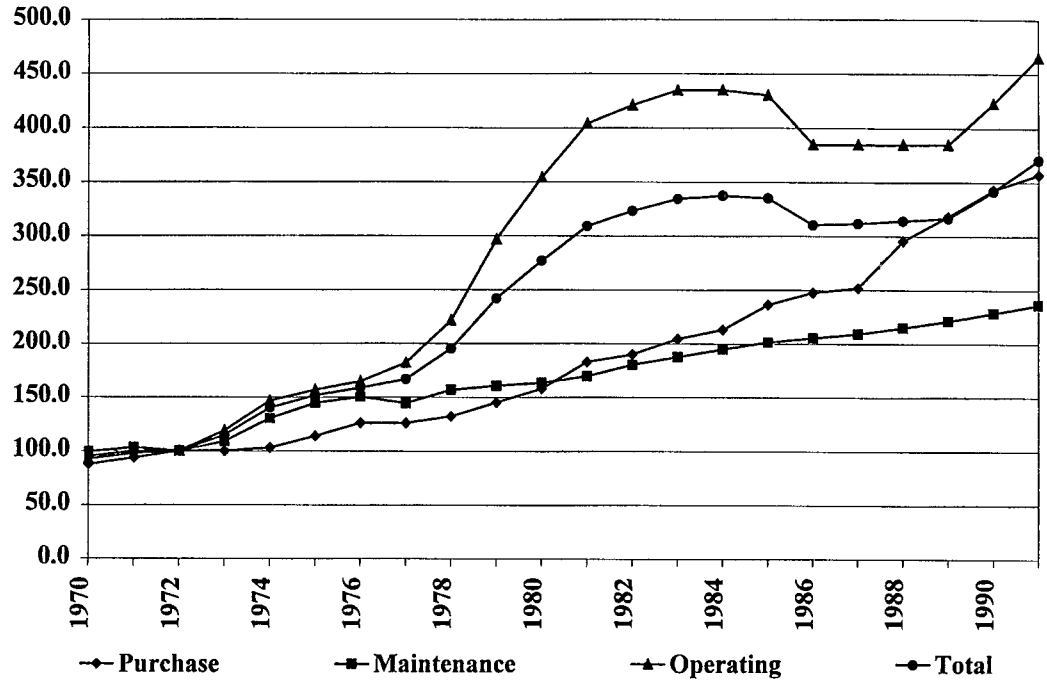
1992 FAA GA Forecast.xls / SEP Cost Index

Exhibit 5-15 General Aviation Aircraft Cost Indices
Multi-Engine Piston Aircraft
(1972 = 100)



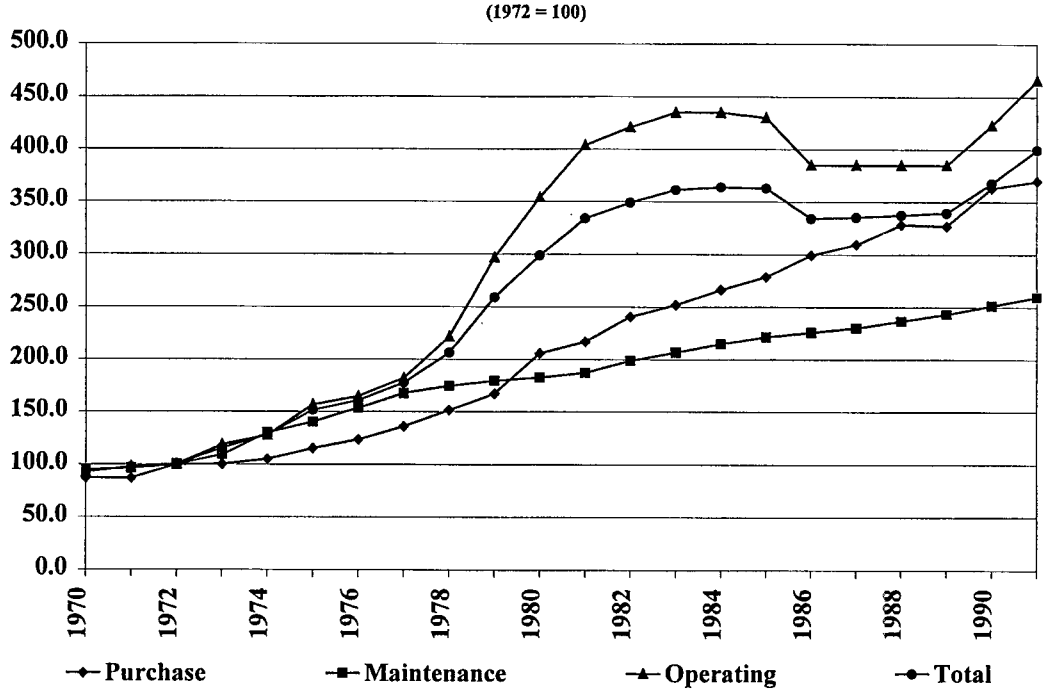
1992 FAA GA Forecast.xls / MEP Cost Index

Exhibit 5-16 General Aviation Aircraft Cost Indices
Turboprop Aircraft
(1972 = 100)



1992 FAA GA Forecast.xls / Turboprop Cost Index

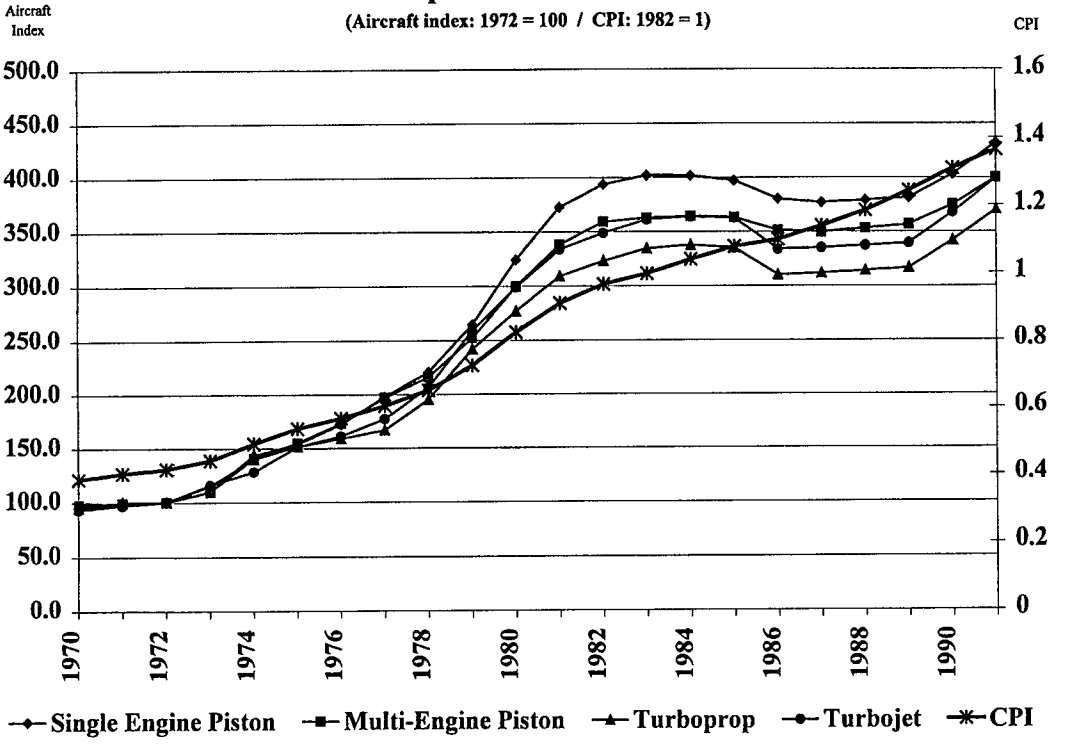
Exhibit 5-17 General Aviation Aircraft Cost Indices
Turbojet Aircraft
(1972 = 100)



1992 FAA GA Forecast.xls / Turbojet Cost Index

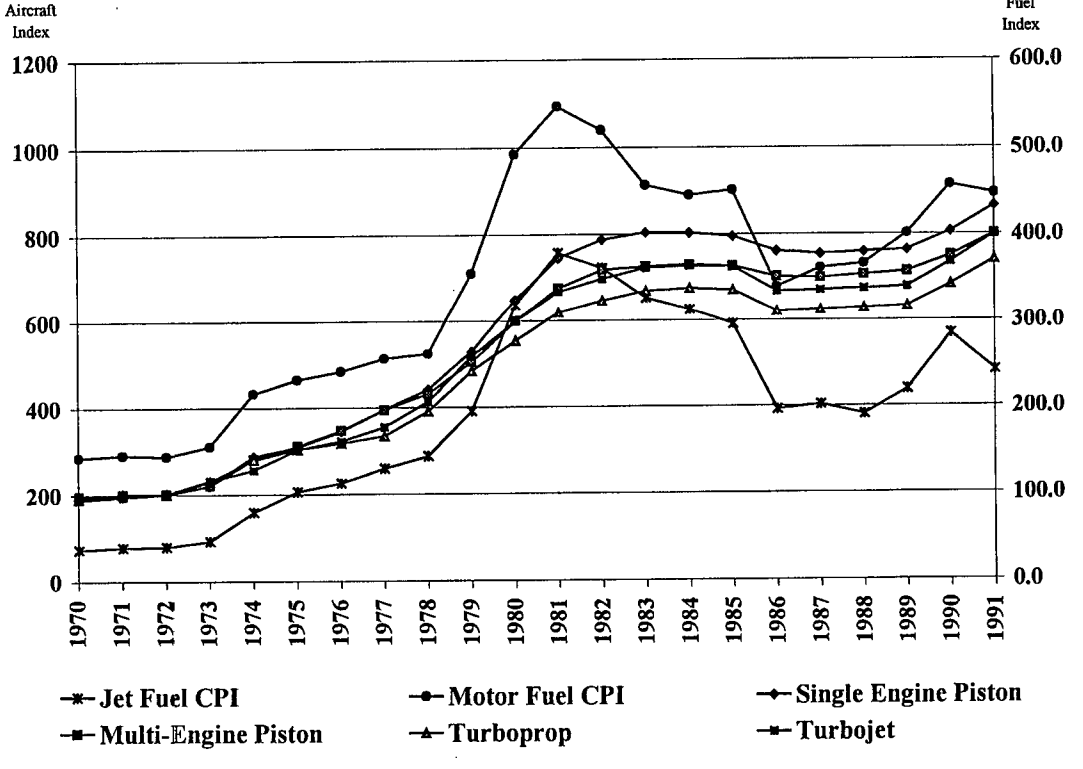
Exhibit 5-18 General Aviation Aircraft Cost Indices
Comparison of Total Cost

(Aircraft index: 1972 = 100 / CPI: 1982 = 1)



1992 FAA GA Forecast.xls / Total Cost Index

Exhibit 5-19 U.S. GA Aircraft and Fuel Price Indices



1992 FAA GA Forecast.xls / Aircraft and Fuel CPI

Also shown on Exhibit 5-19 is the overall U.S. Consumer Price Index (CPI). Beginning in 1970 the U.S. CPI grew from a value of 0.4 and reached nearly 1.4 by the year 1991, for an increase of 250%. During this same time frame, the average cost index for all GA aircraft grew from about 100 to about 400, an increase of 300%. As these two sets of numbers show, the cost of owning and operating a general aviation aircraft has risen somewhat faster than the national consumer price index, particularly from 1978 to 1982. During this time frame the national CPI also increased at a rate higher than previous years, but aviation prices were affected more than general prices. From 1978 to 1982, while the overall national consumer price index increased by 48%, the total cost of aircraft ownership and operation increased by between 160 and 180%. Between 1983 and 1991 aviation costs slowed, and were overtaken by general consumer prices, so that by 1991 aviation costs had fallen slightly below the CPI.

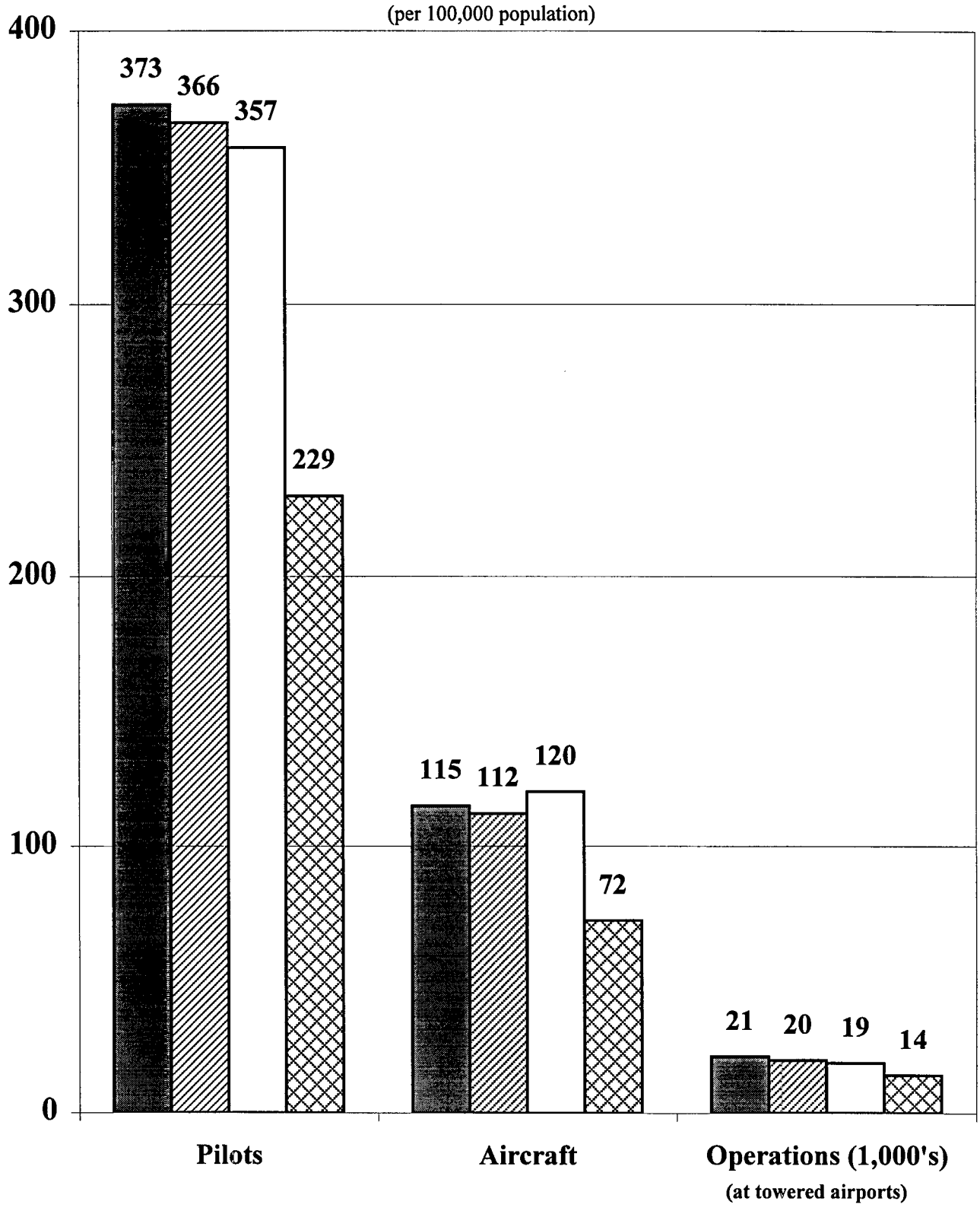
The cost of fuel is clearly an important component of the cost of operating an aircraft. To assess how these two prices have compared over time, historical price indices are displayed in Exhibit 5-19. There is a close correlation between the fuel price and aircraft cost indices. Both are flat from 1970 until 1973, grow somewhat through 1978, skyrocket from 1978 until 1981, decline until 1986, and begin to increase again in 1989.

Comparison of Regional and National Per Capita Aviation Activity

One method of measuring the relative level of aviation activity in the PSRC region is to compare it to larger geographic areas. These comparative data can be useful in "calibrating" future forecasts for the region when compared to national aviation forecasts. To allow for such a comparison, aviation activity data were collected for the nation, the FAA's Northwest Mountain Region, the State of Washington, and the Puget Sound Region. Three basic measures of aviation were analyzed: the number of active pilots, number of active GA aircraft, and GA aircraft operations at airports with air traffic control services. To measure the relative propensity for aviation activity, these aviation data were then compared with the respective national, state, and regional population to develop a ratio of activity per unit of population. The results, which are described below and displayed in Exhibit 5-20, show the ratio of active pilots, active GA aircraft, and GA operations (at towered airports) per 100,000 population for 1998.

As of 1998 there were approximately 618,000 active pilots in the nation with an estimated April 1, 1998 population of 269,429,000. Comparable figures for the PSRC region were 11,743 active pilots and a total population of 3,149,700. Active GA aircraft in the U.S. totaled 194,826 in 1998, while the Puget Sound Region had 3,620. Total national GA aircraft operations at airports with air traffic control services equaled 38,063,100 for the 1998 calendar year, while the Puget Sound Region's total was 668,000. Comparable figures for the FAA's Northwest Mountain Region are also shown below. The ratios of pilots, aircraft, and operations per population for these three geographic regions are shown in tabular form below and in graphic form in Exhibit 5-20.

Exhibit 5-20 Comparison of 1998 Aviation Activity Measures



Compare Region vs Nation.xls / Summary Comparison

1998 Activity Levels	Nation	FAA NW. Mtn. Region *	State of Washington	PSRC Region
Active Pilots	618,298	62,969	20,841	11,743
Active Aircraft	194,826	21,190	6,379	3,620
GA Operations **	38,063,100	3,315,760	1,228,291	668,000
Ratio of Activity to Population				
Population	269,429,000	17,632,010	3,149,700	3,149,700
Active Pilots per 100,000	229.5	357.1	366.3	372.8
Active Aircraft pre 100,000	72.3	120.2	112.1	114.9
GA Operations (1,000s) per 100,000	14.1	18.8	19.8	21.2

* *FAA's NW Mountain Region includes Colorado, Idaho, Montana, Oregon, Utah, Washington, and Wyoming*
** *Operations numbers are for GA aircraft operations at airports with air traffic control services*

All three measures of aviation activity relative to population show the Puget Sound Region significantly above the national ratios. Comparing active pilots to population, the ratio is nearly 62% higher for the Puget Sound region (372.8 pilots per 100,000) than for the nation (229.5). Similarly, active aircraft figures for the region are 59% higher than the nation, and operations figures for 1998 are 50% higher in the region than for the nation as a whole. While the operations figures are more difficult to verify, due to differences in data collection techniques and data sources, the figures clearly show the Puget Sound region has a much higher ratio of GA aircraft operations to population than the rest of the nation.

The Puget Sound Region can be favorably compared with the FAA's Northwest Mountain Region, which contains the seven northwest states of Colorado, Idaho, Montana, Oregon, Utah, Washington, and Wyoming. This region contains nearly 18 million people, 63,000 active pilots, over 21,000 active GA aircraft, and in 1998 accounted for almost 8 million aircraft operations at airports with air traffic control services. Similar to the PSRC region of western Washington, the FAA Northwest Mountain Region has consistently generated higher levels of aviation activity per unit of population than the nation as a whole. The mountain region had a pilot ratio of 357.1 per 100,000 resident population; aircraft ratio of 120; and annual operations ratio (in 1,000s) of 18.8. These figures are consistent with the Puget Sound region, all being considerably higher than the nation. Comparable numbers for the state of Washington are also shown above. These figures show that the Puget Sound Region has slightly higher ratios of pilots, aircraft, and operations than the state, but both areas are significantly higher than the nation. The only measure where the FAA's Northwest Mountain Region had higher ratios is in the number of active aircraft per population. This high propensity to own aircraft might be partially explained by the large geographic size of most states in the region, and the relatively large distances between urban centers.

Based upon these numbers, the Puget Sound region, the state of Washington, and the FAA's Northwest Mountain Region have all historically generated per capita general aviation activity levels higher than the national average. If this relationship holds true into the future, both regions can be expected to experience higher numbers of pilots, aircraft, and aircraft operations (relative to population) than those forecast by the FAA for the nation as a whole. Several factors which are likely to affect this relationship include forecasts of regional population, employment, and economic growth. Analysis of these factors is included later in this chapter.

Previous Forecasts

Several sources of previous aviation activity forecast data were reviewed. These included the *1982 PSRC Regional Airport System Plan*, the *1988 PSRC Regional Airport System Plan*, forecasts prepared in 1992 by the Washington State Air Transportation Commission ("AIRTRAC"), and the 1993 *Washington State Aviation System Plan*. Most of these sources included forecasts of based aircraft and operations, either by airport, by county, for the region, or for the entire state. Several difficulties arise from using data from previous forecasts. These include the differing times when each forecast was prepared, different geographic areas of analysis, differing forecasting horizons, differing sets of historical information and forecasting assumptions, and forecasts of differing measures of aviation activity. These difficulties can be seen in viewing the several previous forecasts shown in Exhibits 5-21 through 5-23. These charts display based aircraft, operations, and operations per based aircraft (OPBA) forecasts for the total regional airport system (excluding Sea-Tac). In addition, these charts display actual counts through the year 1998 for comparison.

Previous forecasts of based aircraft for the Puget Sound Region's airports show a wide range (see Exhibit 5-21). For the year 2000 the regional based aircraft forecasts range from a low of 3,712 to a high of 5,784. The actual number of regional based aircraft in 1998 was about 3,620, below even the lowest forecast. For the year 2020 three forecasts range from 3,732 to 7,207.

Previous aircraft operations forecasts show a similarly wide range. As seen in Exhibit 5-22, operations forecasts for the year 2000 range from 1,804,703 (1993 SASP) to 3,376,380 (1982 RASP). Total aircraft operations in the region for the year 1998 reached 1,636,819, below all the previous estimates.

1982 Regional Airport System Plan (RASP)

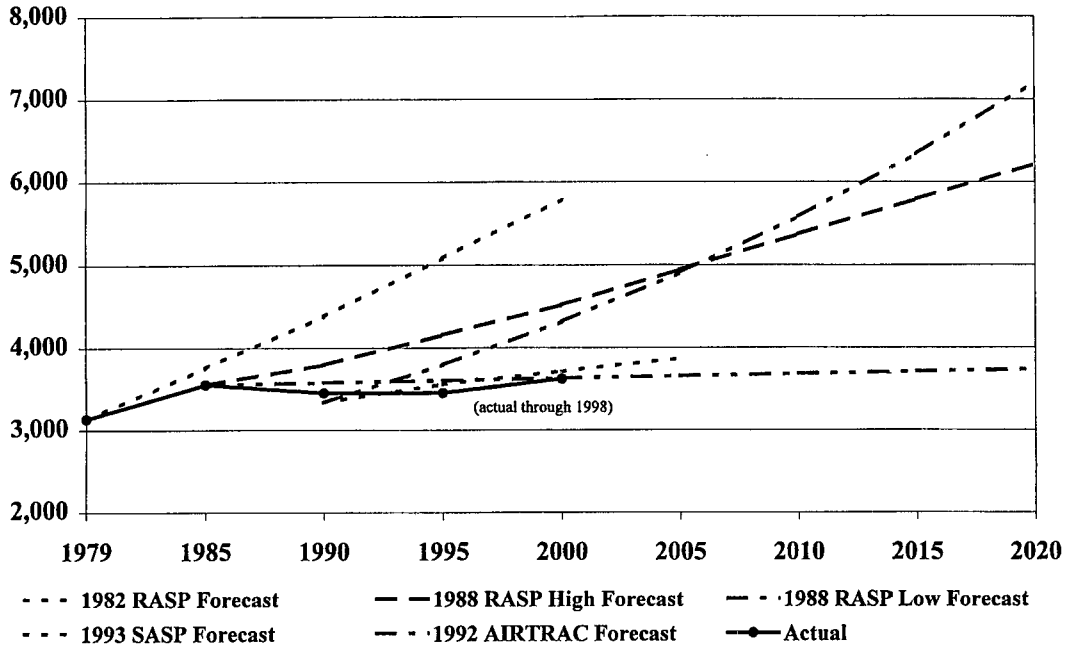
The *1982 Regional Airport System Plan* (RASP) used 1979 as its base year and projected growth through the year 2000. That forecast showed some 3,100 based aircraft in 1979 growing to about 5,800 in the year 2000, an average annual growth rate of 3%. The based aircraft forecast was developed using the historical relationship between growth in the regional based aircraft fleet and growth in the regional population. Assumptions were made for future (increasing) aircraft ownership rates and then applied to the projected population through the forecast period. The total regional based aircraft forecast was then allocated to the individual airports based on their "market share" in the base year (1979). The 1982 RASP forecast for aircraft operations was prepared by applying aircraft utilization rates for each airport (based on 1979 utilization rates) to the based aircraft forecast. Future utilization rates were assumed to remain at the 1979 level. That forecast showed regional operations increasing from 1,782,298 in 1979 to 3,376,380 in the year 2000.

1988 Regional Airport System Plan (RASP)

Although the 1988 RASP also predicted steady growth, it assumed slower growth than contained in the earlier plan. The *1988 RASP* forecast showed 3,551 based aircraft in 1985 (its base year) and developed both high and low forecasts. The high forecast showed 4,518 based aircraft in the year 2000 and 6,214 based aircraft in 2010. The low forecast showed 3,627 based aircraft in the year 2000 and 3,732 based aircraft in the year 2020. While the high forecast proved to be too optimistic through 1998, the low forecast is consistent with actual based aircraft numbers in 1998. The 1988 RASP based aircraft "high" forecasts were based on FAA national projections for the period 1986 to 1997 and were then extrapolated

Exhibit 5-21 Comparison of Based Aircraft Forecasts with Actual

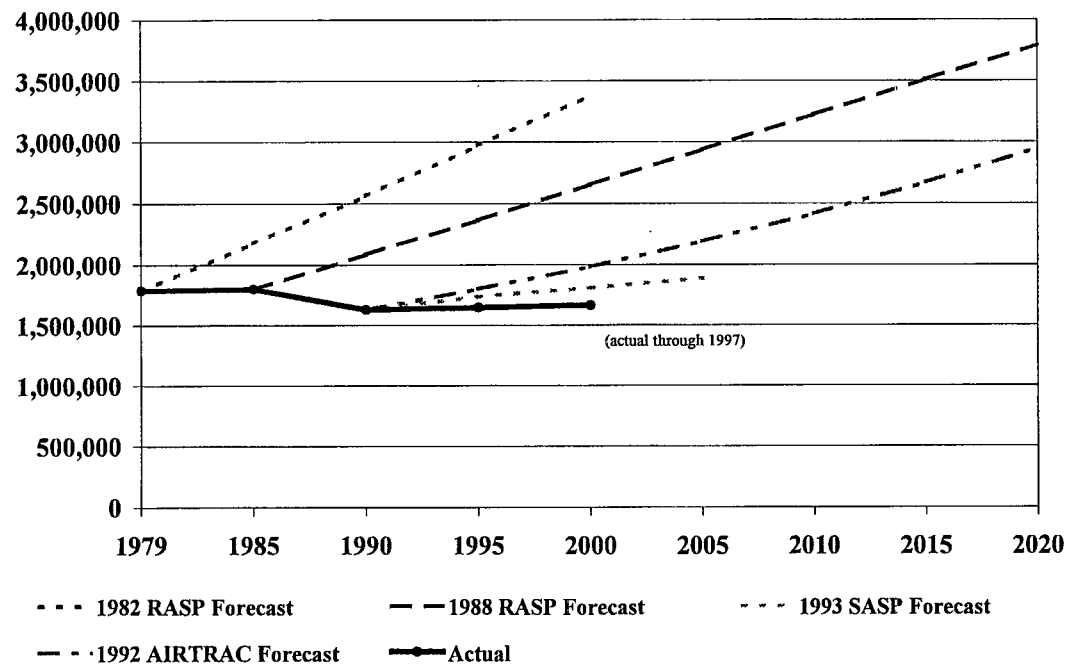
(excluding Sea-Tac)



Previous Forecasts.xls / BA Forecasts vs Actual

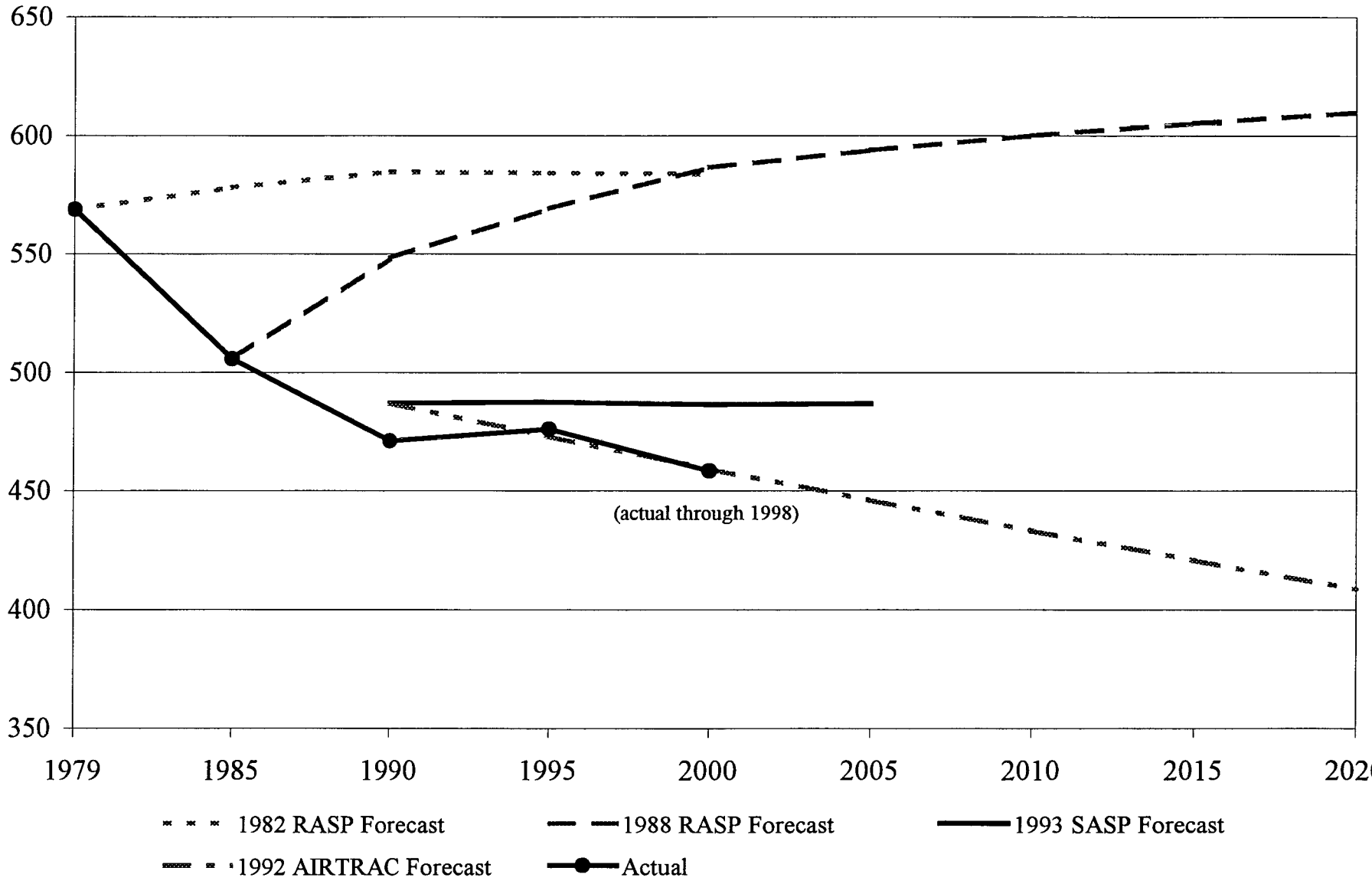
Exhibit 5-22 Comparison of Previous Operations Forecasts and Actual

(excluding Sea-Tac)



Previous Forecasts.xls / Ops FC versus Actual

Exhibit 5-23 Comparison of Forecast Operations per Based Aircraft (OPBA) with Actual (excluding Sea-Tac)



Previous Forecasts.xls / OPBA Forecasts vs Actual

for the years 1998 through the year 2020. Using FAA national based aircraft forecasts as a baseline, the regional aviation forecast was adjusted upward based upon the region's historically higher rate of aircraft ownership and projections of greater population growth in the four counties. Much of the growth was forecast for the east and southeast areas of King County.

Unlike the 1982 RASP forecast, the 1988 forecast assumed the 1988 aircraft ownership rate for the region would remain constant in the future. The "low" forecast contained in the 1988 RASP was based on conservative assumptions at the national and regional levels.

The 1998 RASP aircraft operations forecast was developed using FAA national forecast for the year 1997 and extrapolating that forecast to the year 2020.

1992 AIRTRAC Forecast

The Washington State Air Transportation Commission (AIRTRAC) prepared aviation forecasts in 1992 as part of its statewide analysis of aviation trends, demand, and capacity needs. That forecast was based on average annual growth rates derived from recent historic aviation activity across the state. Those forecasts were based in a average annual growth rate of 2.6%, and show total regional based aircraft growing from 3,337 in 1990 (base year) to 3,870 in the year 2005 and 7,207 in the year 2020. The 1992 AIRTRAC forecast for aircraft operations utilized annual growth rates derived from the FAA's Terminal Area Forecasts and Washington State Aviation System Plan. That forecast, when applied to the PSRC region airports, regional aircraft activity growing from 1,624,925 operations in the base year (1985) to 2,943,327 operations in the year 2020.

1993 Washington State Aviation System Plan (SASP)

The 1993 Washington aviation system consisted of 129 public use airports, seaplane bases, and heliports. The State Aviation System Plan ("SASP") developed forecasts for each of these facilities (see Exhibits 5-21 and 5-22). The figures discussed below were derived by separating the PSRC region airports from the statewide system. The 1993 SASP used 1990 figures as its base year and forecast based aircraft to the year 2005. The SASP developed relatively conservative forecasts, showing the region increasing from 3,337 based aircraft in 1990 to 3,870 based aircraft in the year 2005. This is only slightly above the 1988 RASP low forecast.

In addition to based aircraft and aircraft operations forecasts, the SASP developed statewide forecasts of active pilots, using FAA nationwide forecasts as a base. The statewide active pilot forecasts were correlated to nationwide pilot forecasts, nationwide population, and statewide population. The number of active pilots in the state were forecast to grow by an average annual rate of 1.85% from 1990 to the year 2005, or from 22,110 to 28,643 over the 15 year period.

Using the pilot forecast as a base, the 1993 SASP developed registered aircraft forecasts using a linear regression built upon the historical relationship between pilots and aircraft. The resulting registered aircraft forecast equates to an average annual growth rate of 1.00%. The total statewide registered aircraft forecast was then allocated to each county in the state based on each county's average "market share" of the total state aircraft for the period 1980-1990. Once allocated to the counties, the aircraft were allocated to airports in a similar way, assuming a each airport's share of the county's aircraft would remain constant.

The 1993 SASP developed aircraft operations forecasts by applying an assumed "operations per based aircraft (OPBA)" factor to the based aircraft forecast. These OPBA levels are displayed in Exhibit 5-23. These forecasts assume a constant number of annual operations per based aircraft over the forecast period, using historical OPBA figures for each airport. Applying the OPBA estimate to projections of future based aircraft yields a forecast of total aircraft operations. By combining the state's operations forecasts for just the PSRC region airports, the state's forecast process yielded an increase from 1,624,925 PSRC regional aircraft operations in the base year (1990) to 1,883,709 PSRC regional aircraft operations in the year 2005.

Summary of Previous Forecasts

All the previous forecasts have exceeded actual activity levels over time. The earliest forecasts contained in the 1982 RASP were prepared during a period of strong growth in the general aviation market, and predicted continued growth in the numbers of pilots, aircraft, operations, and aircraft production. Between 1970 and 1978 the number of new general aviation aircraft had increased by 144%, and all components of the aviation industry were on the rise. Those forecasts simply did not anticipate the structural change that was about to occur, and the ensuing decline in general aviation, which was to begin in 1980 and last into the mid-1990s.

The newest forecasts contained in the State's 1993 SASP are much more conservative, reflecting more recent general aviation trends. The SASP forecast comes closest to matching actual activity levels for the period 1990 through 1998. The SASP forecast predicts 3,712 regional based aircraft in the year 2000, which compares with an actual number of 3,620 in 1998. The SASP operations forecast for the year 2000, while not as accurate as the based aircraft prediction, is still within 9% of actual figures for 1998. In terms of the number of operations per based aircraft, the 1992 AIRTRAC forecast comes closest to matching actual levels. For 1998 estimated OPBA levels stood at 452, while the AIRTRAC forecast predicted 459 by the year 2000. Clearly, the more recent forecasts, which had the benefit of more recent aviation trend information, have thus far been better reflections of actual aviation activity levels during the 1990s.

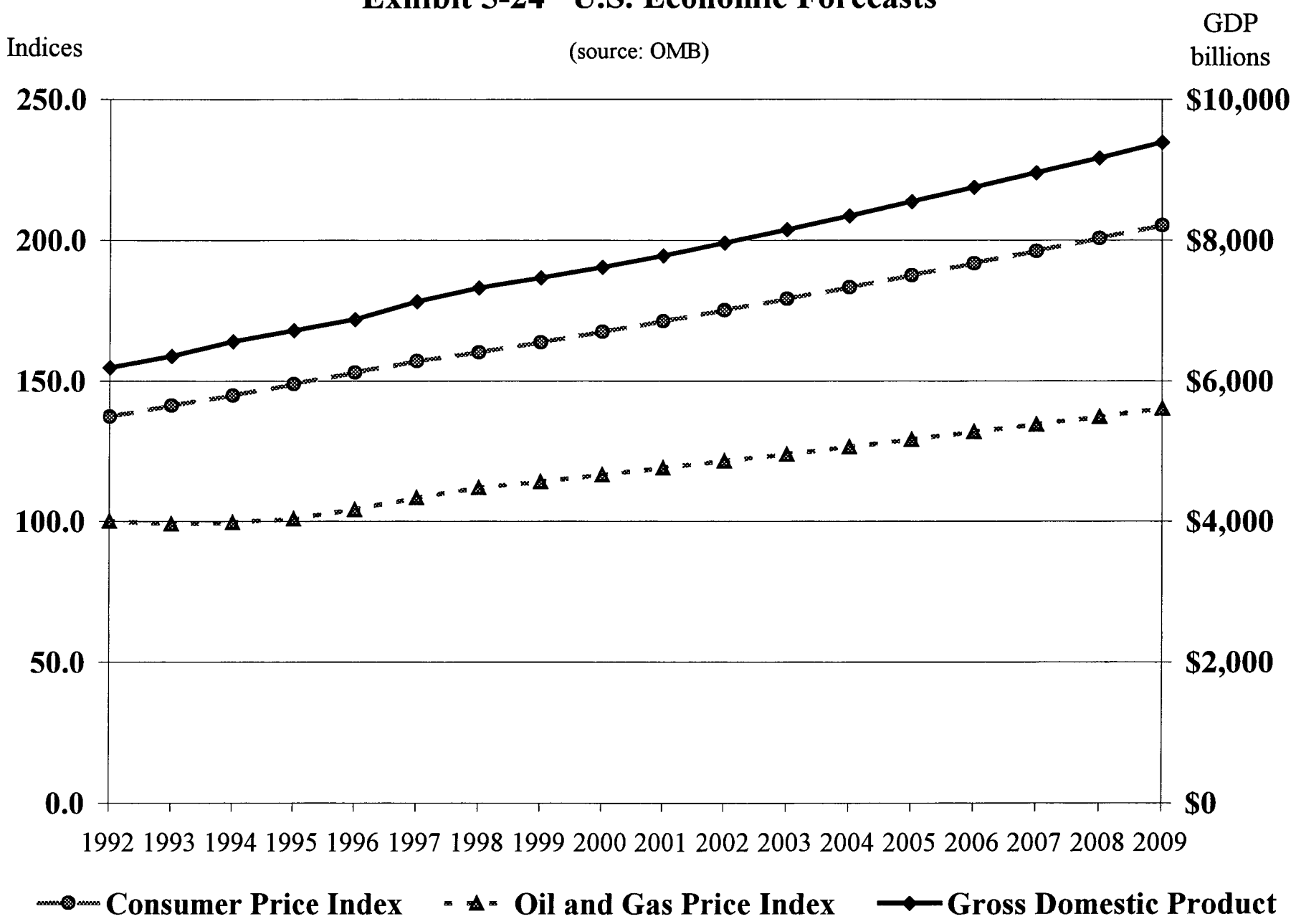
Current FAA Aerospace Forecasts

The most recent FAA Aerospace Forecasts were published in March 1999. In addition, the FAA's most recent Long Range Forecasts for the years 2015, 2020, and 2025 were published in June 1999. These forecasts provide a backdrop for the forecasting of regional activity. Among the many methods used by the FAA to measure aviation activity, the following are considered to be the most important: U.S. economic forecasts, active pilots, active aircraft, aircraft operations, aircraft hours flown, and aircraft fuel consumed. Each of these are discussed below.

U.S. Economic Forecasts

National economic forecasts form an important underpinning of the FAA's annual aviation forecast. A summary of U.S. long term economic forecasts (prepared in December 1997 by the U.S. Office of Management and Budget) was derived from the FAA's 1998 *Aviation Forecasts.* The OMB economic forecast (see Exhibit 5-24) displays historical data for the years 1992 through 1997 and shows forecasts for the years 1998 through 2009. The U.S. forecasts include an estimate of the consumer price index (CPI), the oil and gas price index, and gross domestic product (GDP). The consumer price index is indexed to 1983 (1983=100). The CPI forecast shows steady growth, from 157 in 1997 to 205 in the year

Exhibit 5-24 U.S. Economic Forecasts



FAA Forecasts 1998-2009.xls / Economic Forecasts Chart

2009. This forecast translates to an average annual CPI increase of just under 2.3%. For the total period the index is forecast to increase by 30%. The oil and gas price index is also forecast to increase by 30% between 1997 and 2009. Also included is a forecast of the U.S. Gross Domestic Product (GDP), which is estimated to grow from $7.124 trillion in 1997 to $9.386 trillion in the year 2009, a total increase of 32%, and an average annual growth rate of 2.3%.

FAA Forecasts of General Aviation Activity

To summarize the thrust of the most recent FAA general aviation forecasts, the following quote was taken from the March 1999 FAA forecast report *FAA Aerospace Forecasts Fiscal Years 1999-2010*:

Review of 1997-98

> *"In 1998, general aviation completed its fourth year of operations following the enactment of the General Aviation Revitalization Act of 1994. The industry followed through with constructive actions to stimulate the development and production of new general aviation products and services. The industry also made efforts to promote interest in general aviation flying and pilot training. Over the past several years this optimistic outlook and the positive actions began yielding tangible results. The resurgence of the industry is evidenced by increased general aviation activity at FAA air traffic facilities, an increasing active fleet size, and record shipments and billings of fixed-wing general aviation aircraft. What follows is a review of the industry's performance during 1997 and 1998. For the most part, results for this period have been positive. On this foundation the forecast is for continued growth over the next 12 years and the foreseeable future.*

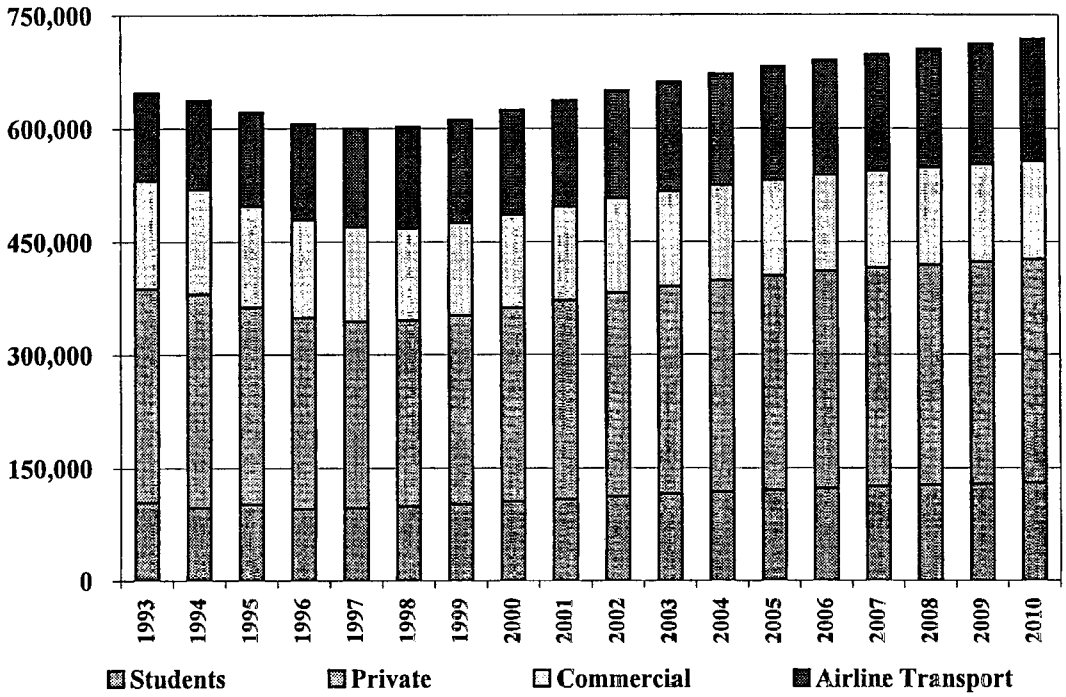
The FAA's general aviation forecasts for the period 1999-2010 (briefly summarized below) reflect this optimism on the part of the FAA and the general aviation industry as a whole. The FAA forecasts are based on the assumption of moderate and sustained economic growth for the U.S. In addition, the FAA's forecasts for general aviation assume that the legislation enacted in 1994 limiting the liability of GA aircraft manufacturers will have its greatest impact on the general aviation fleet around the turn of the century and beyond. The FAA states that while the predicted growth in GA activity will, to some degree, be driven by am expanding U.S. economy, the actual rate of growth will depend on how successful the industry is in stimulating the development of new general aviation products and services. To the extent that industry and government programs/initiatives are successful in revitalizing and expanding the market for general aviation products and services, the FAA's forecasts are likely to be met or possibly exceeded. If the industry's programs are not successful, the number of active general aviation fleet, hours flown, and pilots will be considerably lower than forecast.

FAA Forecast of Active Pilots

The U.S. population of active pilots, as shown in Exhibit 5-25 is forecast to increase at an average annual growth rate of 1.5% between 1999 and 2010, with a total increase of nearly 117,000 pilots for the period. For the entire long range forecast period (1998-2025) the FAA predicts annual growth of 1.2%. This forecast reflects the industry view that current initiatives, such as "GA Team 2000," will foster the growth of student starts. Increased student starts are expected to lead to larger numbers of pilots in other categories, particularly private pilots, over the course of the forecast period. The FAA's forecasts show

Exhibit 5-25 National Forecast of Active Pilots

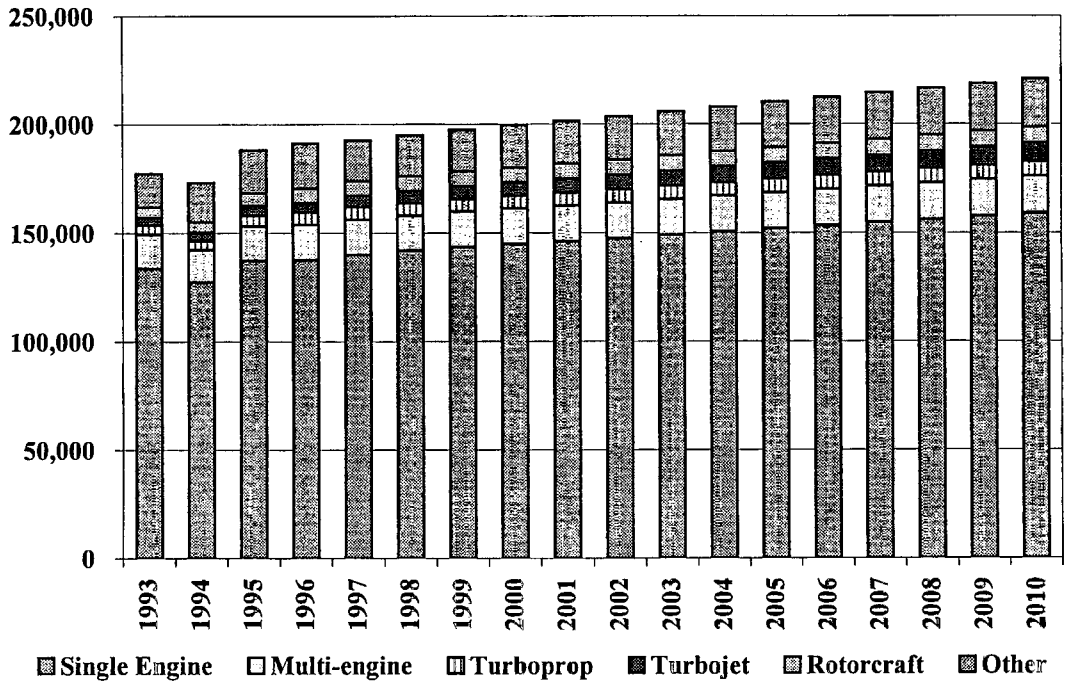
(source: FAA)



FAA Forecasts 1998-2009.xls / FAA Active Pilots FC

Exhibit 5-26 National Forecast of GA Active Aircraft

(source: FAA)



FAA Forecasts 1998-2009.xls / FAA GA Aircraft Forecast

the following annual growth rates for the four major pilot groups:

FAA Forecast 1999-2010

Pilot Group	Annual Growth Rate
Student	2.3%
Private	1.6%
Commercial	0.5%
Airline transport	1.5%

These growth rates can be seen on Exhibit 5-25. Excluding glider-only and helicopter-only pilots, the chart shows the total population of U.S. active pilots increasing from 618,000 in 1998 to 735,000 in 2010. The most pronounced growth can be seen in the student and private pilot groups. Whereas in recent years, when air transport pilots were the only growth sector for general aviation, the FAA forecast shows this trend will change.

FAA Forecast of GA Active Aircraft

Recent trends and the FAA's forecast of active general aviation aircraft are displayed in Exhibit 5-26. Total U.S. GA active aircraft bottomed out at 173,000 in 1994, and has grown each year since. The estimated total for 1998 was 195,000. Figures from the General Aviation Manufacturers Association (see Exhibits 5-11, 5-12, and 5-13) support the resurgence in the market for new GA aircraft, which is largely responsible for these increased numbers in the past 3 years. Between 1998 and 2010 the FAA estimates the total U.S. general aviation active aircraft fleet will grow from 195,000 to 221,000. Three trends are apparent in the FAA aircraft forecast. First is the steady overall growth throughout the period. The FAA's forecast is based on a 1.3% annual growth rate over the forecast period. Second is the fact that most of the predicted growth in active aircraft will occur in single engine aircraft. The forecast shows this sector of the GA fleet increasing from 127,000 in 1994 to 159,000 by the year 2010, a total increase of 25% for the period. This forecast is based on recent trends. The actual U.S. fleet of single engine piston GA aircraft has increased from 127,000 in 1994 to an estimated 142,000 in 1998, an increase of nearly 12% in 4 years. Third, the FAA forecast shows much slower growth in the multi-engine piston and rotorcraft fleets. Within the rotorcraft fleet, the number of piston-powered helicopters are forecast to remain constant at 2,259 while the turbine-powered helicopter fleet is expected to grow by nearly 12%, from 4,589 in 1998 to 5,151 in 2010. Total percentage growth for the various GA aircraft fleet segments for the period 1997-2009 are as follows:

FAA Forecast 1998-2010

Aircraft Type	Total Growth
Single engine piston	12.0%
Multi engine piston	5.0%
Turboprop	16.0%
Turbojet	59.5%
Rotorcraft	8.2%
Piston-powered	0%
Turbine-powered	14.8%
Experimental and Other	17.6%

The projected growth of single engine piston aircraft reflects the resurgence of the industry following the liability reform bill passed in 1994, and the optimism for growth in student and private pilot activity. The higher growth rates in the turboprop and turbojet sectors of the GA fleet reflect the already-established market for business and corporate general aviation. The figures for the two rotorcraft types reflect a significant shift in propulsion systems coupled with a continuing market for business-related rotorcraft applications, such as traffic reporting, police activity, medical evacuation, and others.

FAA Forecast of GA Operations at Airports with Air Traffic Control Services

Exhibits 5-27 through 5-30 display the FAA's current forecast of general aviation aircraft operations activity at airports with air traffic control services. These are typically airports with air traffic control towers. While this does not include many airports, and therefore excludes a component of GA activity, it represents an important component of the GA industry. Activity levels at towered airports is measured regularly, and can provide more statistically reliable data for future forecasting.

Total general aviation operations as towered airports are shown in Exhibit 5.27. After dropping from 38,355,000 to 35,300,000 annual operations between 1992 and 1996, operations rebounded, with a 2-year 7.8% jump to 38,063,100 in 1998. The forecast predicts this number will reach 45,215,000 annual GA operations in 2010, a growth rate of just under 1.5% per year.

Exhibit 5-28 displays the same data as Exhibit 5-27, but adds the split between local and itinerant GA operations. Both sectors of GA activity are forecast to grow, though itinerant will grow slightly faster than local. The forecast shows the split between local and itinerant will remain stable at 42% local versus 58% itinerant. Itinerant operations are forecast to increase by a total of 19.1% between 1998 and 2010, while local operations will increase by 18.4% for the period.

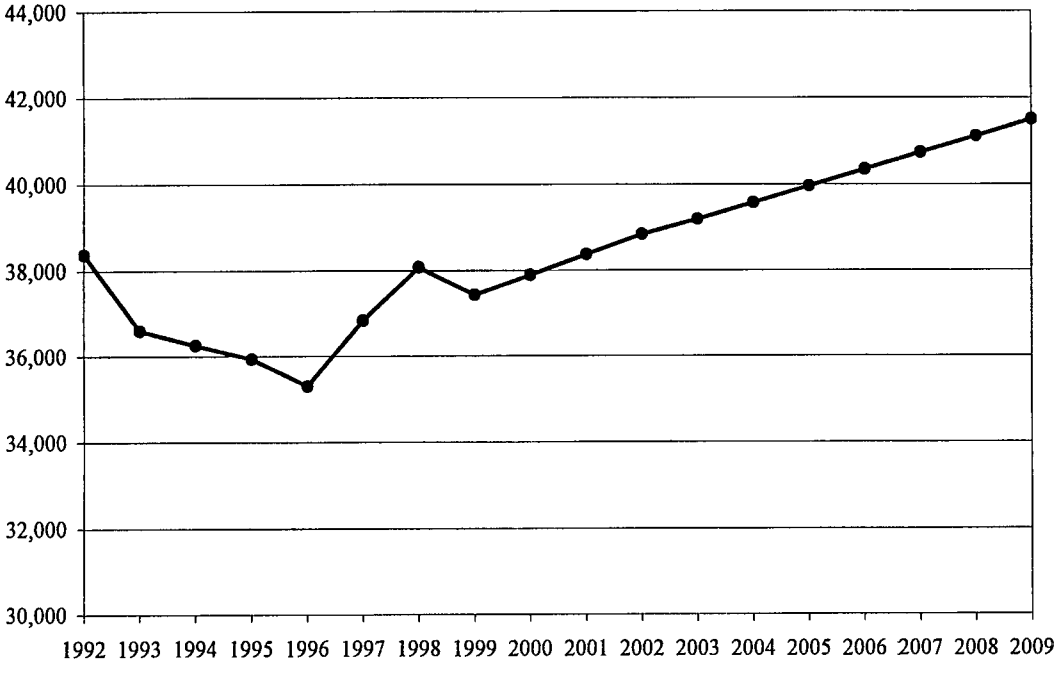
The FAA's instrument operations forecasts are displayed in Exhibit 5-29. These are a measure of the increasing sophistication of the GA industry as well as the health of the corporate and business segment of general aviation. The FAA predicts GA instrument operations to increase from 19,908,300 in 1998 to a projected 24,354,000 in the year 2010, a total growth of 22%. This is consistent with the projected growth in GA itinerant operations discussed above (see Exhibit 5-28).

FAA Forecast of GA Aircraft Hours Flown

Another measure of aviation activity is the amount of time aircraft are flying. The FAA forecast of aircraft hours flown is the total number of annual flight hours logged by general aviation aircraft. The forecast predicts total U.S. GA hours flown to grow from 28.2 million in 1998 to 34.1 million in 2010, a total increase of 21%. Exhibit 5-30 displays total aircraft hours flown for the six major aircraft types. The largest share of the total increase in hours flown is predicted for single engine piston aircraft, which are forecast to increase by 18% for the period 1998 to 2010. Turboprop and rotorcraft will see gains of 16% and 19%, respectively, while multi engine piston aircraft will see slower gains of only 7% for the period. The greatest increase in flight hours is expected to occur in turbojet use, with a total increase of 81%. This forecast reflects the assumption that business and corporate aviation will continue its strong growth trend of the past several years.

Exhibit 5-27 FAA Forecast of GA Operations at U.S. Airports with Air Traffic Control Service

(in thousands)



FAA Forecasts 1998-2009 (Appendices).xls / Total GA Ops Forecast Chart

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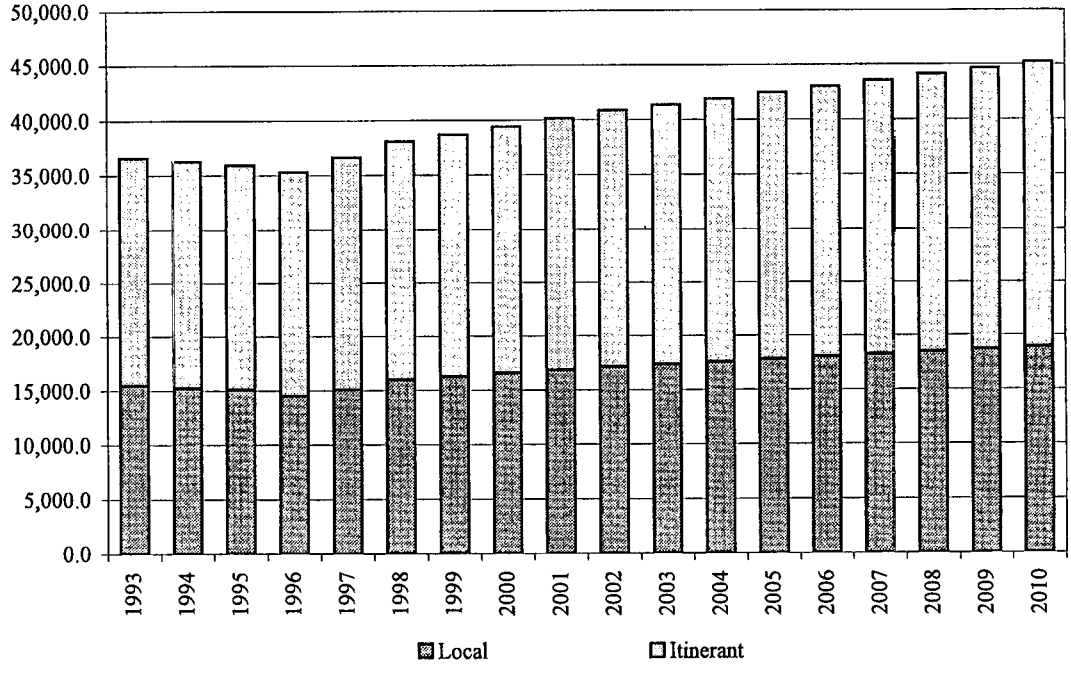
Exhibit 5-28 FAA Forecast of U.S. Local and Itinerant GA Operations at Airports with Air Traffic Control Service

(in thousands)



FAA Forecasts 1998-2009 (Appendices).xls / Local & Itin GA Ops Forecast

Exhibit 5-29 FAA Forecast of GA Instrument Operations at Airports with Air Traffic Control Services

(In thousands)

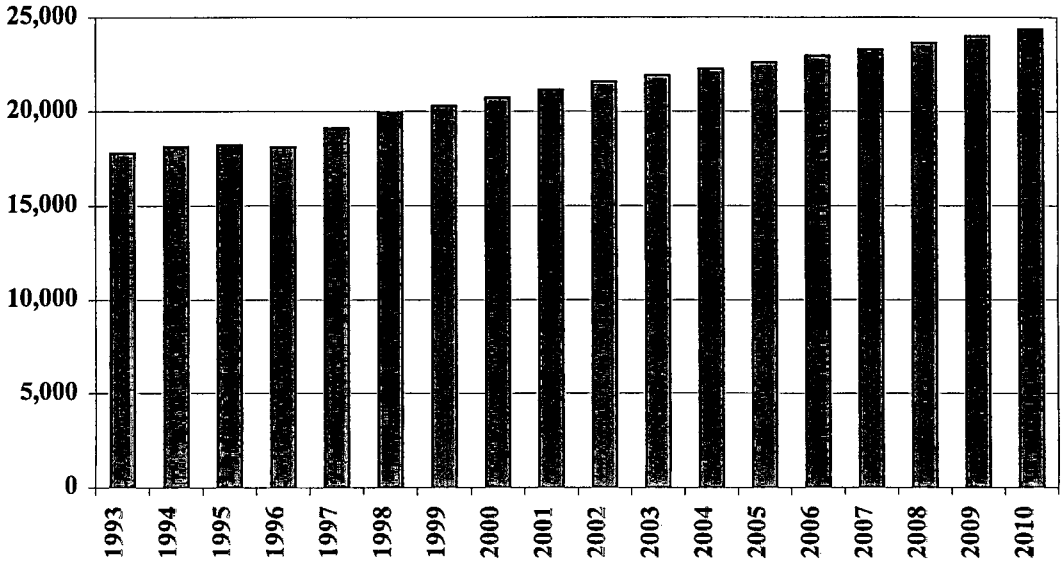
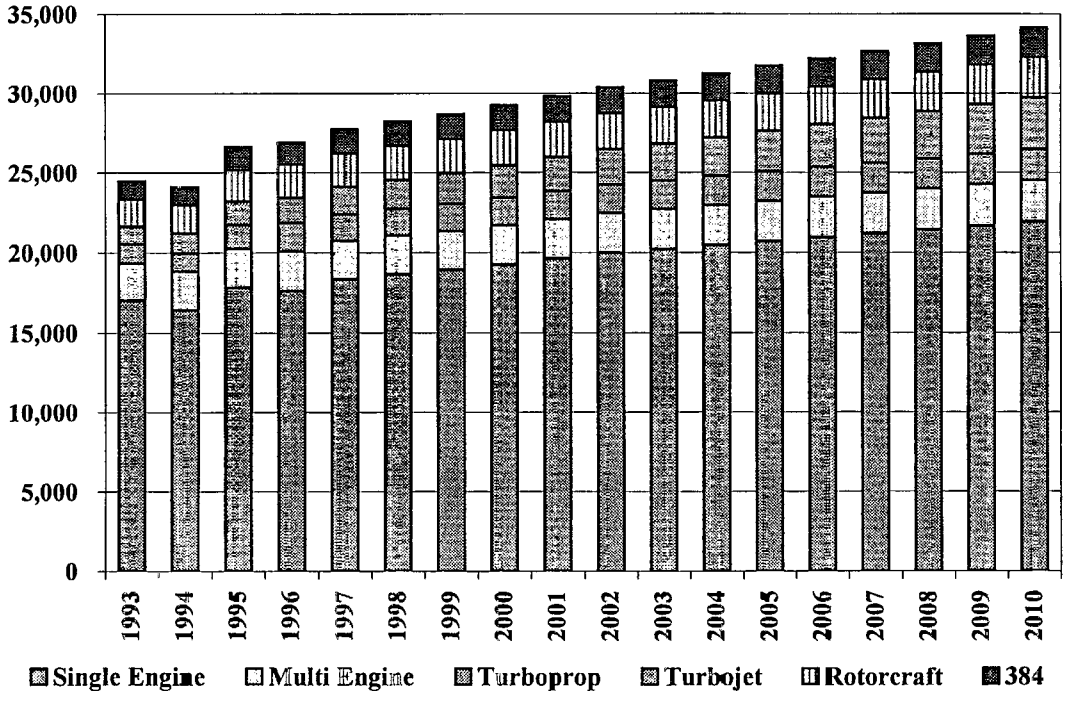


Exhibit 5-30 National Forecast of GA Aircraft Hours Flown

(in thousands)

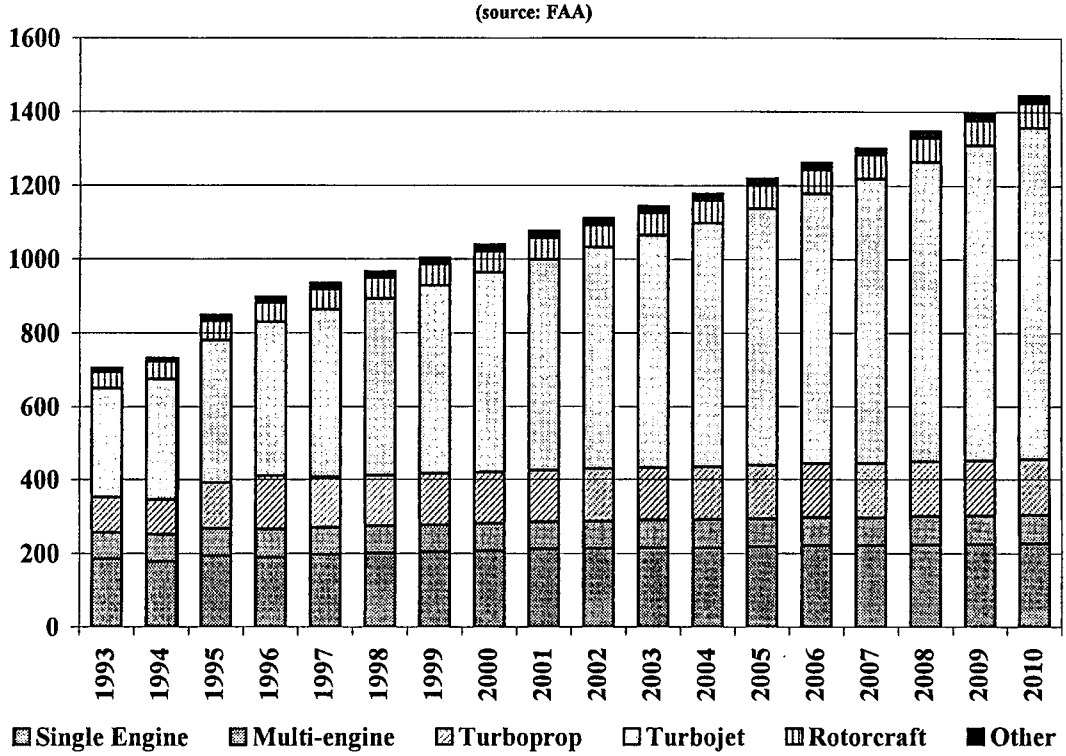
(source: FAA)



FAA Forecasts 1998-2409.xls / FAA FC of GA Hours Flown

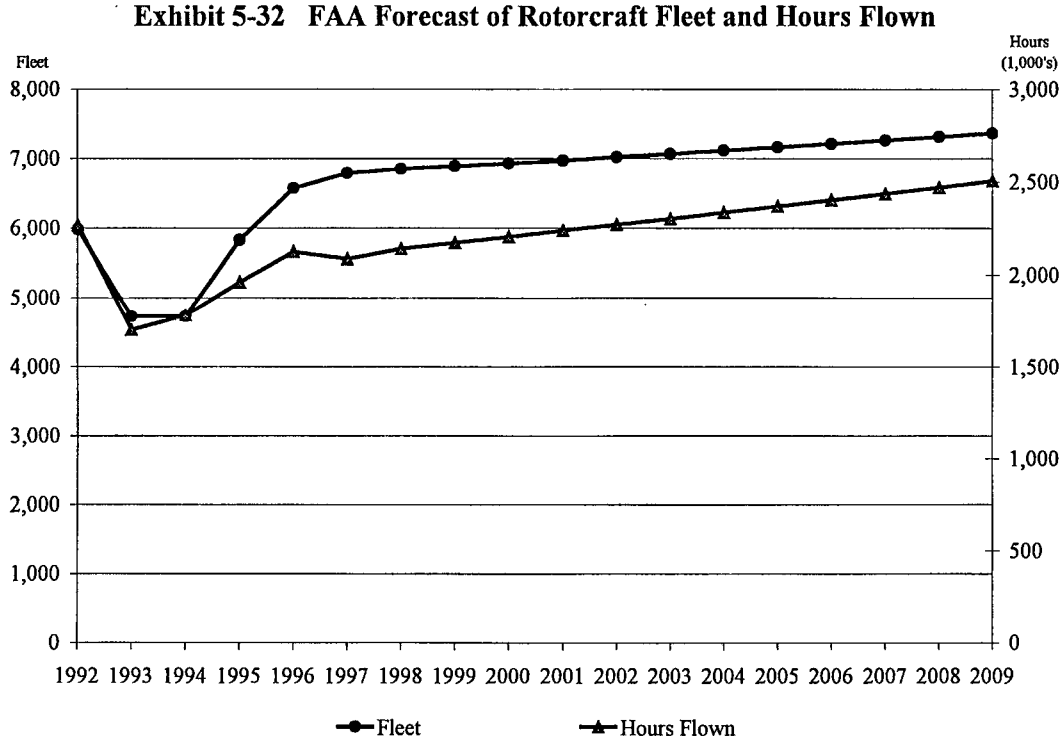
Exhibit 5-31 National Forecast of GA Aircraft Fuel Consumed

(millions of gallons)
(source: FAA)



FAA Forecasts 1998-2009.xls / Fuel Consumed Forecast

Exhibit 5-32 FAA Forecast of Rotorcraft Fleet and Hours Flown



FAA Forecasts 1998-2009.xls / FAA Rotorcraft Forecast

FAA Forecast of GA Aircraft Fuel Consumed

Exhibit 5-31 displays the FAA forecast of general aviation aircraft fuel consumption by aircraft type. Overall, fuel consumption reached a low point of 703 million gallons in 1993, and has grown steadily, reaching 965 million gallons in 1998. Total fuel consumed is forecast to increase to 1,445 million gallons by 2010, an increase of 50 % over 1998. The most significant component of the forecast is fuel consumed by turbojet aircraft. During the coming 12 forecast years, this segment of general aviation is expected to grow by 87%, from 482 million gallons to 903 million gallons by the year 2010. All other components are forecast to grow by between 10 and 20% overall during the forecast period, except for multi-engine piston aircraft fuel consumed, which is forecast to increase by only 5% in the coming 12 years.

Regional Socio-economic Forecasts

Historical analysis has shown a strong correlation between the level of aviation activity and three underlying socio-economic factors: population, employment, and income. Exhibits 5-33 through 5-35 display historic regional totals for these three demographic forecasts for the period from 1985 through 1998 while Exhibits 5-36 through 5-39 show regional demographic forecasts for the entire region and by county.

Population

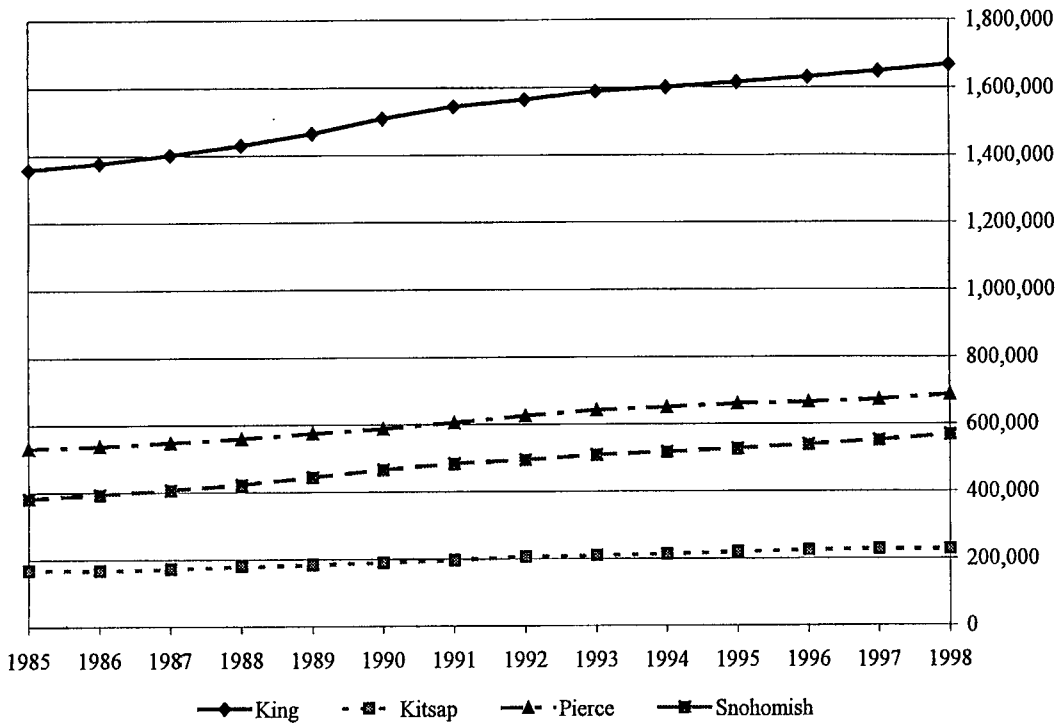
The most recent population forecasts for the Central Puget Sound Region show total population growing from 3.2 million in 1998 to 3.8 million in 2010 and 4.3 million in 2020, a total increase of 34% between 1998 and 2020. Average annual population growth is expected to be nearly 1.5%. Exhibit 5-33 displays forecast population for the region by county. Those forecasts are summarized below.

Puget Sound Population Forecasts by County

	1998		2010		2020	
County	**Population**	**% of Region**	**Population**	**% of Region**	**Population**	**% of Region**
King	1,665,800	52.9%	1,922,888	50.6%	2,122,453	49.8%
Kitsap	229,000	7.3%	293,486	7.7%	347,438	8.2%
Pierce	686,800	21.8%	841,722	22.1%	938,906	22.0%
Snohomish	568,100	18.0%	744,134	19.6%	853,956	20.0%
Total	3,149,700	100.0%	3,802,230	100.0%	4,262,753	100.0%

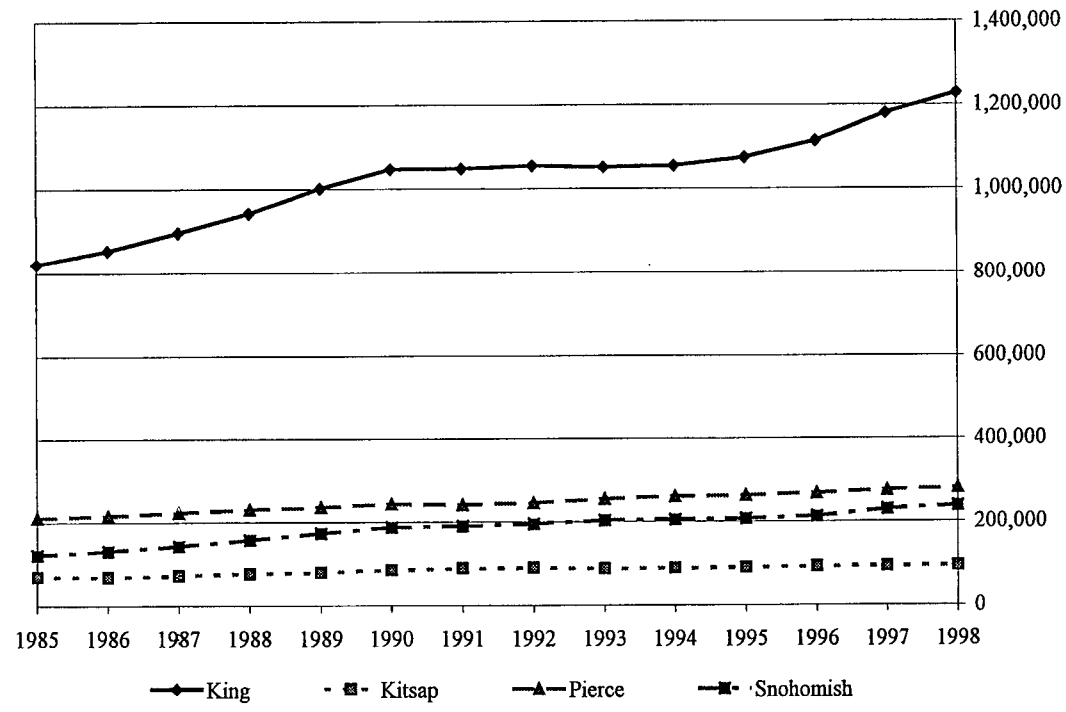
Within the region slight population shifts are expected to occur. King County's share of regional population will decline from 52.9% in 1998 to 49.8% by the year 2020. Most of that shift will go to Snohomish County, which will pick up 2 percentage points (from 18% to 20%), and Kitsap County, which will increase its share from 7.3% to 8.2%.

Exhibit 5-33 Regional Population



Regional and National Data.xls / Reg Pop chart

Exhibit 5-34 Regional Employment



Regional and National Data.xls / Re Empl chart

Employment

Regional employment is forecast to increase by an average annual growth rate of slightly over 1.2% over the 22 year period, from 1.84 million in 1998 to 2.2 million in 2010 and 2.4 million in 2020. The table below summarizes the annual employment forecasts, which are displayed in Exhibit 5-34. Similar to the expected intra-regional population trends shown above, regional employment is expected to shift slightly over time, with King County's share declining and the other three counties increasing. Pierce County should see its share of regional employment increase the most over the period, from 15.2% to 16.6%.

Puget Sound Employment Forecasts by County

	1998		2010		2020	
County	**Employment**	**% of Region**	**Employment**	**% of Region**	**Employment**	**% of Region**
King	1,227,798	66.7%	1,441,245	64.9%	1,554,278	64.4%
Kitsap	94,425	5.1%	117,613	5.3%	128,564	5.3%
Pierce	280,644	15.2%	362,360	16.3%	401,398	16.6%
Snohomish	238,108	12.9%	297,890	13.4%	328,357	13.6%
Total	1,840,975	100.0%	2,219,108	100.0%	2,412,597	100.0%

Per Capita Income

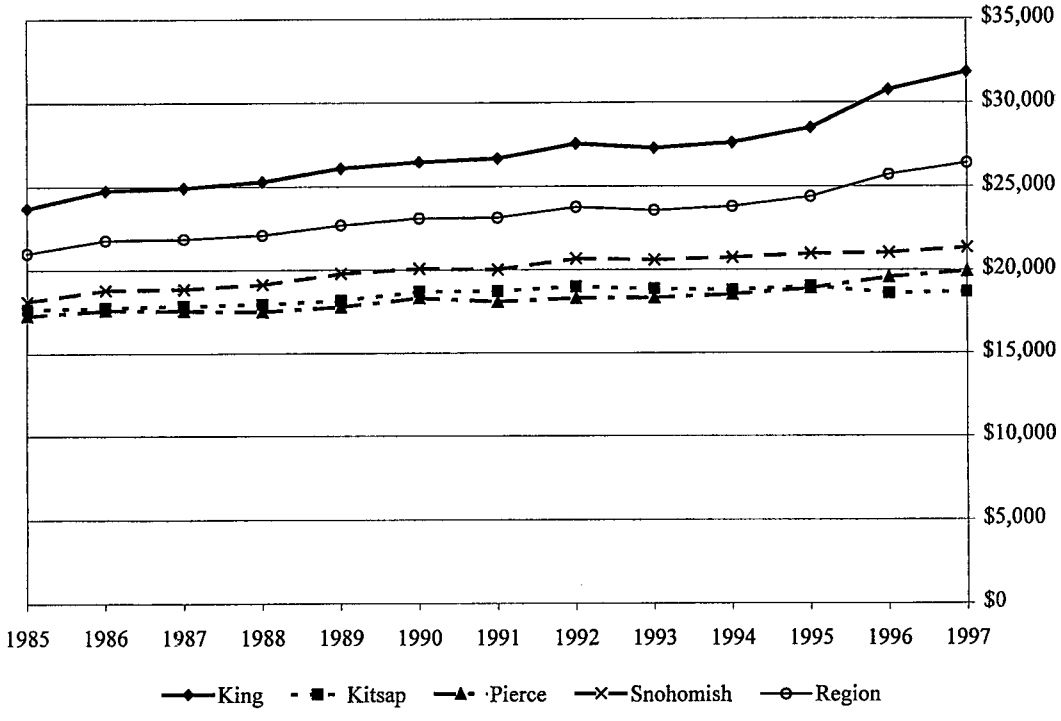
Forecasts of future per capita income are displayed in Exhibit 5-35 along with the population and employment forecasts. The figures show income in constant 1992 dollars. Over the 22-year forecast period, per capita income is expected to grow from $26,747 in 1998 to $32,615, a total increase of 22% and an average annual increase of 0.9%.

Comparison of Regional and National Socio-economic Forecasts

Continuing historical trends, the Central Puget Sound Region is expected to grow at a faster rate than the rest of the nation. Between 1998 and the year 2020, total U.S. population is forecast to increase by an average annual growth rate of 0.8% compared with the PSRC region's projected 1.5% annual growth rate. This places the regional population growth rate 87.5% higher than the national growth rate for population. National employment is expected to grow by 0.85% per year between 1996 and 2006 (U.S. Bureau of Labor Statistics), increasing from 124 million in 1998 to 150.8 million in the year 2020. This compares with the regional employment forecast of 1.2% growth per year for the period 1998 through 2020. This regional employment growth rate is 41% higher than the national employment growth rate.

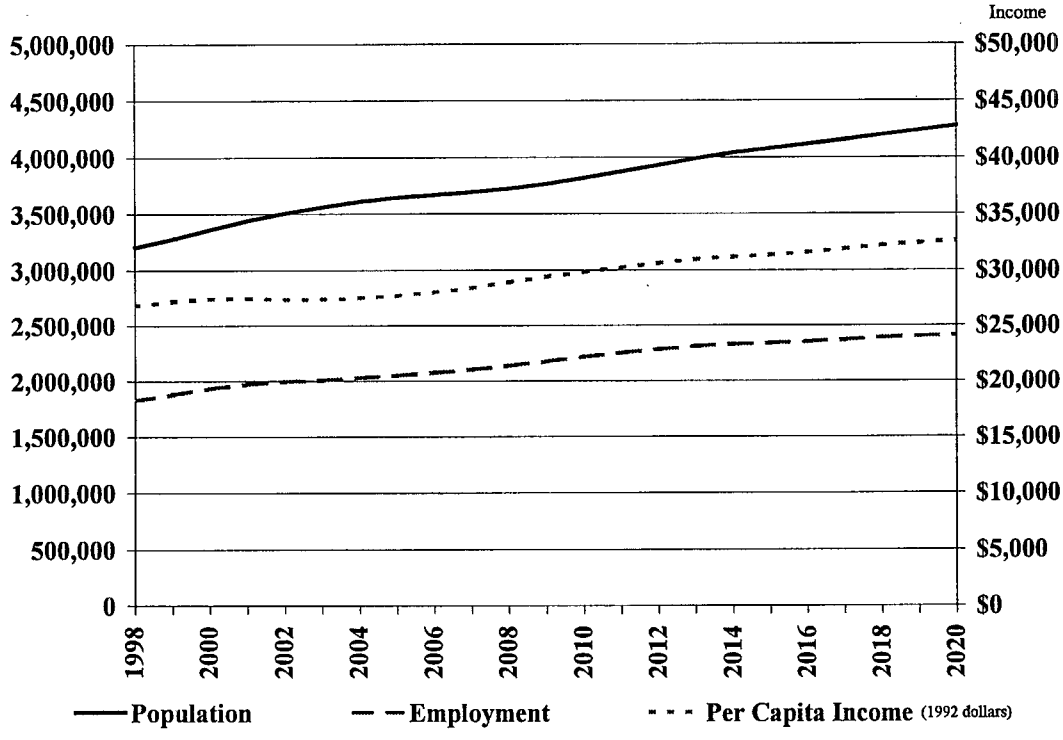
Exhibit 5-35 Regional Per Capita Income

(1992 dollars)



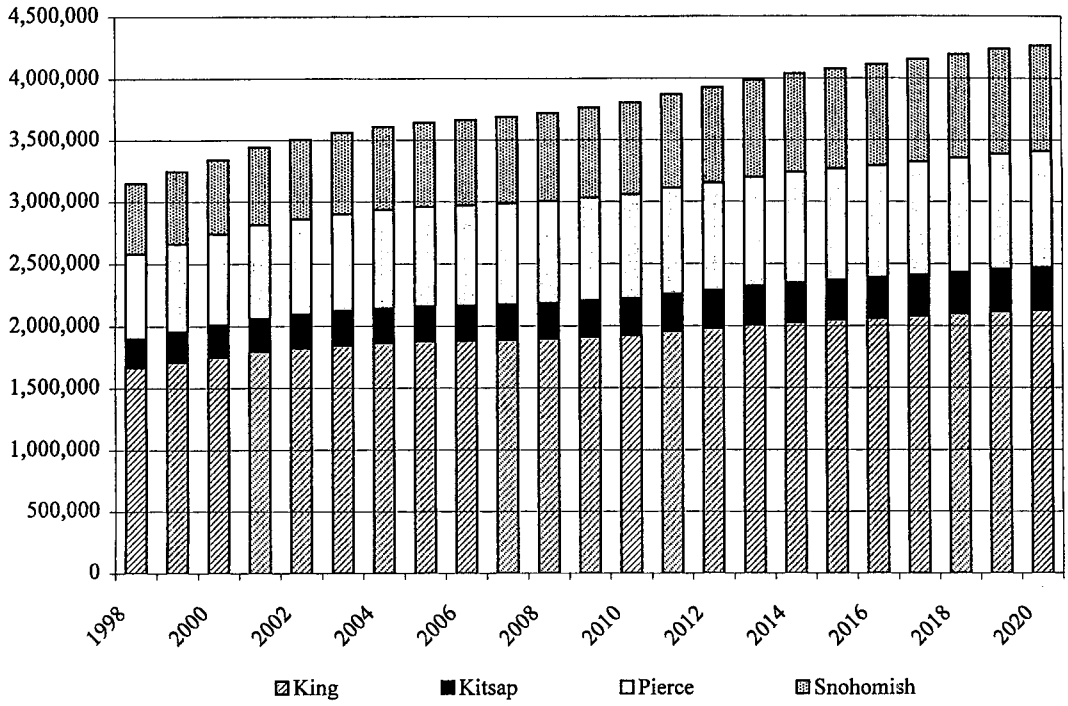
Regional and National Data.xls / Reg PCI chart

Exhibit 5-36 Puget Sound Region Demographic Forecasts



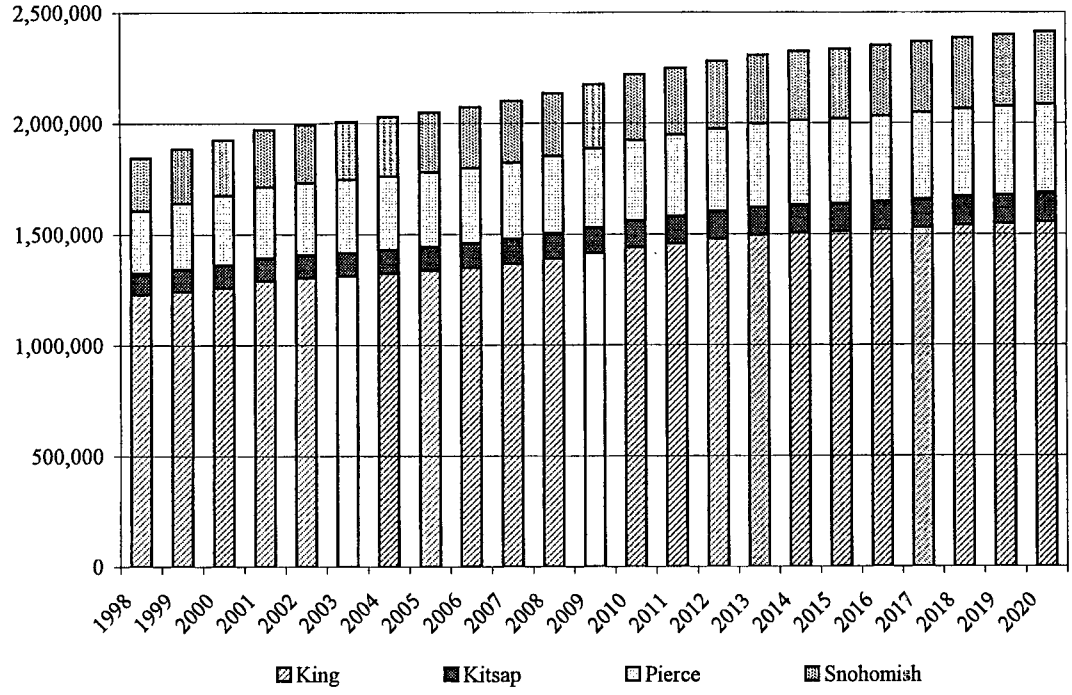
PSRC 2010 Forecasts.xls / Forecasts Chart

Exhibit 5-37 Regional Population Forecast by County



PSRC 2010 Forecasts.xls / Pop fc by county

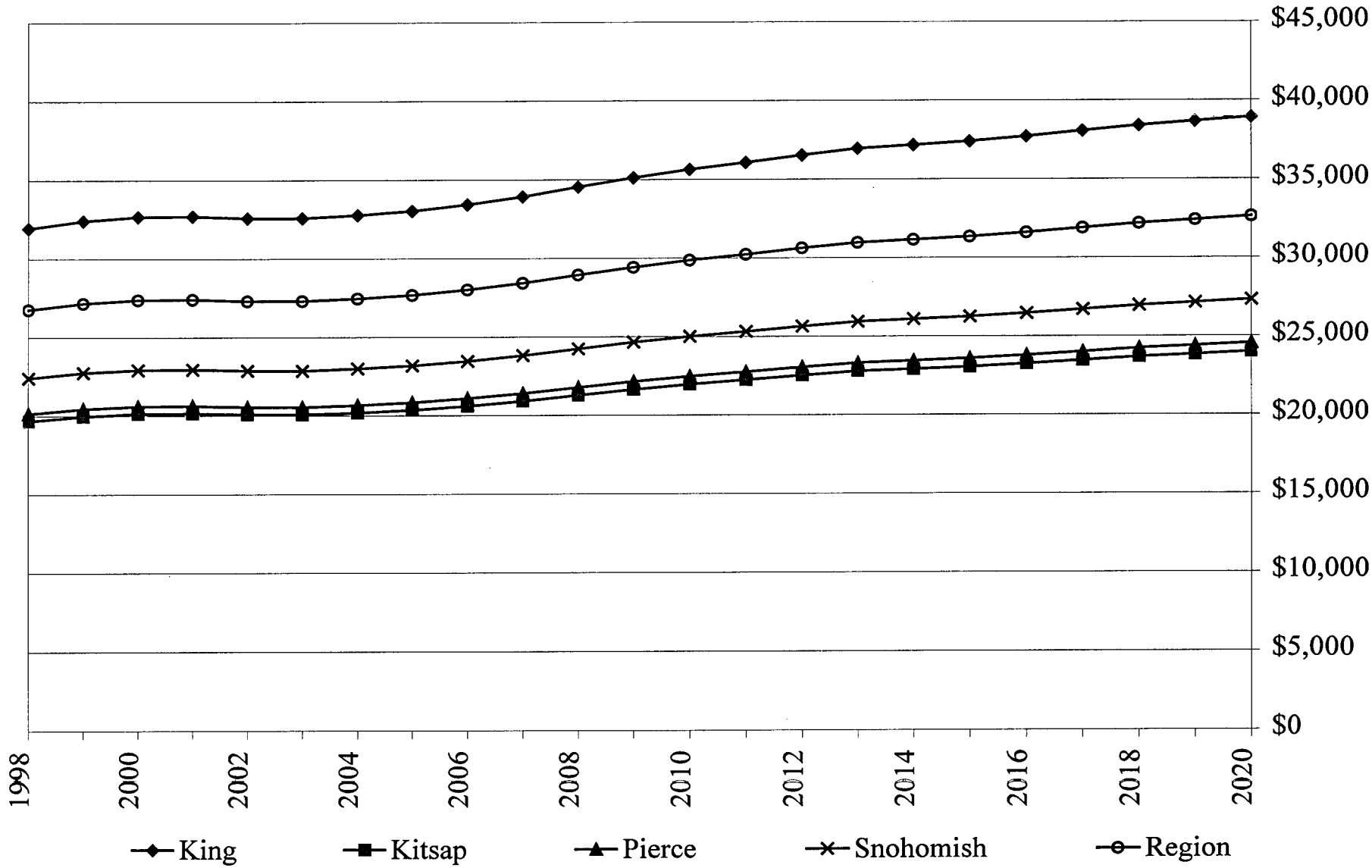
Exhibit 5-38 Regional Employment Forecasts by County



PSRC 2010 Forecasts.xls / Empl fc by county

Exhibit 5-39 Regional Per Capita Income Forecast by County

(1992 dollars)



Regional and National Data.xls / PCI Forecast

Forecast Methodology

This forecast methodology includes the preparation of forecasts using a variety of forecast approaches, a discussion of the results of those forecast approaches, and selection of a preferred forecast. Following is a summary of typical approaches to aviation activity.

Trend Analysis

A trend analysis forecast is based solely on historical trends. Using historical aviation data it establishes a linear trend (mathematical regression) and simply extends that trend into the future to establish a forecast. Trend analysis can be accurate in predicting future activity when historical trends have shown a low level of volatility, and where time is the only major variable affecting growth. A trend forecast is included here as one of several approaches to forecasting regional based aircraft. One of the weaknesses of trend analysis forecasts is their inability to account for unpredictable variables, such as population, employment, or income shifts, changing prices, or other factors affecting aviation.

Market Share

Market share forecasts are based upon the historical relationship between the Puget Sound region and larger markets, such as the State, the FAA's Northwest Mountain Region, and the nation. Typically a market share forecast reviews these historical relationships and establishes the region's "share" of the larger market. That share may be static or changing over time. If, for example, the region is growing at the same rate as the nation, a market share forecast would simply apply the region's existing "market share" (or percentage) to a national forecast to develop a regional forecast. If, on the other hand, the region were growing faster than the nation, the region's share of the national market would be increasing. Applying this approach to a national forecast would result in a higher regional forecast. The market share approach will be included here to produce a regional forecast of based aircraft.

FAA Annual Growth Rate

An annual growth rate forecast is included here to reflect the FAA's national active aircraft forecast. The latest *FAA Aerospace Forecasts 1999-2010* (March 1999) and *FAA Long Range Aviation Forecasts for 2010, 2015, and 2020* (June 1999) predict the total number of active aircraft to grow at 1.0% per year between 1998 and the year 2010 and then 0.85% per year between 2011 and 2020. As a comparison, we have included a regional based aircraft forecast here using these same average annual growth rates applied to the existing regional aircraft fleet (3,620 based aircraft in 1998).

Demographic Regression

One of the most widely used forecast approaches is demographic regression. This approach establishes an historical relationship between aviation activity and demographic variables such as population, employment, and income. This type of forecast approach can be accurate when there is a strong correlation between aviation activity and demographic variables. Using statistical regression techniques this approach produces an aviation forecast by applying the historical relationship to demographic forecasts. Demographic regression analysis will be used in the RASP to prepare three based aircraft forecasts based on population, employment, and income.

Bottom Up Forecasts (Master Plans)

Using the "bottom up" approach, regional aviation forecasts could be developed by combining the individual forecasts for each airport. This would most likely be done using the current forecasts from airport master plans throughout the region. Unfortunately, this approach has several drawbacks. First, it requires fairly consistent forecast data for all regional airports, and such data are not available. Second, it would require consistent forecasts from each master plan to allow for a regional aggregation of the forecast data into a regional aviation forecast. Again, this level of consistency is not available. And third, a regional forecast prepared using individual master plan forecast would need to account for each airport's "market area," and would have to eliminate all "duplication" caused by overlaps in the forecast markets for each airport, including duplicate waiting lists for all regional airports. Because the market area for each airport is not well defined, this task would be very difficult, making preparation of a bottom-up regional forecasts nearly impossible. For these reasons a bottom-up forecast was not attempted here.

Hybrid / Scenario Forecast

This type of forecast approach might combine some aspects of the other approaches. In addition, this approach might be built around a specific set of assumptions describing the effects of some future scenario. An example might be a forecast assuming the successful deployment of NASA's proposed *National General Aviation Roadmap* and *Small Aircraft Transportation System (SATS)* concept. Such a forecast would likely predict significantly greater numbers of based aircraft and operations, and would generate the need for a much expanded aviation infrastructure to serve those emerging markets.

Regional Allocations

Once a regional based aircraft forecast is complete, those aircraft must be allocated within the region. A regional based aircraft allocation methodology will allow us to assign total regional aircraft to each of the four counties and then to each airport. The regional allocation model will need to consider numerous factors which are likely to affect the regional distribution of based aircraft. These factors might include such items as: aircraft tie-down and hangar rates; landing fees; airport facilities and services (availability, type, price, and condition); airport and airspace complexity and congestion; regional distribution of population, employment, and aircraft owners and pilots; airport locations within the region relative to population, employment, and aircraft owners and pilots; and airport access.

Sensitivity Analysis

The forecasts may include sensitivity analysis to assess the impact of changing forecast variables on the actual forecasts. For example, if the selected forecast were based on regional population, sensitivity analysis would allow us to predict how future aviation activity might be affected by higher or lower population growth. This might allow us to monitor the difference between our forecasts and actual activity, and make adjustments as needed to our regional airport development program.

High and Low Forecasts / Forecast Ranges

Where there is some degree of uncertainty in our ability to predict future aviation activity, we might develop high and low forecasts, or a forecast range, to account for that uncertainty. Such a forecast would likely set a range wide enough so that there is a high probability that future aviation activity levels will

fall inside the forecast range. Planning would not be dependent on precise forecast accuracy, but would focus on meeting the needs within the forecast range of activity.

Market Sectors

Certain sectors of the general aviation industry might behave in ways that are quite different than the industry as a whole. For these reasons it may be necessary to prepare separate sub-forecasts for these aviation markets. Examples include seaplane and heliport activity. These sectors may respond to a different set of market forces, and might therefore require a different approach to forecasting.

Based Aircraft Forecast

Seven regional based aircraft forecasts were prepared, as displayed in Exhibit 5-40. They include trend, increasing market share, constant market share, FAA's average annual growth rate, and three separate demographic forecasts based on population, employment, and income.

The trend forecast predicts a total of 4,004 based aircraft in the region by the year 2020. This forecast is equivalent to an average annual growth rate of 0.46% (under ½ of 1%). This forecast falls in the middle of the seven based aircraft forecasts prepared here. The highest forecast is the increasing market share. This forecast is based on the Puget Sound Region's historical share of the total national active aircraft fleet. The region's share has been growing steadily over the past 20 years, from 1.49% of the national total in 1979 to 1.86% in 1998. These figures are consistent with other data reported in this chapter, that the Puget Sound Region has seen greater growth in aircraft ownership than the nation as a whole.

The increasing market share forecast is built on the region's increasing share of the national fleet, and predicts that share will continue to grow from 1.86% in 1998 to 2.31% in the year 2020. Applying this increasing market share to the FAA's most recent national forecasts of active aircraft yields a regional based aircraft forecast of 4,662 in the year 2010 and 5,558 in the year 2020. By combining the region's greater propensity for aviation activity with the FAA's optimistic national aviation forecasts, the market share forecast is the highest of all the based aircraft forecasts. Translated into an average annual growth rate, the increasing market share forecast yields a growth rate of nearly 2.0%.

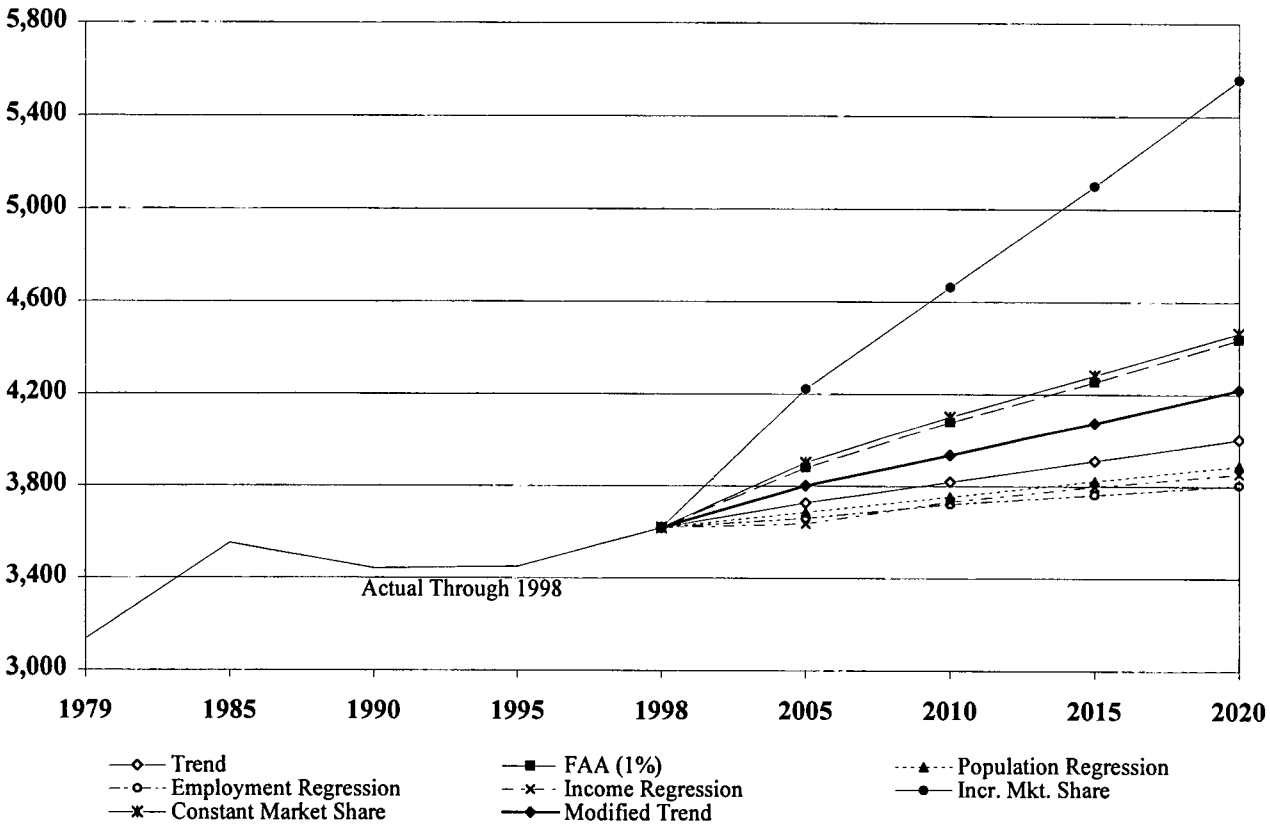
A constant market share forecast was also prepared. This forecast is based on the Puget Sound Region maintaining its current (1998) share of the national active aircraft fleet. That share is 1.86%. The forecast is derived by applying that share to the FAA's most recent forecast of total national active aircraft. The results of this forecast show the regional GA fleet growing from 3,620 in 1998 to 4,465 in the year 2020, an average annual growth rate of 0.96%.

The FAA's most recent national forecast of active aircraft (March 1999) predicts an average annual growth rate of 1% for the years 1999 through 2010 and 0.85% from 2011 until 2020. Applying this growth rate to the existing number of regional based aircraft produced a future forecast of 4,439 based aircraft in the region. This is the third highest of the based aircraft forecasts, just below the constant market share forecast. Three demographic forecasts were prepared using the historical relationship between regional based aircraft and regional population, employment, and income. These three forecasts yielded similar results, all of which predict between 3,800 and 3,900 based aircraft in the year 2020. Average annual growth rates for these three forecasts fall between 0.23% and 0.33%.

Exhibit 5-40 Summary of Regional Based Aircraft Forecasts

	1998	2005	2010	2015	2020
Trend	3,620	3,727	3,819	3,911	4,004
Modified Trend (selected forecast)	***3,620***	***3,801***	***3,936***	***4,076***	***4,220***
Increasing Market Share	3,620	4,223	4,662	5,100	5,558
Constant Market Share	3,620	3,902	4,103	4,284	4,465
FAA's 1% Annual Growth	3,620	3,881	4,079	4,255	4,439
Population Regression	3,620	3,686	3,754	3,823	3,891
Employment Regression	3,620	3,661	3,723	3,764	3,805
Income Regression	3,620	3,637	3,733	3,798	3,855

Regional Based Aircraft Forecasts



Analysis of Based Aircraft Forecasts

The regional based aircraft forecast forms the foundation of the aviation forecast, and will be used (along with the analysis of system capacity) to identify existing and future system requirements. As shown in Exhibit 5-40 above, seven potential based aircraft forecasts were prepared. In the year 2020 they range from a high of 5,558 to a low of 3,805, this compared with the existing number of 3,620 regional based aircraft. The following two sections present a synopsis of factors affecting the forecast and a discussion of each regional based aircraft forecast.

Factors Affecting the Forecast

* ***U.S. and regional economies*** - - Strong growth in both the national and regional economies have been major contributors to the overall aviation industry's health and to the current rebound in the general aviation segment. Growing employment and increasing disposable income, combined with a healthy overall business climate, have led to increased investment in private and business aircraft and to growing general aviation activity. The Puget Sound Region has seen economic growth above the nation as a whole, which contributes to the region's higher ratio of aircraft ownership and use than the nation as a whole. If current projections of national and regional economic activity hold true, the resulting strong economy is likely to lead to continued growth in the national general aviation industry. The Puget Sound Region could expect to see additional demand for based aircraft and aircraft operations. If the strong economy does not materialize, future aviation activity could stagnate.

* ***Regional population and employment growth*** - - Aviation activity is linked to the region's economy and to its population and employment base. Increasing regional population and employment, combined with a growing economy, have translated into increasing numbers of based aircraft and aircraft operations in recent years. Forecasts of regional population, employment, income, and other economic indicators all point to continued growth, and should exert upward pressure on regional aviation activity. Given the Puget Sound Region's higher than average propensity to engage in aviation, forecast growth in population, employment and income will very likely translate into growing aviation demand. Perhaps the most critical forecasting issue will be where, within the region, that demand lies, and how it should be accommodated.

* ***Cost of aircraft ownership (purchase, operation, fuel, maintenance, insurance)*** - - One of the greatest historical influences on aviation activity, especially general aviation, is cost. Analysis of historical data on aviation cost and activity levels shows that aviation is extremely price sensitive, with the most critical elements being aircraft purchase price, operating cost (particularly fuel cost), aircraft maintenance, and insurance. Until passage of the General Aviation Revitalization Act of 1994 the cost of aircraft product liability insurance had increased rapidly as a result of several major aircraft liability suits, making the cost of flying prohibitively expensive.

  The cost of fuel is another major factor affecting the level of activity. Between 1970 and 1981 the average national cost of motor fuel increased nearly fourfold while jet fuel increased by nearly 700%. Since 1981 the price of both fuel types has decreased sharply, and since 1994 several other cost factors have turned around. It appears these downward shifts in aviation cost have contributed to the recent resurgence in general aviation. As shown in Exhibit 5-24, U.S. long term economic forecasts predict stable price of oil and gas (as measured by the oil and gas price index), with overall fuel prices rising less than the consumer price index over the coming 10 years. If these predictions occur, the price of aviation fuel would effectively decrease over time, creating an upward push on aviation activity. On the other hand, if unforeseen increases in aviation fuel occur in the future, they will likely have a significant downward influence on aviation activity, primarily aircraft operations. If other factors remain favorable, short term increases in fuel prices would tend to reduce the number and or length of flights, but would have little affect on the basic structure of the GA industry. Long term fuel price increases could have a more significant impact on the overall industry.

While the factors listed above have, in recent years, combined to produce an upturn in overall general aviation activity, there has not been a marked change in the purchase price for small general aviation aircraft. In order for the recent growth in GA to be sustainable, aircraft must be affordable. The long term prospect of more affordable aircraft will likely have a strong impact on the market for new GA aircraft. If prices fall due to the affects of the General Aviation Revitalization Act of 1994, new technologies, or other factors, the number of new aircraft entering the fleet could increase. If prices do not stabilize or fall, the prospects of continued growth in new aircraft production are not likely to materialize. The market for new higher end corporate GA aircraft, however, continues to be strong, and appears to be somewhat less sensitive to purchase price and other operations and maintenance costs.

* ***Fractional ownership of general aviation aircraft*** - - Because of increasing costs and other factors, more and more aviators are joining together to purchase aircraft in partnership. Fractional ownership companies purchase aircraft, sell shares of the aircraft, and provide management services, including managing the use of the aircraft, provision of pilots, and aircraft maintenance. Combining their resources provides fractional owners with several benefits, including lower purchase cost, sharing of operating and maintenance costs, reduced insurance cost, and sharing of the costs of aircraft storage. The reduced costs associated with fractional ownership may allow owners to purchase more advanced aircraft that would otherwise be far too expensive to own individually. In addition, it's likely that the joint owners of such aircraft would demand higher quality storage facilities rather than open tie-downs. As fractional ownership grows in popularity, this could lead to greater demand for T-hangars and conventional hangars. The national trend toward fractional ownership may decrease the demand for new aircraft, but it may also increase the utilization rate of those aircraft. The trend toward fractional ownership can be seen in the latest FAA forecasts published in April of 1999. These forecasts for the period 2000-2010 predict a 1% annual growth rate in the nation's general aviation fleet and a 2.1% average annual growth rate in active pilots. The General Aviation Manufacturers Association (GAMA) 1999 figures show 15% of all new GA turbojet aircraft shipments are delivered to fractional owner programs.

* ***Congestion and complexity of regional airspace / availability and cost of landside facilities / intra-regional trends*** - - The Central Puget Sound Region has experienced rapidly increasing aviation activity over the past 10 years. Sea-Tac Airport in particular is one of the fastest growing airports in the U.S. Combined with the overall resurgence in general aviation throughout the region, the region's airspace has become more congested and complex, and many of the region's airports have seen increased landside and runway congestion. With the supply of airport facilities generally fixed, this growing demand has increased the pressure for regional airports to increase prices. The increasing cost of operating airports is also pressuring airports to pass those costs on to their users in the form of higher landing fees, fuel costs, tie-down and hangar rates, and other aviation services. While the region-wide demand for aviation may increase in the future, intra-regional trends in pricing may have a significant effect on which airports can actually accommodate future demand. In addition, the availability of adequate land for airport expansion and new aviation facilities and services will affect how much demand can be met, and where. Related issues include potential regulatory and environmental factors (discussed below), which may also affect future demand. Related to the above items, recent years have seen noticeable trends within the region. In the past 10-15 years, growth in based aircraft and aircraft operations has begun to focus around the edges of the urbanized region, with aviation activity growing at airports like Arlington, Harvey Field, Crest Airpark, and Tacoma Narrows. At the same time,

Boeing Field, Bremerton National, and Renton Airports have seen little or no growth. In terms of regional aviation market share, Snohomish County has seen a steady increase over the past 10 years, while King and Pierce Counties' shares have dropped. Meanwhile, Kitsap County has maintained a fairly constant share. If these trends continue in the future, the region's aviation growth may be further concentrated at the peripheral airports, primarily in Snohomish County.

* ***Competitive relationship between commercial and general aviation / climate and market for business aviation*** - - Although commercial and general aviation generally have separate and distinct markets, certain aspects of these two aviation sectors overlap. In the short to medium range passenger market, corporate aviation competes cost effectively with the commercial air carriers. Two major factors contribute to this equation: cost and convenience. As long as corporate general aviation can compete in these two areas the market will remain strong. There is the potential, however, for the growing commuter airline industry to cut into the corporate aviation market as more city pairs are served, as new commuter jets enter the fleet, and if commuter flight ticket prices fall. This market is untested, and it is currently unclear how commuter ticket prices and flight schedules will compare/compete with the corporate aviation alternative.

* ***Regulatory, legal, and environmental factors / new aviation initiatives*** - - Regulatory, legal, and environmental factors are difficult to predict, but can have a significant effect on future aviation activity. It is widely believed that the reform of general aviation liability laws in 1994 is partially responsible for the current resurgence of the general aviation industry nationwide. Conversely, during the 1980s several major aviation liability lawsuits are held responsible for skyrocketing insurance costs, which had a devastating affect on general aviation across the country. While liability insurance costs have relaxed somewhat since passage of the General Aviation Revitalization Act of 1994, it is still too early to tell what the long term impacts of the new law may be on the overall price structure of general aviation.

Environmental constraints (including noise, air and water quality, and land use encroachment) continue to affect airports' ability to serve the nation's aviation needs. Additional constraints may dampen future aviation demand, especially if they translate into higher costs to either airport operators, airport users, or both.

Several recent aviation initiatives may have a long term positive affect on the forecast. These initiatives include the *Advanced General Aviation Transport Experiments ("AGATE"),* the *National General Aviation Roadmap,* the *GA Team 2000* program, the *Be A Pilot* program, and others. These programs are designed to stimulate new pilots and introduce new technology to the general aviation industry, and so far have been successful. According to the GAMA, since 1996 the number of new student pilot starts has increased by nearly 12% while employment at GAMA member companies was up 11.5% for the year 1998 and is up 46% since 1994. If these programs continue to be successful, they could increase demand, reduce costs, improve safety, and usher in a new era of aviation growth. The FAA's optimistic forecasts for general aviation are based, in part, on the anticipated success of these programs. If they are less successful than anticipated, aviation activity may not reach the levels forecast.

Several regulatory proposals being considered in Congress have the potential for major impacts on general aviation. These include proposals to privatize air traffic control (which would then be

dependent on user fees) and to charge GA aircraft for use of Air Traffic Control services similar to commercial aircraft. These proposals would significantly increase costs for GA users, which could have a major dampening effect on GA activity.

Discussion of Based Aircraft Forecasts

Increasing Market Share Forecast

The increasing market share forecast yields a 2020 regional total of 5,558 based aircraft, an increase of 53.5% over the existing total. The forecast is based on a continuation of recent trends, which show the Puget Sound Region has seen more growth in based aircraft than the nation as a whole. Thus its share of the nation's total aircraft has increased over time. Applying this increasing market share to the rather robust FAA forecasts of total U.S. active aircraft produces a doubly robust regional forecast. This forecast translates to an annual growth rate of nearly 2.0%, which compares with the FAA's national active aircraft forecast growth rate of 1.0% per year. While the region has seen growth above that of the nation over the past several years, it is unlikely that such growth will continue at its current rate through the 20-year forecast period. In the past 3 years the rate at which the region's based aircraft fleet grew showed significant slowing when compared with the nation. In addition, the region's economic growth has softened in recent years, in part due to Boeing Company slowdowns. Regional employment growth, which had reached 5.44% in 1997 over 1996, fell back to 3.6% in 1998. These data point toward a modest cooling of the region's overall economy, which is likely to result in a slightly lower future growth rate in based aircraft. The increasing market share forecast is therefore considered overly optimistic.

FAA U.S. Active GA Aircraft Forecast (FAA's 1% Annual Growth)

The FAA's most recent national long range forecast of active GA aircraft (June 1999) is based on an average annual increase of 1.0% for the period 1999 through 2010 and then 0.85% per year from 2011 through 2020. At the national level, this forecast shows the nation's active GA aircraft fleet growing from 194,826 in 1998 to 240,300 in 2020 for a total 20-year increase of 23.3%. Factors included in the FAA's forecast are the recent upward trends in new GA aircraft production, positive trends in the U.S. active GA aircraft fleet, increasing GA aircraft hours flown and fuel consumed, increasing numbers of operations, the current Federal budget surplus, stable fuel prices, forecast economic growth, and predicted success of several new aviation programs. The FAA's 1999 Aerospace Forecasts note as particularly encouraging for the future of GA the recent increases in the number of student pilots, a 15.3% increase in the number of GA aircraft whose primary use is instructional, and the increase in the number of instruction hours flown by GA aircraft (up over 4%). These measures point to a brightening future by increasing the supply of future aviation system users (young pilots). Translating these FAA growth forecasts into regional based aircraft numbers yields a forecast of 4,079 in 2010 and 4,439 in the year 2020 for a total 22-year gain of 22.6%.

The FAA forecast does not appear to consider any significant negative forces which could reduce future general aviation demand. These forces, discussed above, include increasing fuel prices, regulatory controls (such as user fees), slower economic growth, lower expectations regarding the success of the new general aviation initiatives, and external factors such as environmental regulations, legal issues, land use encroachment, and overall public sentiment. A variety of these factors could potentially dampen the prospects for future GA growth. For these reasons the FAA forecast appears too high.

Constant Market Share Forecast

The constant market share forecast assumes the Puget Sound Region will retain its existing share of the nation's general aviation fleet in the future. In 1998 that share was 1.86%, or 3,620 aircraft out of the national total of 194,826 active aircraft. Applying that percentage to the FAA's national forecast of active GA aircraft resulted in a regional based aircraft of 4,465 in the year 2020. This forecast is nearly identical with the FAA 1% annual growth forecast discussed above, and results in a 23.3% increase in the regional based aircraft fleet between 1998 and 2020. This forecast is relatively high (the second highest of the seven forecasts contained here) because it applies the Puget Sound Region's historically high market share of the national GA aircraft fleet to the FAA's optimistic national GA fleet forecast. This forecast is considered to be somewhat too optimistic.

Trend (time series) Forecast / Modified Trend Forecast

The trend forecast extrapolates historical regional based aircraft fleet trends into the future. This trend forecast used based aircraft numbers for the period 1979 through 1998 and generated future forecasts for the years 1999 through 2020. The forecast is a simple trend projection, and incorporates no other variables. The trend forecast predicts a regional total of 4,004 based aircraft numbers in the year 2020. The trend forecast is quite low when compared to the increasing market share forecast (4,004 based aircraft as compared with 5,558) and compares somewhat more favorably with the constant market share forecast (4,465) and FAA annual growth forecast (4,439). The trend forecast (4,004) is slightly higher than the three demographic forecasts, which predict between 3,805 and 3,891 based aircraft in the year 2020. While the trend forecast does not specifically incorporate external factors, extrapolating the historical trend in regional based aircraft does inherently account for the same variables that have historically affected the regional based aircraft fleet. One weakness in the trend methodology is that it does not account for any future changes in the factors affecting aviation, but rather assumes the future will match the past. One of the strengths of the trend forecast is its simplicity. It looks only at the past performance of the regional aviation system and projects that performance into the future. From this perspective it captures the regional aviation system. On the other hand, the Trend Forecast's annual growth rate of 0.46% is somewhat low, especially when compared with the FAA's 1% forecast and actual growth in the region's GA aircraft fleet, which has averaged 0.7% per year from 1990 through 1998 and 1.5% per year for 1996, 1997, and 1998. For these reasons it seems appropriate to adopt a "Modified Trend" forecast which shows slightly more growth than the trend forecast, reflecting the more recent regional aviation market. The Modified Trend Forecast (displayed in Exhibit 5-40) was derived using an average annual growth rate of 0.7%, and yields 4,220 regional based aircraft in the year 2020. This forecast adds 600 new aircraft to the regional aircraft fleet over the 22-year forecast period, an average annual gain of 27 aircraft. This is consistent with long term regional trends and it reflects recent growth rates since 1990. The Modified Trend Forecast therefore captures both long term regional trends and the effects of recent changes in the aviation industry.

Population, Employment, and Income Regression Forecasts

All three demographic forecasts evaluated historical relationships between the region's based aircraft fleet and regional population, employment, or income. Those historical relationships (expressed as linear regression equations) were then applied to future forecasts of regional population, employment, and income to generate three regional forecasts of based aircraft. The results are quite similar. For the year 2020 the population regression forecast yields 3,891 based aircraft, the income regression 3,855, and the

employment regression 3,805. Average growth rates for these forecasts vary between 1/4% and 1/3% per year, significantly less than the FAA's projected 1% annual growth forecast. In simple terms, the three demographic forecasts predict the region's entire aircraft fleet will grow by only 8-12 aircraft per year for the 22 year forecast period. Historically, the regional GA based aircraft fleet has grown by an average of 26 aircraft per year between 1979 and 1998, a period that includes over a decade of stagnation and decline in the national and regional GA markets. While population, employment, and income are thought to be closely related to general aviation activity, these three demographic based forecasts do not seem to reflect the recent positive trends in both the national and regional aviation markets. These upward trends have occurred as a result of specific aviation industry-related forces (such as the GA Revitalization Act of 1994 and more recent industry initiatives), which are not associated with population, employment, or income. None of the demographic regression forecasts are considered to be reasonable for use in this aviation system plan.

Regional Distribution of Based Aircraft

In addition to forecasting the total number of based aircraft in the region, it is important to forecast how those aircraft will be distributed to the counties and individual airports throughout the region. Historical data show noticeable trends in the distribution of based aircraft. These regional trends are displayed in Exhibit 5-41 and summarized in the table below.

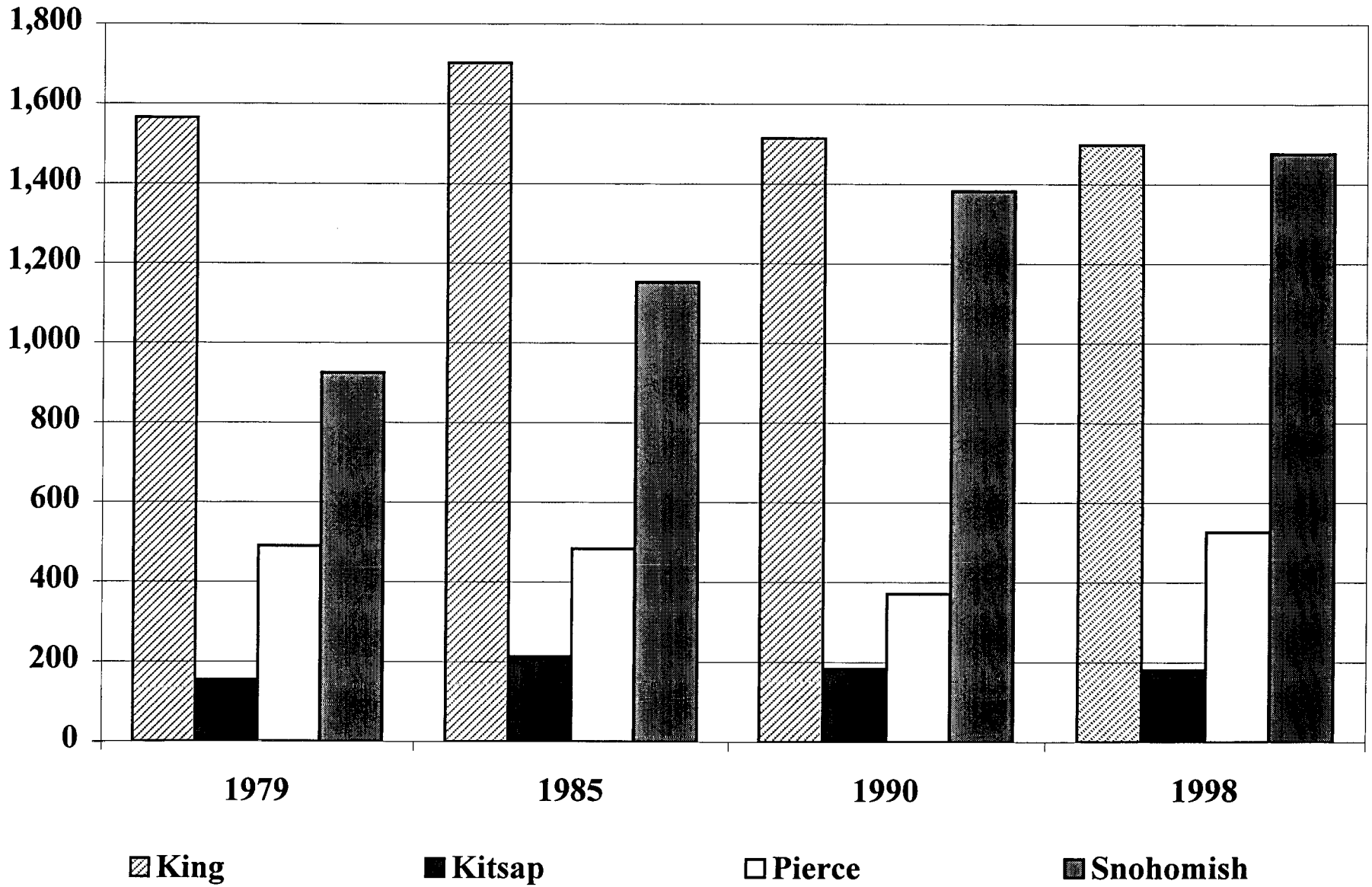
Trends in Regional Distribution of Based Aircraft

	1979	1985	1990	1998
King County Aircraft	1,565	1,702	1,514	1,498
Percent of region	50.0%	47.9%	43.9%	40.7%
Kitsap County Aircraft	154	213	183	181
Percent of region	4.9%	6.0%	5.3%	4.9%
Pierce County Aircraft	490	483	371	526
Percent of region	15.6%	13.6%	10.7%	14.3%
Snohomish County Aircraft	925	1,153	1,382	1,476
Percent of region	29.5%	32.5%	40.1%	40.1%

While the region as a whole has seen growth in the number of based aircraft (total aircraft increased from 3,134 in 1979 to 3,681 in 1998[4]), much of the growth in the region's GA aircraft fleet has occurred in Snohomish County. Between 1979 and 1998, Snohomish County's GA fleet increased from 925 to 1,476, increasing its regional share of the GA aircraft fleet from 29.5% in 1979 to 40.1% in 1998. While Snohomish County's GA aircraft fleet grew both in number and in its share of the regional GA aircraft fleet, King County lost regional market share while its fleet stayed relatively constant (between 1,500 and

[4] *These figures include Apex Airpark in Kitsap County for reasons of consistency. The current airport system does not include Apex, which reduces the regional based aircraft total for 1998 from 3,681 to 3,620.*

Exhibit 5-41 Regional Distribution of Based Aircraft



Previous Forecasts.xls / Regional BA Distribution

1,700 aircraft). Between 1979 and 1998 King County's share of the regional GA aircraft fleet dropped from 50% to 40%. During this time frame, while both Kitsap and Pierce County's shares remained fairly stable. But all the growth wasn't just in Snohomish County. There were some shifts within the counties, with some airports gaining and some losing based aircraft. In addition, the closure of several airports in King County created opportunities for growth at other airports in region, both within and outside King County. Notable changes in the number and regional distribution of based aircraft between 1979 and 1998 include the following:

- ***Arlington Airport*** saw based aircraft grow from 195 to 498 (a 155% increase)
- At ***King County International Airport (Boeing Field)*** based aircraft dropped from 617 in 1979 to 466 in 1998 (a 24% drop)
- ***Crest Airpark*** (Kent) tripled its based aircraft, from 106 to 334
- ***Harvey Field*** (Snohomish) grew from 235 to 356 based aircraft
- ***Renton*** and ***Auburn*** airports remained fairly stable, together increasing their based aircraft fleet by 79 aircraft over the 20-year period
- ***Snohomish County Airport (Paine Field)*** grew by 116 aircraft
- ***Tacoma Narrows Airport*** has remained stable at 200 based aircraft between 1979 and 1998
- ***Bellevue, Cedar Grove, Duvall, Enumclaw, Flying F, and Issaquah*** Airports (over 200 based aircraft) closed

A number of factors may have contributed to these regional trends, including:

- Shifts in the regional distribution of population and employment. While the Puget Sound Region has seen overall growth in all factors, there have been continuing shifts in the distribution of regional demographics. King County's share of regional population has dropped from 56.68% in 1980 to 52,89% in 1998, and will continue to decline, to less than 50% in the year 2020. King County's share of regional employment has also dropped, although to a lesser degree. This share is also predicted to drop, from 66.69% in 1998 to 64.4% in the year 2020. While Kitsap and Pierce Counties have increased their shares of total regional population, both have lost market share (between 1980 and 1998) in terms of regional employment. Between 1998 and the year 2020 both are predicted to show slight increases in their shares of population and employment. Snohomish County has claimed the largest gains. Between 1980 and 2020 Snohomish will have increased its regional population share from 15% to 20%, and its employment share from just over 10% to 13.6%.

	Population			Employment		
	1980	1998	2020*	1980	1998	2020*
King	56.68%	52.89%	49.8%	67.19%	66.69%	64.4%
Kitsap	6.57%	7.27%	8.2%	5.41%	5.13%	5.3%
Pierce	21.68%	21.81%	22.0%	17.10%	15.24%	16.6%
Snohomish	15.07%	18.04%	20.0%	10.29%	12.93%	13.6%

* *Forecast*

- The growth and regional distribution of income are shown below. King County continues to dominate the region's income growth, with the other three counties falling below the regional average. This trend is predicted to continue through the year 2020, when King County income will be double that of Kitsap and Pierce Counties and 70% above Snohomish County.

	Per Capita Income		
	1980	1998	2020*
King	$22,111	$31,922	$42,652
Kitsap	$17,146	$19,671	$18,180
Pierce	$16,597	$20,131	$21,310
Snohomish	$18,245	$22,398	$25,190
Region	$20,004	$26,747	$32,615

* *Forecast*

- Urban development, land use encroachment, and financial pressures leading to the closure of several airports (containing over 200 based aircraft). In the past 20 years the region has seen the closure of the following public use airports: Bellevue Airfield, Issaquah Skyport , Duvall Airport, Enumclaw Airport, Cedar Grove Airport, and Flying F Ranch. With the closure of these airports (all of which were located in King County), some 200 based aircraft were moved to other airports in the region. The owners of Martha Lake Airport in Alderwood Manor recently announced that the airport would close in the next several months. The airport is home to 51 based aircraft, and last year served over 40,000 aircraft operations. This airport closure may place additional capacity pressure on other Snohomish County airports, including Snohomish County Airport, Harvey Field, Arlington Airport, and First Air Field (in Monroe).
- Increasing complexity if the regional airspace, particularly in the vicinity of Sea-Tac International Airport, King County International Airport (Boeing Field), and McChord Air Force Base
- Increasing congestion and delay at the larger, busier urban airports
- Increasing competition for reasonably priced, high quality hangar space
- Increases in the cost of hangars, tie-downs, fuel, landing fees, and other services at close-in airports such as King County International Airport (Boeing Field), Renton, and Auburn
- Increasing congestion on the region's surface transportation system (freeways, highways, bridges, arterial streets, ferries, etc.)
- Shifts in the regional distribution of aircraft owners and pilots

Forecast Shifts in Regional Based Aircraft Distribution

With the closure of several public use airports in the past 20 years, the region's aviation activity has been consolidated at the (fewer) remaining airports. The airport closures led to a regional shift of based aircraft from King County airports to Snohomish County airports. These airports have accommodated the aircraft displaced by the airport closures, and they have also provided facilities to accommodate the regional growth (180 new based aircraft) since 1990. In the future, however, it appears less likely that wholesale airport closures will occur. Therefore, major shifts in regional market share are less likely than in the past. Nevertheless, given regional urban development trends, airport congestion, pricing differentials, and airspace complexity, some continued shifting of based aircraft from congested urban airports, such as Boeing Field, to outlying airports, such as Crest Airpark, Harvey Field, and Arlington Airport can be expected. These shifts are likely to respond to lower price, available capacity, and improved services.

These shifts will also reflect continued changes in the regional distribution of population and employment between the four central Puget Sound counties. Recent forecasts by the Regional Council predict that historic trends will continue, with King County's share of regional population and employment slowly declining between 1998 and 2020. Kitsap, Pierce and Snohomish Counties will all see slight increases in both population and employment market share. Snohomish County is expected to see the greatest increase in its regional population share (10%) over the forecast period. This shift in population and employment toward Kitsap, Pierce, and Snohomish Counties will support increased aviation demand in these areas, and reflects the historical trend of demand moving away from the central part (Seattle) of the region. The figures below display the forecast distribution of based aircraft, both in terms of market share and based aircraft. The based aircraft numbers reflect the selected regional based aircraft forecast (the Modified Trend Forecast).

Forecast Future Distribution in Based Aircraft *

	1998	2005	2010	2015	2010
King County Aircraft	1,498	1,498	1,504	1,512	1,519
Percent of region	40.7%	39.4%	38.2%	37.1%	36.0%
Kitsap County Aircraft	181	201	216	236	253
Percent of region	4.9%	5.3%	5.5%	5.8%	6.0%
Pierce County Aircraft	526	555	579	603	633
Percent of region	14.3%	14.6%	14.7%	14.8%	15.0%
Snohomish County Aircraft	1,476	1,547	1,637	1,724	1,815
Percent of region	40.1%	40.7%	41.6%	42.3%	43.0%
Total Based Aircraft	***3,620***	***3,801***	***3,936***	***4,076***	***4,220***

* *Figures show the Modified Trend Based Aircraft Forecast (see Exhibit 5-40)*

Based on the data available, current trends in the distribution of based aircraft are expected to continue, although at a slower rate. King County's regional share will decline from 40.7% to 36%. When combined with the regional forecast of based aircraft growth, King County should see its based aircraft demand remain near the 1,500 mark over the forecast period. Kitsap and Pierce Counties should each see slow growth in their market share, with resulting increases in their based aircraft. Snohomish County will see continued growth in its regional market share, from 40.1% in 1998 to 43% in the year 2020. This expanding market share combined with expected regional demand will result in fairly strong growth for Snohomish County, amounting to some 340 new aircraft over the 22-year forecast period, or about 15 aircraft per year.

General Aviation Fleet Mix Forecast

The based aircraft fleet mix forecast is an estimate of the number of aircraft by type. Those aircraft categories include single engine piston, multi-engine piston, turbojet, helicopter, and other (which includes gliders, experimental aircraft, and ultralight aircraft). Accurate historical fleet mix trend data for the region is not available. Therefore, the fleet mix forecast relies on the regional aircraft fleet mix figures for 1990 and 1998, fleet mix data as reported in the 1988 *Regional Airport System Plan*, and fleet mix data from individual airport master plans, to provide a historical trend. The future fleet mix forecast is based on the 1990 and 1998 regional data plus national GA fleet mix forecasts prepared by the FAA, and previous regional fleet mix forecasts prepared in 1988 by the Regional Council. The most recent aviation forecasts prepared by the Washington DOT Aviation Division for their 1993 *State Aviation System Plan* did not include GA aircraft fleet mix forecasts.

Exhibit 5-42 displays the previous fleet mix forecast contained in the 1988 Regional Airport System Plan prepared by the Regional Council. In addition, the exhibit includes the FAA's most recent (April 1999) forecast of the national active GA aircraft fleet. And finally, Exhibit 5-42 shows the regional based aircraft fleet developed for this system plan, displaying the mix of aircraft in percentage and in numbers of based aircraft. Previous fleet mix forecasts by the FAA and the Regional Council are based on stronger growth in the jet, helicopter, and "other" components of the GA fleet (gliders, ultralights, and experimental aircraft), with less growth in the single and multi engine piston powered aircraft. In short, the market for low end piston aircraft has been weak, while the markets for high end corporate and business aircraft, as well as cost-effective alternatives to traditional piston powered aircraft, have been strong. This growth differential is forecast to result in a shift in the composition of the fleet, as shown in Exhibit 5-42. Much of the logic for this forecast shift is due to historical and recent industry trends. Production of new piston powered aircraft peaked in 1978, declined until 1994, and has only recently rebounded (since 1994f). New jet aircraft production fell off between 1981 and 1987, it has grown steadily over the past 11 years.

The 1988 RASP showed single engine piston aircraft dropping from 85.6% of the fleet in 1990 to 74.1/% in 2020. The FAA's 1999 aerospace forecasts show a smaller drop in these aircraft, from 73.1% in 1990 to 70.9% in 2020. Both showed strong increases in jet aircraft. The 1988 RASP predicted a near tripling of jet aircraft share of the regional fleet, and the FAA forecast shows jet aircraft will increase their share of the GA fleet by 57% (from 4.9% to 7.7%) between 1990 and 2020.

Actual fleet mix percentages for the Puget Sound Region are shown in the lower half of Exhibit 5-42. As of 1998 the region had not yet seen the drop in piston powered aircraft that were predicted by either the 1988 RASP or the more recent FAA forecast. However, the region's actual fleet composition, between 1990 and 1998, has matched the overall trends predicted by both the earlier forecasts. The current fleet mix forecast anticipates these trends to continue, with slight reductions in fleet share for piston powered aircraft (both single and multi-engine) and slow, steady increases in share for jets, helicopters, and others. While the region's strong business and corporate general aviation market will produce continued demand for high end fixed wing jet aircraft, and for helicopters, the market for gliders, ultralights, and experimental aircraft will also be steady. The "other" category should see a slight increase in its share of the regional fleet. Meanwhile, with new single engine aircraft production growing rapidly at the national level, the market for these aircraft is predicted to buoy its regional share of the GA fleet, with this segment dropping to 80% of the regional total, as opposed to 70% of the national fleet.

Exhibit 5-42 Fleet Mix Forecasts

1988 PSRC Regional Airport System Plan

	1985	1990	2000	2010	2020
Single engine	86.6%	85.6%	81.3%	77.7%	74.1%
Multi-engine	8.4%	8.3%	8.2%	8.3%	8.3%
Jet	1.4%	1.7%	2.3%	3.4%	4.5%
Helicopter	2.5%	3.0%	5.8%	6.4%	6.9%
Other	1.1%	1.4%	2.4%	4.3%	6.2%
	100.0%	100.0%	100.0%	100.0%	100.0%

1999 FAA National Forecasts

	1985	1990	1998	2010	2020
Single engine	77.8%	72.6%	72.7%	71.9%	70.9%
Multi-engine	11.5%	10.7%	8.2%	7.6%	7.6%
Jet	4.6%	4.9%	5.7%	6.9%	7.7%
Helicopter	3.2%	3.4%	3.5%	3.4%	3.8%
Other	2.9%	8.4%	9.8%	10.1%	10.0%
	100.0%	100.0%	100.0%	100.0%	100.0%

Forecast Future Fleet Mix - PSRC Region

	1985	1990	1998	2010	2020
Single engine	86.6%	85.9%	85.6%	82.3%	80.0%
Multi-engine	8.4%	7.7%	7.3%	7.2%	7.0%
Jet	1.4%	1.5%	2.0%	3.0%	4.0%
Helicopter	2.5%	1.2%	2.0%	2.5%	3.0%
Other	1.2%	3.6%	3.1%	5.0%	6.0%
	100.0%	100.0%	100.0%	100.0%	100.0%

Forecast Future Fleet - PSRC Region

	1985	1990	1998	2010	2020
Single engine	3,075	2,957	3,098	3,239	3,376
Multi-engine	297	266	265	283	295
Jet	50	51	73	118	169
Helicopter	88	43	71	98	127
Other	41	125	113	197	253
	3,551	3,442	3,620	3,936	4,220

Aircraft Operations Forecast

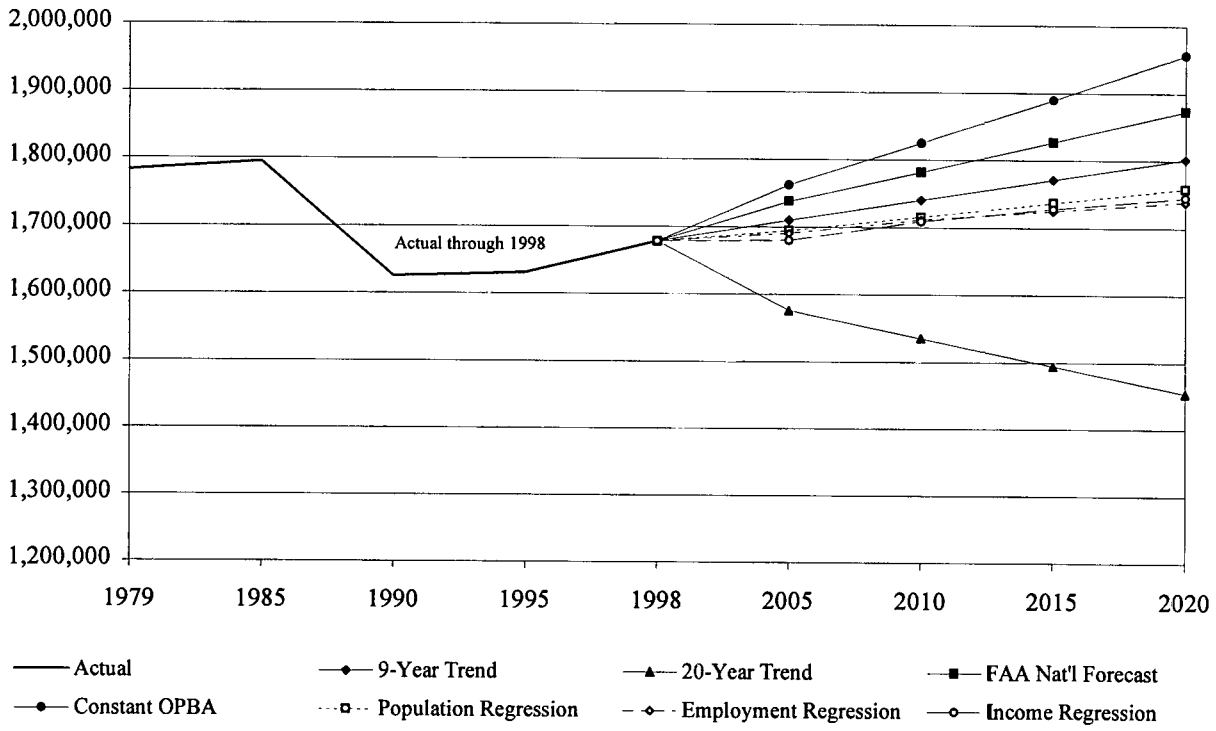
Similar to based aircraft, several GA aircraft operations forecasts were prepared (see Exhibit 5-43). For purposes of these forecasts, air carrier and commuter operations at all regional airports were excluded. These GA operations forecasts include a 20-year trend, 9-year trend, constant operations per based aircraft ("OPBA"), FAA national forecast, and three demographic forecasts based on population, employment, and income. All forecasts are aggregate for the entire region.

Exhibit 5-43 Summary of Regional GA Operations Forecasts

	1998	2005	2010	2015	2020
20-Year Trend	1,678,354	1,575,718	1,535,155	1,494,593	1,454,031
9-Year Trend	1,678,354	1,709,981	1,740,573	1,771,166	1,801,758
Constant OPBA*	1,678,354	1,762,341	1,824,892	1,889,664	1,956,735
FAA Nat'l Forecast **	***1,678,354***	***1,737,985***	***1,781,871***	***1,826,866***	***1,872,996***
Population Regression	1,678,354	1,694,572	1,715,802	1,737,086	1,758,370
Employment Regression	1,678,354	1,690,822	1,711,293	1,725,031	1,738,769
Income Regression	1,678,354	1,680,344	1,708,992	1,728,318	1,745,244

* *Derived from Modified Trend Based Aircraft Forecast (see Exhibit 5-40)*
** *Selected Forecast*

Regional GA Operations Forecasts



Discussion of Operations Forecasts

The operations forecasts for the year 2020 range from a high of 1,956,735 (Constant OPBA forecast) to a low of 1,454,031 (20-year trend). Respectively, these two forecasts represent a total increase of 16.6% and a decrease of 13% from 1998 activity levels. The remaining six forecasts are based on a 9-year historical trend from 1990 to 1998. These other six forecasts are fairly tightly clustered, with all predictions falling between 1.7 and 1.9 million annual operations for the year 2020 (a spread of only 10% between the high and low forecasts). This spread is much narrower than the based aircraft forecasts (all of which showed positive growth), where the highest forecast was 42% above the lowest. This suggests the potential for greater precision in forecasting operations than based aircraft.

20-Year Trend Forecast

The 20-year trend forecast is based on a historical trend from 1979 through 1998, and was heavily affected by the drop in regional operations activity between 1985 and 1990. The 20-year trend forecast was prepared using total regional aircraft operations data for the years 1979, 1985, 1990, 1995, and 1998. Historical operations data (see Exhibit 5-43) show a slight increase from 1979 to 1985 followed by a sharp decline between 1985 and 1990, when operations fell from 1.8 million to 1.6 million. This decline can be partially explained by the rapidly rising cost of flying during this time frame, which was driven by increasing fuel and insurance costs. Between 1986 and 1990 the national aviation fuel index increased by some 30%. For the period 1978 through 1988, the total annual national cost of aviation liability lawsuits increased nearly tenfold. With costs rising so rapidly, aircraft operations activity declined. In this same time frame the market for new GA aircraft had collapsed, and by 1990 aircraft manufacturers were producing a post-war low of 1,144 aircraft, down from 17,811 in 1978. Between 1990 and 1998 regional GA operations showed renewed growth, increasing from 1,625,000 to 1,678,000. Because of the sharp decline between 1985 and 1990, the 20-year trend forecast shows a decrease in future activity, with recent growth unable to overcome the declines of earlier years. This forecast shows operations declining from 1,678,354 in 1998 to 1,454,031 in the year 2020. Given the fact that recent operations trends are positive, combined with major positive changes in the national and regional aviation market, the 20-year trend forecasts is considered too low for use in the regional airport system plan.

9-Year Trend Forecast

The 9-year trend forecast used more recent historical data for the period 1990-1998 to forecast future aircraft operations. This forecast capitalizes on the recent growth trend, and yields 1,801,758 operations in the year 2020, a total increase of 7.4% for the 22-year forecast period and an average annual increase of 0.32%. This compares with the FAA's latest national GA operations growth rate forecast of 0.5% per year. The modest growth resulting from the 9-year trend forecast reflects the numerous factors (such as high fuel costs, liability insurance issues, rising aircraft purchase costs, and the increasingly congested and competitive regional aviation market) that have dampened aviation activity. As a result, this forecast takes the region only back to the operations levels experienced in 1985 (1.8 million). Given the region's propensity to embrace aviation activity, and the nationwide positive forces affecting the industry, the annual growth rate of 0.32% contained in the 9-year trend forecast appears too low. In addition, the rapidly growing trend toward fractional ownership of aircraft would seem to support a somewhat faster growth rate for aircraft operations.

Constant OPBA Forecast

The constant operations per based aircraft (OPBA) forecast develops aircraft operations estimates based on aircraft utilization rates. The forecast approach assumes the future number of aircraft operations will remain at current (1998) levels, e.g. approximately 464 annual operations per based aircraft. This aircraft utilization rate is consistent with, though slightly below, 1990 and 1995 levels. FAA national data for estimated total GA aircraft operations at towered and non-towered airports (87,400,000 GA operations) and total active GA aircraft (194,800) yields 449 operations per aircraft in 1998 (source: *FAA Long Range Aviation Forecasts Fiscal Years 2010, 2015, and 2020, Table 1*). This comparison of national and regional data confirms that the actual regional OPBA of 464 is consistent with (though slightly higher than) national data.

To generate the operations forecast, the OPBA figure of 464 was applied to the Modified Trend based aircraft forecast (see based aircraft forecast section above) to predict future aircraft operations. The constant OPBA operations forecast produced 1,956,735 operations in the year 2020, a total increase of 16.6% over the 22-year period, or an average annual grow rate of 0.7%. This is the highest of the seven operations forecasts, approximately 40% higher than the FAA's national GA aircraft operations forecast.

FAA National Forecast

The FAA national forecast is based on the FAA's latest long range forecasts prepared in June 1999. Those forecasts predict an average growth rate of 0.5% between 1998 and 2020. The regional operations forecast used these same annual growth rate figures, producing a forecast of 1,872,996 regional operations in 2020, the second highest operations forecast. The FAA national forecast represents a mid-range between the constant OPBA forecast (0.7% annual growth rate) and the 9-year trend forecast (0.32% annual growth rate). Total growth in operations from 1998 to 2020 would be 11.6%. Comparing this operations forecast with the selected Modified Trend Forecast for based aircraft would yield a resulting drop in operations per based aircraft (OPBA) from the 1998 ratio of 464 to a projected ratio of 444 in the year 2020. Given the present and predicted popularity of fractional ownerships in GA aircraft, it is likely that future OPBA ratios will actually increase over time. If this were the case, this FAA national forecast of aircraft operations would likely be too conservative. On the other hand, potential external factors, such as fuel prices, potential new user fees, and increasing airport congestion could act to limit future growth in aviation activity. Taken together, the FAA forecast may be the most reasonable one, representing a blend of positive and negative factors.

Regional Demographic Regression Forecasts

The final three operations forecasts were predicated on the assumption that regional aviation activity is based in part on regional population and economic factors, and that future activity could be forecast using independently predicted demographic variables. Three demographic forecasts were prepared based on the historical relationship between aircraft operations and regional population, employment, and income. Based on these historical relationships (using linear regression models), future operations levels were estimated using forecasts of regional population, employment, and income published by the Regional Council. All three demographic operations forecasts used the 1990 to 1998 time frame as their base years.

The demographic forecasts were very tightly clustered, producing operations levels between 1,738,769 and 1,758,370 operations in the year 2020. These forecasts predict a total regional operations increase of between 3.6% and 4.8% for the 22-year period, fairly modest growth compared with the FAA's 1999 GA operations forecast, which predicts national GA operations will grow by 11.2% between 1999 and 2020.

The three regional demographic-based forecasts fail to take into account the significant positive changes in the national aviation industry in recent years. Nor do they consider recent growth in both based aircraft and aircraft operations in the region, which have grown by 5% and 3%, respectively, in the past three years alone. Because of their low predictions of future aviation activity, and their inability to consider the significant aviation trends, the three demographic forecasts are not considered to be accurate predictors of future operations growth in the region.

Regional Distribution of Aircraft Operations

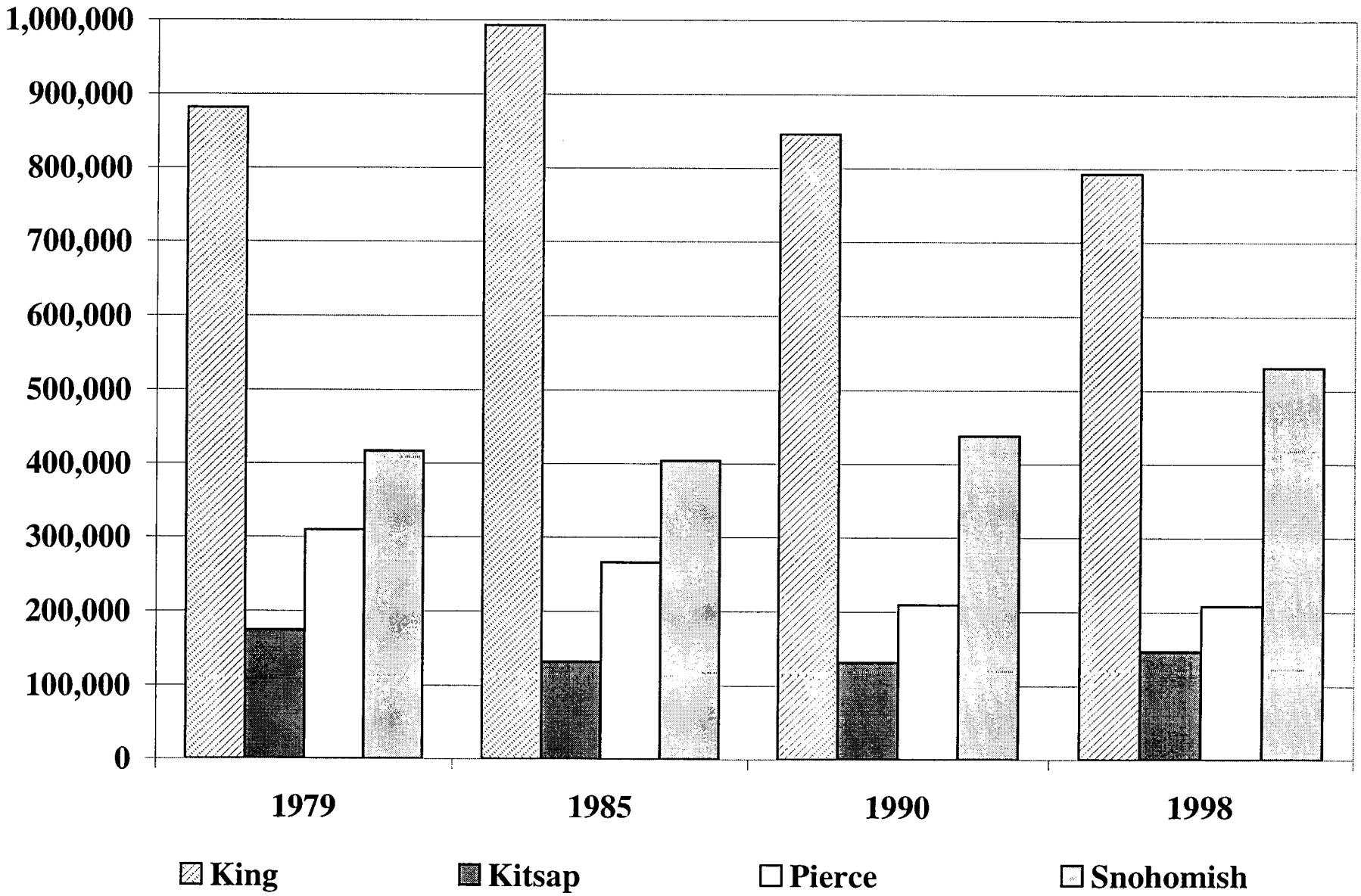
In addition to forecasting the total number of aircraft operations in the region, this forecast will distribute aircraft operations to counties and individual airports throughout the region. Similar to based aircraft historical data show noticeable regional trends in the distribution of aircraft operations. These regional trends are displayed in Exhibit 5-44 and summarized in the table below.

Trends in Regional Distribution of Aircraft Operations

	1979	1985	1990	1998
King County Operations	881,814	992,654	845,943	792,544
Percent of region	49.5%	55.3%	52.1%	47.2%
Kitsap County Operations	174,200	132,226	131,484	146,939
Percent of region	9.8%	7.4%	8.1%	8.8%
Pierce County Operations	309,500	265,904	209,145	207,965
Percent of region	17.4%	14.8%	12.9%	12.4%
Snohomish County Operations	416,784	404,127	438,418	530,906
Percent of region	23.4%	22.5%	27.0%	31.6%

While King County airports saw some growth between 1979 and 1985, the county's total GA aircraft operations has fallen by over 20% since 1985. As a result, King County's regional share has declined, from 55% in 1985 to 47% in 1998. The factors behind this decline include airfield and airspace congestion and delay; increasing landing fees and fuel costs; and increasing aircraft operating costs. Pierce County's trend has been similar to King County, with declined over the entire historical period coupled with decreasing market share. While Kitsap County's market share declined from 1979 to 1985, it has rebounded somewhat since then, increasing from 7.4% in 1985 to 8.8% in 1998.

Exhibit 5-44 Regional Distribution of Aircraft Operations



Previous Forecasts.xls / Regional Ops Distribution

As with the regional distribution of based aircraft, Snohomish County has been the regional leader in GA aircraft operations growth. Between 1979 and 1998 the county saw a total increase of 28%, with 21% of that growth in just the last 8 years. Snohomish County's regional share of GA aircraft operations has similarly grown, from 22.5% in 1985 to 31.6% in 1998.

It appears that population, employment, and income growth, together with favorable pricing, excess capacity, adequate airport facilities, and reasonably uncrowded airspace, have combined to give Snohomish County airports an edge over many other regional airports. Since 1990 Arlington Airport has seen its operations grow by 23%, Harvey Field has grown by 22%, and Snohomish County Airport (Paine Field) has seen a 25% increase. Other notable changes in aircraft operations activity include:

- ***Auburn Airport*** operations have grown by 13% since 1990
- Operations at ***Bremerton National Airport*** have increased by 16% in the past 8 years
- ***Crest Airpark*** operations have increased by 28% since 1990
- ***Pierce County Thun Field*** has grown by 21% since 1990
- ***King County International Airport/Boeing Field*** saw a 10% decline from 1990 to 1998
- Between 1990 and 1998 operations at ***Renton Municipal Airport*** decreased by 33%
- ***Tacoma Narrows Airport*** operations have dropped 13% since 1990.

Forecast Shifts in Regional Aircraft Operations Distribution

Similar to the predicted regional shifts in based aircraft, this system plan forecasts that growth in aircraft operations will vary across the region, with some counties growing more than others. The table below displays the predicted future distribution of aircraft operations among the region's four counties.

Forecast Future Distribution of Aircraft Operations *

	1998	2005	2010	2015	2020
King Co. Operations	792,544	799,473	801,842	803,821	805,388
Percent of region	47.2 %	46.0 %	45.0 %	44.0 %	43.0 %
Kitsap Co. Operations	146,939	158,157	167,496	177,206	187,300
Percent of region	8.8 %	9.1 %	9.4 %	9.7 %	10.0 %
Pierce Co. Operations	207,965	217,248	224,516	233,839	243,489
Percent of region	12.4 %	12.5 %	12.6 %	12.8 %	13.0 %
Snohomish Co. Operations	530,906	563,107	588,017	612,000	636,819
Percent of region	31.6 %	32.4 %	33.0 %	33.5 %	34.0 %
Total Aircraft Operations	***1,678,354***	***1,737,985***	***1,781,871***	***1,826,866***	***1,872,996***

* *Figures show the Modified Trend Based Aircraft Forecast (see Exhibit 5-40)*

The forecast shift tracks closely with the predicted changes in distribution of based aircraft. King County's share of the region's operations is predicted to decline from 47.2% in 1998 to 43% in 2020. Snohomish County is predicted to increase its regional share from 31.6% in 1998 to 34% in 2020. Both Kitsap and Pierce Counties are should increase their shares slightly, with absolute numbers of operations increasing by 35-40,000 in each county between 1998 and 2020. In actual numbers, Snohomish County will se the greatest increase, some 100,000 annual aircraft operations between 1998 and 2020. King County will see a very slight increase in operations (13,000) over the period.

While not significant, these shifts in the distribution of aircraft operations across the region do reflect the continued impacts of several forces which have historically caused shifts in activity. These include continued higher population and employment growth in Kitsap, Pierce, and Snohomish Counties than in King County; increasing airspace complexity and landside congestion in the central portion of the region; pricing differentials; landside access issues; and airports' relative ability to expand.

Allocation of Forecast Based Aircraft and Aircraft Operations to Airports

Using the forecast distribution of based aircraft and aircraft operations between the four counties, the aircraft and operations were then "allocated" to each airport in the system. These allocations are displayed in Exhibits 6-2 and 6-3 in the Capacity chapter. This allocation was based on each airport's current (1998) share of its county's total. That share was held constant for each airport through the forecast period, with the exceptions of Martha Lake Airport and Apex Airpark. Martha Lake Airport is expected to close within the next 3 years. The 51 aircraft currently based there and potential future based aircraft were allocated to other Snohomish County airports according to those airports' 1998 shares of Snohomish County aviation activity. Aircraft operations at Martha Lake Airport were similarly reallocated to other Snohomish County airports. For Apex Airpark, based aircraft were held constant at the 1998 number (50) because the airport is limited to that figure by an agreement with Kitsap County. Future based aircraft demand that would have been allocated to Apex Airpark were redistributed to Bremerton National Airport and Port Orchard Airport based on these two airports' current share of the Kitsap County total. Forecast aircraft operations were allocated to Apex Airpark according to its current county share.

Chapter 6 - System Capacity and Future Facility Requirements

The system capacity and facility requirements work element consists of two interrelated tasks. First, the capacity of the existing airport system is determined using information from the system inventory. The capacity information is then evaluated against existing and forecast aviation activity to determine the extent of additional facilities needed to meet future demand. The following sections describe these two related work efforts.

System Capacity

Analysis of airport system capacity was done using existing facility information from the system inventory work task. The analysis identifies facility capacity for each system airport and for the total airport system. Analysis of airport capacity (and future facility needs) includes facilities' ability to meet numeric demand, such as total annual or peak hour takeoffs and landings, as well as meeting the more specialized needs of the system, such as runway length or strength. The following airport facilities are included in the analysis of airport capacity and determining future system needs:

Overall airport capacity	*	total airport acreage
	*	acreage available for airport development
Airfield capacity	*	annual capacity (measured as "annual service volume, or ASV")
	*	runway length
	*	runway strength
	*	runway condition (pavement condition index, or PCI)
Aircraft parking capacity	*	apron area (for itinerant aircraft parking)
	*	aircraft tie-downs (for based aircraft)
	*	aircraft T-hangars (for based aircraft)
	*	large aircraft hangars (for based aircraft)
Airport support facilities	*	aircraft fuel
	*	terminal
	*	auto parking
	*	other
Access	*	roadway access
	*	public transit

The analysis of system capacity and future requirements was done for five time periods: 1998 (current), 2005, 2010, 2015, and 2020. Exhibit 6-1, *Existing System Capacity (1999)* displays existing capacity compared with existing demand levels for the base year (1998). The table shows existing aircraft parking capacity (tie-downs and hangars), current number of based aircraft, current waiting lists for aircraft parking, existing airport acreage devoted to aviation use plus additional acreage available for future development, existing (1998) aircraft operations, and annual operations capacity, measured as annual service volume (ASV).

Two critical ratios are included in the table, which are calculated by comparing the existing demand and

Exhibit 6-1 Existing System Capacity (1999)

	Apron	Aircraft	Total			# on	Potential	Potential	Acres avail.			Airfield	
	Tie-down	Hangar	Aircraft	Based	Landside	waiting	total	Landside	Airport	for future	Airport	Operations	Airfield
Airport	Capacity	Capacity	Capacity	Aircraft	D/C Ratio	list	aircraft *	D/C Ratio **	Acreage	dev't	Operations	Capacity ***	D/C Ratio
American Lake	15	4	19	15	79%		15	79%	0	0	700	60,000	1%
Apex Airpark	5	45	50	50	100%		50	100%	15		19,425	180,000	11%
Arlington Municipal	114	463	577	510	88%	53	563	98%	1,202	40	135,000	270,000	50%
Auburn Municipal	225	105	330	238	72%	140	378	115%	107	25	172,000	230,000	75%
Bandera State	0	0	0	0					25		300	150,000	0%
Boeing Field	350	200	550	443	81%		443	81%	634		345,120	380,000	91%
Bremerton National	78	116	194	116	60%	17	133	69%	1,169	560	108,800	240,000	45%
Crest Airpark	180	176	356	334	94%	95	429	121%	62	68	95,222	240,000	40%
Darrington	15	0	15	4	27%		4	27%	90		3,025	180,000	2%
FirstAir Field	25	62	87	78	90%	25	103	118%	33		18,169	200,000	9%
Gray Army Airfield												180,000	0%
Harvey Field	53	362	415	360	87%	186	546	132%	65	117	140,700	230,000	61%
Kenmore Air Harbor	77	2	79	79	100%	3	82	104%	6		40,000	75,000	53%
Lake Union Seaplane			0	0					1		30,500	60,000	51%
Lester State	0	0	0	0					56		5	150,000	0%
Martha Lake	32	20	52	51	98%		51	98%	32		40,400	180,000	22%
McChord AFB												180,000	0%
Pierce Co. / Thun Field	140	138	278	229	82%	30	259	93%	144		86,710	240,000	36%
Port Orchard	12	16	28	15	54%	12	27	96%	120		18,714	175,000	11%
Ranger Creek State	0	0	0	0					20		250	140,000	0%
Renton Municipal	170	85	255	240	94%	55	295	116%	170	0	100,710	230,000	44%
Sea-Tac Int'l	4	2	6	6	100%		6	100%	2,500		407,597	460,000	89%
Sky Harbor	12	0	12	8	67%		8	67%	10		1,000	140,000	1%
Skykomish State	0	0	0	0					35		300	150,000	0%
Sno. Co. / Paine Field	208	356	564	483	86%	96	579	103%	1,243		192,612	288,000	67%
Spanaway	20	57	77	63	82%	0	63	82%	24		19,380	140,000	14%
Swanson	12	14	26	22	85%	0	22	85%	14		5,609	150,000	4%
Tacoma Narrows	200	82	282	200	71%	30	230	82%	644	31	95,316	240,000	40%
Vashon Island	10	22	32	31	97%		31	97%	20		6,000	160,000	4%
Will Rogers/Wiley Post	45	0	45	45	100%		45	100%	1		2,387	60,000	4%
Total Airport System:	2,002	2,327	4,329	3,620	84%	742	4,362	101%	8,442	841	2,085,951	5,758,000	36%

* Equals current based aircraft plus waiting list

** Ratio of based aircraft plus waiting list to capacity

*** Measured as "Annual Service Volume"

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capacity figures. These ratios are the "Landside Demand/Capacity (or D/C) Ratio" and the "Airside Demand/Capacity (D/C) Ratio." Both these ratios represent the portion of existing capacity that is being used. For the total airport system the demand for landside aircraft parking is 84% of existing capacity, while airside demand (annual operations) is at 32% of existing airfield capacity(excluding Sea-Tac airport). These ratios are totals for the entire airport system. As Exhibit 6-1 shows, individual airports' D/C ratios vary widely. On the landside, 4 airports have reached their current aircraft parking capacity. These are Apex Airpark, Kenmore Air Harbor, Sea-Tac, and Will Rogers/Wiley Post Seaplane Base. Thirteen airports fall between 75% and 100% of their landside capacity; six airports have landside D/C ratios between 0% and 75%; and seven airports have either no based aircraft (0% of capacity) or there is insufficient data to determine their ratios.

In addition to existing based aircraft, information on current waiting lists was collected from individual airports where available. The waiting list information represents a measure of latent or unmet demand, which is important to consider when planning for future facilities. Waiting list figures are shown in Exhibit 6-1. As of August 1999 there were a total of 742 on documented waiting lists, plus the 3,620 existing based aircraft. When total waiting list figures for the region are added to current based aircraft, the total aircraft demand figure could reach 4,362. Given the existing landside capacity of 4,329, the airport system would reach its landside capacity, with a demand-to-capacity ratio of 101%. Unfortunately, the waiting list data area not sufficiently complete to allow detailed analysis. For example, it is not known what share of those on waiting lists represent actual unmet demand, e.g. have an aircraft not currently based inside the region they wish to bring to an airport in the region. It is also not known how many on waiting lists are trying to move their aircraft from one airport within the region to another. A third unknown is how many on waiting lists have aircraft currently in tie-downs and are wishing to move those aircraft to hangars. Both these last two groups represent existing based aircraft demand, although the latter also represents unmet demand for hangar space. An additional unknown is how many people have placed their names on more than one waiting list. The lack of reliable, statistically significant data on waiting lists makes it difficult to develop solid plans to meet this undefined demand. Nevertheless, it is important to consider these needs in planning for the future airport system.

The data displayed in Exhibit 6-1 cannot precisely document the level of unmet demand for hangar space in the region. However, discussions with most airport managers in the region confirm that as of 1999 nearly all aircraft hangars in the region are full, while there aircraft tie-down spaces available. Using the numbers from Exhibit 6-1, and assuming all hangar space is full, there are about 700 vacant tie-down spaces in the region. At the same time there are up to 742 names on airport waiting lists, presumably all waiting for hangar spaces. These data, which are consistent with national trends, suggest that the region is providing enough total aircraft parking to meet demand, but those facilities are of the wrong type. Pilots and owners of increasingly expensive and sophisticated aircraft are demanding secure, weather-proof storage facilities for their airplanes. While the region's existing supply of aircraft parking is comprised of 54% hangars and 46% tie-downs, actual demand would appear to be split more toward hangars, with 70% demanding hangars and 30% requiring tie-downs. As the regional aircraft fleet expands in the future, with newer aircraft and fractional ownership increasing, it is likely that the preference for hangars will grow. The implications for future planning indicate that perhaps some existing tie-down space could be redeveloped for hangars to meet existing demand. In the longer term, if demand materializes as the forecasts predict, up to 85% of new aircraft parking facilities might be devoted to hangars.

In terms of airfield operations capacity, the analysis used "annual service volume" (ASV) as the measure of capacity. Annual Service Volume represents the airports' annual runway capacity (total takeoffs and

Exhibit 6-2 Future Landside Capacity Requirements

	Apron Tie-down Capacity	Aircraft Hangar Capacity	Total Aircraft Capacity	Forecast Based Aircraft Demand					Landside D/C Ratio *	Landside D/C Ratio *	Additional Capacity Needed in	# on waiting list	Additional capacity needed including those on waiting list
				1998	2005	2010	2015	2020	1998	2020	2020 ****		
American Lake	15	4	19	15	16	16	17	18	79%	94%	3		3
Apex Airpark **	5	45	50	50	50	50	50	50	100%	100%	0		0
Arlington Municipal	114	463	577	510	547	579	609	641	88%	111%	112	53	165
Auburn Municipal	225	105	330	238	252	253	254	255	72%	77%	15	140	155
Bandera State	0	0	0	0	0	0	0	0			0		0
Boeing Field	350	200	550	443	469	470	473	475	81%	86%	27		27
Bremerton National	78	116	194	116	134	147	164	178	60%	92%	53	17	70
Crest Airpark	180	176	356	334	353	355	357	358	94%	101%	21	95	116
Darrington	15	0	15	4	4	5	5	5	27%	34%	1		1
FirstAir Field	25	62	87	78	84	89	93	98	90%	113%	17	25	42
Gray Army Airfield											0		0
Harvey Field	53	362	415	360	386	408	430	453	87%	109%	79	186	265
Kenmore Air Harbor	77	2	79	79	84	84	84	85	100%	107%	5	3	8
Lake Union Seaplane			0	0	0	0	0	0			0		0
Lester State	0	0	0	0	0	0	0	0			0		0
Martha Lake ***	32	20	52	51	0	0	0	0	98%	0%	0		0
McChord AFB											0		0
Pierce Co. / Thun Field	140	138	278	229	240	250	261	274	82%	99%	38	30	68
Port Orchard	12	16	28	15	18	20	23	25	54%	89%	8	12	20
Ranger Creek State	0	0	0	0	0	0	0	0			0		0
Renton Municipal	170	85	255	240	254	255	256	257	94%	101%	15	55	70
Sea-Tac Int'l	4	2	6	6	6	6	6	6	100%	107%	0		0
Sky Harbor	12	0	12	8	9	9	10	10	67%	84%	2		2
Skykomish State	0	0	0	0	0	0	0	0			0		0
Sno. Co. / Paine Field	208	356	564	483	518	548	577	607	86%	108%	106	96	202
Spanaway	20	57	77	63	66	69	72	75	82%	98%	11	0	11
Swanson	12	14	26	22	23	24	25	26	85%	101%	4	0	4
Tacoma Narrows	200	82	282	200	210	219	228	239	71%	85%	33	30	63
Vashon Island	10	22	32	31	33	33	33	33	97%	104%	2		2
Will Rogers/Wiley Post	45	0	45	45	48	48	48	48	100%	107%	3		3
Total Airport System:	2,002	2,327	4,329	3,620	3,801	3,936	4,076	4,220	84%	99%	553	742	1,295

* With no new landside capacity.

** Based aircraft for Apex Airpark is limited to 50 by agreement with Kitsap County. Future demand has been redistributed to other Kitsap County airports.

*** Year 2020 D/C ratio is based on closure of Martha Lake Airport. Based aircraft forecasts for 2005, 2010, 2015, and 2020 show Martha Lake based aircraft redistributed to other Snohomish County Airports.

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landings) with minimal delay. For the smaller airports, the ASV number was derived from FAA Advisory Circular AC 150/5060-5, "Airport Capacity and Delay." For other airports the annual service volume figures were taken from their most current airport master plans. Overall, the current ratio of demand to airfield capacity is 36%. With the exception of Sea-Tac and Boeing Field, most of the region's airports are operating well below their airfield capacity. Only eight airports are operating above half their runway capacity. These include Arlington (50%), Auburn (75%), Boeing Field (91%), Harvey Field (61%), Kenmore Air Harbor (53%), Land Union Seaplane Base (51%), Sea-Tac International (89%) and Snohomish County/Paine Field (67%). FAA airport planning guidelines suggest that airports with ASV ratios between 60 and 80% should begin planning for additional runway capacity, while those with ratios between 80 and 100% should be taking action to build more capacity. Sea-Tac (at 89%) is currently underway implementing its third runway project. Boeing Field (91%) has insufficient land to accommodate additional runway development. Therefore, excess demand at Boeing Field must be diverted to other airports in the region.

Analysis of Future Capacity Requirements

To evaluate future system capacity requirements the information on existing system capacity was compared to the selected aviation demand forecasts developed in chapter 5 above. The two major measures of demand used to assess capacity were based aircraft and aircraft operations. These two measures were then used to derive other measures of demand, such as airfield access requirements and overall airport services, such as terminal requirements, demand for aircraft fuel, and other needs. Exhibits 6-2 and 6-3 below display the analysis of existing landside and airfield capacity compared with forecast demand for the years 1998 (existing), 2005, 2010, 2015, and 2020. The tables show the analysis for each airport as well as totals for the entire airport system.

Exhibit 6-2 includes existing apron tie-down and aircraft hangar capacity figures for each airport, which are summed for the region. Existing capacity is then compared with future based aircraft demand for the years 2005, 2010, 2015, and 2020. Total capacity for the region is approximately 4,329 aircraft spaces compared with the existing 3,620 based aircraft. This puts 1998 demand at 84% of total regional capacity. Future demand is forecast to grow to 4,220 based aircraft, while system capacity will drop by 52 with the expected closure of Martha Lake Airport. Future capacity will therefore be reduced to 4,277 compared with the 2020 forecast of 4,220, putting total demand at 99% of the region's capacity. This assumes that all demand would locate where there is currently excess capacity (all of which is tie-downs). In reality, however, most of the 600 additional forecast aircraft will likely require high quality, weatherproof storage in the form of hangars. Based on existing figures and waiting lists, this ratio is estimated to be 85% of all aircraft demand. Therefore the region will likely see demand for 510 new aircraft hangars and 90 tie-downs. As existing vacant tie-downs are available throughout the region, this demand will likely be met by existing supply. The new hangar demand, however, will require new construction. The figures shown in Exhibit 6-2 show that new hangar demand will reach 553 aircraft by 2020. Adding the existing waiting lists to that figure produces a total 2020 hangar demand of 1,295 aircraft. As this regional demand is distributed throughout the region (see Exhibits 6-2 and 6-3), several airports, particularly those in Snohomish County, are expected to see demand exceed supply by the year 2020, if not before.

If demand materializes as shown in the forecast, and that demand were distributed as predicted here, the following airports would exceed their landside capacity by the year 2020: Arlington, Crest, First Air Field, Harvey Field, Kenmore Air Harbor, Port Orchard, Renton, Snohomish County, Swanson, Vashon

Island, and Will Rogers/Wiley Post. While several of these are small airports that might comfortably increase capacity to meet modest future demands, several others would require significant improvements to accommodate forecast landside demand. These include Arlington (needing 112 new hangars or tie-downs), Harvey Field (needing 79 new parking spaces), and Snohomish County/Paine Field (requiring 106 new spaces).

If existing waiting list counts are considered, these three airports would need to increase landside capacity by up to 632 additional aircraft parking positions, and Crest, Pierce County/Thun Field, and Renton airports would also exceed their existing capacity. At the regional level, based aircraft demand in 2020 will reach 99% of regional capacity. At the airports where forecast demand is expected to exceed existing capacity, some 364 additional aircraft parking positions would be required. If existing 1999 waiting list information is added to those 2020 demands, total regional capacity would fall short of demand by nearly 650 aircraft. At some airports this situation would be most acute. The following are the most significant based aircraft capacity shortfalls predicted for 2020:

Airport	Capacity Shortfall (including waiting list)
Arlington	165
Auburn	155
Crest Airpark	116
Harvey Field	265
Pierce County/Thun Field	68
Renton	70
Snohomish County	202
Tacoma Narrows	63

According to staff at numerous airports around the region, all persons on the existing waiting lists are seeking space in hangars, and none are waiting for tie-downs. In fact, virtually all existing vacancies at system airports are open tie-downs, while nearly 100% of all hangars in the region are occupied. At the regional level there are currently some 742 persons on waiting lists for hangars while at the same time there are approximately 700 vacant aircraft tie-downs. These statistics support the observation that most aircraft owners prefer covered or enclosed hangars to open tie-downs. If demand at the region's airports continues to be oriented toward hangars while existing tie-downs are underutilized, there may be growing pressure to redevelop existing tie-down apron to new aircraft hangars.

Future forecast airfield demand is not predicted to exceed current airfield capacity at any airport during the forecast period, except at Sea-Tac International. Exhibit 6-3 shows that forecast demand in the year 2020 will reach 116% of existing annual capacity at Sea-Tac without the third runway. When the additional capacity from the third runway at Sea-Tac is added, forecast annual operations at Sea-Tac in the year 2020 (532,000) will be reduced to between 84% and 89% of future annual runway capacity (assuming future annual capacity is between 600,000 and 630,000 operations, as shown in Exhibit 2-7, page 2-28 of *Final Supplemental EIS for the Proposed Master Plan Update Development Actions, Volume I, May 1997*).

The airfield capacity analysis shows that during the coming 20 years the following airports will

Exhibit 6-3 Future Airfield Capacity Requirements

	Operations Capacity *	Forecast Aircraft Operations Demand					Airfield D/C Ratio	Airfield D/C Ratio ***
		1998	2005	2010	2015	2020	1998	2020
American Lake	60,000	700	731	756	787	820	1%	1%
Apex Airpark	180,000	19,425	20,908	22,143	23,426	24,761	11%	14%
Arlington Municipal	270,000	135,000	154,982	161,838	168,438	175,269	50%	65%
Auburn Municipal	230,000	172,000	173,504	174,018	174,447	174,787	75%	76%
Bandera State	150,000	300	303	304	304	305	0%	0%
Boeing Field	380,000	345,120	348,137	349,169	350,031	350,713	91%	92%
Bremerton National	240,000	108,800	117,106	124,021	131,211	138,685	45%	58%
Crest Airpark	240,000	95,222	96,055	96,339	96,577	96,765	40%	40%
Darrington	180,000	3,025	3,473	3,626	3,774	3,927	2%	2%
FirstAir Field	200,000	18,169	20,858	21,781	22,669	23,589	9%	12%
Gray Army Airfield	180,000						0%	0%
Harvey Field	230,000	140,700	161,525	168,671	175,550	182,669	61%	79%
Kenmore Air Harbor	75,000	40,000	40,350	40,469	40,569	40,648	53%	54%
Lake Union Seaplane	60,000	30,500	30,767	30,858	30,934	30,994	51%	52%
Lester State	150,000	5	5	5	5	5	0%	0%
Martha Lake	180,000	40,400	0	0	0	0	22%	0%
McChord AFB	180,000						0%	0%
Pierce Co. / Thun Field	240,000	86,710	90,581	93,611	97,498	101,522	36%	42%
Port Orchard	175,000	18,714	20,143	21,332	22,569	23,854	11%	14%
Ranger Creek State	140,000	250	261	270	281	293	0%	0%
Renton Municipal	230,000	100,710	101,590	101,892	102,143	102,342	44%	44%
Sky Harbor	140,000	1,000	1,148	1,199	1,248	1,298	1%	1%
Skykomish State	150,000	300	303	304	304	305	0%	0%
Sno. Co. / Paine Field	288,000	192,612	221,121	230,903	240,320	250,066	67%	87%
Spanaway	140,000	19,380	20,245	20,922	21,791	22,690	14%	16%
Swanson	150,000	5,609	5,859	6,055	6,307	6,567	4%	4%
Tacoma Narrows	240,000	95,316	99,571	102,902	107,175	111,598	40%	46%
Vashon Island	160,000	6,000	6,052	6,070	6,085	6,097	4%	4%
Will Rogers/Wiley Post	60,000	2,387	2,408	2,415	2,421	2,426	4%	4%
Total GA Airport System:	5,298,000	1,678,354	1,737,985	1,781,871	1,826,866	1,872,996	32%	37%
Sea-Tac Int'l **	460,000	407,597	445,000	474,000	503,000	532,000	89%	116%
Total Airport System Including Sea-Tac:	5,758,000	2,085,951	2,182,985	2,255,871	2,329,866	2,404,996	36%	42%

* Measured as "Annual Service Volume"

** Forecasts prepared by the Port of Seattle

*** With no new runway capacity and loss of Martha Lake Airport

PAGE 6-14

experience increasing ratios of demand to capacity as follows: Arlington (50-65%), Auburn (75-76%), Boeing Field (91-92%), Bremerton National (45-58%), Harvey Field (61-79%), and Snohomish County Airport/Paine Field (67-87%). Clearly, the biggest jumps in operations activity will occur at Arlington, Harvey Field, and Snohomish County Airport. Because it is already approaching its practical landside and airfield capacities, aviation demand at Boeing Field will continue to be diverted to other general aviation airports that either have excess capacity or can provide it.

The analysis of how and where future landside and airfield capacity should be provided to meet demand will be discussed in detail in the *Aviation System Strategies* portion (Chapter 7) of this plan.

Puget Sound Regional Council
PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Thursday, January 27, 2000
1:00 - 3:30 p.m.

Puget Sound Regional Council
1011 Western Avenue
Seattle, Washington
5th Floor Board Room

1:00 p.m. 1. **Call to Order and Introductions** - *King Cushman and Dave Waggoner*

1:10 p.m. 2. **Subcommittee Report:** Summary of Recommended Forecasts for Based Aircraft and Operations* - *Dave Waggoner and Steve Kiehl*

1:40 p.m. 3. **Discussion**: The Role of General Aviation - Regional and Statewide Benefits - *King Cushman and Theresa Smith*

2:00 p.m. 4. **Review and Discuss:** Chapter 6 - System Capacity and Future Facility Requirements* - Steve Kiehl

5. **Other Business**

6. **Next Meeting:** Thursday, May 25, 2000, 1:00-4:00 p.m.
   • System Strategies

3:30 p.m. 7. **Adjourn**

*Supporting material enclosed

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling Grace Foster at (206) 464-7090. TDD/TTY: (206) 464-5409

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Puget Sound Regional Council

PSRC

MEMORANDUM January 20, 2000

To: Regional Airport System Plan Advisory Committee

From: Stephen Kiehl

Subject: Summary of Recommended Forecasts for Based Aircraft and Operations

As you may recall, at the last Regional Airport System Plan (RASP) Advisory Committee meeting on September 30, a subcommittee was formed to hold further discussions regarding the aviation forecasts. That subcommittee met on October 20. As a result, we have now completed a recommendation for based aircraft and operations forecasts. These forecasts are attached and will be discussed at the RASP Advisory Committee meeting next week. The attached forecast charts display the various forecast approaches and highlight the selected forecasts. The attachments also include a fleet mix forecast by county and a summary of the selected regional aviation forecasts.

At the September 30 full Advisory Committee meeting, we discussed using the "Modified Trend" forecast for based aircraft, which predicted a regional total of 4,220 based aircraft in the year 2020. At its October 20 meeting, the subcommittee felt it prudent to adopt a more robust-based aircraft forecast. The committee agreed to endorse the FAA's national forecast for both based aircraft and aircraft operations. These recommended forecasts predict the regional-based aircraft fleet will reach 4,439 by the year 2020, and total operations will reach 1,872,996 (excluding Sea-Tac) by 2020. In recommending these forecasts, the group cited two major factors: (1) current and forecast strong growth in general aviation at the regional and national levels; and (2) the region's historic tendency toward high aviation activity. In addition, the group agreed that a slightly higher based aircraft forecast would assist the region in addressing the more critical landside constraints which exist in the airport system.

Attachments: **Exhibit A:** Regional-Based Aircraft Forecast Approaches
Exhibit B: Regional General Aviation Operations Forecast Approaches
Exhibit C: Existing and Forecast-Based Aircraft Fleet Mix by County
Exhibit D: Selected Regional Aviation Forecasts Summary

X:\TRANS\COMM\RASP\2000\forecast memo for January 27 meeting.wpd

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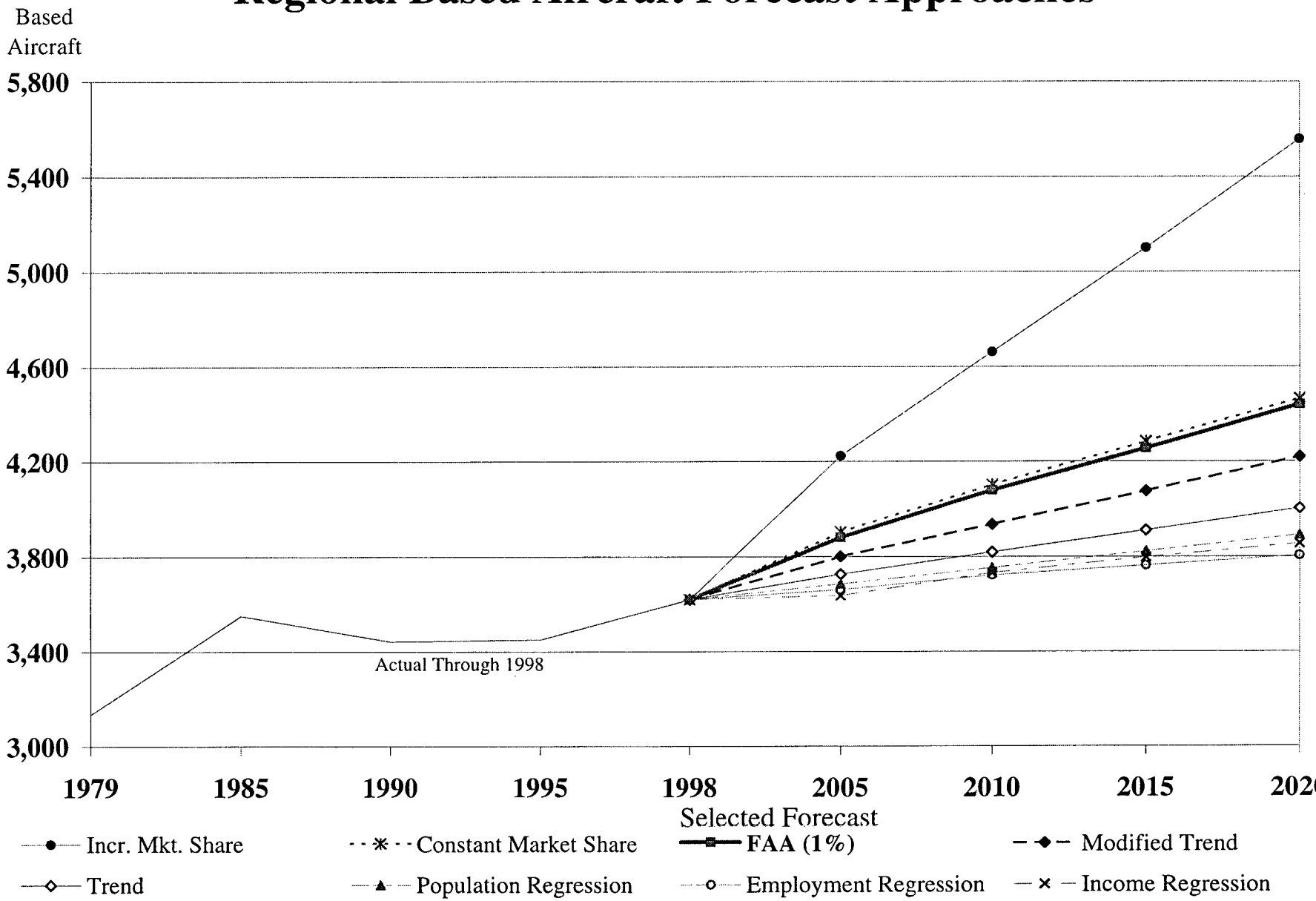
Regional Based Aircraft Forecast Approaches



NEW GA Forecasts.xls / Based Aircraft Forecasts

Regional General Aviation Operations Forecast Approaches

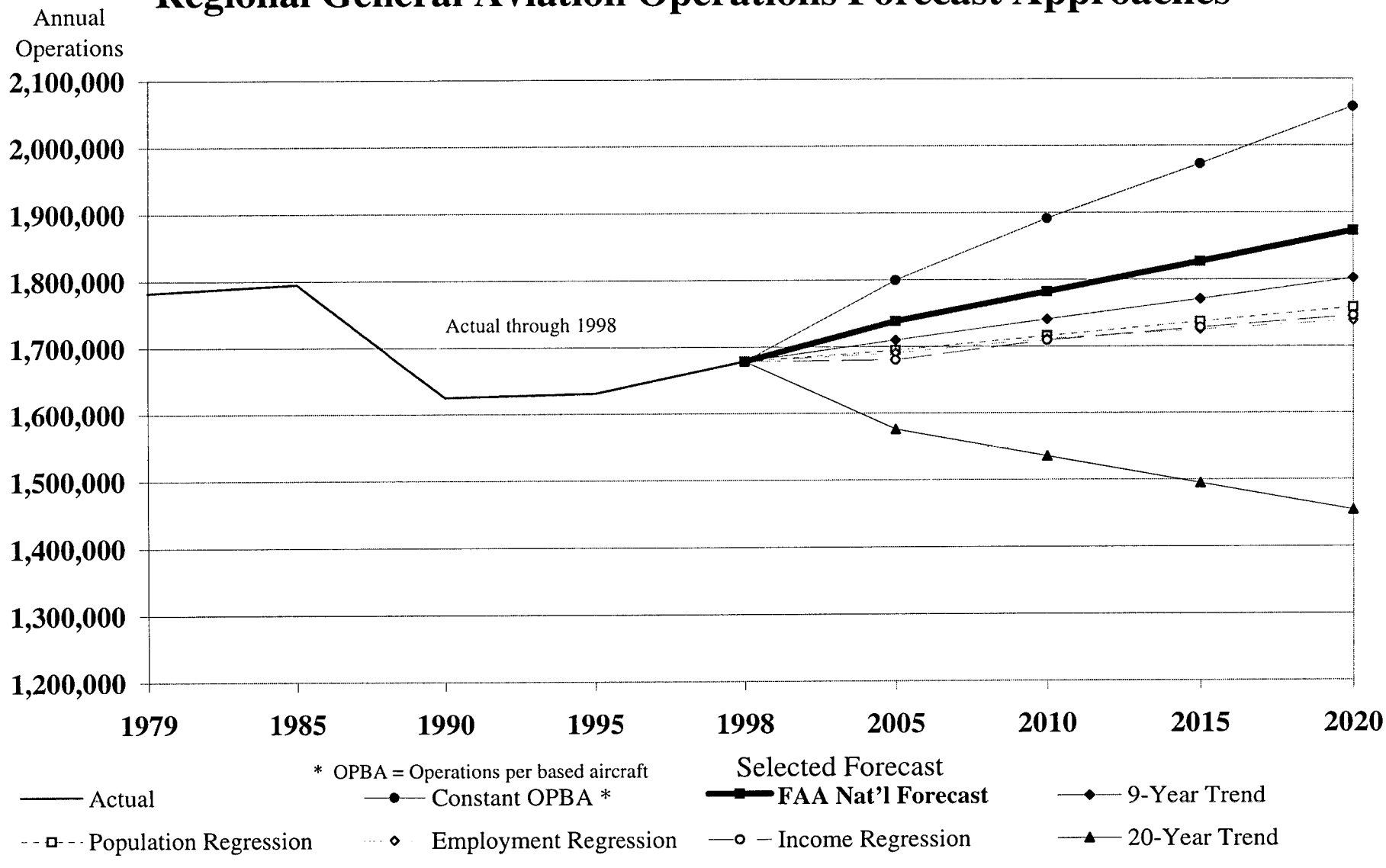


Exhibit B

Existing and Forecast Based Aircraft Fleet Mix by County

1999 Based Aircraft Fleet Mix by County

	King	Kitsap	Pierce	Snohomish	Total
Single engine	1,195	176	481	1,246	3,098
Multi-engine	141	5	41	78	265
Jet	41	0	7	25	73
Helicopter	38	0	0	33	71
Other	1	0	0	112	113
	1,416	181	529	1,494	3,620

2020 Based Aircraft Fleet Mix by County

	King	Kitsap	Pierce	Snohomish	Total
Single engine	1,312	222	589	1,429	3,551
Multi-engine	162	6	51	92	311
Jet	98	1	18	61	178
Helicopter	69	1	1	62	133
Other	1	0	0	265	266
	1,642	230	659	1,908	4,439

Additional Aircraft Demand by County - - 1999-2020

	King	Kitsap	Pierce	Snohomish	Total
Single engine	117	46	108	183	453
Multi-engine	21	1	10	14	46
Jet	57	1	11	36	105
Helicopter	31	1	1	29	62
Other	0	0	0	153	153
	226	49	130	414	819

Selected Regional Aviation Forecasts Summary *

Based Aircraft Forecast

	1998	2005	2010	2015	2020
King	1,416	1,498	1,554	1,600	1,642
Kitsap	181	198	208	221	230
Pierce	529	567	600	625	659
Snohomish	1,494	1,618	1,717	1,808	1,908
Total	3,620	3,881	4,079	4,255	4,439

Aircraft Operations Forecast

	1998	2005	2010	2015	2020
King	792,544	808,163	817,879	829,397	840,975
Kitsap	146,939	156,419	162,150	168,072	174,189
Pierce	207,965	218,986	228,079	237,493	247,235
Snohomish	530,906	554,417	573,762	591,905	610,597
Total	1,678,354	1,737,985	1,781,871	1,826,866	1,872,996

Forecast Distribution of Based Aircraft

	1998	2005	2010	2015	2020
King	39.1%	38.6%	38.1%	37.6%	37.0%
Kitsap	5.0%	5.1%	5.1%	5.2%	5.2%
Pierce	14.6%	14.6%	14.7%	14.7%	14.8%
Snohomish	41.3%	41.7%	42.1%	42.5%	43.0%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

Forecast Distribution of Aircraft Operations

	1998	2005	2010	2015	2020
King	47.2%	46.5%	45.9%	45.4%	44.9%
Kitsap	8.8%	9.0%	9.1%	9.2%	9.3%
Pierce	12.4%	12.6%	12.8%	13.0%	13.2%
Snohomish	31.6%	31.9%	32.2%	32.4%	32.6%
Total	100.0%	100.0%	100.0%	100.0%	100.0%

* *Based on FAA 1% based aircraft forecast and FAA aircraft operations forecast*

Puget Sound Regional Council

Regional Airport System Plan Refinement

– Work in Progress –

January 20, 2000

■ Chapter 6: System Requirements

For discussion by the
Regional Airport System Plan (RASP) Technical Advisory Committee
January 27, 2000

Chapter 6 - System Capacity and Future Facility Requirements

The system capacity and facility requirements work element consists of two interrelated tasks. First, the capacity of the existing airport system is determined using information from the system inventory. The capacity information is then evaluated against existing and forecast aviation activity to determine the extent of additional facilities needed to meet future demand. The following sections describe these two related work efforts.

System Capacity and Requirements

Analysis of airport system capacity was done using existing facility information from the system inventory work task. The analysis identifies facility capacity for each system airport and for the total airport system. Analysis of airport capacity (and future facility needs) includes facilities' ability to meet numeric demand, such as total annual or peak hour takeoffs and landings, as well as meeting the more specialized needs of the system, such as runway length or strength. The following airport facilities are included in the analysis of system capacity and requirements:

Aircraft parking capacity	*	aircraft tie-downs (for based aircraft)
	*	aircraft hangars (for based aircraft)
Airfield capacity	*	annual capacity (measured as annual service volume, or "ASV")
Airport acreage	*	acreage available for airport development
Pavements	*	pavement condition index (PCI)
	*	runway surface type
Safety & standards	*	runway length
	*	runway width
	*	runway safety areas (width and length beyond)
	*	runway approaches and obstructions
	*	approach lighting
Support facilities	*	control towers
	*	air cargo
	*	aircraft fuel

System Capacity

The analysis of system capacity and future requirements was done for five time periods: 1998 (current), 2005, 2010, 2015, and 2020. Exhibit 6-1, *Existing System Capacity (1999)* displays existing capacity compared with existing demand levels for the base year (1999). The table shows the capacity of existing aircraft parking inventory (tie-downs and hangars), current number of based aircraft, current waiting lists for aircraft parking, existing airport acreage devoted to aviation use plus additional acreage available for future development, existing (1998) aircraft operations, and annual operations capacity, measured as annual service volume (ASV).

Two critical ratios are also included in the table, which are calculated by comparing the existing demand and capacity figures. These ratios are the "Landside Demand/Capacity (or D/C) Ratio" and the "Airside Demand/Capacity (D/C) Ratio." Both these ratios represent the portion of existing capacity that is being used. For the total airport system the demand for landside aircraft parking is 84% of existing capacity, while airside demand (annual operations) is at 36% of existing airfield capacity. These ratios are totals for the entire airport system.

Existing Based Aircraft Capacity

Exhibit 6-1 displays a comparison of based aircraft with existing aircraft parking inventory for the region as a whole and for each airport. The inventory is divided into tie-down capacity and hangar capacity. As of 1999, the region had 2,002 aircraft tie-downs and 2,327 hangars for a total inventory of 4,329. This breakdown represents 46% tie-downs and 54% hangars. With 3,620 aircraft based in the region, the airport system has reached 84% of its existing aircraft parking capacity. Discussions with most airport managers in the region confirm that as of 1999 virtually all aircraft hangars in the region (2,327) are full, while 1,293 tie-downs (65%) are occupied, leaving 709 tie-downs (35%) vacant.

Individual airports' D/C ratios vary around the region. Several airports have reached or are nearing their existing based aircraft parking capacity. These include Apex Airpark (100%), Arlington (88%), Boeing Field (81%), Crest Airpark (94%), First Air Field (90%), Kenmore Air Harbor (100%), Martha Lake (98%), Pierce County Airport/Thun Field (82%), Renton Municipal (94%), Snohomish County Airport/Paine Field (86%), Spanaway (82%), Swanson (85%), Vashon Municipal (97%), and Will Rogers/Wiley Post Seaplane Base (100%). Several small airports, including Port Orchard, Darrington, and the four state-owned airports, have few or no based aircraft and are not approaching their capacity.

In addition to existing based aircraft, information on current waiting lists was collected from individual airports where available. As of August 1999, there were a total of approximately 817 names on documented waiting lists. All these waiting lists represent aircraft waiting for hangars, not tie-downs. Most people on the waiting list are current airport tie-down tenants hoping to upgrade to covered storage. A review of the waiting lists for Crest Airpark, Harvey Field, and Snohomish County Airport/Paine Field shows approximately 90% are existing tie-down tenants inside the region, while 10% have aircraft located outside the Puget Sound region. This smaller segment of the waiting list represents latent (unmet) demand, while the vast majority represents demand that is being met, though not of the type required.

These data, which are consistent with national trends, suggest that the region is providing enough total aircraft parking to meet demand, but those facilities are of the wrong type. Pilots and owners of increasingly expensive and sophisticated aircraft are demanding secure, weatherproof storage facilities for their airplanes. While the region's existing supply of aircraft parking is comprised of 54% hangars and 46% tie-downs, actual demand would appear to be split more toward hangars, with 87% demanding hangars and 13% requiring tie-downs. As the regional aircraft fleet expands in the future, with newer aircraft and fractional ownership increasing, it is likely that the preference for hangars will continue and perhaps even grow. The implications for future planning indicate that perhaps some existing tie-down space could be redeveloped for hangars to meet existing demand. In the longer term, if demand materializes as the forecasts predict, up to 90% of new aircraft parking facilities might be devoted to hangars. The feasibility of providing this high ratio of hangars would depend in part on whether hangar rents are affordable by most aircraft owners.

Unfortunately, the waiting list data are not sufficiently complete to allow detailed analysis. For example, it is not known how many on waiting lists are trying to move their aircraft from one airport within the region to another. Given the historical trend of lower end GA away from congested, more expensive airports in the region toward less congested, less expensive airports, it's probable that some people on waiting lists are tenants of airports waiting for space to become available at other airports. An additional unknown is how many people have placed their names on more than one waiting list. A third unknown is the price these people on waiting lists would be willing to pay for hangar space. The lack of reliable, statistically significant data on waiting lists makes it difficult to develop solid plans to meet this undefined demand. Nevertheless, it is important to consider these needs in planning for the future airport system.

Existing Airfield Capacity

In terms of airfield operations capacity, the analysis used here is based on "annual service volume" (ASV) as the measure of capacity. Annual service volume represents the airports' approximate annual runway capacity (total takeoffs and landings) with minimal delay. Calculation of an airport's "ASV" considers factors such as overall airfield geometry, number of runways, runway separation, runway utilization patterns, hourly capacity, airport capability during poor visibility (and nighttime operations), and aircraft fleet mix. For the smaller airports, the ASV numbers used here were derived from FAA Advisory Circular AC 150/5060-5, "Airport Capacity and Delay." For the larger airports, the annual service volume figures were taken from their most current airport master plans.

With the exception of Sea-Tac (at 89%) and Boeing Field (at 91%), most of the region's airports are operating well below their airfield capacity. Only eight airports are operating at or above half their annual runway capacity. These include Arlington (50%), Auburn (75%), Boeing Field (91%), Harvey Field (61%), Kenmore Air Harbor (53%), Lake Union Seaplane Base (51%), Sea-Tac International (89%) and Snohomish County/Paine Field (67%). FAA airport planning guidelines suggest that airports with ASV ratios between 60% and 80% should begin planning for additional runway capacity, while those with ratios between 80% and 100% should be taking action to build more capacity. Sea-Tac (at 89%) is currently underway implementing its third runway project. Boeing Field (91%) has insufficient land to accommodate additional runway development. Therefore, excess demand at Boeing Field must be diverted to other airports in the region, a condition that has been the case for many years.

Analysis of Future Capacity Requirements

To evaluate future system capacity requirements the information on existing system capacity was compared to the selected aviation demand forecasts developed in Chapter 5. The two major measures of demand used to assess capacity were based aircraft and aircraft operations. Exhibits 6-2 and 6-3 display the analysis of existing landside and airfield capacity compared with forecast demand for the years 1998 (existing), 2005, 2010, 2015, and 2020. The tables show the analysis for each airport as well as totals for the entire airport system.

Future Based Aircraft Capacity Requirements

Exhibit 6-2 includes existing aircraft tie-down and aircraft hangar capacity figures for each airport, which are summed for the region. Existing capacity is then compared with future based aircraft demand for the years 2005, 2010, 2015, and 2020. Total capacity for the region is approximately 4,329 aircraft spaces compared with the existing 3,620 based aircraft. This puts 1998 demand at 84% of total regional capacity. Future demand is forecast to grow to 4,439 based aircraft, while system capacity will drop by 52 spaces with the expected closure of Martha Lake Airport. Future capacity will therefore be reduced to 4,277 compared with the 2020 forecast of 4,439 based aircraft, putting total demand at 104% of the region's capacity. At the regional level, supply would be 162 spaces short of projected demand. This assumes that all demand would locate where there is currently excess capacity (all of which is tie-downs). Future regional based aircraft demand shows a strong preference for hangars combined with uneven demand across the region. Exhibit 6-2 shows the distribution of future demand by airport, and also displays that future demand by its preference for hangars. According to these data, 737 new aircraft hangars will be needed by the year 2020, while 82 new aircraft will prefer tie-downs, virtually all of which can be accommodated by existing supply. As a result, no new tie-downs would be needed. If construction of new hangars were to displace a significant number of existing aircraft tie-downs, however, there could be a need for new tie-downs.

If future demand is distributed as predicted here, the following airports would reach or exceed their landside capacity by the year 2020: Apex, Arlington, Crest, First Air Field, Harvey Field, Kenmore Air Harbor, Pierce County Airport/Thun Field, Renton, Sea-Tac, Snohomish County Airport/Paine Field, Spanaway, Swanson, Vashon Island, and Will Rogers/Wiley Post. While several of these are small airports that might comfortably increase capacity to meet modest increases in future demand, several others would require significant improvements to accommodate forecast landside demand. These include Arlington (needing 148 new hangars), Harvey Field (needing 104 new hangars), and Snohomish County Airport/Paine Field (requiring 140 new hangars).

The above calculations of future based aircraft demand (primarily new hangars) do not include current hangar waiting lists, which are a measure of latent hangar demand. Though difficult to quantify, the waiting lists display a preference for upgraded aircraft storage facilities, and perhaps more importantly illustrate the trend toward more expensive, more sophisticated business and corporate aircraft. Though the large majority of these aircraft are currently tenants at the region's airports, they represent a growing market for hangars. When combined with the anticipated future hangar demand from new aircraft (737) the 817 aircraft on the region's hangar waiting lists brings the total potential hangar demand to over 1,500 hangars, a 64% increase over the current regional hangar supply.

Future Airfield Capacity Requirements

At most airports in the region, airfield capacity is sufficient to accommodate future demand. However, several airports may begin to approach their annual airfield capacity (annual service volume) by the year 2020. These include Auburn (reaching 81% of its airfield capacity), King County International/Boeing Field (reaching 99%), Harvey Field (reaching 75%), and Snohomish County/Paine Field (reaching 82%), all of which are reliever airports. As these airports approach their annual runway capacity, airport users may increasingly seek alternative airports that are less congested. Over the forecast period, the biggest jumps in operations activity (measured in percentage of annual runway capacity used) will occur at Arlington (increasing from 50% to 61%), Boeing Field (increasing from 91% to 99%), Harvey Field (increasing from 61% to 75%), and Snohomish County/Paine Field (increasing from 67% to 82%). Because it is already approaching its practical landside and airfield capacities, aviation demand at Boeing Field will continue to be diverted to other general aviation airports that either have excess capacity or can provide it.

Auburn Airport, which is predicted to reach 81% of its annual airfield capacity by the year 2020, occupies a 107-acre site with approximately 25 acres available for expansion. The site is constrained by urban development on all sides. Expansion potential to accommodate a second runway is highly unlikely.

King County International Airport/Boeing Field sits on a 634-acre site bounded by Airport Way and major railroad tracks on the east, urban development on the north and south, and major industrial uses (including Boeing Company facilities and the Museum of Flight) on the west. There is no feasible way for Boeing Field to expand its airfield capacity.

Harvey Field in Snohomish County will reach 75% of its annual runway capacity by the year 2020. The airport maintained a second, turf crosswind runway until 1999, when it was closed to allow for construction of aircraft hangars. The owner plans to construct a new parallel runway in the future (also turf), and also plans to install ramps, docks, and other support facilities to serve float planes on the Snohomish River. These improvements would increase the airport's airfield capacity and would likely serve projected demand beyond the year 2020.

Snohomish County Airport/Paine Field is expected to see airfield operations increase to over 235,000 by the year 2020. This would place the airport at approximately 82% of its annual capacity (288,000 annual operations), second in the region to Boeing Field. According to the airport's most recent master plan (completed in July 1995), the existing airfield configuration will accommodate projected demand (the master plan projected 279,000 annual operations in the year 2014). This airport system plan forecasts aircraft operations to reach 235,000 at Paine Field by the year 2020, somewhat below the airport master plan forecast for the year 2014. While this operations level is lower than the airport's forecast, it is still above 80% of the airport's capacity, and raises the issue of long-term capacity at Paine Field.

The analysis of how and where future landside and airfield capacity should be provided to meet demand will be discussed in the *Aviation System Strategies* portion (Chapter 7) of this plan.

Acreage Available for Airport Development

The analysis of future airport system capacity enhancement to meet growing demand includes a review of existing acreage of the system's airports as well as the amount of existing airport land available for airport growth. Exhibit 6-1 includes both these figures. Excluding the two military airfields, the region's airports contain a current total of approximately 8,442 acres. Of this total, some 1,092 acres are available to accommodate airport development needs (584 of the 1,092 available acres are located at Bremerton National Airport). Following is a display of the top ten airports facing the most significant future demand for aircraft parking space and their land available for development. It identifies the amount of airport property potentially available for additional airport development to accommodate new based aircraft. In addition, it identifies airport standards issues that could require additional property.

Airport	Total new aircraft demand (2020)	Airport land available for development	Airport standards potentially affecting property needs
Arlington	164	40 acres	None
Snohomish County	156	170 acres	None
Harvey Field	116	117 acres	Runway length Runway width
Boeing Field	71	0 acres	RSA length beyond (Runway 13R)
Pierce County/Thun	56	11 acres	RSA width
Crest Airpark	53	68 acres	Runway width
Tacoma Narrows	49	31 acres	Runway length RSA length beyond
Bremerton National	42	584 acres	Runway length RSA length beyond
Auburn	38	25 acres	None
Renton	38	0 acres	RSA length beyond

Pavements

Pavement Condition Index ("PCI")

Airport pavements – particularly runways – represent one of the most expensive investments in airport infrastructure. Maintenance and preservation of airport pavements is a cornerstone for aviation system planning. The FAA requires airport sponsors to collect and regularly update airport pavement condition information as a condition to remain eligible to receive federal funding for pavement replacement and reconstruction projects. The national standard for monitoring the condition of airport pavements is the pavement condition index ("PCI") system. This pavement evaluation system establishes a pavement condition "index" number (between 1 and 100) for each section of pavement. Pavements in excellent condition will have high PCI numbers, while those in poor condition will have low index numbers. Developing and maintaining PCI data for airports in a system, and for individual airports over time, helps in tracking pavement deterioration and provides for comparative analysis of the pavement needs of airports in a system.

The Washington State Department of Transportation (WSDOT) Aviation Division is developing a pavement maintenance and management program for most of the public use airports in the state, including those in the central Puget Sound region. The information presented here is derived from the WSDOT program. Inventory information on airport system pavements, including current PCI numbers, was developed by the WSDOT and its consultants during 1999. In addition to the pavement inventory and PCI information in the pavement program database, the state's program includes development of a computerized pavement management and maintenance program utilizing "MicroPaver" software. The MicroPaver program allows for comparative analysis of pavement needs, helps to identify funding priorities for pavement investment, and can be used to predict future pavement performance given various pavement investment options. With this information, funding for airport pavements can be most effectively allocated to the airports of the system.

Exhibit 6-4 displays two separate assessments of pavement condition for the region's airports, both of which were developed by the WSDOT Aviation Division. The first, based on visual inspections performed during the 1998 statewide airport inventory, uses a scale of "good," "fair," and "poor" to describe airport pavements. The second, completed in 1999-2000 as part of the WSDOT's pavement management program, displays pavement condition index (PCI) numbers for all airport pavements.

According to the 1998 visual pavement inspections, the region's 31 land-based runways scored reasonably well: 21 runways were considered in good condition, 7 were in fair condition, and only 3 were in poor condition. The three poor condition runways are located at Bandera (turf), Lester (turf), and Spanaway. The fair condition runways are at Crest Airpark, First Air Field, Harvey Field, Martha Lake, Port Orchard, Skykomish State, and Tacoma Narrows.

Runway Surface Type

The regional airport system currently has a variety of runway surface types, including concrete, asphaltic concrete, asphalt, turf/gravel, and water. Of the region's 36 active runways, 1 is concrete, 4 are asphaltic concrete, 21 are asphalt, 5 are turf/gravel (a sixth, Harvey Field's crosswind turf runway, has been closed), and 5 are water. These data are displayed in Exhibit 6-4. The existing airport system runway surface types are appropriate for current airport roles. All primary and reliever airports have either concrete, asphaltic concrete, or asphalt runways. Sea-Tac's runway 16R-34L is concrete. The four asphaltic concrete runways include those at Boeing Field (both), Renton, and McChord AFB. The remainder of the region's busier airports have runways constructed of asphalt (including Sea-Tac's runway 16L-34R). The system's turf and gravel runways are confined to three of the four state-owned airports plus Sky Harbor (Sultan) and Vashon Island. The five airports with turf/gravel runways serve the smallest GA aircraft (airport reference code A-1), have low numbers of annual operations (all served less than 6,000 annual operations in 1998), and have limited based aircraft fleets (Vashon has the most based aircraft, with 31). Based on the existing airport system runway surface types, existing airport roles, expected future roles, and forecasts of future aviation activity, no changes in runway surface types are needed.

Safety & Standards

This section describes the extent to which the airport system meets operational requirements and safety standards, and identifies areas where the region's airports fail to meet standards. Those deficiencies that are considered critical to the maintenance, preservation, and/or enhancement of the system are identified

as critical system needs and will be addressed in the capital improvements program (CIP) in the Implementation chapter.

Runway Length

Airports must be planned and designed to standards which will accommodate the most demanding aircraft ("critical aircraft") using the airport. These standards include runway length, runway width, and runway safety area (width and length beyond the runway end). Recommended runway length is largely determined by the performance requirements of each airport's current and future critical aircraft, including its size, speed, and operating characteristics. In addition, airport elevation and average daily maximum temperature of the hottest month are used to calculate required runway length. The runway length requirements shown here were derived from two major sources. For small airports, the FAA's "Airport Design for Microcomputers" program, version 4.2, was used to determine recommended runway length. For the larger airports, the recommended future runway length contained in their airport master plan is shown. Several runway length recommendations show longer future runways, not because the existing length is inadequate, but because the airport plans to accommodate future aircraft that require a longer runway. For the region's two military airfields and four seaplane bases, no recommended runway length is shown.

Larger Airports Planning for Longer Runways

Airport	Existing Runway Length	Planned Runway Length
Arlington	5,333 ft.	6,000 ft.
Bremerton	6,200 ft.	7,400 ft.
Sea-Tac Int'l	11,900 ft.	12,500 ft.
Tacoma Narrows	5,002 ft.	6,000 ft

Smaller Airports with Less Than Recommended Runway length

Airport	Existing Runway Length	Recommended Length
Apex	2,500 ft.	3,040 ft.
Bandera	2,342 ft.	3,440 ft.
Darrington	2,490 ft.	3,040 ft.
First Air	2,095 ft.	2,910 ft.
Harvey Field	2,660 ft.	2,900 ft.
Lester	2,150 ft.	3,470 ft.
Martha Lake	1,680 ft.	3,030 ft.
Port Orchard	2,460 ft.	3,000 ft.
Ranger Creek	2,700 ft.	3,980 ft.
Sky Harbor	1,930 ft.	2,970 ft.
Skykomish	2,050 ft.	3,190 ft.
Spanaway	2,720 ft.	3,000 ft.
Swanson	3,000 ft.	3,150 ft.
Vashon	1,940 ft.	2,450 ft.

Runway Width

Runway width requirement is determined by the category of aircraft ("design aircraft") using the airport (a combination of approach speed and wing span) and the airport's (or runway's) level of instrumentation (ability to handle landings in low visibility). The greater the capability to handle low visibility conditions, the wider the runway must be. According to the most recent airport inventory information obtained from current airport master plans and the WSDOT's airport inventory database, the region's airport system has 12 airports with runways that do not meet FAA runway width requirements to accommodate their current "design aircraft." These airports include Apex, Crest, Darrington, First Air, Harvey Field, Martha Lake, Pierce County/Thun Field, Port Orchard, Ranger Creek, Spanaway, Swanson, and Vashon.

Since these airports serve a wide range of roles in the system, from reliever to state-owned (primarily emergency access), sub-standard runway width is not equally critical for all airports. Most important on this list would be the reliever (Harvey Field) and those airports serving greater numbers of operations and/or larger, more demanding aircraft. Based on these criteria, runway width requirements are most critical at Crest Airpark, Harvey Field, and Pierce County/Thun Field. In addition, the magnitude by which the runways fail to meet width requirements can also be evaluated. In this category, Spanaway is most critical, with a runway width of 20 feet compared with a 60-foot standard. Airports with discrepancies between existing runway width and FAA runway width requirements are shown below.

Comparison of Runway Width and FAA Runway Width Requirements

Airport	Runway Width	Requirement
Apex Airpark	28 feet	60 feet
Crest Airpark	40 feet	60 feet
Darrington	40 feet	60 feet
First Air Field	34 feet	60 feet
Harvey Field	36 feet	60 feet
Martha Lake	38 feet	60 feet
Pierce County/Thun	60 feet	75 feet
Port Orchard	28 feet	60 feet
Ranger Creek	30 feet	60 feet
Spanaway	20 feet	60 feet
Swanson	50 feet	60 feet
Vashon	50 feet	60 feet

All other airports in the region either meet or exceed current runway width requirements.

Runway Safety Area (width and length beyond)

Runway safety area standards are established to protect operating aircraft and persons and objects on the ground during takeoffs and landings. Similar to runway width requirements, runway safety areas (width and length beyond) are determined by the category of aircraft using the airport (a combination of approach speed and wing span) and the airport's (or runway's) level of instrumentation (ability to handle landings in low visibility). Runway safety areas include runway safety area width (symmetrical about the runway centerline) and runway safety area length beyond (length beyond the end of each runway). The entire runway safety area (a rectangle with the runway inside) should be kept clear of buildings, persons,

and objects (including parked aircraft and vehicles) that would pose a hazard to the safe use of the runway. The airport system currently has 14 airports with substandard runway safety area width and 16 airports with sub-standard runway safety area length beyond the runway end. These two groups of airports are listed below.

Comparison of Runway Safety Area Width and FAA Requirements

Airport	Runway Safety Area Width	Requirement
Apex Airpark	42 feet	120 feet
Bandera	feet	120 feet
Darrington	80 feet	120 feet
First Air Field	54 feet	120 feet
Lester	feet	120 feet
Martha Lake	feet	120 feet
Pierce County/Thun	120 feet	150 feet
Port Orchard	feet	120 feet
Ranger Creek	feet	120 feet
Sea-Tac	180-500 feet	500 feet
Sky Harbor	feet	120 feet
Skykomish	feet	120 feet
Swanson	98 feet	120 feet
Vashon	76 feet	120 feet

Comparison of Runway Safety Area Length Beyond and FAA Requirements

Airport	Runway Safety Area Length Beyond	Requirement
Apex Airpark	65 feet	240 feet
Bandera	feet	240 feet
King County/Boeing Field	200 feet	1,000 feet
Crest Airpark	150 feet	240 feet
Darrington	100 feet	240 feet
First Air Field	42 feet	240 feet
Lester	feet	240 feet
Martha Lake	feet	240 feet
Port Orchard	feet	240 feet
Ranger Creek	feet	240 feet
Renton	300 feet	600 feet
Sea-Tac	535-700 feet	1,000 feet
Sky Harbor	feet	240 feet
Skykomish	feet	240 feet
Snohomish County/Paine	205/235 feet	240/1,000 feet
Spanaway	155 feet	240 feet
Swanson	40 feet	240 feet
Tacoma Narrows	330 feet	600 feet
Vashon	50-160 feet	240 feet

Runway Approaches and Obstructions

Establishing and maintaining the approaches to runways is critical to a safe and efficient airport system. Exhibit 6-5 displays a summary of the information available regarding the runway approaches at the region's airports. Listed in the exhibit are the existing approach, the required approach, objects that obstruct the airport's runway approaches, and the runways' visibility minimums. The approach surface listed in Exhibit 6-5 refers to the slope of the imaginary plane leading to the runway end. The goal of the approach slope is for no objects to penetrate the approach plane, leaving the area above the plane clear for unobstructed and safe landings. The slope is given as a ratio of horizontal distance to vertical distance. For example, a 20:1 approach slope rises 1 foot for each 20 feet horizontally. For most general aviation airports serving small GA aircraft, a 20:1 approach is required. Runway approach requirements increase to 34:1, 40:1, and 50:1 for airports serving larger commercial aircraft that operate in low visibility conditions. The more strict approaches required at these airports allow for aircraft flying under instrument flight rules (IFR) to use instrument landing systems (ILS), global positioning systems (GPS), and other electronic systems providing guidance to pilots. The more strict the approach slopes of the region's airports, the more flexibility the system has to meet demand in all weather conditions by a wide range of aircraft.

The airport approach surface information presented in Exhibit 6-5 was derived from the WSDOT's airport database and from current airport master plans, and represent conditions as of 1998 or the date of the last airport master plan. According to those data, the region currently has 72 runways ends. Of these, 55 are A-visual approach runways requiring 20:1 approaches; six runway ends are B-visual or non-precision instrument runways requiring 34:1 approaches; and nine are precision instrument runways requiring a 50:1 approach.

Of the 55 runways requiring 20:1 approaches, 33 runway ends do not currently meet these standards. Of the six runways with 34:1 required approaches, three runways currently do not met the standard. Of the nine 50:1 approach required runway ends, three currently do not meet the standard. In total, 39 of 72 runway end approaches fail to meet current standards, due to the presence of obstructions which penetrate the approach slope. Exhibit 6-5 lists both the required and existing approaches to the region's airport runways. In addition, it lists airports that can support 50:1 approaches, which allow for precision instrument approaches in poor visibility. These airports include those that currently have 50:1 approaches as well as those that could support them in the future. Those currently with 50:1 approaches include King County International/Boeing Field, McChord AFB, Seattle-Tacoma International, Snohomish County Airport/Paine Field, and Tacoma Narrows. Those airports that do not currently have 50:1 approaches, but could support them, include Arlington, Bremerton, and Will Rogers/Wiley Post seaplane base. In addition, runway 35 at Tacoma Narrows has the capability to support a 50:1 approach in the future, which would give both runway ends instrument approach capability.

Lighting, marking, trimming, and removal of obstructions is an important element of airport system maintenance and preservation. Man-made and natural obstructions near airport approach and departure paths can limit airports' ability to meet demand and can compromise safety. Information regarding obstructions in the vicinity of the region's airports was collected from various sources and is summarized in Exhibit 6-5. Nearly every airport in the region has some type of obstruction. The region's four seaplane bases are the only airport facilities free from obstructions. The majority of man-made obstructions include buildings, power lines, roads, railroads, poles, and fences. Natural obstructions are primarily trees. In some locations, such as near airports in the Cascade foothills, terrain may create

obstructions. Lighting, marking, and removal are typical approaches to resolving man-made obstructions. Tree trimming and removal are typically used to control or eliminate these natural obstructions. Where terrain acts as an obstruction, mitigation can include grading to lower hills, displacing runway thresholds, relocating runways, or, in extreme cases, airport relocation or closure.

Following is a tabulation of the airport system's existing runway approaches by obstruction type. Of the 72 runway ends in the system, 40 have obstructions while 32 do not. Of the 32 unobstructed approaches, 10 are located at seaplane bases, while 22 are located at the following land-based airports: Arlington (both runways), Boeing Field (runway 13L-31R), Gray Army Airfield, McChord AFB, Pierce County Airport/Thun Field (runway 16), Renton (runway 15), Sea-Tac (runways 16L, 34R, and 16R), Snohomish County /Paine Field (all but runway 11), and Tacoma Narrows.

Current Airport System Runway Approaches and Obstructions

Obstruction type	Number
Trees	21
Roads, railroads, parking	7
Buildings	3
Brush	4
Fence/pole	2
Power lines	1
Ground	1
Aircraft	1
None	32
Total	72

Control of obstructing trees and brush can be a simple issue of trimming (if on airport property), or it can be more complex, involving the need for easements or property acquisition followed by tree trimming or removal. Roads, railroads, and parking lots may become obstructions due to encroachment on adjacent property, or they may be located on airports with highly constrained sites. Buildings, fences, poles, and power lines are likely to be located off airport, though they can also be located on constrained airports. Lighting and marking of these obstructions can be accomplished with relative ease, but removal may be difficult or impossible. Parked aircraft which are obstructions (such as at Crest Airpark) may be the result of site constraints or may indicate the need for improved planning or airport investment. Ground obstructions (occurring at Bremerton) may be the result of topographic or airport siting constraints. In either event, elimination of the obstruction may be infeasible.

Approach Lighting

Approach lighting is a key component to airports' ability to serve traffic at night and in low visibility conditions, and is used for both precision instrument and non-precision runway approaches. Approach lighting is used in conjunction with electronic and visual navigational aids to increase the safety of aircraft approaching a runway to land. Approach lighting systems ("ALS") consist of a row or rows of lights aligned along the extended runway centerline leading to the end of a runway, and provide visual guidance to pilots. ALS can have medium or high intensity lights, and often include sequenced flashing

lights that provide visual guidance (both alignment and direction) to the runway end. When combined with other navigational aids, approach lighting significantly improves the safety and reliability of an airport, and when installed at several airports in a region provides increased system capability to accommodate a wide range of traffic in varying conditions.

Of the 30 airports in the regional airport system, eight have approach lighting systems. These systems are summarized below. McChord AFB, Sea-Tac International, and Snohomish County/Paine Field each have more than one set of runway approach lighting systems.

Airport	Runway Number	Approach Category	Approach Lighting
Arlington	34	B-NPI	MALS
Boeing Field	13R	D-PIR	SALSF
Bremerton	19	B-PIR	MALSR
Gray Army Airfield	33	B-NPI	ODALS
McChord AFB	16	PIR	SALS
	34	PIR	NSTD
Sea-Tac Int'l	34R	D-PIR	ALSF1
	16R	D-PIR	ALSF2
	34L	D-PIR	MALSR
Paine Field	16R	D-PIR	MALSR
	34L	A-visual	ODALS
Tacoma Narrows	17	B-PIR	MALSR

Safety and Standards Summary

Following is a summary of runway, runway safety area, runway approaches, obstruction, and approach lighting information for the region's 10 busiest airports, which include Sea-Tac, the five relievers, and the four next busiest general aviation airports.

Arlington Airport meets runway length recommendations, though the current airport master plan includes a proposal to extend the main runway from 5,333 feet to 6,000 feet. The two runways are constructed of asphalt, are in good condition, and both are wider than required. All runway safety areas meet and exceed FAA standards. The airport has three 20:1 approaches and one 34:1 approach, all four of which meet standards. The airport master plan includes upgrades for runway 16 from visual to non-precision instrument and from a 20:1 approach to a 27:1 approach. The plan includes upgrades for runway 34 from a non-precision instrument runway to a precision instrument runway, improving its approach from 34:1 to 50:1. Runway 34 currently has a medium intensity approach lighting system (MALS). All four runway ends are free of obstructions.

Auburn Airport (reliever) meets its planned runway length and width requirements with its 3,400-foot asphalt runway in good condition. The airport meets all runway safety area standards. Its two runway approaches (18:1 and 15:1) come close to meeting its 20:1 approach standards. Obstructions to these approaches include buildings and a parking lot.

Boeing Field (King County International) meets runway length requirements and both runways exceed runway width requirements. Both runways are constructed of asphaltic concrete and are in good condition. All runway safety areas meet standards with the exception of the length beyond runway end for runway 13R. This is caused by the presence of Airport Way and railroad tracks. Runway 13L-31R meets and exceeds its required 20:1 approach slope, while runway 13R-31L does not.

Crest Airpark has a single asphalt runway in fair condition. The runway meets length requirements, but at 40 feet wide, it falls short of the required 60 feet width. The runway safety area width meets requirements. Runway safety area length beyond falls short of standards at one end by 90 feet, but exceeds standards by 170 feet at the other end. The airport's approaches are required to be 20:1. Neither runway end meets these standards due to obstructions in the form of parked aircraft and trees.

Harvey Field (reliever) has a single asphalt runway in fair condition. The runway is 2,660 feet long compared with a recommended length of 2,900 feet. The runway falls significantly short of the required runway pavement width, with 36 feet of pavement compared to a requirement for 60 feet. The runway safety areas meet both width and length beyond standards. The presence of trees and power lines near the runway causes obstructed approaches to both ends of runway 14-32. The airport's former turf runway (13-31) was closed in 1999 to make room for additional aircraft hangars.

Pierce County/Thun Field has an asphalt runway in good condition. The runway exceeds current length requirements, but falls 15 feet short of meeting runway pavement width standards (60 feet compared to the 75 foot standard). The airport meets runway safety area length beyond requirements but has sub-standard runway safety area width. One runway end exceeds its 20:1 approach standards while the other runway end is obstructed by trees in the approach.

Renton Municipal (reliever) has a single 5,379 foot long asphaltic concrete runway in good condition. The runway meets existing and planned length standards and exceeds by 100% the runway width standard. Runway safety area width meets standard, and runway safety area length beyond meets standard at the south end. The north end of the runway adjoins Lake Washington, and as such does not meet the runway safety area standards at the north end. While this north end approach meets the 34:1 standard, a road near the south runway end obstructs that 34:1 approach.

Sea-Tac International Airport has two parallel runways. Both meet runway width standards, and while both meet runway length recommendations, the airport plans to lengthen runway 16L-34R from 11,900 feet to 12,500. Runways 16L and 16R fall short of meeting runway safety area width requirements, and all but runway 34L fails to meet current runway safety area length beyond standards. All four runway approaches are precision instrument runways requiring 50:1 approach slopes. All meet this standard except runway 34L, which maintains a 37:1 approach, which is obstructed by trees.

Snohomish County Airport/Paine Field has three runways, all constructed of asphalt, and all in good condition. All three runways meet recommended length and width standards. Two of the three runways meet safety area width standards, and four of the six runway ends meet runway safety area length beyond requirements. Only one of the six runway approaches is obstructed, that being trees obstructing the approach to runway 11. The airport has five 20:1 approaches and one 50:1 approach (the main runway: 16R).

Tacoma Narrows Airport has a single 5,002 foot long asphalt runway in fair condition. The runway meets existing length standards and exceeds current runway width standards. The airport master plan calls for a future runway of 6,000 feet. Existing runway safety area width exceeds standard. Runway safety area length beyond significantly exceeds standards for runway 35 but falls short of standards for runway 17. The airport has no obstructed approaches, and maintains both a 34:1 approach to runway 35 and a 50:1 approach to runway 17.

Support Facilities

Control Towers

Air traffic control towers provide an increased level of safety and control over arriving and departing aircraft. This is especially important for airports serving commercial flights (passenger and cargo), airports with higher end general aviation activity, airports serving large numbers of aircraft operations, and airports located in regions with congested or complex air space. Within the four county PSRC region there are currently seven airports with control towers: King County International/Boeing Field, Gray Army Airfield, McChord AFB, Renton Municipal, Sea-Tac International, Snohomish County/Paine Field, and Tacoma Narrows.

Air Cargo

The air cargo section of the aviation forecasts in chapter 5 above predicts regional air cargo demand (combined air cargo at Sea-Tac Airport and Boeing Field) will increase from 613,099 tons in 1998 to 1,422,755 tons in 2020, a total increase of 132% and an average annual growth rate of 3.9% over the 22-year period. According to the two airports' most recent master plans, air cargo volumes are expected to grow slightly faster at Boeing Field than Sea-Tac Airport. Boeing Field's average annual cargo growth rate is predicted to be 4.6% while the grow rate for Sea-Tac Airport is forecast at 3.7% for the period 1998 through 2020. Boeing Field's current Master Plan (*Working Paper One*, September 1999) forecasts a need to increase air cargo space from 22 acres in 1998 to 43 acres in 2015 (the master plan's planning horizon). Extrapolating those requirements from 2015 to 2020, the airport would need approximately 54 acres to accommodate air cargo in the year 2020. This is a total increase of 32 acres. Given the fact that Boeing Field has no significant vacant property to accommodate expansion, the need for more air cargo facilities to meet growing demand will necessitate the redevelopment of existing airport property currently devoted to other uses. The airport master plan proposes to accommodate future cargo facility requirements along the east side of the airport to the south of the terminal building. Much of this area is currently used for general aviation.

According to the Master Plan Update for Sea-Tac Airport (1994) the airport will require significantly more air cargo space to accommodate forecast growth. As of 1993 the airport had approximately 81 acres of air cargo space. Of this, some 21 acres were vacant. The plan identified a need for 176 acres of air cargo space by the year 2020, and recommended a two phase approach to meeting those needs. Between 1993 and 2010 air cargo needs will be met using a decentralized approach by expanding existing cargo areas north of the main passenger terminal and redeveloping the existing sites used for United Airlines aircraft maintenance and Port of Seattle maintenance functions. After 2010 projected air cargo demand will be met by developing the "south aviation support area ("SASA"), located south of the main passenger terminal across south 188th street. In addition, the plan anticipates the possible need for additional air cargo warehousing at remote north locations.

Both Sea-Tac Airport (2,500 acres) and Boeing Field (634 acres) are constrained airports. Both are nearly fully developed, and neither has significant undeveloped land area available to accommodate all potential demand by all users. Nor does either airport have the ability to easily accommodate significant spikes in air cargo demand caused by a fluctuating market or major shifts in regional cargo share between the two airports. In order to meet anticipated growth in air cargo activity both airports plan to redevelop airport property currently used for other functions (general aviation, aircraft maintenance, and airport maintenance). Development of air cargo facilities at both airports will likely require the relocation of these existing uses, which could complicate the air cargo facility development process.

The issue of space availability (along with airfield and airspace congestion and delay, airport fee structure, airport access, and regional location), is an important component of air cargo carriers' decisions regarding how they serve the regional air cargo market.

Aircraft Fuel

Aircraft fuel is available at most airports in the region. Seven airports do not offer fuel: the four state-owned airports (Bandera, Lester, Ranger Creek, and Skykomish), Apex Airpark, Swanson, and Vashon. The state-owned airfields have no based aircraft and low levels of activity (all under 300 annual aircraft operations). The other three airports have a combined 103 based aircraft (50 at Apex, 22 at Swanson, and 31 at Vashon). Total combined aircraft activity at these seven airports for 1998 was 31,889 operations. Forecasts of future activity at these seven airports shows based aircraft increasing to a combined total of 113 (50 at Apex, 27 at Swanson, and 36 at Vashon) by the year 2020, while aircraft operations is forecasts to grow to 36,714 in 2020. Given the low level of activity at these airports and the availability of fuel at many airports nearby, there appears to be no need for new aircraft fuel facilities at these seven airports.

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Exhibit 6-1 Existing System Capacity (1999)

Airport	Apron Tie-down Capacity	Aircraft Hangar Capacity	Total Aircraft Capacity	Based Aircraft	Landside D/C Ratio *	# on waiting list	Airport Acreage	Airport property avail. for future aviation dev't (ac)	Airport Operations	Airfield Operations Capacity **	Airfield D/C Ratio ***
American Lake	15	4	19	15	79%	0	0	0	700	60,000	1%
Apex Airpark	5	45	50	50	100%	0	15	0	19,425	180,000	11%
Arlington Municipal	114	463	577	510	88%	53	1,202	40	135,000	270,000	50%
Auburn Municipal	225	105	330	238	72%	140	107	25	172,000	230,000	75%
Bandera State	0	0	0	0		0	25	0	300	150,000	0%
Boeing Field	350	200	550	443	81%	75	634	0	345,120	380,000	91%
Bremerton National	78	116	194	116	60%	17	1,169	584	108,800	240,000	45%
Crest Airpark	180	176	356	334	94%	95	62	68	95,222	240,000	40%
Darrington	15	0	15	4	27%	0	90	10	3,025	180,000	2%
FirstAir Field	25	62	87	78	90%	25	33	10	18,169	200,000	9%
Gray Army Airfield	-	-	-	-	-	-	-	-		180,000	0%
Harvey Field	53	362	415	360	87%	186	65	117	140,700	230,000	61%
Kenmore Air Harbor	77	2	79	79	100%	3	6	0	40,000	75,000	53%
Lake Union Seaplane			0	0		0	1	0	30,500	60,000	51%
Lester State	0	0	0	0		0	56	0	5	150,000	0%
Martha Lake	32	20	52	51	98%	0	32	0	40,400	180,000	22%
McChord AFB	-	-	-	-	-	-	-	-		180,000	0%
Pierce Co. / Thun Field	140	138	278	229	82%	30	144	11	86,710	240,000	36%
Port Orchard	12	16	28	15	54%	12	120	20	18,714	175,000	11%
Ranger Creek State	0	0	0	0		0	20	0	250	140,000	0%
Renton Municipal	170	85	255	240	94%	55	170	0	100,710	230,000	44%
Sea-Tac Int'l	4	2	6	6	N/A	0	2,500		407,597	460,000	89%
Sky Harbor	12	0	12	8	67%		10		1,000	140,000	1%
Skykomish State	0	0	0	0		0	35	0	300	150,000	0%
Sno. Co. / Paine Field	208	356	564	483	86%	96	1,243	170	192,612	288,000	67%
Spanaway	20	57	77	63	82%	0	24	4	19,380	140,000	14%
Swanson	12	14	26	22	85%	0	14		5,609	150,000	4%
Tacoma Narrows	200	82	282	200	71%	30	644	31	95,316	240,000	40%
Vashon Island	10	22	32	31	97%		20	2	6,000	160,000	4%
Will Rogers/Wiley Post	45	0	45	45	100%	0	1	0	2,387	60,000	4%
Total Airport System:	2,002	2,327	4,329	3,620	84%	817	8,442	1,092	2,085,951	5,758,000	36%

* Ratio of based aircraft to capacity (current airport inventory)
** Measured as Annual Service Volume ("ASV"
*** Ratio of aircraft operations to capacity (annual service volume

Exhibit 6-2 Future Landside Capacity Requirements

	Apron Tie-down Capacity	Aircraft Hangar Capacity	Total Aircraft Capacity	Forecast Based Aircraft Demand					Landside D/C Ratio *	Landside D/C Ratio *	Total new aircraft demand	Demand for new tie-downs	Demand for new hangars	Future Based Aircraft Demand in Excess of
				1998	2005	2010	2015	2020	1998	2020	(1998-2020)	(10%)	(90%)	1999 Inventory
American Lake	15	4	19	15	16	17	18	19	79%	98%	4	0	3	0
Apex Airpark **	5	45	50	50	50	50	50	50	100%	100%	0	0	0	0
Arlington Municipal	114	463	577	510	572	607	639	674	88%	117%	164	16	148	97
Auburn Municipal	225	105	330	238	252	261	269	276	72%	84%	38	4	34	0
Bandera State	0	0	0	0	0	0	0	0			0	0	0	0
Boeing Field	350	200	550	443	469	486	501	514	81%	93%	71	7	64	0
Bremerton National	78	116	194	116	131	139	151	158	60%	82%	42	4	38	0
Crest Airpark	180	176	356	334	353	367	377	387	94%	109%	53	5	48	31
Darrington	15	0	15	4	4	5	5	5	27%	35%	1	0	1	0
FirstAir Field	25	62	87	78	87	93	98	103	90%	119%	25	3	23	16
Gray Army Airfield					0	0	0	0			0	0	0	0
Harvey Field	53	362	415	360	404	428	451	476	87%	115%	116	12	104	61
Kenmore Air Harbor	77	2	79	79	84	87	89	92	100%	116%	13	1	11	13
Lake Union Seaplane			0	0	0	0	0	0			0	0	0	0
Lester State	0	0	0	0	0	0	0	0			0	0	0	0
Martha Lake ***	32	20	52	51	0	0	0	0	98%	0%	-51	-5	-46	0
McChord AFB					0	0	0	0			0	0	0	0
Pierce Co. / Thun Field	140	138	278	229	245	260	271	285	82%	103%	56	6	51	7
Port Orchard	12	16	28	15	17	18	20	21	54%	75%	6	1	5	0
Ranger Creek State	0	0	0	0	0	0	0	0			0	0	0	0
Renton Municipal	170	85	255	240	254	263	271	278	94%	109%	38	4	35	23
Sea-Tac Int'l	4	2	6	6	6	7	7	7	100%	116%	1	0	1	1
Sky Harbor	12	0	12	8	9	10	10	11	67%	88%	3	0	2	0
Skykomish State	0	0	0	0	0	0	0	0			0	0	0	0
Sno. Co. / Paine Field	208	356	564	483	542	575	605	639	86%	113%	156	16	140	75
Spanaway	20	57	77	63	67	71	74	78	82%	102%	15	2	14	1
Swanson	12	14	26	22	24	25	26	27	85%	105%	5	1	5	1
Tacoma Narrows	200	82	282	200	214	227	236	249	71%	88%	49	5	44	0
Vashon Island	10	22	32	31	33	34	35	36	97%	112%	5	0	4	4
Will Rogers/Wiley Post	45	0	45	45	48	49	51	52	100%	116%	7	1	6	7
Total Airport System:	2,002	2,327	4,329	3,620	3,881	4,079	4,255	4,439	84%	104%	819	82	737	339

* With no new landside capacity.

** Based aircraft for Apex Airpark is limited to 50 by agreement with Kitsap County. Future demand has been redistributed to other Kitsap County airports.

*** Year 2020 D/C ratio is based on closure of Martha Lake Airport. Based aircraft forecasts for 2005, 2010, 2015, and 2020 show Martha Lake based aircraft redistributed to other Snohomish County Airports.

**** Future capacity requirements include replacement for 52 lost due to Martha Lake closure plus assumes 87% of all new aircraft demand (819 * 87% = 712) wants hangars (all of which would be new)

Exhibit 6-3 Future Airfield Capacity Requirements

	Operations Capacity *	Forecast Aircraft Operations Demand					Airfield D/C Ratio	Airfield D/C Ratio ***
		1998	2005	2010	2015	2020	1998	2020
American Lake	60,000	700	731	756	781	807	1%	1%
Apex Airpark	180,000	19,425	20,678	21,436	21,977	22,780	11%	13%
Arlington Municipal	270,000	135,000	151,633	155,953	160,394	164,959	50%	61%
Auburn Municipal	230,000	172,000	176,521	179,818	183,566	186,982	75%	81%
Bandera State	150,000	300	308	314	320	326	0%	0%
Boeing Field	380,000	345,120	354,192	360,808	368,328	375,182	91%	99%
Bremerton National	240,000	108,800	115,819	120,063	123,095	127,590	45%	53%
Crest Airpark	240,000	95,222	97,725	99,550	101,625	103,516	40%	43%
Darrington	180,000	3,025	3,398	3,494	3,594	3,696	2%	2%
FirstAir Field	200,000	18,169	20,408	20,989	21,587	22,201	9%	11%
Gray Army Airfield	180,000						0%	0%
Harvey Field	230,000	140,700	158,036	162,537	167,166	171,924	61%	75%
Kenmore Air Harbor	75,000	40,000	41,051	41,818	42,690	43,484	53%	58%
Lake Union Seaplane	60,000	30,500	31,302	31,886	32,551	33,157	51%	55%
Lester State	150,000	5	5	5	5	5	0%	0%
Martha Lake	180,000	40,400	0	0	0	0	22%	0%
McChord AFB	180,000						0%	0%
Pierce Co. / Thun Field	240,000	86,710	90,581	93,611	96,736	99,960	36%	42%
Port Orchard	175,000	18,714	19,921	20,651	21,173	21,946	11%	13%
Ranger Creek State	140,000	250	261	270	279	288	0%	0%
Renton Municipal	230,000	100,710	103,357	105,288	107,482	109,482	44%	48%
Sky Harbor	140,000	1,000	1,123	1,155	1,188	1,222	1%	1%
Skykomish State	150,000	300	308	314	320	326	0%	0%
Sno. Co. / Paine Field	288,000	192,612	216,344	222,506	228,842	235,356	67%	82%
Spanaway	140,000	19,380	20,245	20,922	21,621	22,341	14%	16%
Swanson	150,000	5,609	5,859	6,055	6,258	6,466	4%	4%
Tacoma Narrows	240,000	95,316	99,571	102,902	106,337	109,881	40%	46%
Vashon Island	160,000	6,000	6,158	6,273	6,403	6,523	4%	4%
Will Rogers/Wiley Post	60,000	2,387	2,450	2,496	2,548	2,595	4%	4%
Total GA Airport System:	5,298,000	1,678,354	1,737,985	1,781,871	1,826,866	1,872,996	32%	37%
Sea-Tac Int'l **	460,000	407,597	445,000	474,000	503,000	532,000	89%	116%
Total Airport System Including Sea-Tac:	5,758,000	2,085,951	2,182,985	2,255,871	2,329,866	2,404,996	36%	42%

* Measured as "Annual Service Volume"

** Forecasts prepared by the Port of Seattle

*** With no new runway capacity and loss of Martha Lake Airport

Exhibit 6-4 Airport Runway Standards

Airport	Runway Number	Runway Length (ft.)	Recommended Runway Length (ft.) *	Runway Surface	Runway Pavement Condition	Airport Reference Code	Existing Runway Width (ft.)	Required Runway Width (ft.)	Runway Width Compliance
American Lake	02-20	5,500	-	Water	-	SP	500	-	-
Apex Airpark	17-35	2,500	3,040	Asphalt	Good	A-1	28	60	Sub-standard
Arlington Municipal	11-29	3,500	2,940	Asphalt	Good	A-1	75	60	Meets standard
	16-34	5,333	6,000 **	Asphalt	Good	B-1	100	60	Meets standard
Auburn Municipal	16-34	3,400	3,400 **	Asphalt	Good	B-II	75	75	Meets standard
Bandera State	08-26	2,342	3,440	Turf	Poor	A-1	100	60	Meets standard
Boeing Field	13L-31R	3,710	3,710 **	Asphalt/conc.	Good	B-1	100	60	Meets standard
	13R-31L	10,001	10,000 **	Asphalt/conc.	Good	D-IV	200	150	Meets standard
Bremerton National	01-19	6,200	7,400 **	Asphalt	Good	B-II	150	100	Meets standard
Crest Airpark	15-33	3,267	3,020	Asphalt	Fair	B-1	40	60	Sub-standard
Darrington Municipal	10-28	2,490	3,040	Asphalt	Good	M/A	40	60	Sub-standard
FirstAir Field	07-25	2,095	2,910	Asphalt	Fair	A-1	34	60	Sub-standard
Gray Army Airfield	15-33	6,125	-	Asphalt	Good	ML	150	-	-
Harvey Field	14-32	2,660	2,900	Asphalt	Fair	B-1	36	60	Sub-standard
Kenmore Air Harbor	16-34	10,000	-	Water	-	SP	1,000	-	-
	18-36	3,000	-	Water	-	SP	1,000	-	-
Lake Union Chrysler Air	18-36	9,500	-	Water	-	SP	300	-	-
Lester State	05-23	2,150	3,470	Turf (CLOSED)	Poor	A-1	100	60	Meets standard
Martha Lake	16-34	1,680	3,030	Asphalt	Fair	A-1	38	60	Sub-standard
McChord AFB	16-34	10,100	-	Asphalt/conc.	Good	M	150	-	-
Pierce County / Thun Field	16-34	3,650	3,040	Asphalt	Good	B-II	60	75	Sub-standard
Port Orchard	18-36	2,460	3,000	Asphalt	Fair	A-1	28	60	Sub-standard
Ranger Creek State	17-35	2,700	3,980	Asphalt	Good	A-1	30	60	Sub-standard
Renton Municipal	15-33	5,379	5,379 **	Asphalt/conc.	Good	B-II	200	100	Meets standard
Sea-Tac Int'	16L-34R	11,900	12,500 **	Asphalt	Good	D-V	150	150	Meets standard
	16R-34L	9,425	9,425 **	Concrete	Good	D-V	150	150	Meets standard
Sky Harbor	07-25	1,930	2,970	Turf	Good	A-1 (small)	100	60	Meets standard
Skykomish State	06-24	2,050	3,190	Turf	Fair	A-1	100	60	Meets standard
Snohomish Co. / Paine Field	11-29	4,514	4,514 **	Asphalt	Good	B-1	75	60	Meets standard
	16L-34R	3,000	3,000 **	Asphalt	Good	B-1	75	60	Meets standard
	16R-34L	9,010	9,010 **	Asphalt	Good	D-V	150	150	Meets standard
Spanaway	16-34	2,724	3,000	Asphalt	Poor	A-1	20	60	Sub-standard
Swanson	16-34	3,000	3,150	Asphalt	Good	B-1	50/100	60	Sub-standard
Tacoma Narrows	17-35	5,002	6,000 **	Asphalt	Fair	B-II	150	100	Meets standard
Vashon Island	17-35	1,940	2,450	Turf/gravel	Good	A-I (small)	50	60	Sub-standard
Will Rogers/Wiley Post	12-30	5,000	-	Water	-	SP	200	-	-

* Recommended runway length was derived from FAA's "Airport Design for Microcomputers" program, Version 4.2 using the standard of serving 95 percent of the aircraft using the airport, and using actual airport elevation and a mean daily max. temperature of the hottest month = 75 degrees.

** Recommended in airport master plan.

Exhibit 6-5 Runway Safety Areas, Approaches, Obstructions, and Visibility Minimums

Airport	Runway Number	Existing RSA Width	Required RSA Width	RSA Width Compliance	Existing RSA Length Beyond	Required RSA Length Beyond	RSA Length beyond Compliance
American Lake	02	-	-	-	-	-	-
	20	-	-	-	-	-	-
Apex Airpark	17	42	120	Sub-standard	65	240	Sub-standard
	35	42	120	Sub-standard	330	240	Meets standard
Arlington Municipal	11	360	120	Meets standard	1,900	240	Meets standard
	29	360	120	Meets standard	630	240	Meets standard
	16	540	120	Meets standard	767	240	Meets standard
	34	540	120	Meets standard	930	240	Meets standard
Auburn Municipal	16	150	150	Meets standard	300	300	Meets standard
	34	150	150	Meets standard	300	300	Meets standard
Bandera State	08		120	Sub-standard		240	Sub-standard
	26		120	Sub-standard		240	Sub-standard
Boeing Field	13L	150	120	Meets standard	300	240	Meets standard
	31R	150	120	Meets standard	300	240	Meets standard
	13R	500	500	Meets standard	200	1,000	Sub-standard
	31L	500	500	Meets standard	1,000	1,000	Meets standard
Bremerton National	01	150	150	Meets standard	300	300	Meets standard
	19	150	150	Meets standard	0	300	Sub-standard
Crest Airpark	15	120	120	Meets standard	410	240	Meets standard
	33	120	120	Meets standard	150	240	Sub-standard
Darrington Municipal	10	80	120	Sub-standard	100	240	Sub-standard
	28	80	120	Sub-standard	300	240	Meets standard
FirstAir Field	07	54	120	Sub-standard	420	240	Meets standard
	25	54	120	Sub-standard	42	240	Sub-standard
Gray Army Airfield	15	-	-	-	-	-	-
	33	-	-	-	-	-	-
Harvey Field	14	120	120	Meets standard	240	240	Meets standard
	32	120	120	Meets standard	240	240	Meets standard
Kenmore Air Harbor	16	-	-	-	-	-	-
	34	-	-	-	-	-	-
	18	-	-	-	-	-	-
	36	-	-	-	-	-	-
Lake Union Chrysler Air	18	-	-	-	-	-	-
	36	-	-	-	-	-	-
Lester State (closed)	05		120	Sub-standard		240	Sub-standard
	23		120	Sub-standard		240	Sub-standard

Exhibit 6-5 Runway Safety Areas, Approaches, Obstructions, and Visibility Minimums

Airport	Runway Number	Existing RSA Width	Required RSA Width	RSA Width Compliance	Existing RSA Length Beyond	Required RSA Length Beyond	RSA Length beyond Compliance
Martha Lake	16	0	120	Sub-standard	0	240	Sub-standard
	34	0	120	Sub-standard	0	240	Sub-standard
McChord AFB	16	-	-	-	-	-	-
	34	-	-	-	-	-	-
Pierce County / Thun Field	16	120	150	Sub-standard	470	300	Meets standard
	34	120	150	Sub-standard	300	300	Meets standard
Port Orchard	18		120	Sub-standard		240	Sub-standard
	36		120	Sub-standard		240	Sub-standard
Ranger Creek State	17		120	Sub-standard		240	Sub-standard
	35		120	Sub-standard		240	Sub-standard
Renton Municipal	15	150	150	Meets standard	0	300	Sub-standard
	33	150	150	Meets standard	300	300	Meets standard
Sea-Tac Int'l	16L	180	500	Sub-standard	700	1,000	Sub-standard
	34R	500	500	Meets standard	535	1,000	Sub-standard
	16R	180	500	Sub-standard	645	1,000	Sub-standard
	34L	500	500	Meets standard	1,000	1,000	Meets standard
Sky Harbor	07		120	Sub-standard		240	Sub-standard
	25		120	Sub-standard		240	Sub-standard
Skykomish State	06		120	Sub-standard		240	Sub-standard
	24		120	Sub-standard		240	Sub-standard
Snohomish Co. / Paine Field	11	120	120	Meets standard	140	240	Sub-standard
	29	120	120	Meets standard	240	240	Meets standard
	16L	120	120	Meets standard	240	240	Meets standard
	34R	120	120	Meets standard	240	240	Meets standard
	16R	250	500	Sub-standard	470	1,000	Sub-standard
	34L	500	500	Meets standard	1,000	1,000	Meets standard
Spanaway	16	120	120	Meets standard	275	240	Meets standard
	34	120	120	Meets standard	155	240	Sub-standard
Swanson	16	98	120	Sub-standard	50	240	Sub-standard
	34	98	120	Sub-standard	40	240	Sub-standard
Tacoma Narrows	17	455	300	Meets standard	330	600	Sub-standard
	35	455	300	Meets standard	1,000	300	Meets standard
Vashon Island	17	76	120	Sub-standard	160	240	Sub-standard
	35	76	120	Sub-standard	50	240	Sub-standard
Will Rogers/Wiley Post	12	-	-	-	-	-	-
	30	-	-	-	-	-	-

Exhibit 6-5 Runway Safety Areas, Approaches, Obstructions, and Visibility Minimums

Airport	Runway Number	Existing Approach Surface Slope	Required Approach Surface Slope	Obstructed Approach (Object)	Approach Category	Approach Lights	Visibility Minimums	Supports 50:1 Approach?
American Lake	02	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	20	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
Apex Airpark	17	10:1	20:1	Hangar, trees	A-visual	None	Greater than 1 mile	No
	35	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Arlington Municipal	11	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	29	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	16	20:1	20:1	None	B-visual	None	Greater than 1 mile	No
	34	34:1	34:1	None	B-NPI	MALS	Not less than 3/4 mile	Yes
Auburn Municipal	16	18:1	20:1	Building	A-visual	None	Greater than 1 mile	No
	34	15:1	20:1	Parking lot	A-visual	None	Greater than 1 mile	No
Bandera State	08	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	26	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Boeing Field	13L	50:1	20:1	None	A-visual	None	Greater than 1 mile	Yes
	31R	22:1	20:1	None	A-visual	None	Greater than 1 mile	No
	13R	3:1	50:1	Fence	D-PIR	SALSF	Greater than 1 mile	No
	31L	0:1	34:1	Railroad	D-NPI	None	Greater than 1 mile	No
Bremerton National	01	7:1	34:1	Ground	B-NPI	None	Greater than 1 mile	Yes
	19	0:1	50:1	Ground, SR-3	B-PIR	MALSR	Not less than 3/4 mile	Yes
Crest Airpark	15	0:1	20:1	Aircraft	A-visual	None	Greater than 1 mile	No
	33	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Darrington Municipal	10	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	28	0:1	20:1	Trees, road	A-visual	None	Greater than 1 mile	No
FirstAir Field	07	17:1	20:1	Tree	A-visual	None	Greater than 1 mile	No
	25	1:1	20:1	Pole	A-visual	None	Greater than 1 mile	No
Gray Army Airfield	15	-	-	None	-	None	-	
	33	-	-	None	-	ODALS	-	
Harvey Field	14	0:1	20:1	Power line	A-visual	None	Greater than 1 mile	No
	32	8:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Kenmore Air Harbor	16	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	34	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	18	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	36	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
Lake Union Chrysler Air	18	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	36	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
Lester State (closed)	05	0:1	20:1	Brush	A-visual	None	Greater than 1 mile	No
	23	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No

Exhibit 6-5 Runway Safety Areas, Approaches, Obstructions, and Visibility Minimums

Airport	Runway Number	Existing Approach Surface Slope	Required Approach Surface Slope	Obstructed Approach (Object)	Approach Category	Approach Lights	Visibility Minimums	Supports 50:1 Approach?
Martha Lake	16	0:1	20:1	Brush	A-visual	None	Greater than 1 mile	No
	34	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
McChord AFB	16	-	-	None	PIR	SALS	-	Yes
	34	-	-	None	PIR	NSTD	-	Yes
Pierce County / Thun Field	16	23:1	20:1	None	A-visual	None	Greater than 1 mile	No
	34	11:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Port Orchard	18	0:1	20:1	Road	A-visual	None	Greater than 1 mile	No
	36	0:1	20:1	Brush	A-visual	None	Greater than 1 mile	No
Ranger Creek State	17	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	35	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Renton Municipal	15	34:1	34:1	None	B-NPI	PAPI	Greater than 1 mile	No
	33	0:1	34:1	Road	B-visual	PAPI	Greater than 1 mile	No
Sea-Tac Int'l	16L	50:1	50:1	None	D-PIR	None	Greater than 1 mile	Yes
	34R	50:1	50:1	None	D-PIR	ALSF1	CAT I	Yes
	16R	50:1	50:1	None	D-PIR	ALSF2	CAT III	Yes
	34L	37:1	50:1	Tree	D-PIR	MALSR	CAT I	Yes
Sky Harbor	07	0:1	20:1	Tree	A-visual	None	Greater than 1 mile	No
	25	0:1	20:1	Brush	A-visual	None	Greater than 1 mile	No
Skykomish State	06	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	24	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Snohomish Co. / Paine Field	11	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	29	23:1	20:1	None	A-visual	None	Greater than 1 mile	No
	16L	22:1	20:1	None	A-visual	None	Greater than 1 mile	No
	34R	20:1	20:1	None	A-visual	None	Greater than 1 mile	No
	16R	50:1	50:1	None	D-PIR	MALSR	CAT I	Yes
	34L	30:1	20:1	None	A-visual	ODALS	Greater than 1 mile	No
Spanaway	16	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	34	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Swanson	16	0:1	20:1	Access road	A-visual	None	Greater than 1 mile	No
	34	0:1	20:1	Tree, hill, house	A-visual	None	Greater than 1 mile	No
Tacoma Narrows	17	50:1	50:1	None	B-PIR	MALSR	CAT I	Yes
	35	34:1	34:1	None	B-NPI	None	Greater than 1 mile	Yes
Vashon Island	17	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
	35	0:1	20:1	Trees	A-visual	None	Greater than 1 mile	No
Will Rogers/Wiley Post	12	50:1	20:1	None	A-visual	None	Greater than 1 mile	Yes
	30	50:1	20:1	None	A-visual	None	Greater than 1 mile	Yes

Exhibit 6-6 Airport Support Facility Requirements

	Runway Number	Runway Length	Electronic Navaids	Visual Navaids	Approach Lights	Runway Lighting	Tower	FBO	Fuel	Aircraft Maint./Repair	Terminal	Weather Reporting
American Lake	02-20	5,500	No	No	None	None	No	Yes	Yes	Major		-
Apex Airpark	17-35	2,500	No	No	None	LIRL	No	No	No	Major		
Arlington Municipal	11-29	3,500	No	Yes	None	None	No	Yes	Yes	Major		AWOS
	16-34	5,333	Yes	Yes	MALS	MIRL	No	Yes	Yes	Major		AWOS
Auburn Municipal	16-34	3,400	Yes	Yes	None	MIRL	No	Yes	Yes	Major		
Bandera State	08-26	2,342	No	Yes	None	None	No	No	No	None		
Boeing Field	13L-31R	3,710	No	Yes	None	MIRL	Yes	Yes	Yes	Major	Yes	
	13R-31L	10,001	Yes	Yes	SALSF	HIRL	No	Yes	Yes	Major	Yes	
Bremerton National	01-19	6,200	Yes	Yes	MALSR	HIRL	No	Yes	Yes	Major	Yes	AWOS
Crest Airpark	15-33	3,267	No	Yes	None	LIRL	No	Yes	Yes	Major		
Darrington Municipal	10-28	2,490	No	Yes	None	MIRL	No	No	Yes	None		
FirstAir Field	07-25	2,095	No	Yes	None	None	No	Yes	Yes	Major		
Gray Army Airfield	15-33	6,125	Yes	Yes	ODALS	HIRL	Yes	-	?	-		
Harvey Field	14-32	2,660	No	Yes	None	NSTD	No	Yes	Yes	Major		
Kenmore Air Harbor	16-34	10,000	No	No	None	None	No	No	Yes	Major	Yes	
	18-36	3,000	No	No	None	None	No	No	Yes	Major	Yes	
Lake Union Chrysler Air	18-36	9,500	No	No	None	None	No	No	Yes	None	Yes	
Lester State	05-23	2,150	No	Yes	None	None	No	No	No	None		
Martha Lake	16-34	1,680	?	?	None	LIRL	No	No	Yes	None		
McChord AFB	16-34	10,100	Yes	Yes	SALS	HIRL	Yes	-	Yes	Major		
Pierce County / Thun Field	16-34	3,650	No	Yes	None	MIRL	No	Yes	Yes	Major		
Port Orchard	18-36	2,460	No	No	None	LIRL	No	Yes	Yes	None		
Ranger Creek State	17-35	2,700	No	No	None	None	No	No	No	None		
Renton Municipal	15-33	5,379	Yes	Yes	None	MIRL	Yes	Yes	Yes	Major		ASOS
Sea-Tac Int'l	16L-34R	11,900	Yes	Yes	ALSF1	HIRL	Yes	No	Yes	None	Yes	ASOS
	16R-34L	9,425	Yes	Yes	MALSR	HIRL	No	No	Yes	None	Yes	ASOS
Sky Harbor	07-25	1,930	No	No	None	None	No	Yes	Yes	None		
Skykomish State	06-24	2,050	No	Yes	None	None	No	No	No	None		
Snohomish Co. / Paine Field	11-29	4,514	Yes	Yes	None	MIRL	Yes	Yes	Yes	Major		LAWRS
	16L-34R	3,000	No	Yes	None	MIRL	Yes	Yes	Yes	Major		LAWRS
	16R-34L	9,010	Yes	Yes	MALSR	HIRL	Yes	Yes	Yes	Major		LAWRS
Spanaway	16-34	2,724	No	Yes	None	LIRL	No	Yes	Yes	Major		
Swanson	16-34	3,000	No	Yes	None	NSTD	No	Yes	No	Major		
Tacoma Narrows	17-35	5,002	Yes	Yes	None	MIRL	Yes	Yes	Yes	Major	Yes	LAWRS
Vashon Island	17-35	1,940	No	Yes	None	NSTD	No	Yes	No	Minor		
Will Rogers/Wiley Post	12-30	5,000	No	No	None	None	No	Yes	Yes	Major		ASOS

Puget Sound Regional Council
PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Wednesday, June 7, 2000
1:00 - 4:00 p.m.

Puget Sound Regional Council
1011 Western Avenue
Seattle, Washington
5th Floor Board Room

1:00 p.m. 1. **Call to Order and Introductions** - *King Cushman and Dave Waggoner*
- Comments on Meeting Summary for Meeting Held January 27, 2000*

1:10 p.m. 2. **Review and Discuss Chapter 7 - System Strategy*** - *Steve Kiehl/Committee*
a. System Needs and Strategic Options
b. Airport System Improvement Priorities
c. Airport System Improvement Program (policies, strategies, improvements)

3:20 p.m. 3. **Integrating the RASP with the MTP** - *King Cushman/Steve Kiehl*
a. Schedule for Updating the Metropolitan Transportation Plan (MTP)*
b. MTP Alternatives and focus of Update*

3:40 p.m. 4. **Other Business**

3:50 p.m. 5. **Next Meeting:** Wednesday, September 27, 2000, 1:00-4:00 p.m.
- Compatible Land Use
- Airport Access Plan
- Implementation Plan

4:00 p.m. 6. **Adjourn**

* Supporting material enclosed

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling Grace Foster at (206) 464-7090. TDD/TTY: (206) 464-5409

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Puget Sound Regional Council
PSRC

RASP TECHNICAL ADVISORY COMMITTEE

January 27, 2000
1:00-3:30 p.m.
Puget Sound Regional Council - 5th Floor Boardroom

MEETING SUMMARY

Members and Alternates in Attendance

Stan Allison, WSDOT-Aviation Division
Dick Brandenberg, Port of Bremerton
Jess Browning, University of Washington-GTTL Studies
Jim Combs, Washington Pilots Association (Alt.)
Ray Costello, Aircraft Owners and Pilots Association
King Cushman, Puget Sound Regional Council, Co-Chair
Nancy Jensen, NW Section, Ninety-Nines
Stephen Kiehl, Puget Sound Regional Council
Dave Waggoner, Snohomish County/Paine Field, Co-Chair

Others in Attendance

Pete Beaulieu, Puget Sound Regional Council
Bill Brubaker, WSDOT-Aviation Division
Cheryl Saltys, Puget Sound Regional Council
Michelle Whitfield, WSDOT-Aviation Division

Subcommittee Report: Forecasts

Stephen Kiehl summarized the issues discussed regarding various ways to approach forecasts and presented the consensus reached at the special subcommittee meeting on forecasts held on October 20, 1999.

The subcommittee discussed the uncertainty involved in forecasting, and the possibility of producing a forecast "range," but agreed on the need to develop a preferred set of forecasts (to be called the "RASP Forecast") on which to base the update of the Regional Airport System Plan (RASP). The group also agreed to prepare an unconstrained forecast of aviation activity, as the subcommittee agreed that the forecast should show what we think the future of aviation in the

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region will be and what the system can do to accommodate that, rather than constraining the forecast to existing capacity. Future work on the update of the RASP will incorporate the RASP Forecast.

Mr. Kiehl then summarized the selected RASP forecasts for aircraft fleet mix, based aircraft, and general aviation operations. The selected based aircraft forecast is the Federal Aviation Administration (FAA) one percent growth forecast, and the selected operations forecast is the FAA national forecast for general aviation operations. The subcommittee also talked about cargo and passenger forecasts and needs, and agreed that these should be incorporated into the plan. The RASP will include official passenger and air cargo forecasts produced for Sea-Tac by the Port of Seattle and for Boeing Field by King County.

Jim Combs asked whether United Parcel Service (UPS) had already signed a new long-term lease with Boeing Field. Mr. Kiehl will verify with King County-Boeing Field staff.

Ray Costello said we should be careful how we describe the relationship between cargo and general aviation at Boeing Field, particularly in how the airport accommodates cargo growth. Mr. Combs suggested looking at the uses all around Boeing Field, as some areas may not be available for cargo so it may not be displacing as much general aviation (GA) activity as might have been expected. Mr. Kiehl will follow up.

Bill Brubaker stated that any emphasis on cargo will require some corresponding planning for connecting ground transportation.

Dick Brandenberg stated that he thought the report underestimated the growth potential of Bremerton National Airport, stating that present activity is greater than indicated in the report and that the airport has plans to provide additional hangars. He thought the future looked more robust than shown in the preferred forecasts. Mr. Kiehl will look into this.

Mr. Kiehl asked committee members if they had comments on the revised forecasts. Mr. Combs asked why so many of the new aircraft fleet was expected to be single engine aircraft. Mr. Costello said there is a lot of growth in this part of the market, with new aircraft production growing. Mr. Kiehl also mentioned strong sentiment on the part of several members of the FAA forecast group that met in Washington, D.C. in September who expressed strong optimism for both new aircraft production and for growth in the pilot program.

Mr. Kiehl concluded the discussion by asking committee members to provide comments and input on the forecasts to Stephen Kiehl, via phone (206) 464-6175, fax (206) 587-4825, or e-mail skiehl@psrc.org.

Role of General Aviation

King Cushman kicked off a discussion of the role and benefits of general aviation. He mentioned that the RASP has thus far focused on the need for airport system improvements but has not addressed why the system is important to preserve. He stressed the importance of

bringing together information about the benefits of aviation and raising public awareness, in order to build support for system improvements and compatible land use measures. General aviation needs to be raised to a level playing field as one of the modal interests that has a role in our communities, our region and the state. Mr. Cushman said that as part of the update of the Metropolitan Transportation Plan (MTP), the Regional Council will look at how policies in the MTP could be applied to the aviation component. Regional policies for other modes will also be looked at to see if they should be modified to address support for general aviation and compatibility issues. He suggested that a subcommittee may be called upon to work with the Regional Council on this as the MTP goes forward for updating this summer and fall, for action in March 2001.

Stan Allison described two upcoming efforts being undertaken by the Washington State Department of Transportation (WSDOT) Aviation Division related to quantifying the benefits that airports provide to their local communities. The first, which will be done through a consultant contract, will combine an aviation forecast and economic modeling study that will provide the data needed to define the economic benefits of aviation around the state. The second will be a research study, involving Gary Smith, Rural Economist from Washington State University, to look at the economic importance of rural airports to rural communities. Nancy Jensen mentioned hearing about a similar study done in Idaho and volunteered to track it down. Bill Brubaker stressed the importance of also looking beyond the obvious to the far reaching impacts that rural airports can have, and raising public awareness about that.

The group engaged in a lively discussion on the benefits of aviation and the need to produce better, more understandable information and make it available to the general public, public officials, the aviation community and the press. Most of the discussion focused on rural aviation.

Mr. Cushman said staff will research the state's information on other airport master plans that have been done as well as look at studies done in other states. A working group may be called to meet between now and the next meeting in May to draft some ideas on how to get the information across to the public. Mr. Costello offered to provide reports that he has collected to assist in this effort.

Mr. Costello raised the issue of cellular telephone towers encroaching on airports, and suggested a policy position should be taken. Mr. Cushman pointed out that the state has already developed aviation guidance under state law and now we need to follow up by communicating that information. One way to do that could be through the policy and plan review process in which the Regional Council reviews and certifies all jurisdictions' plans. Stan Allison then described the WSDOT Aviation Division's ongoing obstruction program and reported that to date the program has yielded good results. He also noted that local jurisdictions are beginning to work more closely with the Aviation Division to review State Environmental Policy Act (SEPA) documents, building permits and conditional use permits relative to the aviation guidelines.

System Capacity and Future Facility Requirements (RASP Chapter 6)

Mr. Kiehl summarized the results of the landside and airside capacity analysis provided in the draft Chapter 6 that was sent with the agenda. He noted that the report primarily focuses on the top 10 airports in the region, since that is where most (87%) of the existing based aircraft are located and where most (95%) of the future growth in based aircraft is expected to occur.

He explained that the selected forecasts were used as input to the analyses of based aircraft and airfield capacity. There is a need for new landside capacity to accommodate the growing based aircraft fleet, and the analysis found a strong demand for new hangars as opposed to tie-downs (virtually all existing hangars are full while many tie-downs are available). The analysis of airfield capacity shows most airports are well within their annual capacity with some ability to grow, although Boeing Field will approach its annual service volume by the year 2020.

Next, Mr. Kiehl presented information about system requirements related to safety and standards. He began with information on existing runway length and width, runway safety area width and length beyond, and runway approaches, lighting and obstructions. The Committee noted that the airports at Lester and Martha Lake should be removed from the report, since they either have been or soon will be closed.

Mr. Kiehl asked the Committee to consider whether runway length is an issue that should be addressed in the plan. Mr. Brubaker stated that recommended runway lengths should not be included in the plan if they are unrealistic with respect to what is possible for the airports to provide. Several members agreed with this, adding that such information could weaken the credibility of the plan and possibly create a liability. Mr. Brubaker said it may be more appropriate to look at those airports that are unconstrained when it comes to potential runway length, and make a higher value assessment on a recommended runway length to meet the capacity. Stan Allison pointed out that this is a design standard compliance issue, which raises the question of whether we want to bring all the airports in the system up to compliance with design standards. Mr. Kiehl added that another consideration is whether a less-than-recommended runway length affects the airport's ability to accommodate the fleet that we foresee - is there a limitation on critical aircraft because of this, and does that have systemwide or airport-specific implications that we should talk about?

Next, Mr. Kiehl presented information regarding runway width. Mr. Allison noted that there are new global positioning system (GPS) standards. The new standard for a GPS instrument approach is a minimum runway length requirement of 3,000 feet and a minimum width of 60 feet. Mr. Brubaker said this information should be included in the plan, as it reflects where the industry is going. Mr. Waggoner suggested looking at those airports that are capable of meeting the new GPS standards and focus on those airports for upgrades. Mr. Allison reminded the group that for non-NPAIS(National Plan of Integrated Airport Systems) airports, which include many in our system, these standards do not apply. Given this fact, Mr. Brubaker suggested that the plan needs to be cautious in how it refers to "standards." He cautioned against creating a "checklist" situation that makes it looks like an airport *has* to comply when in fact the airport

could not or may not need to. Mr. Cushman said we could do an assessment of potential runway length and an assessment of the opportunity to change.

It was noted that Boeing Field should be included in the list of Airports with Substandard Runway Safety Area (RSA) Width.

In addition to discussing runway length, width and safety area, Mr. Kiehl also presented information on runway approaches and lighting, obstructions, pavement types and conditions, and air cargo. He noted that 40 of the system's 72 airport ends are obstructed in some way (trees, power lines, etc.). It was pointed out that the information presented on Bremerton Airport is no longer current, as ground clearing has removed the obstruction noted in the report. Mr. Kiehl will update the Bremerton information.

In discussing airport pavement, Mr. Waggoner reminded the group not to generalize pavement conditions for an entire airport. In some cases the main runway may be in good condition, while taxiways and ramps are in poor condition. Mr. Kiehl acknowledged this and said the pavement data we will receive from Pavement Consultants Inc. will be detailed enough to take care of this issue.

Other Business

Mr. Brubaker briefed the group on Senate Joint Memorial 8024, which is a memorial to the President and U.S. Congress from the Senate of the State of Washington requesting that they withhold from any further expansion of the contract tower program and devote their energies to the existing federal tower program. He agreed to fax a copy of SJM 8024 to Committee members.

Next Meeting

The next full Committee is scheduled for Thursday, May 25, 2000, from 1:00 to 4:00 p.m. in the Regional Council's Boardroom *[NOTE: This meeting was subsequently rescheduled to Wednesday, June 7, 1:00-4:00 p.m.]*. Mr. Cushman mentioned there may be a need to convene a subcommittee to discuss unresolved issues before that meeting, and that staff may be calling to some members to request their participation.

Adjournment

The meeting adjourned at 3:45 p.m.

Metropolitan Transportation Plan

2001 Update

Metropolitan Transportation Plan - Schedule for Update -

- ***August 1999:*** Revised Growth & Transportation Policy Boards kick-off update process for 2001 MTP
- ***Sept. – December 1999:*** Public scoping process for MTP & environmental document – Policy Boards set direction for update
- ***Jan. – May 2000:*** Boards discuss background data & develop key issue areas to be addressed in MTP update
- ***June & July:*** Joint Growth & Transportation Policy Board deliberate & endorse blend of ***concepts & choices*** to include in draft MTP & environmental document
- ***August – October:*** Release & public review of draft document

Continued →

Metropolitan Transportation Plan

2001 Update

Metropolitan Transportation Plan - Schedule for Update -

- ***October 2000:*** Executive Board briefing on public input to draft MTP document
- ***November/December:*** Joint Policy Boards review/recommend & release final draft MTP & environmental document for public comment
- ***mid-January 2001:*** Joint Policy Boards hold *Public Hearing* on Final Draft MTP
- ***late-January 2001:*** Executive Board reviews & recommends final MTP for General Assembly
- ***March 2001:*** Scheduled adoption of MTP at General Assembly

Metropolitan Transportation Plan (MTP) Alternatives

The strategic options described here, which are selected for inclusion in the regional aviation system plan, will eventually be incorporated into the regional transportation system alternatives considered in the 2001 Update of the Metropolitan Transportation Plan (MTP) and its associated EIS. These overall MTP alternatives are:

Current Law Revenue

This alternative (essentially a do nothing alternative) is constrained by current funding levels, including the impacts of Initiative 695. This alternative would represent a contraction from the 1995 MTP, with various major transportation improvement projects eliminated due to insufficient funding. This alternative would result in reduced travel speeds, increased congestion, and reduced regional air quality.

Adopted 1995 MTP

This alternative consists of the adopted 1995 MTP and assumes that additional funding can be secured to fully implement that plan. In addition, this alternative extends the plan to the year 2030. The 1995 MTP is the companion plan to the Regional Council's 1995 "VISION 2020" plan, which presents the regional growth plan. This alternative would seek to maintain current levels of congestion and prevent reductions in regional air quality.

"MTP Plus"

The "MTP Plus" alternative is a strategic refinement of the 1995 MTP, focusing on more effective implementation programs, strategic transportation investments, higher density development around transit stations, and a transportation pricing strategy. This alternative builds on the existing 1995 MTP and directs planning and funding programs toward transportation projects and management programs which maximize regional benefits and effectively address critical regional transportation system issues, such as congestion, people-moving capacity, transportation choices, air quality impacts and other environmental issues.

Puget Sound Regional Council

Regional Airport System Plan Refinement

– Work in Progress –

May 26, 2000

■ Chapter 7: Aviation System Strategy

For discussion by the
Regional Airport System Plan (RASP) Technical Advisory Committee
June 7, 2000

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Chapter 7 - Aviation System Strategy

The aviation system strategy chapter presents airport system development needs and strategic options, system improvement priorities, and a recommended system improvement program which responds to projected future demand (presented in chapter 5) and to identified system needs (presented in chapter 6). Using the aviation activity forecasts, chapter 6 presented the existing and future needs of the regional airport system in several categories, including airfield and landside capacity, airport pavements, safety and standards, and support facilities. Airfield and landside capacity analysis focused on existing and future demand, and the timing, type, location, and amount of facilities needed to accommodate that demand. The system capacity and future facility requirements chapter also identified existing airport system deficiencies related to FAA safety and standards criteria and documented potential opportunities for system enhancement. The aviation system strategy chapter is designed to organize these system needs, present a series of strategic options, and then to apply a set of system improvement priorities to develop a capital improvement program for the airport system. Also included in the system strategies chapter is a discussion of the region's existing reliever airports and possible enhancements that could respond to future needs.

System Needs and Strategic Options

The aviation system strategies are built around eight major categories of need: (1) airfield capacity; (2) aircraft parking capacity; (3) pavements; (4) safety and standards; (5) potential system enhancements; and (6) support facilities. In addition, this section of the system plan discusses opportunities for enhancement of the regional reliever airports to meet forecast demand, address existing deficiencies, and provide enhancements. The section also includes a discussion of the region's critical privately owned airports.

Reliever Airports

Existing Reliever Airports

Relievers are general aviation airports designated in the FAA's *National Plan of Integrated Airport Systems (NPIAS)*. One of their primary functions is to relieve general aviation traffic from large or medium hub airports in a metropolitan area. In the Central Puget Sound Region, the five reliever airports accommodate virtually all general aviation traffic that might want to use Sea-Tac International Airport. To illustrate, general aviation activity comprises less than 2% of Sea-Tac Airport's annual operations. The regional airport system currently includes five reliever airports: Auburn, Harvey Field, King County International Airport / Boeing Field, Renton, and Snohomish County Airport / Paine Field. Information on these relievers is displayed in Exhibit 7-1.

The FAA has recently revised its criteria for reliever status. To qualify as a reliever an airport must now have at least 100 based aircraft or 25,000 annual itinerant operations. The previous reliever criteria were at least 50 based aircraft or 25,000 annual itinerant operations. All five existing reliever airports meet the new criteria. In addition, Arlington, Bremerton, Crest Airpark, Pierce County/Thun Field, and Tacoma Narrows airports meet the new criteria. These five potential airports are summarized in Exhibit 7-2. While there is no longer an FAA reliever set-aside program to fund reliever airports, designation of reliever airports is a signal of their importance in a regional airport system.

Exhibit 7-1 Summary of Reliever Airports

	Existing Reliever Airports				
	Auburn	**Boeing Field**	**Harvey Field**	**Paine Field**	**Renton**
County	King	King	Snohomish	Snohomish	King
Ownership	Public	Public	Private	Public	Public
Runway length	3,400	10,001 / 3,710	2,660	9,010 / 4,514 / 3,000	5,379
Recommended runway length *	3,400	10,000 / 3,710	2,900	9,010 / 4,514 / 3,000	5,379
Runway width	75	200 / 100	36	150 / 75 / 75	200
Runway width standard	75	150 / 60	60	150 / 60 / 60	100
Meets all runway safety area stds?	Yes	No	Yes	No	No
Runway pavement condition	Good	Good / Good	Fair	Good / Good / Good	Good
Annual operations (1997)	172,000	345,120	140,700	192,612	100,710
Forecast 2020 operations	186,982	375,182	171,924	235,356	109,482
Annual runway capacity (ASV)	230,000	380,000	230,000	288,000	230,000
Based aircraft (1997)	238	443	360	483	240
Forecast 2020 based aircraft	276	514	476	639	278
Based aircraft capacity (1997)	330	550	415	564	255
Airport growth constrained?	Yes	Yes	No	No	Yes
Air traffic control Tower	No	Yes	No	Yes	Yes
Instrument approach **	No	Yes/ILS	No	Yes/ILS/GPS	Yes
Supports 50:1 approach?	No	Yes	No	Yes	No
Approach lighting	No	MALSF/R	No	MALSR	No
Runway edge lights	MIRL	MIRL/HIRL	Non-standard	MIRL/MIRL/HIRL	MIRL
Visual approach aids	VASI/PAPI REIL Beacon	VASI/PAPI REIL Beacon	VASI/PAPI	VASI/PAPI REIL Beacon	VASI/PAPI REIL Beacon
Weather observation/reporting	No	Yes	No	Yes	No
Airport highway access Distance	SR 167 1 mile	I-5 1 mile	SR 9 1/2 mile	SR 525/SR 99 1 mile/2 miles	1-405 1 mile

* Longer runway length is included in airport master plan

** Either precision or non-precision instrument

Exhibit 7-2 Potential Reliever Airports

	Potential Relievers				
	Arlington	**Bremerton**	**Crest Airpark**	**Pierce Co.**	**Tacoma Narrows**
County	Snohomish	Kitsap	King	Pierce	Pierce
Ownership	Public	Public	Private	Public	Public
Runway length	5,333 / 3,500	6,200	3,267	3,650	5,002
Recommended runway length *	6,000 / 2,940	7,400	3,020	3,040	6,000
Runway width	100 / 75	150	40	60	150
Runway width standard	60	100	60	75	100
Meets all runway safety area stds?	Yes	No	No	No	No
Runway pavement condition	Good	Good	Fair	Good	Fair
Annual operations (1997)	135,000	108,800	95,222	86,710	95,316
Forecast 2020 operations	164,959	127,590	103,516	99,960	109,881
Annual runway capacity (ASV)	270,000	240,000	240,000	240,000	240,000
Based aircraft (1997)	510	116	334	229	200
orecast 2020 based aircraft	674	158	387	285	249
Based aircraft capacity (1997)	577	194	356	278	282
Airport growth constrained?	No	No	No	No	No
Air traffic control Tower	No	No	No	No	Yes
Instrument approach **	Yes	Yes/ILS	No	No	Yes/ILS
Supports 50:1 approach?	Yes	Yes	No	No	Yes
Approach lighting	MALS	MALSR	No	No	MALSR
Runway edge lights	MIRL	HIRL	LIRL	MIRL	MIRL
Visual approach aids	PAPI Beacon	VASI Beacon	 Beacon	PAPI REIL Beacon	PAPI/VASI REIL Beacon
Weather observation/reporting	Yes	Yes	No	No	Yes
Airport highway access	I-5	SR 3	SR 18	SR 512	SR 16
Distance	2-1/2 miles	1/16 mile	2 miles	4 miles	1 mile

* Longer runway length is included in airport master plan
** Either precision or non-precision instrument

This system plan has evaluated the existing reliever airports in terms of their ability to accommodate existing and forecast activity levels and provide a safe and reliable regional system of reliever airports. While the existing five relievers provide an excellent foundation for the regional airport system, it has several shortcomings. The system plan is therefore assessing whether the existing relievers can accommodate future needs or whether additional reliever airports should be identified. Exhibit 7-1 displays a summary of both the strengths and weaknesses of the reliever airports. Three of the five relievers are constrained by adjacent urban development that limits their ability to expand. These airports are Auburn, Boeing Field, and Renton. Both Harvey Field and Paine Field have more readily available property to accommodate landside growth, though both will need to provide new aircraft parking (either tie-downs or hangars) to meet future demand. On the airside, Boeing Field is approaching its annual runway capacity. This, combined with its landside constraints, limits its ability to expand its regional role as a reliever.

All five existing reliever airports have visual vertical approach guidance (VASI or PAPI) and runway edge lights. Three of the five reliever airports (Boeing Field, Paine Field, and Renton) have towers and instrument approaches, with Boeing Field and Paine Field also having approach lighting and weather observation/reporting facilities. While Auburn, Boeing Field, and Renton airports are located in close proximity to Sea-Tac, allowing them to conveniently provide "relief," their proximity also puts them within congested air space. In addition, these three relievers are located in congested ground transportation corridors, reducing their overall effectiveness as relievers.

Auburn and Harvey do not have low visibility capability, with no tower, no instrument approach, no approach lighting, and no weather observation or reporting. Neither airport can support a future 50:1 approach. These two airports therefore have limited ability to provide relief to the system during poor visibility conditions, although both airports have visual approach guidance in the form of VASI and PAPI lighting systems.

Harvey Field is privately owned and to date has not accepted any public funding for airport improvements. This may be partially responsible for the fact that the airport has less than recommended runway length, sub-standard runway width, close in obstructions (power lines), and runway pavements rated only "fair."

As the regional airport system moves ahead into the new millennium, the user community will place increasing demands on the system. These demands will include growing numbers of aircraft and aircraft activity plus an increasing need for higher quality facilities and services to meet more sophisticated user needs and accommodate a more expensive and technologically advanced aircraft fleet. The airport system's capability to meet these needs translates into a demand for enhanced airfield capacity, additional aircraft storage facilities (primarily enclosed hangars), improved pavements, investments to improve safety and meet standards, improved electronic and visual navigation aids, additional instrument approaches and approach lighting systems, and better ground access. As future investments result in system improvements, there will be a corresponding need to protect and preserve the system from incompatible land uses. Those needs are addressed in the *Land Use Compatibility* section of this plan.

Potential Additional Reliever Airports

Nearly 90% of the based aircraft and aircraft activity in the region is concentrated at ten airports. This concentration is expected to intensify in the future, with 95% of the future growth (between 1999 and 2020) occurring at these ten airports. To accommodate these growing demands, the system must respond with capacity, safety, and service improvements, not only at the existing reliever airports, but at existing large non-reliever airports. One of the strategic options for accommodating future airport system needs and preserving the more critical airports is to designate new relievers. The following speaks to the rationale for expanding the number of reliever airports.

* The existing reliever airport system already accommodates 1,764 based aircraft (almost half the regional total) and over 950,000 annual operations (57% of the regional total), and will reach or approach their airfield and/or landside capacity within the next 20 years.

* The existing reliever airport system is somewhat constrained in terms of its air space interactions with Sea-Tac (primarily Boeing Field and Renton), and by congestion on the regional surface transportation system providing landside access (Boeing Field, Renton, and Auburn).

* The existing reliever airports in the region are somewhat constrained in terms of their ability to accommodate landside growth. Auburn, Boeing Field, and Renton all have limited land resources, and are closely surrounded by dense urban development that reduces the feasibility of developing new property for airport expansion.

* Distributing general aviation growth to additional airports (in the form of airport investments to attract and accommodate that growth) may reduce system-wide air space congestion and improve overall ground access to the regional airport system.

* While focusing limited funds at a few airports has merit, the existing five relievers cannot physically accommodate the growth forecast for the airport system.

* Projected system growth and increasing user demands (larger, more demanding aircraft, growing numbers of business and corporate users, demand for more access to more airports in low visibility conditions) require that airport system improvements be spread to a larger number and more varied type of airports in the region.

* Existing and forecast geographic distribution of population, employment, and airport system users indicate airport system investments should be geographically distributed more broadly, providing easier access to major system airports.

* Several existing non-reliever airports have attributes that would make them very good choices for investments. These include large numbers of based aircraft and aircraft operations, long runways (over 5,000 feet), meet runway safety area standards, instrument approaches, approach lighting, available land to accommodate growth, and relatively compatible surrounding land uses. Making improvements at these airports and designating all or some as relievers would recognize and enhance their existing market roles, would provide support to the existing reliever airports in meeting the growing aviation needs in the region, and would establish the regional policy basis for the maintenance and preservation of an expanded reliever system. This is a critical factor in maintaining compatible land uses surrounding the busier airports in the system.

This section discusses the attributes of five airports that have the potential to become relievers and compares them with the existing five reliever airports. Comparative data for the existing reliever airports is contained in Exhibit 7-1, and data for the potential relievers is shown in 7-2. The five potential reliever airports (Arlington, Bremerton, Crest Airpark, Pierce County/Thun Field, and Tacoma Narrows) are well distributed throughout the region, with two located in Pierce County, one in Kitsap, one in King, and one in Snohomish County.

Geographically, these locations could provide a good balance of airport locations to meet the projected regional distribution of future demand. In addition, these five airports are somewhat removed from the air space congestion at Sea-Tac and Boeing Field.

Of these five potential reliever airports, Arlington, Bremerton, and Tacoma Narrows have particularly strong potential to serve in reliever roles. All have the following attributes:

* meet runway length recommendations (all runways over 5,000 feet)
* meet runway width standards
* meet RSA width and length beyond standards
* approach lighting
* VASI or PAPI
* either precision or non-precision approaches
* can support 50:1 approaches
* Tacoma Narrows has a tower
* airport beacons
* available land for growth
* nearly unobstructed approaches
* meet both existing and currently proposed FAA criteria for reliever status (more than 50 or 100 based aircraft and over 25,000 annual itinerant operations)

Strategic Options for Reliever Airports

* Retain existing five relievers; invest in all according to needs, and take steps to preserve existing relievers: maintain/improve pavement, enhance safety, meet standards, expand capacity to meet demand, minimize land use encroachment. See Exhibit 7-4 for recommended improvements at each airport.

* Retain existing five relievers; focus investment on Boeing Field, Paine Field, and Renton.

* Public acquisition of Harvey Field combined with improvement plan to up-grade to FAA standards, including runway length and width, mark/light/move/remove obstructions (power lines), improve pavement condition. Expand capacity to meet demand.

* Add Arlington, Bremerton, and/or Tacoma Narrows as relievers; invest in all according to needs, and take steps to preserve these new relievers: maintain/improve pavement, enhance safety, meet standards, expand capacity to meet demand, minimize land use encroachment (this is more a policy statement to publicize the importance of these airports to the system. It may not have a significant impact on funding.) See Exhibit 7-4 for improvements at each airport.

Airfield Capacity

Based on the results of the aviation demand forecasts and analysis of system capacity and future facility requirements, five airports will reach 60% or more of their annual airfield capacity during the planning period (1998-2020). These airports include Boeing Field (91-99%); Paine Field (67-82%); Auburn (75-81%); Harvey (61-75%); and Arlington (50-61%) [shown in parentheses are demand-capacity ratios for 1998 and 2020]. King County International / Boeing Field (BFI) is the only system airport with critical airfield capacity concern, reaching 99% of its annual service volume in the year 2020. Boeing Field has limited ability to expand its airfield capacity. Regional demand management may be the only feasible approach to meeting future need at BFI. The Regional Airport System Plan therefore includes system enhancements to encourage growth at other airports that have the airfield and landside capacity to accommodate growth. These airports may include Arlington, Auburn, Bremerton, Paine Field, Tacoma Narrows, and Thun Field. While Paine Field and Auburn can accommodate moderate growth, both airports are expected to reach over 80% of their annual airfield capacity by 2020. This may necessitate further investment in airport capacity enhancements at Arlington, Tacoma Narrows, Thun Field, and Bremerton to accommodate regional demand in the 10-20 year time frame. All four of these top ten airports are expected to be operating well below their annual runway capacity through 2020. In addition, both Crest Airpark and Harvey Field have the capacity to accommodate some degree of regional growth to relieve Boeing Field, and eventually could relieve Auburn and Paine Field as they approach their current capacity. While Crest has runway capacity to accommodate operations growth, it is site constrained, and can support only a limited amount of growth in based aircraft and other landside support facilities. Therefore, Crest may not be able to realize its theoretical airfield capacity. Both Harvey and Crest may be somewhat financially constrained by their private ownership.

Strategic Options for Airfield Capacity

* No major airfield capacity actions needed before 2010

* Between 2000 and 2010, plan for improved safety and all-weather capability at reliever airports, top ten airports, and/or "critical" airports (see below) to increase effective peak hour capacity in low visibility conditions, thereby increasing annual capacity of the system, and relieving pressure from BFI, and ultimately at Auburn and Paine Field.

* Designate airports with capacity and airspace improvement needs and cooperate with FAA, airport sponsors, State DOT to implement MLS, GPS, LAAS, WAAS approaches to increase airport capability, safety, and capacity

* Increase capacity at Paine Field and Auburn by 2020 to address demand. This would involve airfield improvements or a new runway at each airport.

* Plan for additional capacity at Arlington, Bremerton, Tacoma Narrows, and Thun Field to accommodate growth that cannot be accommodated at Boeing Field, Auburn, and Paine Field. Provide airfield capacity, based aircraft parking capacity, safety and standards improvements, and other support facilities at these alternate airports to attract and accommodate the diverted demand. This may include the following:
    * Tower at Arlington
    * Runway extension at Arlington
    * New GPS approach, approach lighting, REIL, and navaids at Arlington

* New hangars at Arlington
* Runway extension at Bremerton
* New GPS approach and REIL at Bremerton
* Pavement improvements at Tacoma Narrows
* New Hangars at Tacoma Narrows
* Runway extension and widening at Thun Field
* New GPS approach, approach lighting, and navaids at Thun Field
* New hangars at Thun Field

Aircraft Parking Capacity

The regional airport system will need to accommodate 819 total new based aircraft (by 2020). This demand will be concentrated at the top ten airports. Some 96% of the region's forecast growth (783 new aircraft) is expected to occur at these ten airports. In addition, user preferences indicate the vast majority of new aircraft (90% of new demand, or 737 aircraft) will prefer to base their aircraft in hangars. The user preference for hangar aircraft storage is also apparent in existing airport waiting list data, which show over 800 based aircraft are currently stored in tie-downs but waiting for hangars. As of 1999 virtually all aircraft hangars in the region were occupied, and newly constructed hangars have been filling as soon as construction is complete. Therefore, according to forecast figures and waiting list data, the region will see new demand for 737 aircraft hangars from pure growth plus latent demand for 800 hangars from existing tenants wishing to upgrade from tie-downs.

Strategic Options for Aircraft Parking

* Accommodate new based aircraft at each airport without regard for storage type. This would require additional tie-downs at Arlington, Crest, FirstAir Field, Harvey Field, Kenmore Air Harbor, Pierce County Airport/Thun Field, Renton, and Snohomish County Airport/Paine Field.

* Plan for (and invest in) specific new based aircraft needs at each airport (preference for hangars). This would require new hangars at most airports, including 737 new hangars at top ten airports Total additional aircraft hangar space needed would reach 94 acres (see exhibit 6-2).

* Plan for upgrades from tie-downs to hangars to accommodate waiting lists. This would require some 817 new hangars at 13 system airports, with about 88 acres of new hangar development (see Exhibit 6-1).

* Plan for additional capacity only at top 10 airports, which account for 783 new aircraft by 2020 (96% of all growth in the system)

* Plan to accommodate based aircraft growth only at public owned airports. This would leave based aircraft capacity shortfalls at Crest Airpark and Harvey Field, which could be addressed by airport owner or other private investment in additional capacity

* Plan for additional capacity at specified airports that:
  1. Can accommodate growth
  2. Where applicable design standards can be met
  3. Where enhancements can be made to improve level of service
  4. Where land use encroachment goals are most likely to be successful

* Implementation option 1: plan for public investment in hangar development

* Implementation option 2: build partnerships to encourage private investment in hangar development

Pavements

The following discussion of existing pavement condition and possible strategic improvement options is based on visual pavement inspections done by the WSDOT Aviation Division in 1998. When data becomes available from the state's current pavement management program (being done by Pavement Consultants Inc.) this section on pavements will be updated, and may be significantly altered if required by the results of the current pavement study.

System needs (1998):

* Existing generalized runway pavement condition (includes 31 runways at the 26 land based airports and excludes the 4 seaplane bases):
  * Good: 21
  * Fair: 7 (include Harvey, Crest, Tacoma Narrows)
  * Poor: 3 (Bandera, Lester (closed), and Spanaway)

* Evaluate WSDOT pavement condition index data when it becomes available. This analysis will provide much more detailed statement of system needs

Possible Strategic Options for Pavements (based on 1998 pavement information)

* Set a minimum "PCI" rating for the five existing reliever airports. This could require:
  * Pavement improvements at Harvey Field.

* Set a minimum "PCI" rating for top ten airports (includes relievers). This could require:
  * Pavement improvements at Harvey Field, Crest Airpark, and Tacoma Narrows.

* Set a minimum "PCI" rating for 13 NPIAS airports. This could require:
  * Pavement improvements at Harvey Field and Tacoma Narrows.

* Set a minimum "PCI" rating for all public use airports

* Set a minimum "PCI" rating for all publicly owned airports

* Evaluate specific system pavement needs based on WSDOT PCI data and selected strategic option

* Develop policy framework, pavement improvement program, and implementation program to address selected option above

* Plan for pavement improvements based on defined activity levels (based aircraft and/or aircraft operations)

* Plan for pavement improvements based on level and type of activity (focus investment at airports with larger aircraft and/or business activity)

Safety and Standards

Chapter 6 contained a thorough discussion and analysis of the safety and standards of the system. The following are highlights of those system needs and a series of strategic options for addressing airport system needs in the area of safety and standards.

* Runway length
  * Arlington, Bremerton, Sea-Tac, and Tacoma Narrows airports are each planning longer runways to accommodate increasing aircraft requirements (all meet current requirements)
  * 14 airports have runways too short to serve 95% of the small GA fleet (under 10 seats), including Harvey Field and Crest Airpark.
  * 8 have runways too short to serve 75% of the small GA fleet (under 10 seats)

* Runway width
  * 12 airports have runway widths less than standard, including three NPIAS airports (Harvey Field, Pierce County Airport/Thun Field, and Vashon)
  * 3 top ten airports (including 1 reliever) have sub-standard runway width: Crest Airpark, Harvey Field, and Thun Field

* RSA width
  * 7 system airports do not meet FAA runway safety area width standards. Of these, 3 are NPIAS airports: Sea-Tac, Thun Field, and Vashon

* RSA length beyond
  * 12 system airports do not meet RSA length beyond standards, including six NPIAS airports (including 2 relievers), Sea-Tac, and 5 top ten airports

* Obstructions
  * Three top ten airports (including 2 relievers) have close in obstructions resulting in significant deficiency in meeting required approach slopes
  * Two top ten airports (Auburn and Bremerton) have more distant obstructions having modest affect on approach slope

* Approaches and approach lighting
  * Of the system's five reliever airports, only Boeing Field and Paine Field have instrument approaches. In addition, of the remaining top ten airports, Bremerton and Tacoma Narrows have instrument approaches.
  * According to FAA criteria, airports with over 200 annual instrument operations or 1,825 annual scheduled passenger originations qualify for a non-precision approach.
  * Five of the top ten airports have approach lighting. These are Boeing Field, Paine Field, Arlington, Bremerton, and Tacoma Narrows.
  * Only eight of the system's 30 airports have approach lighting. These include the five listed above plus Sea-Tac, McChord AFB, and Gray Army Airfield.
  * According to FAA criteria, airports with over 300 annual instrument operations or 2,725 annual passenger originations qualify for medium intensity approach lighting systems (MALS). Of the top ten airports without approach lighting systems, only Renton qualifies under these FAA criteria.

Strategic Options for Safety and Standards (see Exhibit 7-4)

* Meet all standards and recommendations at all reliever airports. This would require the following:
  * Runway extension and runway widening at Harvey Field
  * Runway safety area length beyond improvements at Boeing Field, Paine Field, and Renton
  * Removal of power lines at Harvey Field (or the equivalent)
  * Obstruction programs at Auburn, Boeing Field, Harvey Field, and Paine Field

* Meet standards and recommendations at top ten airports. In addition to the items listed above at the reliever airports, meeting this recommendation would require the following at other top ten airports:
  * Runway widening at Crest Airpark and Pierce County Airport/Thun Field
  * Runway safety area width improvements at Thun Field
  * Runway safety area length beyond improvements at Crest Airpark and Tacoma Narrows
  * Obstruction program improvements at Bremerton and Crest Airpark

* Meet standards at NPIAS airports. This would include above improvements plus:
  * Runway extension and widening, runway safety area width and length beyond, and obstruction program improvements, all at Vashon

* Meet standards at airports above certain size and/or levels of activity. The FAA's *Regional Airport Plan*, published in Spring 2000, recommends all safety areas be brought up to current standards at all general aviation airports with more than 100 based aircraft. This would include the region's top ten airports. FAA Northwest Mountain Regional Airport Plan goal is to meet runway safety area standards at primary, commercial service, and GA airports with more than 100 based aircraft. Applying this criterion would yield the need for safety area improvements at the following airports: Sea-Tac, Boeing Field, Bremerton, Crest, Thun Field, Paine Field, and Tacoma Narrows.

Potential System Enhancements

In addition to meeting the demands of regional growth and other identified system needs, there are needs for, and opportunities to provide numerous airport system enhancements to improve the level of service provided by the system. The business and corporate aviation market is placing growing demands on the regional airport system to accommodate a GA fleet that is increasingly comprised of high performance turbine powered aircraft. System users are requesting increased capacity, capability, reliability, and safety in an increasingly congested region. Many of these system needs could be addressed by enhancements such as longer, stronger runways, new GPS and/or instrument approaches, improved approach lighting and navigational facilities for low visibility flying, and various other safety-related improvements. The following provide a brief summary of system enhancements and current criteria and standards that would apply to each. Standards and criteria are taken from FAA Advisory Circular AC 150/5300-13 (through draft change 6) and FAA Order 7031.2C through change 11, 3/17/97).

* Runway Length
  * Five of the top ten system airports are planning for longer runways to accommodate increasing demands by their users. These include Boeing Field, Harvey Field, Arlington, Bremerton, and Tacoma Narrows. Currently, all but Harvey Field meet runway length recommendations to accommodate their existing critical/design aircraft.

* Instrument Landing System (ILS)
  * Boeing Field, Bremerton, Paine Field, and Tacoma Narrows currently have ILS
  * No criteria are given by the FAA for new instrument landing systems. FAA is now planning to replace instrument landing systems with GPS

* Microwave Landing System (MLS)
  * FAA Minimum runway standards are 4,200 feet long by 75 feet wide
  * Qualifying activity levels are sustained turbojet operations and between 900 and 2,700 annual GA instrument operations (Annual Instrument Approaches - "AIA" criteria)
  * Airports meeting these criteria include Sea-Tac, Boeing Field, Paine Field, Renton, Arlington, and Tacoma Narrows

* Future Global Positioning System (GPS) approaches
  * Nine of the top ten airports in the region (Tacoma Narrows currently has a GPS approach) are currently planning for new GPS approaches, which will improve their capability in low visibility conditions. GPS capability will provide the region with ten airports with at least non-precision approaches (up from the current six airports)
  * FAA minimum runway length for GPS precision instrument approach is 4,200 feet
  * FAA minimum runway length for GPS non-precision approach with visibility minima of less than 3/4 statute mile is 4,200 feet; minimum runway length with visibility of less than 1 statute mile, equal to 1 statute mile, or greater than 1 statute mile is 3,200 feet
  * Depending on the visibility minima sought, GPS approaches at all of the top ten airports could require runway extensions at Auburn, Crest Airpark, Harvey Field, and Thun Field

* Non-precision instrument approaches
  * Of the system's top ten airports, Auburn, Harvey, Crest, and Thun Field have only visual approach capability
  * FAA qualifying activity levels are 200 annual instrument approaches or more than 1,825 annual scheduled passenger originations

* Visual approach slope indicators (VASI) and/or precision approach profile indicators (PAPI) for non-precision approach
  * Of the system's top ten airports, Crest and Harvey do not have VASI/PAPI or equivalent
  * FAA qualifying activity levels are greater than 28,000 annual operations or greater than 120 annual instrument operations. Both Crest and Harvey would meet this criterion.

* Approach lights (MALS) for non-precision approach
  * Currently Auburn, Harvey Field, Renton, Crest, and Thun Field do not have approach lighting for even a non-precision approach
  * FAA qualifying activity levels are greater than 300 annual instrument approaches or 2,725 annual passenger originations

* Runway end identifier lights (REIL)
  * Boeing Field, Harvey Field, Paine Field, Arlington, Bremerton, and Crest Airpark do not have REIL to provide visual guidance to runway ends in lower visibility conditions
  * Boeing Field and Arlington plan to install REIL where it does not now exist

* Approach protection
  * Airports with ILS/MLS capability, and those planning for new GPS approaches, must protect the approaches to the runway ends from land uses and physical objects that would encroach upon the airplane's path to the runway end. Several airport master plans include recommendations for the airport sponsor to obtain positive control (through ownership, avigation easements, or other means) over airport approaches to protect future capability

  * All airports with ILS, MLS, or GPS capability should be planning for approach protection

* Runway edge lighting
  * Crest Airpark and Harvey Field currently do not have standard runway edge lighting

Strategic Options for System Enhancements

* Support planned runway extensions at Boeing Field, Harvey Field, Arlington, Bremerton, and Tacoma Narrows

* Provide ILS, MLS, or GPS landing systems at all reliever airports. This would require installation of systems at Auburn, Harvey, and Renton, and new relievers. This would also require runway extensions to 3,200 or 4,200 feet at Auburn and Harvey Field (depending on visibility minima)

* Provide ILS, MLS, or GPS landing systems at all top ten airports. This would require installation of systems at Auburn, Harvey Field, Renton, Arlington, Crest, and Thun Field. This would also require runway extensions to 3,200 or 4,200 feet at Auburn, Harvey Field, Crest Airpark, and Thun Field (depending on visibility minima)

* Provide instrument approach (either precision or non-precision) and approach lighting at all relievers. This would require installation of instrument approaches at Auburn and Harvey, and possible approach lighting at Renton

* Provide instrument approach (either precision or non-precision) and approach lighting at top ten airports. This would require installations at Auburn, Harvey Field, Crest Airpark, Renton, and Thun Field

* Provide for GPS approaches at all relievers. This would necessitate runway extensions to 3,200 feet at Harvey Field or 4,200 feet at Auburn and Harvey Field (depending on visibility minima)

* Provide for GPS approaches at top ten airports. This would necessitate runway extensions to 3,200 feet at Harvey Field or 4,200 feet at Auburn and Harvey Field, and extensions to 4,200 feet at Crest Airpark and Thun Field (to achieve lower minima)

* Provide beacon and VASI or PAPI at top ten airports. This would require installation of a beacon at Harvey Field and VASI or PAPI at Harvey Field and Crest Airpark.

* Provide runway edge lighting at airports without such lighting. This would include new lighting at Harvey Field and Crest Airpark

* Retain, preserve, and improve <u>at least one airport in each county</u> that can serve major business aviation needs. These airports would need the following facilities:
    * Runway at least 5,000-6,000 feet long and 100 feet wide
    * Meet all runway safety area standards
    * Precision instrument runway with approach lighting
    * Able to support a 50:1 approach
    * Air traffic control tower
    * Adequate covered/enclosed aircraft storage
    * Adequate support facilities (including aircraft maintenance, aircraft fuel, ground access)
    * Pavement in good condition (or other criterion such as PCI of 80 or higher)
    * Airports that would qualify are Sea-Tac, Boeing Field, Renton, Paine Field, Arlington, Bremerton, and Tacoma Narrows. Arlington would be the second such airport in Snohomish County. Bremerton and Tacoma Narrows would be the first such airports in Kitsap and Pierce Counties, respectively.

Support Facilities

* **System needs:**
  * Control towers
    * Of the five relievers, only Boeing Field and Paine Field have control towers
    * Of the top ten GA system airports, only Boeing Field, Paine Field, Renton, and Tacoma Narrows have control towers
  * Control Tower criteria
    * Open to the public
    * NPIAS airport
    * Assurances to operate into the future
    * FAA must be given land at no cost for the tower
    * B/C ratio is greater than 1
  * Air cargo
    * Regional cargo at SEA and BFI is forecast to increase from 613,099 tons in 1998 to 1,048,795 tons in 2010.
    * At BFI, on airport cargo processing requirements will increase from 22 acres (existing) in 1998 to 43 acres in 2015. It is not certain whether the airport can accommodate all forecast cargo demand after 2015.
    * At SEA, cargo processing requirements will increase from 81 acres (1993) to 176 acres in 2020. The airport has a plan to accommodate forecast cargo demand to the year 2009, and is developing plans to meet longer term needs.
  * Aircraft fuel
    * All system airports (except seven very small airports) have fuel facilities
    * Airports without fuel are state-owned/emergency airfields or are within 15 air miles of other system airports that have fuel

Strategic Options for Support Facilities

* Control towers
  * Consider provision of control towers at all reliever airports
  * Consider provision of control towers at all top ten airports
  * Consider provision of control towers at all airports with approach lighting
  * Consider provision of control towers at all airports with non-precision or precision instrument approaches
  * Consider provision of control towers at all airports which exceed defined based aircraft and/or aircraft activity levels

* Air Cargo
  * Develop facilities (on airport and needed ground access improvements) at SEA and BFI to meet demand as forecast in most recent master plans, and as published in this RASP (this would potentially meet need to 2009 at SEA and 2015 at BFI)
  * Undertake a regional air cargo demand analysis and compare with individual airport master plans. Based on results of this analysis, develop and evaluate regional air cargo improvement options. This may include SEA, BFI, PAE, and/or other airports.

* Fuel Facilities
  * No action needed on aircraft fuel facilities

Critical Privately Owned Airports

Of the 30 public use airports in the regional airport system, 11 are privately owned. The privately owned public use airports provide a major contribution to the regional system in terms of airfield and landside capacity and access to the region, state, nation's air transportation system. These 11 airports are currently home to over 1,000 based aircraft and have a total landside capacity of nearly 1,200 aircraft parking spaces. Although all these airports are important to the system, two have critical regional significance: Crest Airpark and Harvey Airfield. These two airports alone house 690 based aircraft, nearly 20% of the total aircraft in the region. In addition, Crest and Harvey (together with Renton) fill a critical need for airport capacity by accommodating aviation demand from the east side of Lake Washington. According to the RASP forecasts, the region is projected to reach its total based aircraft capacity between 2015 and 2020. The loss of either Crest Airpark or Harvey Field would have serious affects on the rest of the airport system. If both were lost today, there would be no excess capacity, and any new growth anywhere in the system would require construction of tie-downs and or hangars. This would severely limit choice on the part of aircraft owners, would place major financial burdens on many airport sponsors, and could also compromise the efficiency and safety of the system. It is in the interest of the entire airport system to preserve and maintain the region's critical privately owned public use airports.

Strategic Options for Critical Privately Owned Airports

* Allow the market to determine the future of privately owned airports. Take actions in the public sector as needed to respond to overall system needs, and in response to changes at private airports.

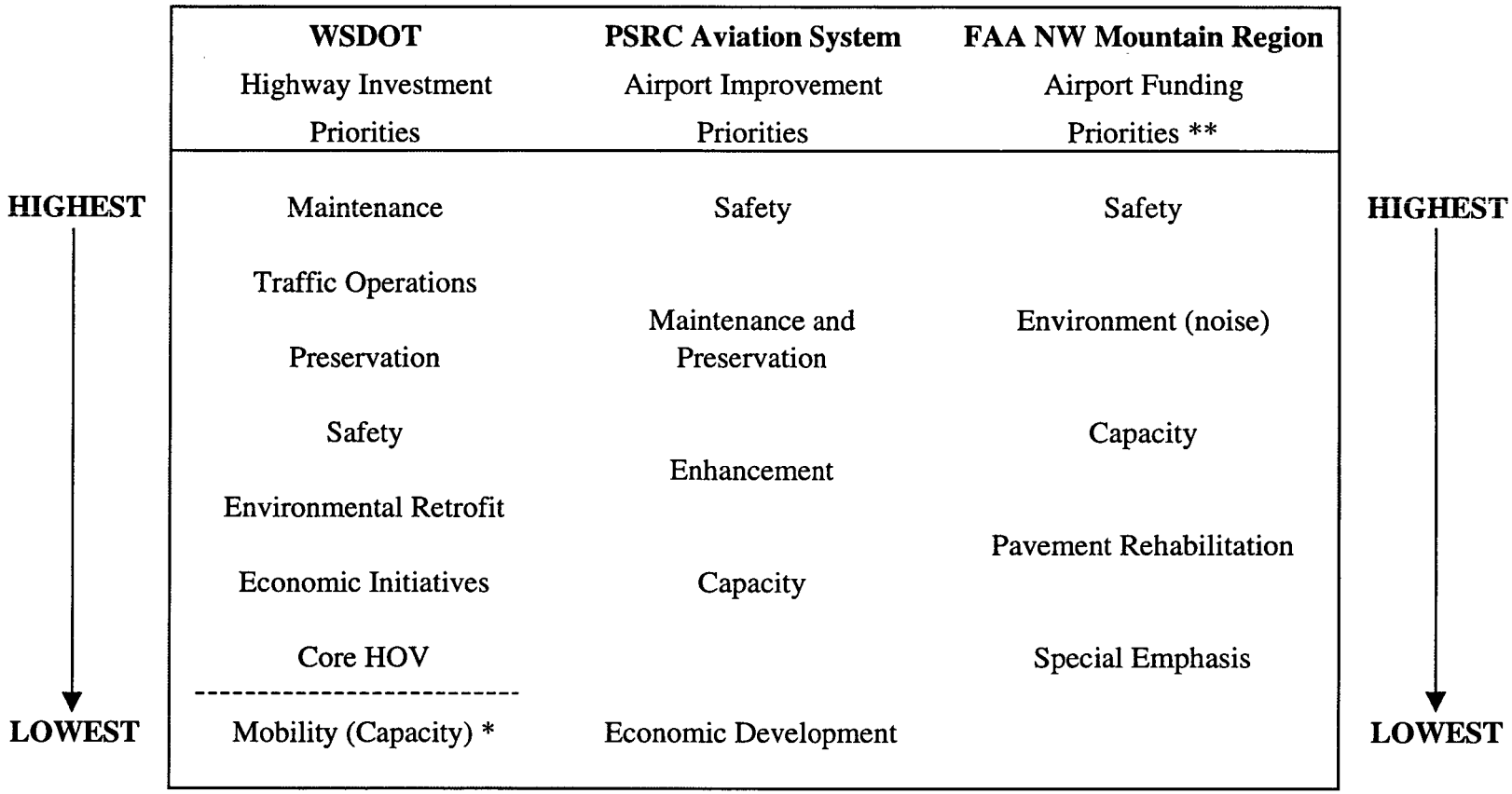
* Monitor the status of the region's critical privately owned public use airports (Crest Airpark and Harvey Field), and if either airport is threatened with closure, coordinate with the WSDOT Aviation Division, the FAA, and other appropriate public agencies, to evaluate public acquisition of the airport.

Regional Airport System Improvement Priorities

Historically, the regional aviation system's improvement needs have been greater than available funding. Given the level of growth forecast for the regional airport system in the next 20 years, and the magnitude of system needs identified here, future system needs are likely to exceed available funding. Planning for system improvements is therefore based on a set of system improvement priorities that are intended to provide policy guidance regarding the relative importance among four categories of improvement programs. These groups in order of priority are: (1) safety and standards, (2) maintenance and preservation, (3) enhancement, and (4) capacity.

In developing these improvement program priority categories we reviewed similar investment and funding priority systems developed by the Washington Department of Transportation and the Federal Aviation Administration. These project priority systems are summarized in Exhibit 7-3 along with recommended PSRC aviation system improvement priorities. The WSDOT and FAA priorities are used to allocate funds to a wide range of competing projects, and are rigorously applied. Given that the Regional Council has no direct funding authority, the PSRC aviation system improvement priorities are meant to provide general guidance to airport sponsors and state and federal funding agencies regarding regional priorities.

Exhibit 7-3 Comparison of Transportation System Improvement Priorities



* Funded only after higher priority needs have been met

** From FAA Northwest Mountain Regional Airport Plan -- 2000

As shown in Exhibit 7-3, the Washington DOT priority system for highway investment places highest priority on system maintenance, operations, preservation, and safety. Capacity projects (their lowest priority) are funded only after all higher priorities have been funded. The FAA Northwest Mountain Region funding priorities shown in Exhibit 7-3 were derived from the *FAA Northwest Mountain Regional Airport Plan* [5], published in spring 2000. That plan puts safety as its highest priority, and focuses a significant proportion of funds to resolving existing safety deficiencies (especially runway safety areas) at the region's airports. The plan recommends all runway safety areas meet standards at all general aviation airports with more than 100 based aircraft. This would include the top ten airports in the Puget Sound Regional Airport System.

Priority 1: Safety and Standards

Consistent with FAA national and regional airport system priorities, the Puget Sound Regional Airport System Plan has identified numerous airport improvements that will enhance the overall safety of the airport system. This group of system improvements primarily addresses deficiencies in the existing airport system as measured against FAA standards, and includes projects to eliminate existing system deficiencies in runway width, runway safety area width, and runway safety area length beyond, and to enhance existing obstruction programs. Safety and standards are considered the top priority in system improvements. Airport sponsors and funding agencies should focus a significant proportion of available funds on projects and programs which address these safety and standards issues at critical airports in the regional airport system. Several airports are already planning to resolve these safety and standards issues.

Priority 2: Maintenance and Preservation

Second level priority improvements include programs to preserve, maintain, and improve airport pavements and programs to address land use encroachment, including height hazards, safety, and noise. Both these airport improvement programs focus on preserving the airport system's ability to meet existing and future needs, and help airports fulfil their role as essential public facilities. After safety and standards, maintenance and preservation of the system is the next highest priority for system improvements. Preserving, maintaining, and improving the condition of airport pavements is a high priority at both the federal and state levels, and pavement maintenance and management programs are eligible for federal and state funding. This high degree of state and national interest should ensure an appropriate level of investment in pavement programs. The WSDOT Aviation Division's latest pavement maintenance and management program, to be available in May 2000, will provide the baseline data and analysis required to define the pavement needs of the regional airport system.

While land use encroachment and compatible land use programs are a high priority in preserving the regional airport system, these programs do not necessarily have high costs. Rather, they require communication and cooperation between airport sponsors and local governments with land use planning and zoning authority over properties surrounding airports. Compatible land use planning programs are a critical component in preserving the regional airport system by maintaining the safety of aircraft using the system, reducing the risk of aircraft accidents involving people in areas adjoining airports, and providing for improved relations between airports and their neighboring communities [see also Chapter 8].

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5 The FAA Northwest Mountain Region includes the states of Washington, Oregon, Idaho, Montana, Utah, Colorado, and Wyoming.

Priority 3: System Enhancements

Assuming that the regional airport system is safe, and that it is being preserved and maintained, the next priority is to enhance the system's ability to serve the public. System enhancement projects are those that provide an increased level of service for airport system users, respond to changing requirements of the aircraft fleet, and enhance airport system access and reliability in poor visibility conditions. In short, system enhancements would provide increased access to more users at more airports using a wider range of aircraft more often during a wider range of weather conditions. System enhancement should also produce the indirect benefits of increased safety and capacity.

System enhancement projects include runway extensions, new and improved instrument/GPS approaches, approach lighting systems, visual aids, airport and runway lighting, and approach protection programs. Enhancements are third priority after safety and standards improvements and maintenance and preservation improvements. Nearly all top ten airports in the regional system are currently planning to implement some type of improved instrument or GPS approach to provide enhanced access to their airports.

Priority 4: System Capacity

Fourth priority improvements are those that increase system capacity and are not related to system safety and standards, maintenance and preservation, or system enhancements. Capacity improvements include airfield projects that increase airport operations capacity and landside capacity projects such as new aircraft tie-downs and hangars. While system capacity is important, existing airfield capacity is generally sufficient to accommodate forecast demand for the next 20 years. The lone exception is Boeing Field, and numerous initiatives contained in this RASP are designed to accommodate growth to relieve the pressure at Boeing Field. On the landside, the airport system has sufficient existing capacity to meet total regional forecast demand until the year 2015, though not necessarily the type required (hangars) or at the locations where market demand is greatest. Demand for additional capacity at certain airports is strong, and many existing tenants on waiting lists are seeking improved storage in hangars. Half the region's airports are currently at or above 80% of their landside capacity, and several top ten airports (Arlington, Auburn, Bremerton, Harvey Field, Tacoma Narrows, and Thun Field) are planning or developing additional aircraft storage capacity (with both public and private funds) to accommodate these demands. While not the highest priority in the region, landside capacity should be provided to meet regional demand, and where financially feasible, hangar storage should be provided to fulfill user preferences.

Recommended Regional Airport System Improvement Program

The recommended regional airport system improvement program is comprised of three components: system policy; system strategy, and system improvements. The policy component states the regional council's overall policy regarding the regional airport system. These include statements regarding how the region will address its long term air transportation needs related to commercial passenger service, air cargo, airport compatible land use, and the general aviation airport system. The strategy and priorities component documents overall system strategies grouped by priority category (safety and standards, maintenance and preservation, system enhancements, and system capacity). The improvements component lists more specifically the airport improvement projects and programs recommended for each airport in the system.

Commercial Passenger Service

* The region will meet its long term commercial passenger air transportation needs through expansion of Sea-Tac International Airport (as identified in its most recent Airport Master Plan Update and related EIS), and consistent with the Puget Sound Regional Council General Assembly's Resolution A-96-02 (including Appendix G). The Regional Council will continue to coordinate with all agencies responsible for implementing Resolution A-96-02, and will continue to monitor and report on progress related to the noise reduction steps contained in the Resolution.
* The Regional Council will coordinate with the state to enact legislation allowing for substantial and equitable incentives and compensation for communities impacted by the proximity of essential public facilities.
* The Regional Council will coordinate with the state and local jurisdictions to implement a comprehensive process for evaluating all options to meet the State of Washington's long-term air travel and inter-regional ground transportation needs including high speed rail.
* The Regional Council will coordinate with the Port of Seattle, WSDOT, the FAA, and other appropriate agencies to identify and implement improvements to the region's surface transportation system to provide improved multi-modal access to Sea-Tac Airport and to mitigate the airport's transportation impacts on surrounding communities.

Air Cargo

* The region will meet short and medium term air cargo demand (2009-2015) through planned improvements at Sea-Tac International Airport and King County International Airport / Boeing Field (as outlined in their most recent airport master plans and related planning documents). The Regional Council will also plan for and support funding of improvements to the regional surface access system to support the regional movement of air cargo shipments.
* The region's longer term air cargo demand (after 2015) will be addressed in future updates to the Sea-Tac Airport and Boeing Field master plans in coordination with regional airport system planning being done by the Regional Council. This coordinated planning for regional air cargo needs will address total regional air cargo demand, the regional distribution of air cargo facilities, the potential for additional regional air cargo activity at airports other then Sea-Tac and Boeing Field, and additional need for surface access improvements.

Airport Compatible Land Use

* Building upon its Policy and Plan Review and Certification authority under the Growth Management Act, the Regional Council will continue and expand its efforts to improve land use compatibility adjacent to public use general aviation airports. These efforts will include the following actions:
    * Refine the policy and plan review process to clarify the airport land use compatibility criteria to be used in plan review and certification process.
    * Establish airport compatible land use guidelines.
    * Provide compatible land use guidelines and technical assistance to local jurisdictions.
    * Monitor regional trends in airport compatible land use to assess the effectiveness of the programs.
* The Regional Council encourages cities and counties with public use general aviation airports to pro-actively use their planning and zoning authority to prevent further land use encroachment and incompatible land use adjacent to these airports.

General Aviation Airports

* The region will preserve, maintain, and enhance its general aviation airport system as detailed in the *2000 Regional Airport System Plan (RASP)*. The region will support the development of appropriate aviation facilities and services to allow each airport to fulfill its regional role as defined in the RASP. The region will support investments in the airport system to meet growing demand, provide increased access to the airport system, meet the broadening needs of the business and corporate aviation sectors, and to improve system safety and reliability.
* The region will apply the concept of "essential public facilities" as defined in Washington's Growth Management Act to the region's public use airports as needed to provide a planning process for addressing airport compatible land use in communities adjacent to all system airports.
* The region will support strategic investments in the regional airport system as identified in the RASP to address airport system safety and standards, maintenance and preservation, system enhancements, capacity expansion, and related economic development.
* The region will encourage and support airport sponsors and other appropriate agencies to undertake the following action strategies to implement the RASP:
    * The Regional Council will work with the FAA, WSDOT Aviation Division, airport sponsors, other appropriate public agencies, and the private sector, to identify additional financial resources required to meet the investment needs of the regional airport system and to help mitigate the impacts of airports on adjacent communities. The Regional Council will also explore the potential of using public funds for critical projects at privately owned public use airports.
    * The region will monitor the status of major privately owned public use general aviation airports throughout the region (particularly Harvey Field and Crest Airpark). If any of these airports are threatened with closure, the Regional Council will coordinate with the WSDOT Aviation Division, the FAA, the current airport owner, and other appropriate public agencies, to evaluate options for public acquisition of these airports.
    * Bremerton National and Tacoma Narrows airports should take steps as outlined in the RASP to accommodate growth in corporate and business aviation to relieve growth pressure at Boeing Field. These steps should include safety and standards programs, obstruction programs, pavement maintenance programs, compatible land use programs, runway extensions, protection of runway approaches, improved approach lighting systems, development of newer technology instrument approaches (such as GPS), and landside capacity enhancements.
    * Arlington should take steps to capitalize on its regional niche as a center for experimental, glider, and ultralight activity. In addition, it should improve its all weather capability to provide increased access to the northern portion of the region.
    * Airport system investment priorities identified in the RASP will be used to communicate the Regional Council's policy concerning funding priorities for airport system investments. The Regional Council will communicate these priorities with the WSDOT Aviation Division, the FAA, and airport management, and encourage airports to include these investments in their individual airport master plans and capital improvement programs.
    * Concurrent with its planning for the region airport system, the Regional Council will work with the WSDOT Aviation Division, the FAA, and other appropriate agencies to identify and document the economic benefits of aviation to local communities and to the region.

Regional Airport System Strategy

The regional airport system needs to respond to the growing and widening needs of its users. It should be safe and reliable. The system should provide for compatibility with surrounding communities. It needs to provide facilities and services that are efficiently located relative to demand. And the system should be preserved and maintained to capitalize on the existing system investment. The system strategy and priorities below are designed to meet these multiple goals for the regional airport system.

System Strategy - Reliever Airports

* The five existing reliever airports will be preserved, maintained, and enhanced as described herein to meet existing and forecast regional needs.
* Paine Field and Harvey Field should make improvements to maintain and enhance their roles as reliever airports serving the northern part of the region. Both could be expanded to meet growing demand.
* Boeing Field, Renton, and Auburn are all constrained, and cannot accommodate forecast growth for reliever airport services and facilities in the south part of the region. To meet this demand, Bremerton National and Tacoma Narrows airports should be designated as additional relievers and maintained and enhanced to accommodate this need.

System Strategy - Safety and Standards

Because of their importance to the system, all top ten airports should be improved to eliminate existing safety and standards deficiencies as shown in Exhibit 7-4. This will necessitate runway widening at three airports, six runway safety area projects, and six expanded programs to address obstructions. At non-top ten airports safety and standards projects are recommended at Darrington, Swanson, and Vashon airports. These improvements will retain system access in the northeast and southernmost areas of the region, as well as Vashon Island. Other safety and standards improvements are shown at several busier privately owned airports (Apex Airpark, FirstAir Field, Port Orchard, and Spanaway). These improvements are shown at the discretion of the airport owners. Lastly, several safety and standards projects are shown for Sea-Tac International Airport. These projects are included in the airport master plan, and are currently being implemented.

System Strategy - Maintenance and Preservation

The airport system's pavements are an expensive and irreplaceable asset. They will be preserved, maintained, and improved as needed to protect the region's airport infrastructure, to maintain the safety, capacity, and reliability of the airport system, and to reduce the long-term system-wide cost of pavement improvements. Using the results of the state's pavement maintenance/management program, the region will identify existing and future airport pavement needs and focus funding to address those needs.

The Regional Council will use its Growth Management Act authority (including its comprehensive plan review and certification process) to improve compatibility between airports and their surrounding communities. This strategy is important for the long term preservation of the region's airports.

System Strategy - System Enhancements

Currently, some 87% of the region's based aircraft fleet and 88% of the region's aircraft operations are concentrated at the top ten airports. According to the RASP forecasts, this concentration is expected to continue, with some 96% of future growth occurring at the top ten airports. The forecasts also predict strong growth in the corporate and business sector, with increasing numbers of higher performance turbine powered aircraft entering the regional fleet, again almost exclusively at top ten airports. As a result, the region will experience growing demand for higher quality facilities and services to accommodate this shifting fleet. A wide variety of system enhancements are recommended at the region's top ten airports, as displayed in Exhibit 7-4, the majority included in both this RASP and in airport master plans. Notable among these enhancements are 6 runway extensions, new or improved instrument/GPS approaches at nine of the top ten, plus numerous improvements to approach and other airport lighting systems. At non-top ten airports very few enhancements are recommended other than at Sea-Tac, where the third runway, runway lengthening, new instrument/GPS approach, approach lighting, and approach protection programs are shown both in the RASP and the Sea-Tac Airport Master Plan. At non-top ten airports, the regional airport system strategy is to preserve and maintain those facilities to provide safe access to the airport system.

System Strategy - System Capacity

Over the life span of this RASP (1998-2020), most system airports will have adequate airfield capacity to accommodate forecast activity with acceptable levels of delay. The exceptions are Boeing Field (which will reach near capacity), and Paine Field and Auburn, both of which will reach over 80% of their annual runway capacity by 2020. Marginal airfield improvements are recommended to reduce delay and maintain safety at these three airports, and landside capacity improvements are planned at other top ten airports with excess airfield capacity as an incentive to attract activity away from congested facilities.

On the landside, regional airport system strategy is to plan for capacity expansion at the region's top ten airports, where 95% of the region's future growth is expected to occur. Most of this increased landside capacity is planned as hangars (90%) in response to user preferences. In addition, the system plan strategy is to provide additional aircraft storage facilities at top ten airports to accommodate existing airport tenants seeking to upgrade from tie-downs to hangars. The figures in Exhibit 7-4 (Regional Airport System Improvements) are based on accommodating all forecast new tenants plus 50% of existing tenant waiting list.

System Strategy - Airport Roles

Historical trends and aviation forecast for the region confirm the dynamic nature of aviation, and the changing roles of airports within the regional airport system. In addition to responding to the needs expressed in sections immediately above, the regional airport system improvement program will be designed to support the designated roles of system airports. The following expresses the overall roles for airports in the RASP.

Sea-Tac International Airport will continue to fulfill its role as the region's ***Primary Commercial Air Carrier Airport***. The RASP supports improvements at Sea-Tac as identified in the 1994 Airport Master Plan and related environmental documents. The Regional Council will continue to coordinate with the Port, the FAA, the WSDOT Aviation Division, and other agencies to address the impacts of Sea-Tac Airport on neighboring communities.

Air Cargo activity will continue to be accommodated at Sea-Tac International Airport and King County International Airport/Boeing Field for the next 10-15 years. Air cargo forecasts have been prepared for each airport, and improvements are planned to accommodate all or much of that demand through 2009 at Sea-Tac and 2015 at Boeing Field. In the longer term, additional air cargo activity, and the necessary airport and ground access support facilities to accommodate that activity, will require additional planning at the airport and regional levels to determine appropriate roles for the region's airports.

Reliever Airports will provide alternative landing fields, aircraft basing, and support facilities to relieve Sea-Tac of pressure from general aviation users. Auburn, Boeing Field, Harvey Field, Paine Field, and Renton will continue to fulfill this role. Paine Field and Harvey Field will be expanded to accommodate continued growth in the north part of the region. Bremerton National and Tacoma Narrows will become designated reliever airports, and will be enhanced to accommodate growth in the south portion of the region.

Top Ten Airports accommodate nearly 90% of the region total based aircraft fleet and aircraft operations, serve nearly all regional activity by turbo jets and rotorcraft, and accommodate all the region's glider, experimental, and ultra-light industry (Arlington). As such, the region's top ten airports must accommodate a growing amount of traffic and an increasingly rigorous set of user needs. The region's top ten airports will be preserved, maintained, and enhanced to meet the multiple needs of the region, including the growing corporate sector, business aviation, and traditional general aviation users.

Non-Top Ten Airports make up 2/3 of the system's landing fields, and provide an important transportation resource for communities throughout the region. Regional airport system strategy is to maintain and preserve these community airports through selective funding of improvement projects, support for obstruction programs, and on-going airport compatible land use programs.

The ***State-Owned Emergency Airports*** (Bandera, Lester, Ranger Creek, and Skykomish) will receive limited funding as needed to maintain their roles as emergency airfields.

Private Airports Open to Public Use will continue to be an important component of the regional airport system. The region's privately owned public use airports will continue to focus primarily on private pilot user groups, training programs, and discretionary/recreational flyers. These airports will continue to fund most of their improvement needs, but the Regional Council will explore the potential for providing public funds for critical projects at major privately owned public use airports (such as Crest Airpark and Harvey Field). The Regional Council will also support preservation and maintenance of the region's private airports through its ongoing airport compatible land use program (see Chapter 8 below).

Seaplane bases are a unique resource and an important component of the regional airport system. The region will support the preservation and enhancement of privately owned seaplane bases through identification of facility needs and through the Regional Council's role in supporting compatible land use. At Will Rogers/Wiley Post Memorial Airport, the region will support the City of Renton's plans for seaplane base improvements as identified in the Renton Municipal Airport Master Plan.

The region's ***heliport system*** has not been addressed in this update of the RASP. The region generally supports the recommendations contained in the *Puget Sound Heliport System Plan* published by the Washington State DOT Aviation Division in 1995. The Regional Council will support the WSDOT Aviation Division in efforts to implement that plan, and would support additional planning studies as required to further clarify the region's heliport system needs.

Regional Airport System Improvements

Exhibit 7-4 (contained on three successive sheets) displays recommended regional airport system improvements grouped by priority for each of the system's public use airports (excluding McChord AFB and Gray Army Airfield). These system improvements are categorized by priority groups: (1) safety and standards; (2) maintenance and preservation; (3) system enhancements; and (4) system capacity.

The first sheet of Exhibit 7-4 displays recommended airport system improvements at the top ten airports. The second and third pages show improvements recommended at the other system airports, which are listed in alphabetical order. The system improvement recommendations are shown for each airport as "X" if the improvement or program is recommended only in the RASP and as "MP" if it is recommended in both the RASP and the airport master plan. Many of the smaller general aviation airports in the system do not have current master plans. In these cases the RASP-proposed improvements were discussed with airport management before the recommendation was included in the RASP. Under system enhancements, listed improvements show the runways or runway ends where the improvement is proposed. Many of these were derived from the airport master plans and reconfirmed in the RASP planning process. For many private airports, improvements listed in Exhibit 7-4 are noted with a "P". In these cases, airport improvements are recommended in the RASP, but are within the sole discretion and control of the private operator. Therefore, implementation of these improvements is uncertain, and the recommendations are meant as a way to communicate regional system priorities and needs to private airport owners and operators. In many of these cases, the improvements are shown in the RASP because these airports have not completed a master plan process in recent years, if at all, and the airport improvement information may be beneficial to airport sponsors.

Exhibit 7-4 Regional Airport System Improvements (part 1)

	Top Ten System Airports									
	Existing Reliever Airports					*Other Top Ten Airports*				
System Improvement Priorities *	Auburn	Boeing Field	Harvey Field	Paine Field	Renton	Arlington	Bremerton	Crest Airpark	Pierce Co. Thun Field	Tacoma Narrows
1. Safety and Standards										
Runway Widening			MP					MP	MP	
RSA Width										MP
RSA Length Beyond		MP		MP	MP			P		MP
Obstruction Program	X	X	P	MP			MP	MP		
2. Maintenance and Preservation										
Pavement Improvements	X		P	X		MP (Apron)	MP		MP	MP
Compatible Land Use Program	X	MP	P	X	X	MP	X	P	X	MP
**3. System Enhancements ** **										
Runway Extension	X	MP	P			MP	MP			MP
New Instrument/GPS Approach	X	X	P	16L, 34L / MP	15 / MP	34 / MP	19 / MP	P	34 / MP	
New Approach Lighting / Navaids	X		P		X	MP		P	X	
New VASI/PAPI		13L-31R / MP	MP					MP		
Install REIL		13L-31R / MP	P	X		34 / MP	X	P	MP	MP
New Airport Beacon			P							
Approach Protection	X					34 / MP		MP		
Runway Edge Lighting			MP					P		
4. System Capacity										
New Aircraft Storage Facilities (RASP) ***	108	109	209	204	66	191	73	101	71	64
New Aircraft Storage Facilities (MP) ***	119	72	144	100	93	Unspecified	70	50	48	49
Additional Air Cargo Facilities		MP								

* Airport improvements shown with "X" are recommended in the RASP; those shown with "MP" are recommended in the RASP and airport master plans; those shown with "P" are recommended at private airports.

** Numbers indicate runway ends where enhancements are planned.

*** Numbers recommended in the RASP are shown in the row marked "RASP." Numbers recommended in the airport master plan are shown in the row marked "MP."

Exhibit 7-4 Regional Airport System Improvements (part 2)

System Investment Priorities *	American Lake	Apex Airpark	Bandera	Darrington	FirstAir Field	Kenmore Air	Lake Union	Lester	Martha Lake
									Marthe Lake Airport to be Closed
1. Safety and Standards									
Runway Widening		P		X	P				
RSA Width		P		X	P				
RSA Length Beyond		P		X	P				
Obstruction Program		P	X	X	P			X	
2. Maintenance and Preservation									
Pavement Improvements					P				
Compatible Land Use Program					P				
**3. System Enhancements ** **									
Runway Extension					P				
New Instrument/GPS Approach									
New Approach Lighting									
New VASI/PAPI									
Install REIL									
New Airport Beacon									
Approach Protection									
4. System Capacity									
New Aircraft Storage Facilities ***	4	0	0	1	25	13	0	0	

* Airport improvements shown with "X" are recommended in the RASP; those shown with "MP" are recommended in the RASP and airport master plans; those shown with "P" are recommended at private airports.

** Numbers indicate runway ends where enhancements are planned.

*** Numbers indicate new based aircraft storage spaces (90% are in hangars).

Exhibit 7-4 Regional Airport System Improvements (part 3)

System Investment Priorities *	Port Orchard	Ranger Creek	Sea-Tac Int'l	Sky Harbor	Skykomish	Spanaway	Swanson	Vashon	Will Rogers
1. Safety and Standards									
Runway Widening	P					P	X	X	
RSA Width			MP				X	X	
RSA Length Beyond			MP			P	X	X	
Obstruction Program	P		MP	P		P	X	X	
2. Maintenance and Preservation									
Pavement Improvements	P		MP			P			
Compatible Land Use Program			MP						
3. System Enhancements **									
New Runway			MP						
Runway Extension			MP	P				X	
New Instrument/GPS Approach			16L / MP						
New Approach Lighting			MP						
New VASI/PAPI									
Install REIL									
New Airport Beacon									
Approach Protection			MP						
Terminal Facilities			MP						MP
4. System Capacity									
New Aircraft Storage Facilities ***	6	0	0	3	0	15	5	5	7
Additional Air Cargo Facilities			MP						

* Airport improvements shown with "X" are recommended in the RASP; those shown with "MP" are recommended in the RASP and airport master plans; those shown with "P" are recommended at private airports.

** Numbers indicate runway ends where enhancements are planned.

*** Numbers indicate new based aircraft storage spaces (90% are in hangars).

Puget Sound Regional Council
PSRC

MEMORANDUM

September 21, 2000

To: Regional Airport System Plan Advisory Committee

From: Stephen Kiehl

Subject: Meeting Materials for September 28 Meeting

Enclosed are meeting materials for the upcoming RASP Advisory Committee meeting on Thursday, September 28, 2000. Included are draft chapters 8, 9, 10, and 11, a draft bibliography, and draft meeting minutes from our last meeting on June 7, 2000. Please note that the compatibility assessment information in Exhibit 8-2 in Chapter 8 is currently blank, since it is under development and needs to be reviewed by airport sponsors before we can complete this exhibit.

We believe we'll need to hold one more meeting to complete loose ends for the RASP, so we have set a tentative date of December 14, 2000, for our next meeting. We'd also like to discuss the committee's potential future role in providing continuing input to the Regional Council as we move into our 2001-2002 work program. Please bring your ideas in this regard.

We look forward to seeing you on the 28th.

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Puget Sound Regional Council

PSRC

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Thursday, September 28, 2000
1:00 - 4:00 p.m.

Puget Sound Regional Council
1011 Western Avenue
Seattle, Washington
5th Floor Board Room

1:00 p.m. 1. **Call to Order and Introductions** - *King Cushman and Dave Waggoner*
- Comments on Meeting Summary for Meeting Held June 7, 2000*

1:10 p.m. 2. **Review and Discuss Chapter 8 - Land Use Compatibility** * - *Steve Kiehl/ Committee*

2:00 p.m. 3. **Review and Discuss Chapter 9 - Implementation Plan** * - *Steve Kiehl/Committee*

2:50 p.m. 4. **Review and Discuss Chapter 10 - Airport Access** * - *Steve Kiehl/Committee*

3:30 p.m. 5. **Report on the WSDOT Pavement Management Program** - *Theresa Smith*

3:50 p.m. 6. **Next Meeting:** Thursday, December 14, 2000, 1:00-4:00 p.m.
- Regional Airport System Pavement Management Program
- Regional Airport System Funding
- Project Wrap-up and Future Committee Roles
- 2001-2002 Regional Council Aviation Program

4:00 p.m. 7. **Adjourn**

* Supporting material enclosed

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling Grace Foster at (206) 464-7090. TDD/TTY: (206) 464-5409

X:\TRANS\COMM\RASP\2000\September 28 agenda.wpd

Puget Sound Regional Council
PSRC

DRAFT

RASP TECHNICAL ADVISORY COMMITTEE

Meeting Summary

June 7, 2000
1:00-4:00 p.m.
Puget Sound Regional Council - 5th Floor Boardroom

Members and Alternates in Attendance

Dave Waggoner, Snohomish County/Paine Field, Co-Chair
King Cushman, Puget Sound Regional Council, Co-Chair
Stan Allison, WSDOT-Aviation Division
John Anderson, Auburn Airport
Rikki Birge, Crest Airpark
Fred Salisbury, Port of Bremerton
Jess Browning, University of Washington-GTTL Studies
Jim Combs, Washington Pilots Association
Ray Costello, Aircraft Owners and Pilots Association
Nancy Jensen, NW Section, Ninety Nines
Stephen Kiehl, Puget Sound Regional Council
Theresa Smith, WSDOT - Aviation Division
Mary Vargas, FAA Seattle Airports District Office

Others in Attendance

Pete Beaulieu, Puget Sound Regional Council
Bill Brubaker, WSDOT - Aviation Division
Cheryl Saltys, Puget Sound Regional Council
Michelle Whitfield, WSDOT-Aviation Division

MEETING SUMMARY

Call to Order and Introductions

King Cushman, PSRC Director of Transportation and Growth Planning, opened the meeting, followed by self introductions by Committee members.

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Comments on Meeting Summary for Meeting Held January 27, 2000

There were no comments on the meeting summary from January 27, 2000.

Review of RASP Chapter 7: Aviation System Strategy

Steve Kiehl led a discussion of three major areas: system needs and strategic options, system improvement priorities, and the draft airport system improvement program. The discussion began with system needs, as outlined in Chapter 6. Those needs were divided into 8 groups: reliever airports, airfield capacity, aircraft parking capacity, pavements, safety and standards, system enhancements, support facilities, and critical privately owned airports. While most of these areas were fairly well defined by the RASP and airport master plan processes, airport pavement needs (and options for addressing them) will not be identified until the state's pavement analysis is complete (which should be in late summer).

Ray Costello stated the plan should stress the need to preserve the existing airport system infrastructure, and to save privately owned airports. The group agreed that maintenance and preservation of the system is a high priority.

The group discussed the issue of system capacity in light of the Chapter 6 analysis, and agreed the plan should be consistent and clear when discussing "capacity" improvements. The system has sufficient airfield capacity to meet forecast demand through 2020, but additional landside capacity in the form of new aircraft hangars is needed. Steve agreed to scan the report and be sure it is both clear and consistent in this regard.

The group discussed improvement priorities, including the comparison of proposed regional system priorities with those of the Federal Aviation Administration (FAA) and the Washington State Departmetn of Transportation (WSDOT) Aviation Policy statements. Mary Vargas commented that the purpose of the regional priorities need to be clear in light of the other two. Steve replied that this would be clarified further in the final report, and that the basic intent was for the regional plan to provide input to the State and FAA funding processes to document what the region feels is important for its system. The regional priority recommendations would not dictate or circumvent State or FAA funding priorities, but would hopefully "inform" the process.

Ray Costello commented that we should remove all references to the Microwave Landing System (MLS), since the FAA and the industry have now decided to move ahead with Global Positioning Systems (GPS). Steve agreed to clarify this issue in the plan and remove references to MLS where needed.

Jess Browning asked if "environment" (especially airport noise) should be considered as a factor in setting priorities. Steve said noise is one of the factors we've included under the heading of "system preservation."

The group then turned to the proposed airport system policy statements. Jim Combs asked that we clarify which are existing adopted PSRC policies (such as those contained in Resolution

A-96-02 regarding Sea-Tac) and which are recommended new policies. Steve agreed to make sure this is clear. Jim Combs also stated the plan should clarify that the third runway at Sea-Tac is not the region's long-term solution to meet passenger and cargo demand. King responded that existing policy (including Resolution A-96-02) did address this issue, and that the RASP would clarify this issue relative to the third runway and the need for long-range comprehensive planning for the region's air and ground transportation demand.

Related to air cargo needs, Dave Waggoner commented that some of the numbers in the RASP were not up to date related to cargo activity at Sea-Tac. He said there is a "crisis" developing related to the need for longer term cargo forecasting and resulting facility planning. Steve agreed to revisit the numbers and include the latest available data. Ray Costello mentioned the staggering growth in E-commerce and its potential affect on air cargo volumes. He said we should be planning to meet these needs now. Jim Combs agreed, and added that the need for good cargo facilities and related ground access improvements was fueled by increasing regional congestion, which is increasingly impacting cargo shippers. Theresa Smith added that due to processing delays at Sea-Tac, some international air cargo arriving at Sea-Tac is shipped "in bond" by truck to Blaine for processing, then trucked back to the region, adding traffic on I-5 and at the border crossing. The group agreed on the need for the RASP to present an accurate and current status on air cargo planning at Sea-Tac and Boeing Field.

In discussing recommended system strategies, the group agreed on the need to clarify the meaning of reliever airports: that they are general aviation airports, NOT commercial service airports.

In discussing the recommended airport system improvements, Michele Whitfield asked how we can recommend improvements at private airports without having the ability to fund them. Bill Brubaker responded by saying it is within the Regional Council's purview to include recommended projects in the RASP and then recommend funding options that a private airport sponsor might implement. Ray asked whether the WSDOT could provide matching funds at private airports; Bill said no.

In discussing runway length recommendation at small airports, Stan commented that we need to be sensitive to the wishes of the local communities, and only include these projects if the community wants them. A potential runway extension at Vashon was used as an example. In discussing these and other improvements, the group agreed the RASP should use language such as "ability and willingness to expand" when describing the plan's recommendations that some airports should provide enhancements or aircraft parking capacity expansions. Dave Waggoner suggested the following language: "the RASP should support airport master plan proposals for landside enhancements or expansion." Steve agreed to review the draft policy and strategy language and respond to this concern.

Dave Waggoner pointed out that some projects included on the recommended airport improvements chart (Exhibit 7-4) are already approved and under construction, and these should be so noted. Steve agreed to do this.

Bill Brubaker pointed out that Lester State Airport no longer exists as an airport, and should be removed from the system plan. Steve agreed to add language to the RASP reflecting this fact.

Theresa Smith asked about apparent discrepancies between the numbers of proposed new hangars at Renton, Crest, and Auburn and those proposed in the airport master plans. Steve agreed to look into this and clarify.

Theresa Smith commented about how the state airports might be shown in the RASP, given how different they are from the rest of the system airports. King Cushman suggested grouping the system into categories for clarity, such as: air carrier airport, relievers, general aviation airports, general aviation emergency airfields (the three state-owned airports), sea-plane facilities, and military airports. Steve agreed to look into this.

King Cushman reviewed the ongoing Metropolitan Transportation Plan (MTP) update process, the schedule for adoption in early 2001, and how it incorporates the regional airport system. He went over the mandates for and the purpose of the MTP and how this update will focus on implementation strategies and innovative financing. He also discussed how the transportation plan relates to the regional growth management plan (VISION 2020) and how the two are being brought together using GMA as a tool. He discussed how the RASP would be addressed in the upcoming MTP and associated Environmental Impact Statement (EIS). He suggested that based on the RASP focus on maintenance and preservation of the existing airport system, the MTP might contain just one aviation system alternative, the "Current Law Revenue" option.

Steve also mentioned that after this RASP process is complete there is a need for ongoing input from the group on future aviation issues, including the next two-year work scope which is now being developed with the FAA. He asked if the committee would think about issues the group could address and think about their willingness to continue meeting in the future. Bill Brubaker suggested this committee should be made a standing PSRC committee, similar to the Regional Airport Planning Committee ("RAPC") in the Bay Area. King Cushman replied perhaps this suggestion could be included as a recommendation as part of the RASP, and acted upon when the RASP is adopted next year. King mentioned other PSRC committees, such as the HOV advisory committee, whose role evolved over time to address issues as they emerged.

Next Meeting

King Cushman reminded the committee the next meeting of the full committee is scheduled for Thursday September 28, 2000, from 1:00 to 4:00 p.m. in the Regional Council's Boardroom.

Adjournment

The meeting adjourned at 4:00 p.m.

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Puget Sound Regional Council

Regional Airport System Plan Refinement

– Work in Progress –

September 21, 2000

Chapter 8: Land Use Compatibility
Chapter 9: Implementation Plan
Chapter 10: Airport Access Plan
Chapter 11: Agency and Public Involvement
Bibliography

For discussion by the
Regional Airport System Plan (RASP) Technical Advisory Committee
September 28, 2000

Chapter 8 - Land Use Compatibility

Land use compatibility around airports is an important issue for the preservation, maintenance, and enhancement of the regional airport system. Zoning, planning, and development decisions on properties adjacent to airports can affect an airport's ability to fulfill its role as an important regional transportation facility. Development of incompatible land uses adjacent to airports can expose neighboring development to airport noise, can create height hazards that compromise the safety of aircraft in the air, and can subject off-airport properties to potential safety risks and liability in known hazard areas. The basic goal of this chapter of the Regional Airport System Plan is to construct a baseline of information on land use compatibility around the region's airports to identify the extent of the issue. This baseline program will provide a building block for additional future work in the area of airport compatible land use. This chapter of the RASP:

* Describes the three dimensions of airport land use compatibility
* Provides sources of technical guidance in planning for airport compatible land use
* Summarizes the Regional Council's mandates for dealing with airport compatible land use
* Reviews existing and planned future land uses adjacent to the region's airports, and identifies the types of critical areas affected (height hazard, safety zones, and noise contours)
* Identifies the status of ordinances and plans dealing with airport compatible land use, height hazard, and safety concerns around system airports
* Presents analysis and findings relative to airport land use compatibility in the region

Three Dimensions of Airport Land Use Compatibility

Noise and compatible land use. Aircraft noise and its effect on surrounding land use is perhaps the most contentious issue in aviation. The political and technical dimensions of airport noise have been studied exhaustively and documented in hundreds of plans, studies, environmental reports, and government regulations. The central issues in the discussion of airport noise and land use compatibility are: (1) what level of noise constitutes "significant" impact to surrounding communities, and (2) how does this noise affect different types of land uses? Both these issues have received considerable attention, particularly from the FAA. Recognizing that high levels of airport noise are generally not compatible with residential land uses, schools, hospitals, and other noise sensitive uses, the FAA has established criteria that outline the level of noise which is considered to be compatible with various types of land uses. These criteria are displayed in Table 1 on the following page. In addition, the FAA has established guidelines and procedures to assist airport sponsors and local planning agencies conduct noise and land use compatibility planning efforts (see FAA Advisory Circular AC 150/5020-1, *Noise Control and Compatibility Planning for Airports*).

In concert with the FAA program addressing compatible land use around airports, both the State of Washington and the Puget Sound Regional Council are developing and expanding programs to address these issues at the state and regional levels. These coordinated efforts by the WSDOT Aviation Division and the Regional Council are founded in 1995 amendments to the State's Growth Management Act. Both programs build upon the foundation laid down in the FAA's airport noise compatibility program, including the FAA guidelines for defining which land uses are compatible with varying levels of airport noise. Table 1 below, which was taken from FAA's Part 150 program, outlines these land use compatibility guidelines concerning airport noise. Additional guidelines related to height hazards and safety are discussed later in this chapter.

Exhibit 8-1
Land Use Compatibility* With Yearly Day-Night Average Sound Levels (DNL)

Land use	Yearly day-night average sound level (DNL) in decibels					
	Below 65	65-70	70-75	75-80	80-85	Over 85
RESIDENTIAL						
Residential, other than mobile homes and transient lodgings,	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
PUBLIC USE						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
COMMERCIAL USE						
Offices, business, and professional	Y	Y	25	30	N	N
Wholesale and retail-building materials, hardware and farm equipment.	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
MANUFACTURING AND PRODUCTION						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction.	Y	Y	Y	Y	Y	Y
RECREATIONAL						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

This exhibit was taken from FAA Advisory Circular AC 150/5020-1 "Noise Control and Compatibility Planning for Airports."

See next page for key to abbreviations and notes for numbers in parenthesis.

* The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Key to Exhibit 8-1

SLUCM	Standard Land Use Coding Manual.
Y (Yes)	Land Use and related structures compatible without restrictions.
N (No)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35	Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes for Exhibit 8-1

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.

Planning for noise and land use compatibility around airports is primarily focused in two areas: (1) "remedial" programs (such as acquisition of noise-impacted properties and redevelopment with compatible uses, and provision of noise insulation for existing and new structures inside noise contour areas); and (2) "preventive" programs (planning and zoning programs which prevent the construction of land uses that are incompatible with airport noise). Remedial programs are primarily used by airport sponsors and the FAA to address noise problems. Local land use planning agencies, however, are in a position to effectively develop and implement "preventive" approaches to avoid future land use development that is incompatible with airport activity.

Information used to identify potential noise compatibility concerns adjacent to the region's airports included existing airport noise programs (where available), noise contour information from airport master plans, generalized existing land use, aerial photography, and planned future land use as included in currently adopted comprehensive plans.

Height hazard / obstructions to navigable airspace (safety in the air). In addition to addressing airplane noise, communities surrounding airports can establish and maintain zoning and development regulations dealing with height hazard and obstructions. By limiting the height and location of structures and other obstructions to navigation in the vicinity of airports (buildings, towers, trees, etc.), these regulations can protect the safety of aircraft during takeoff and landing in the immediate vicinity of the airport.

The Federal Aviation Administration (FAA) has developed regulations and standards for dealing with height hazard, obstructions, and objects affecting navigable airspace. Cities and counties wishing to establish programs dealing with these issues should refer to the FAA's official guidelines: Code of Federal Regulations ("CFR"), Title 14, Part 77 ("Objects Affecting Navigable Airspace") and FAA Advisory Circular AC 150/5190-4A, *A Model Zoning Ordinance to Limit Height of Objects Around Airports*. Part 77 defines a system of imaginary surfaces (three dimensional space) around airports through which no fixed object or structure (including trees) should penetrate. These imaginary surfaces are designed to protect the critical airspace around airports and allow for safe operation of aircraft.

Public agencies or private developers proposing to construct structures or locate objects that would penetrate the Part 77 imaginary surfaces must notify the FAA using FAA Form 7460-1, "Notice of Proposed Construction or Alteration." FAA review will then determine whether the object should be allowed, and if so, how it should be marked and/or lighted so it can be seen by pilots. Of course, the best approach to maintaining the safety of navigable airspace around airports is to prohibit the construction of tall structures, regulate their location in relation to the extended runway centerline, and/or strictly limit their height. With technical assistance from airport sponsors, the FAA, WSDOT Aviation Division, and the Regional Council, local governments can develop regulations that address these issues, allowing for new development and providing for aviation safety.

Ground safety and potential risk / liability (safety on the ground/accident potential). While civilian U.S. airports have devoted significant effort and resources to addressing noise issues for decades, only recently have airport sponsors and land use planners begun actively addressing the issues of safety, risk potential, and liability. The issue centers on planning for the safety of people and structures on the ground, and is of primary concern in areas beneath the approaches to runways (runway protection zones, runway safety areas, approach transition zones, accident potential zones, and areas beneath "imaginary surfaces" as defined in CFR Part 77). The U.S. Department of Defense recognizes the need to actively plan for these potential safety risk zones in its *Air Installation Compatible Use Zones* (or "AICUZ") program, which addresses noise compatibility issues and safety concerns around military airfields. The objective of the AICUZ program is to encourage compatible uses of public and private lands in the vicinity of military airfields through the local communities' comprehensive planning process.

The military's studies of historical aircraft accidents shows that most aircraft accidents happen on or near the extended runway centerline. Studies of aircraft accident patterns at U.S. civil airports (notably those done by the National Transportation Safety Board) have confirmed the military's experience, and provide the foundation for compatible land use planning in these "Accident Potential Zones" (APZs). Communities can reduce potential risk to life and property, and exposure to possible liability, by limiting the types of land uses and minimizing the number of structures and people allowed in known aircraft accident safety zones adjacent to civil airports and accident potential zones adjoining military airfields.

The first step in compatibility planning to address noise, height hazard, and safety, risk, and liability issues near both military and civil airports is to document existing structures and land uses in the vicinity. Using existing information available from airport master plans, community comprehensive plans and land use maps, aerial photography, and site visits, generalized information on existing land uses and

structures in airport noise contours, height hazard areas, and potential aircraft accident safety zones was collected. Exhibit 8-2 displays this information for the region's airports, showing a preliminary analysis for those airports that may have potential incompatible land uses such as residential units inside noise contours; buildings, towers, utilities, poles, and trees affecting airport height hazard zones, and residential and other potential incompatible land uses inside potential aircraft accident safety zones [Several columns in Exhibit 8-2 are currently blank, and will be completed after the information is reviewed by airport sponsors.]

Technical Guidance in Planning for Airport Compatible Land Use

Federal guidance regarding airport land use compatibility is contained primarily in technical materials published by the FAA. The FAA's Advisory Circular AC 150/5020-1, *Noise Control and Compatibility Planning for Airports* provides technical information regarding airport noise and compatible land use, and outlines the Federally prescribed "Part 150" airport noise compatibility planning process.

The WSDOT Aviation Division published the first in a series of technical guidelines on airport compatible land use in February 1999 with its technical handbook titled *Airports and Compatible Land Use - Volume I.* Volume I provides an introduction and overview for decision makers in addressing airport compatible land use issues at the local government level. Future volumes are planned to provide additional technical assistance for local agencies, including comprehensive plan and zoning language, model ordinances, overlay zones, and other compatible land use planning tools.

The *Airport Land Use Planning Handbook*, prepared in December 1993 by California Department of Transportation (CalTrans) Division of Aeronautics, also contains useful information for agencies interested in developing regulations or taking land use actions to reduce risk and potential liability associated with incompatible land uses adjoining airports. In addition, the Denver Regional Council of Governments has produced a summary document ("Airport Compatible Land Use Design Handbook", May 15, 1998) which contains an excellent discussion of these issues and how local governments can address them.

The Washington, California, and Colorado airport compatible land use guidelines each recognize the three primary dimensions of compatible land use: height hazard, safety, and noise. These guidelines are all built upon the foundation laid by the FAA's Part 150 process. The Washington State DOT Aviation Division and CalTrans Aeronautics airport compatible land use guidelines both identify aircraft accident safety zones derived from general aviation aircraft accident statistics collected by the National Transportation Safety Board (NTSB). These zones, displayed in Exhibit 8-3, show the areas of relative risk associated with possible aircraft accidents around typical general aviation airports. The aircraft accident safety zones information, supported by the underlying NTSB research, provide the basic foundation for airport compatible land use planning. The WSDOT and CalTrans land use guidelines provide recommendations for population density, residential and non-residential land use, and special function land use, and provide a list of land use planning strategies to guide local land use planners.

The PSRC airport compatible land use program is based upon these guidance materials published by the FAA and the WSDOT Aviation Division, and also draws upon the information contained in the CalTrans program. The Regional Council's program is primarily implemented through its ongoing planning for the regional airport system and in its Policy and Plan Review responsibilities under the State's Growth Management Act (see "Mandates" below).

Mandates Supporting the Regional Council's Involvement in Airport Compatible Land Use

Several Regional, State, and Federal laws provide support for the Regional Council's interest and involvement in the issue of airport compatible land use. The most relevant of these are the state's Growth Management Act (Chapter 36.70A RCW) and Planning Enabling Act (Chapter 36.70 RCW), state law governing Regional Transportation Planning Organizations (RCW 47.80), Regional Council policies and procedures implementing these laws, and FAR Part 150 of the Federal Aviation Regulations (FAR Part 150) governing Noise Control and Compatibility Planning for Airports. These are each described briefly below.

Substitute Senate Bill SSB-6422 (adopted June 6, 1996) amended the State's Growth Management Act (GMA) to protect public use general aviation airports from encroachment of incompatible land uses. The new law requires cities and counties planning under GMA, through their local comprehensive plans and development regulations, to "discourage" the siting of incompatible land uses adjacent to such airports. Formal consultation with the aviation community is required, and all plans and regulations must be filed with the WSDOT Aviation Division. The Regional Council is working with the WSDOT Aviation Division and other state agencies in developing guidelines for implementing the law. Using their respective authority under SSB-6422, relevant sections of the Planning Enabling Act (Chapter 36.70 RCW), the Growth Management Act (Chapter 36.70A RCW), and RTPO legislation (see below), the State and the Regional Council are developing new and expanded requirements for review and certification of local comprehensive plans. In late 1998 the Regional Council began implementing its mandated GMA provisions by incorporating the review of **compatible land use** around airports into its comprehensive plan review and certification criteria. In 1999, the Regional Council began using these criteria in its review and certification of all local comprehensive plans.

Chapter 47.80 RCW (Regional Transportation Planning Organizations) instructs regional transportation planning organizations ("RTPOs") to prepare Regional Transportation Plans ("RTPs") and authorizes RTPOs to review and certify that the transportation elements of comprehensive plans adopted by counties, cities, and towns within the region reflect state guidelines and are consistent with the Regional Transportation Plan ("RTP"). In addition, all local comprehensive plans are expected to be consistent with the aviation component of the RTP. The Regional Council has produced guidance materials for local agencies concerning how aviation facilities should be addressed in local comprehensive plans.

Chapter 14.12 RCW ("Airport Zoning"). Chapter 14.12 of the RCW provides cities and counties with the authority to establish airport zoning. The act declares airport hazards to be a nuisance, states the public interest in preventing airport hazards, and provides the authority of police power to implement the provisions. The act finds that airport hazards endanger the lives and property of users of the airport and of occupants of land in its vicinity, and also finds that the existence of hazards impairs the utility of the airport and the public investment therein. The act states "....It is further declared that both the prevention of the creation or establishment or airport hazards and the elimination, removal, alteration, mitigation, or marking and lighting of existing airport hazards are public purposes for which political subdivisions may raise and expend public funds and acquire land or property interests therein." Among other things, these provisions of RCW 14.12 establish the authority to limit the height of buildings, towers, smoke stacks, and transmission lines, as well as the authority to implement height (avigation) easements around the state's airports.

Federal Aviation Regulation (FAR) Part 150 (Noise Control and Compatibility Planning for Airports). This FAA program provides airport sponsors and local communities with technical guidance and outlines the planning process used to document existing airport noise, predict future noise exposure, help reduce

airport noise at the source, and reduce impacts in communities exposed to aircraft noise. The program also provides guidelines for determining what types of land uses are compatible with various levels of noise exposure. Following successful completion of the specified process, the Part 150 program provides access to FAA noise funds, which can be used to install noise insulation, purchase property, and implement other eligible programs designed to reduce airport noise impacts. For more information see FAA Advisory Circular AC 150/5020-1, *Noise Control and Compatibility Planning for Airports.*

Existing and Planned Land Use Adjacent to System Airports

Data was collected from a variety of sources to document both existing and planned future land uses around system airports. Data sources included county current use taxation files and aerial photography to document generalized current land use, and city and county comprehensive plans and airport master plans to assess future planned land use. In addition, inventory data collected by the WSDOT Aviation Division in 1998 for the Washington State Aviation System Plan update was used. The State's airport inventory included a discussion of existing land uses and structures in the vicinity of airports, and a listing of compatible land use planning programs adjoining the state's airports. The Regional Council's geographic information system (GIS) was employed to document, display, and analyze the land use data. Land uses were assessed according to FAA land use compatibility criteria. The uses of most critical concern include residential units, schools, churches, hospitals, libraries, and public sites which congregate people, either indoors or outdoors (such as theaters and amphitheaters, playgrounds, zoos, and amusement parks). These uses and their relative compatibility with airport noise are displayed above in Exhibit 8-1.

Exhibit 8-2 displays a preliminary summary of land use compatibility conditions for the 29 airports in the system. Because the aircraft safety zones are related to runway length, the exhibit shows the length of each runway in the airport system. The exhibit identifies which airports are located within the urban growth boundary. In addition, the exhibit shows the types of land uses which currently exist around the region's airports, and identifies the type of compatibility issue (height hazard, safety, or noise) that may be affected. The exhibit also displays which airports have known compatible land use plans and height hazard ordinances in place in neighboring communities. The exhibit also shows future planned land uses as identified in currently adopted comprehensive land use plans, including the range of densities allowed for future residential uses. Lastly, the exhibit shows for each airport whether future land use plans would allow additional development of incompatible land uses in future noise contours, height hazard, or safety zones.

For airports where noise contour information is available, existing and planned future land use inside the existing and projected future 65 DNL noise contours was used. For airports without documented noise contour information, the size and shape of aircraft noise impact areas was estimated based on the amount and type of aircraft traffic. In many cases at the smaller airports, the noise contours remain within airport boundaries, and noise is not a significant compatibility issue. In several cases at small privately owned airports, residential units immediately adjoin the airport. While these residences may be exposed to airport noise in the 60-70 DNL level, many are owned by pilots and airport users, and are considered to be compatible.

The potential for incompatible land uses in airport safety zones was generally determined using existing and future planned land use information prepared by the Regional Council, safety zone information developed by the WSDOT Aviation Division using National Transportation Safety Board (NTSB) data, as well as information developed by the California Department of Transportation (CalTrans) Aeronautics Program. Using this information, the size and shape of airport safety zones is determined by the airports' runway length, with safety zone dimensions grouped into three classes: runways less than 4,000 feet; those between 4,000 and 5,999 feet; and those longer than 5,000 feet. The geometric shapes and

dimensions of the six aircraft safety zones for each runway length are displayed in Exhibit 8-3. The total area contained within the combined six aircraft safety zones equals 935 acres for runways less than 4,000 feet long, 1,700 acres for runways between 4,000 and 5,999 feet long, and 2,183 acres for runways of 6,000 feet and longer. The location, shape, and dimensions of several zones correspond closely with FAA airport design criteria contained in Advisory Circular AC 150/5300-13 "Airport Design." Safety zone 1 is similar to the Runway Protection Zone (RPZ); safety zone 2 corresponds to the inner approach object free zone ("OFZ"); and safety zone 5 is similar to the runway safety area ("RSA").

While the six safety zones displayed in Exhibit 8-3 have unique characteristics relative to aircraft accident potential, and therefore have varying compatible land use and density standards, this analysis of land use adjoining the 29 system airports did not allow for that level of detail. Instead, this analysis reviewed existing and future planned land uses inside the entire area represented by the sum of all six safety zones. Future more detailed analysis will evaluate the smaller zones for each airport, evaluate their relative safety potential, and develop land use guidelines for use by local planners. For the current system plan analysis, existing adopted comprehensive land use plans were evaluated to identify potential future land uses that might be incompatible anywhere within the six safety zones for each airport and each runway. Because of the number of airports and runways, this analysis is somewhat generalized. The intent is to identify major region-wide issues related to airport compatible land use so future actions to address them can be taken.

Land Use Compatibility Analysis and Preliminary Findings

The regional airport system is large, busy, and complex. It serves a great variety of users who place high and growing levels of demand on the system. In order to meet these needs, most of the region's airports are located within easy access of its major users. They are close to the regional highway system, and are largely located within the urban growth area ("UGA"). Many of the region's airports are also located conveniently to serve the region's population and employment base. Those that are not are strategically located to serve emergency response and natural resource needs.

Unfortunately, all these characteristics of the airport system also mean that compatible land use is a major issue facing the regional airport system. Of the 29 airports in the system, 21 are located within the UGA. Land use and development within the urban growth area is increasing the pressure for encroachment around airports. Residential, commercial, and industrial development is creeping ever closer to airports that are at the same time getting busier, and needing more space to meet airport needs. Of the 8 airports outside the UGA, six serve emergency response or rural aviation needs. The other two, Tacoma Narrows and Crest Airpark, are busy airports meeting important regional needs, and are currently located outside the UGA. Lack of urban services is an issue at Tacoma Narrows, while Crest Airpark is located in a rapidly growing region of southeast King County.

The fact that most of the region's airports are within the urban growth area creates two inherent conflicts. On the one hand, location inside the UGA offers benefits: airports have access to urban utility and transportation services; growth planning in the urban area offers potential avenues to address compatible land use issues; and economic development supports airports financially. On the other hand, the rapid growth and expanding urban development that is encouraged inside the UGA gives rise to many of the land use encroachment problems that now face many of the region's airports. The growth management act encourages regions to contain development within the urban growth area boundary, which stimulates increased densities and urban infill development. The indirect result can be more people are exposed to aircraft noise, and more people and structures are potentially affected by the issues of height hazard and aircraft safety. Evaluating the extent of these issues begins with an inventory of existing and planned future land uses surrounding the region's airports.

Exhibit 8-2 Preliminary Analysis of Airport Compatible Land Use - - Part 1 - - (for review by system airports)
[blank columns in the table are under additional analysis]

						Critical Areas Affected by		
			Airport Inside		Existing	Existing Adjacent Land Use **		
	Runway	Runway	Urban Growth	Existing Adjacent	Incompatible	Height	Safety	Noise
Airport	Number	Length (ft.)	Boundary	Land Use	Land Use? *	Hazard	Zones	Contour
American Lake	02-20	5,500	*	Residential				
Apex Airpark	17-35	2,500		Residential, industrial		*	*	
Arlington Municipal	11-29	3,500	*	Commercial, industrial, residential				
	16-34	5,333	*	Commercial, industrial, residential				
Auburn Municipal	16-34	3,400	*	Commercial, industrial			*	
Bandera State	08-26	2,342		Forest		*		
Boeing Field	13L-31R	3,710	*	Commercial, industrial				
	13R-31L	10,001	*	Residential, commercial, industrial		*	*	*
Bremerton National	01-19	6,200	*	Commercial, industrial, residential				
Crest Airpark	15-33	3,267		Residential		*	*	
Darrington Municipal	10-28	2,490	*	Cemetery, bus barn, residential		*	*	
FirstAir Field	07-25	2,095	*	Fairgrounds, residential, commercial		*	*	
Gray Army Airfield	15-33	6,125	*	Residential (on base), commercial (on base)				
Harvey Field	14-32	2,660	*	Rural		*	*	
Kenmore Air Harbor	16-34	10,000	*	Industrial, commercial, residential				
	18-36	3,000	*	Industrial, commercial, residential				
Lake Union Chrysler Air	18-36	9,500	*	Industrial, commercial				
McChord AFB	16-34	10,100	*	Residential, commercial		*	*	*
Pierce County / Thun Field	16-34	3,650	*	Residential, commercial, landfill (south)		*		
Port Orchard	18-36	2,460		Light industrial				
Ranger Creek State	17-35	2,700		Forest		*		
Renton Municipal	15-33	5,379	*	Commercial, industrial, residential, high school			*	
Sea-Tac Int'l	16L-34R	11,900	*	Residential, schools, churches				*
	16R-34L	9,425	*	Residential, schools, churches				*
Sky Harbor	07-25	1,930	*	Forest, residential		*		
Skykomish State	06-24	2,050		Forest		*		
Snohomish County / Paine Field	11-29	4,514	*	Commercial				
	16L-34R	3,000	*	Industrial, residential				
	16R-34L	9,010	*	Residential, industrial, commercial, SR525/526		*	*	*
Spanaway	16-34	2,724	*	Residential, commercial, industrial		*	*	
Swanson	16-34	3,000	*	Residential, forest		*	*	
Tacoma Narrows	17-35	5,002		Residential				
Vashon Island	17-35	1,940		Residential		*	*	
Will Rogers/Wiley Post	12-30	5,000	*	Commercial, residential				

* At some privately owned airports adjacent residential development (typically aircraft owners living next to the airport) is considered to be compatible with airport noise. Residential use on military bases is considered c
Existing land uses are not considered incompatible unless they are noise sensitive and occur within noise contours; pose a potential height hazard; or are located in airport safety zones.

** Height hazard includes known natural and man-made obstructions (see Exhibit 6-5). Safety includes uses and/or structures in airport safety zones (runway safety area, RPZ, ATZ, etc.). Noise includes uses inside noise

Exhibit 8-2 Preliminary Analysis of Airport Compatible Land Use - - Part 2 - - (for review by system airports)
[blank columns in the table are under additional analysis]

Airport	Runway Number	Compatible Use Plan or Zoning?	Height Restriction Ordinance?	Future Planned Land Uses Adjacent to Airport	Planned Residential Density (Units/ac)	Potential Future Incompatible Land Use allowed inside future noise contour? ***	Potential Future Incompatible Land Use allowed in height hazard & safety zones? ****	Size of aircraft accident zones 1-6
American Lake	02-20			Residential	2 - 6			1,700
Apex Airpark	17-35			Residential, airport	0 - .2			935
Arlington Municipal	11-29	Yes	Yes	Industrial, commercial, agriculture, residential	.1 - 24			935
	16-34	Yes	Yes	Industrial, commercial, agriculture, residential	.1 - 24			1,700
Auburn Municipal	16-34		Yes (per ALP)	Commercial, industrial, parks/open space	0			935
Bandera State	08-26			Forest	0			935
Boeing Field	13L-31R	On-going		Commercial, industrial	N/A			935
	13R-31L	On-going		Commercial, industrial, mixed use, residential	4 - 20			2,183
Bremerton National	01-19	Yes	Yes	Commercial, industrial, residential, parks & open space, airport	0 - .2			2,183
Crest Airpark	15-33		No	Residential	.1 - 12			935
Darrington Municipal	10-28			Light industrial, parks/open space, forest service, residential	1 - 1.35			935
FirstAir Field	07-25			Fairgrounds, residential, commercial, industrial, open space	3 - 7			935
Gray Army Airfield	15-33			Government (military base)	NA			2,183
Harvey Field	14-32			Commercial, industrial, agriculture, parks/open space	.4 - 6			935
Kenmore Air Harbor	16-34			Residential, mixed use	4 - 24			2,183
	18-36			Residential, mixed use	4 - 24			935
Lake Union Chrysler Air	18-36			Industrial, commercial, mixed use, parks/open space	4 - 30			2,183
McChord AFB	16-34	Yes		Residential, commercial, industrial, government (military base)	2 - 30			2,183
Pierce County / Thun Field	16-34		No	Industrial, mixed use, residential	2 - 25			935
Port Orchard	18-36	Yes		Light industrial, residential	0 - .2			935
Ranger Creek State	17-35			Forest	0			935
Renton Municipal	15-33			Center/downtown, industrial, residential, mixed use	8 - 25			1,700
Sea-Tac Int'l	16L-34R	Yes	Yes	Res'l, schools, churches, parks, ind'l, comm'l	3 - 87			2,183
	16R-34L	Yes	Yes	Res'l, schools, churches, parks, ind'l, comm'l	3 - 87			2,183
Sky Harbor	07-25			Residential, office/industrial, agriculture	1 - 12			935
Skykomish State	06-24			Forest	0			935
Snohomish Co. / Paine Field	11-29			Industrial	3 - 29			1,700
	16L-34R			Industrial, residential	3 - 29			935
	16R-34L			Residential, industrial, commercial, mixed use	3 - 29			2,183
Spanaway	16-34			Residential, commercial, mixed use, military	2 - 25			935
Swanson	16-34	Yes	Yes	Airport, forest, commercial, residential	.1 - 12			935
Tacoma Narrows	17-35	Yes *****		Residential, rural airport/essential public facility	0 - 4			1,700
Vashon Island	17-35		No	Residential, agriculture	.1 - 12			935
Will Rogers/Wiley Post	12-30			Industrial, residential	8 - 20			1,700

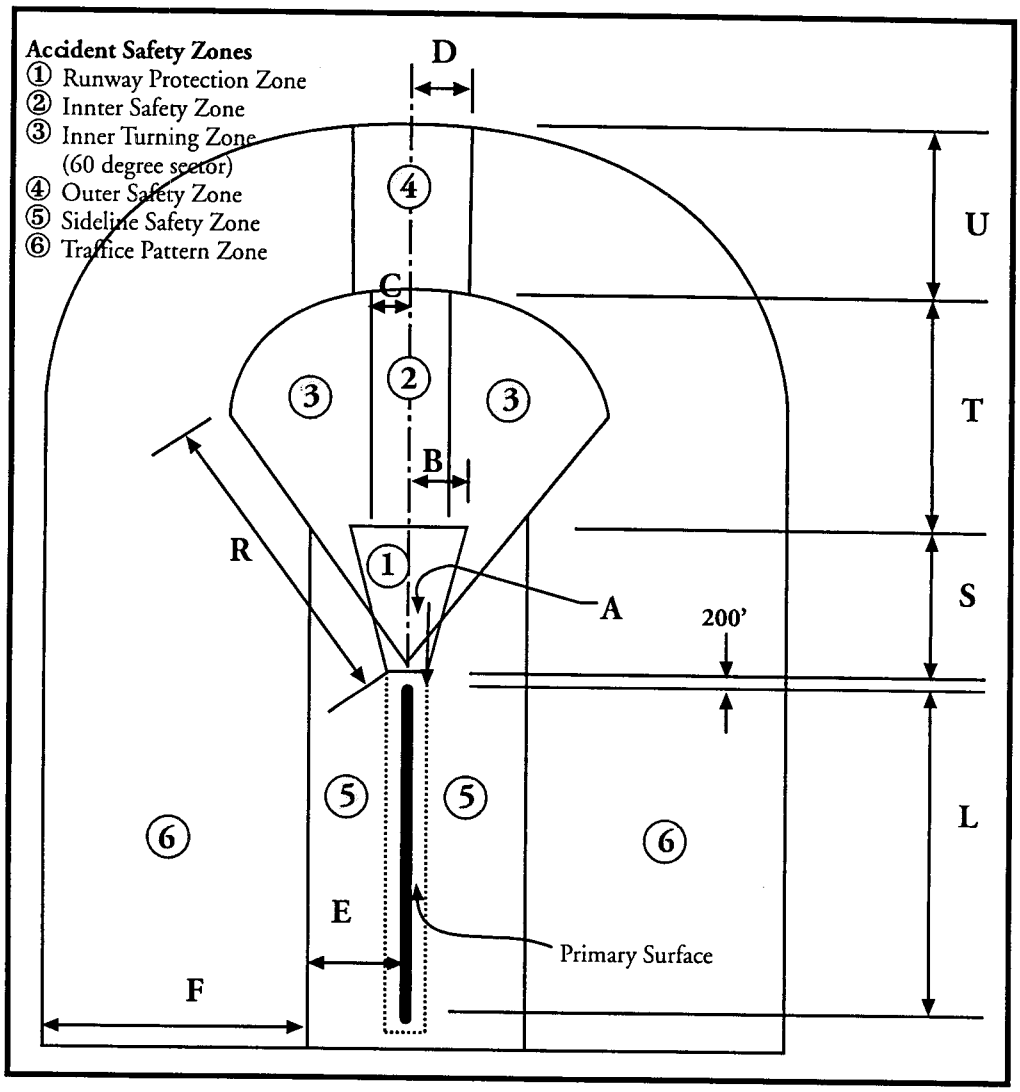
*** Future planned land uses are not considered incompatible unless they are noise sensitive and occur within 65 DNL noise contours; pose a potential height hazard; or are located in airport safety zones.

**** Height hazard zones are from FAR Part 77. Safety zones include runway safety area, RPZ, ATZ, and "Aircraft Accident Safety Zones 1-6" from WSDOT *Airports and Compatible Land Use* Handbook.

***** Plan designation is "Rural airport - essential public facility overlay."

Exhibit 8-3

AIRCRAFT ACCIDENT SAFETY ZONE DIAGRAM



Note:
Data Source: NTSB accident investigations 1984-1991. Illustration Source: Hodges and Shutt, Institute of Transportation Studies, University of California, Berkley, 1993.

Dimension	Runway Length Category (L)		
	Runway less than 4,000	Runway 4,000 to 5,999	Runway 6,000 or more
A	125	250	500
B	225	505	875
C	225	500	500
D	225	500	500
E	500	1,000	1,000
F	4,000	5,000	5,000
R (60°Sector)	2,500	4,500	5,000
S	1,000	1,700	2,500
T	1,500	2,800	2,500
U	2,500	3,000	5,000

RUNWAY LENGTH	Zone	Zone Size (acres)	ARRIVALS % Accidents (per Zone)	ARRIVALS % Accidents (per Zone/Acre)	DEPARTURES %Accidents (per Zone)	DEPARTURES % Accidents (per Zone/Acre)	TOTAL ACCIDENTS % Accidents (per Zone)	TOTAL ACCIDENTS % Accidents (per Zone/Acre)
Less Than 4,000'	1	8	31	3.88	20	2.46	24.00	3.01
	2	16	10	0.63	9	0.61	10.00	.62
	3	113	8	0.07	16	0.14	13.00	0.11
	4	26	3	0.13	1	0.04	2.00	0.07
	5	72	18	0.25	34	0.48	28.00	0.40
	6	700	8	0.01	13	0.02	11.00	0.16
Sub Totals		**935**	**78**	**4.97**	**93**	**3.75**	**88.00**	**4.37**
4,000-5,999'								
	1	30	23	0.77	17	0.57	20.00	0.67
	2	64	8	0.13	3	0.05	6.00	0.09
	3	365	5	0.01	9	0.03	7.00	0.02
	4	69	7	0.06	5	0.07	6.00	0.08
	5	232	19	0.08	23	0.10	21.00	0.09
	6	940	10	0.01	35	0.04	23.00	0.02
Sub Totals		**1,700**	**72**	**1.06**	**92**	**0.86**	**83.00**	**0.97**
6,000' or Greater	1	79	22	0.28	18	0.23	18.00	0.23
	2	57	6	0.10	3	0.06	3.00	0.06
	3	451	15	0.03	15	0.03	15.00	0.03
	4	115	10	0.09	6	0.05	6.00	0.05
	5	234	6	0.03	11	0.05	11.00	0.05
	6	1247	19	0.02	24	0.04	24.00	0.04
Sub Totals		**2,183**	**78**	**0.55**	**77**	**0.46**	**77.00**	**0.46**

Existing land uses adjoining the region's airports vary from forest to residential to commercial to industrial. Only three airports are surrounded by non-noise sensitive land uses: Bandera, Ranger Creek, and Skykomish, all being State-owned emergency airfields located in the Cascade foothills. To some degree all other system airports have residential and other non-compatible land uses (such as schools, libraries, churches, and hospitals) nearby. Nevertheless, because their existing noise contours are largely contained within airport property, most of the system's airports are not considered to be incompatible with surrounding land use. Only four system airports (Boeing Field, McChord AFB, Sea-Tac, and Paine Field) generate off-airport 65 DNL noise contours that are known to affect adjoining non-compatible land uses. Each of these airports has prepared, or is currently preparing, airport compatible land use programs to address airport noise issues.

While relatively few of the region's airports are experiencing significant noise-related issues, many airports are facing compatible land use issues related to height hazards and safety zones. Of the 29 airports in the system, some 17 have existing height hazard concerns related to obstructions (see also Exhibit 6-5 and Chapter 6 for more information about obstructions). Of the system's 36 runways and 72 runway ends, 40 runway ends have some type of obstructed approach as of late 1999. Of these, 22 were trees and 18 were either buildings, poles, fences, power lines, or other man-made objects. Height hazards near airports are addressed by the FAA's Part 77 obstruction notification and review process, which requires that anyone proposing to place or construct objects that would penetrate an airport's Part 77 surfaces must notify the FAA using FAA form 7460-1, "Notice of Proposed Construction or Alteration." The FAA's review will determine whether there is a potential hazard to navigation, if so, what form of action is needed (e.g. lighting, marking, redesign, relocation, or denial of the application). In addition, by authority of the state's "Airport Zoning" law (Chapter 14.12 RCW), public agencies may enact airport zoning provisions which limit the height of objects near airports and provide for the elimination, removal, alteration, mitigation, or marking and lighting of existing airport hazards. A preliminary review of existing zoning ordinances shows that local jurisdictions adjoining six airports in the region have adopted zoning provisions addressing height hazards near airports.

Fourteen system airports have existing land uses or structures located within airport safety zones. These include uses and structures located in existing runway safety areas and runway protection zones. Of these, the majority are related to airport layout and lack of sufficient airport property rather than land use encroachment, per se. Others may have adjoining land uses or structures located in the airports' aircraft accident safety zones. For example, Harvey Field is listed in Exhibit 8-2 as having critical areas affected by existing adjacent land use because of the power lines traversing the airport off the end of runway 14, which constitute both height hazard and safety zone compatibility concerns.

In addition to reviewing the status of existing land uses and structures related to airport height hazard, safety, and noise, future land use plans were reviewed to assess the potential for additional new development (land uses or structures) within areas affected by airport noise and within each airport's aircraft accident safety zones. This information is reported in Part 2 of Exhibit 8-2. Adopted land use plans for areas adjacent to the region's airports allow a wide range of residential densities, from a low of about 1 unit per 10 acres to a high of 87 units per acre in the city of SeaTac's downtown urban center on the east side of Sea-Tac Airport. Six airports have currently adopted adjoining community land use plans that would allow additional development of residential uses within future 65 DNL noise contours. These include Boeing Field, Bremerton, Crest Airpark, FirstAir Field, McChord Air Force Base, and Sea-Tac Airport. Of these, planned densities adjoining Bremerton Airport would allow only 1 unit per 5 acres, while those in King County around Crest Airpark would allow development of between 1 unit per 10 areas and 12 units per acre. Around FirstAir Field in Monroe, future residential densities allowed range from 3 to 7 units per acre. The other three larger airports, Boeing Field, McChord AFB, and Sea-Tac Airport, would allow for much higher residential densities ranging up to 20 units per acre near Boeing

Field, up to 30 units per acre in Lakewood adjoining McChord AFB, and up to 87 units per acre in the City of SeaTac. In response to existing development trends, forecast future noise contours, and the potential for new residential development adjoining these three airports, all three airport sponsors are actively involved in airport compatible land use planning programs with their neighboring communities. Sea-Tac will complete its FAR Part 150 Update process in late 2000; McChord AFB completed an updated AICUZ study in 1998; and Boeing Field is currently undertaking its first FAR Part 150 study. The City of Lakewood, in its first comprehensive plan since the city's incorporation, has adopted the compatible land use planning recommendations contained in the McChord AFB AICUZ study.

Related to height hazards and aircraft accident safety zones, nine system airports have no future planned incompatible land uses in their aircraft accident safety zones. These include the four seaplane bases, the three state-owned emergency airfields, Sky Harbor, and Gray Army Airfield at Fort Lewis. The other 20 system airports have adjoining community land use plans which allow new potentially incompatible development (primarily residential) within the airports' aircraft accident safety zones (see Exhibit 8-3). These six zones total between 935 acres for airports with shorter runways (less than 4,000 feet) and 2,183 acres for airports with runways longer than 6,000 feet. The total area encompassed by these combined zones for the entire airport system is over 48,000 acres (75 square miles). For those airports with future planned incompatible land uses inside these zones the total area within the zones is nearly 33,000 acres, or nearly 52 square miles. Given the sheer size of these areas, and their location largely inside the urban growth area, it's not surprising that many adopted land use plans allow residential and other potentially incompatible uses there.

Among these six zones, those most critical to protect aircraft safety and reduce safety risk on the ground are zones 1, 2 and 5. These zones roughly correspond in location, shape, and size to FAA airport design criteria for the runway protection zone (RPZ), the inner approach object free zone ("OFZ"), and the runway safety area (RSA). The combined size of these three zones varies from 96 acres for runways less than 4,000 feet to 370 acres for runways longer than 6,000 feet. Land use guidelines for these three zones generally recommend the prohibition of all residential uses. While our analysis has not determined the extent of area within these three zones that is planned for residential use, the total system-wide area within these zones comprises some 4,868 acres. The vast majority of area within these zones is contained within airport property or is governed by avigation easements. However, there is some potential for new construction and urban development to occur within these zones, further compromising airports' ability to maintain safe approaches to the runway ends to minimize risk to the general public. Additional more detailed analysis would be required in order to evaluate the location and extent of this issue throughout the region, and to identify appropriate measures to address the issue.

Based on the results of this preliminary airport compatible land use analysis the following findings have been prepared:

* Airport growth combined with future urban development surrounding the region's airports will keep the pressure on to effectively address compatible land use issues

* Significant compatible land use issues related to airport noise are largely focused at three large airports: Sea-Tac, Boeing Field, and McChord AFB. These airports are addressing these issues through FAR Part 150 and AICUZ planning programs.

* Height hazard and safety related compatible land use issues are much more prevalent throughout the region. Existing land use encroaches on several airports' safety zones, and obstructions currently affect some 40 of the region's 72 runway ends.

* Currently adopted land use plans for communities surrounding the region's airports will allow for additional noise-sensitive development, as well as potential incompatible structures and land uses in airport aircraft accident safety zones. In addition, construction of new structures affecting airport height hazard zones is a continuing issue in maintaining the safety and function of the regional airport system.

* Airport master planning, airport system planning, and coordination between airport sponsors and local land use planners can and should be a forum to more effectively address these issues.

* The state's Growth Management Act (GMA) provides a good foundation for beginning to address airport compatible land use issues around the region's general aviation airports. The Regional Council is already using GMA authority in its plan review and certification process, and plans to expand upon this process.

* The WSDOT Aviation Division has developed technical guidance materials which can be very useful to local land use planners in planning for compatible land use around airports. The state has an active program which provides technical assistance in this arena, and coordinates closely with the Regional Council on the two related programs.

* The is the potential for the regional airport system to be compromised by new development in surrounding communities if the issue of airport compatible land use is not more effectively addressed in a comprehensive and collaborative way by all parties involved. These include airport sponsors, the FAA, local communities, the State DOT Aviation Division, and the Regional Council.

Chapter 9 - Implementation Plan

The future improvement needs of the regional airport system are both varied and significant. They span a broad range of program types, from maintenance and preservation to system enhancement, from safety and standards to capacity expansion, from obstruction removal to airfield lighting, and from pavement rehabilitation to compatible land use. The improvement program also spans a broad range of airport types, including a large hub commercial service airport, two air cargo airports, five major relievers, four seaplane bases, several medium and small general aviation facilities, and three emergency airfields. Nearly half the region's public use airports are privately owned, and face a unique set of financial constraints as well as opportunities.

Three of the region's largest airports support the manufacture, testing, certification, and ultimate client delivery of Boeing heavy jet aircraft which currently capture over 60% of the world's passenger and cargo market. These three airports (Boeing Field, Paine Field, and Renton Airport) are home to some 90,000 jobs, of which over 62,000 are aerospace-related. The region's primary air carrier airport, Seattle-Tacoma International, will serve nearly 30,000,000 passenger in the year 2000 on over 400,000 flights. These numbers are forecast to grow to 44,600,000 passengers on 532,000 flights by the year 2020. Sea-Tac Airport and Boeing Field will process over 700,000 tons of air cargo this year, and will process over 1 million tons of air cargo by the year 2010.

The region's general aviation airports will be home to over 800 new based aircraft by 2020, and total regional take-offs and landings will grow by nearly 200,000 in the coming 20 years. While some of the system airports' needs are very different in scale, many needs are similar. Large and small airports throughout the region face the challenge of maintaining their pavements, improving their lighting systems, addressing obstructions, meeting FAA airport design standards, improving safety, and working with neighboring jurisdictions to address compatible land use issues. Meeting these long range needs of the regional airport system will require an investment program that can meet the many different needs and conditions of the region's airports.

Airport Capital Improvement Program ("ACIP")

This regional airport capital improvement program ("ACIP") is based on the system improvements outlined in Chapter 7 (System Strategy), in particular those projects listed in Exhibit 7-4. Many of the improvement projects shown in Exhibit 7-4 are also included in currently adopted airport master plans. Of the 85 system improvements listed in Exhibit 7-4 for the top ten system airports, some 59 airport improvement projects are also included in current airport master plans. The improvement projects shown in Exhibit 7-4, and included here in the ACIP, represent a regional level planning effort which identifies regionally significant system needs. These system improvement projects are considered critical to the maintenance, preservation, and enhancement of the regional airport system. These projects do not, however, represent a comprehensive list of all improvements needed at the region's airports. Individual airport master plans and capital improvement programs, as well as the Washington State Aviation System Plan (SASP), contain comprehensive capital improvement programs that in sum would represent the total system-wide investment needs of the regional and state airport systems. The objective of this regional airport capital improvement program is to provide a regional framework for airport system improvements within which major projects can be funded, and within which individual airport improvement programs will occur. Smaller airport improvement projects which enhance individual airports but do not substantially contribute to the entire system are not included in this regional ACIP. This in no way detracts from their importance to each airport.

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
American Lake	N/A		$0	$0	$0	$0
	American Lake Total:		***$0***	***$0***	***$0***	***$0***
Apex	Install PAPI	E	$10,000	$0	$0	$10,000
	Apex Total:		***$10,000***	***$0***	***$0***	***$10,000***
Arlington	Acquire land - runway 34 approach	S	$110,000			$110,000
	Acquire land - runway 16 approach	S	$362,000			$362,000
	Install PAPI	E	$30,000			$30,000
	Install REIL	E	$30,000			$30,000
	ODALS runway 11-29	S	$60,000			$60,000
	ODALS runway 16	S	$60,000			$60,000
	Install MIRL runway 11-29	E	$232,000			$232,000
	Master Plan	O	$170,000			$170,000
	Eastside apron	P	$219,000			$219,000
	Taxiway A lighting	E	$283,000			$283,000
	Partial parallel taxiway D	E	$364,000	$638,000		$1,002,000
	Runway 11-29 apron	P	$219,000	$219,000		$438,000
	Pavement improvements	P				$0
	Approach lighting runway 34	E				$0
	New aircraft hangars	C				$0
	Airport Drive extension	C		$213,000		$213,000
	Taxiway C lighting	E		$160,000		$160,000
	Runway safety area fill	S		$1,300,000		$1,300,000
	Runway extension	E		$325,000		$325,000
	Taxiway B extension	E		$120,000		$120,000
	Arlington Total:		***$2,139,000***	***$2,975,000***	***$0***	***$5,114,000***
Auburn	Runway Rehab./Overlay	P	$388,889			$388,889
	Runway Rehab./Overlay	P	$277,778			$277,778
	Taxiway overlay	P	$210,000			$210,000
	Runway extension	E				$0
	GPS approach/lighting	E				$0
	Approach protection	S	$100,000			$100,000
	Runway Rehab./Overlay	P		$300,000		$300,000
	New Hangars	C	$150,000	$300,000		$450,000
	Auburn Total:		***$1,126,667***	***$600,000***	***$0***	***$1,726,667***
Bandera State	no projects					$0
	Bandera State Total:		***$0***	***$0***	***$0***	***$0***
Bremerton	Avigation easements	S	$350,000			$350,000
	NE Access Road	C	$275,000			$275,000
	Master Plan Update	O	$100,000			$100,000
	Runway Extension	E		$1,184,000		$1,184,000
	Taxiway Extension	E		$398,300		$398,300
	Widen/strengthen taxiway	S		$792,000		$792,000
	Runway/taxiway rehab.	P		$2,310,000		$2,310,000
	GPS approach	E				$0
	Install REIL	E	$50,000			$50,000
	Runway shift	E	$3,940,000			$3,940,000
	Aviation business building	C	$500,000			$500,000
	Bremerton Total:		***$5,215,000***	***$4,684,300***	***$0***	***$9,899,300***

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
Crest Airpark	Avigation easements	S	$20,000			$20,000
	Install MIRL	E	$74,000			$74,000
	Install PAPI/VASI	E	$5,000			$5,000
	Install REIL	E				$0
	Widen Runway	S	$109,000			$109,000
	Runway safety area	S				$0
	Obstruction removal	S				$0
	Apron expansion	C	$95,000			$95,000
	New tie-downs	C	$120,000			$120,000
	Pavement crack sealing	P	$30,000			$30,000
	Crest Airpark Total:		***$453,000***	***$0***	***$0***	***$453,000***
Darrington	Pavement maintenance	P	$30,000			$30,000
	Runway widening	S				$0
	Runway safety area	S				$0
	Obstruction removal	S				$0
	Darrington Total:		***$30,000***	***$0***	***$0***	***$30,000***
FirstAir Field	Install MIRL	E		$47,000		$47,000
	Install NDB	E		$4,000		$4,000
	Install PAPI	E	$10,000			$10,000
	Obstruction removal	S	$2,000			$2,000
	Runway widening	S				$0
	Runway extension	E				$0
	Runway safety area	S				$0
	Parallel taxiway	C		$50,000		$50,000
	Runway overlay	P		$50,000		$50,000
	New hangars	C	$200,000	$300,000		$500,000
	FirstAir Field Total:		***$212,000***	***$451,000***	***$0***	***$663,000***
Harvey Field	Runway widening	S	$104,000			$104,000
	Runway extension	E				$0
	Apron expansion/taxiway ext'n	C	$661,000			$661,000
	Land acq'n/obstruction removal	S	$612,000			$612,000
	Pavement maintenance	P	$63,000			$63,000
	GPS approach / lighting	E				$0
	Install MIRL	E	$56,000			$56,000
	Navaids (wind cone, circle)	E	$13,000			$13,000
	Install NDB	E				$0
	Install PAPI/VASI	E	$28,000			$28,000
	Install REIL	E				$0
	New hangars	C				$0
	Harvey Field Total:		***$1,537,000***	***$0***	***$0***	***$1,537,000***
Kenmore Air Harbor	no projects					$0
	Kenmore Air Harbor Total:		***$0***	***$0***	***$0***	***$0***

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
King County Int'l/	Property acquisition - RPZ	S	$498,000			$498,000
Boeing Field	Runway safety area	S	$5,555,556			$5,555,556
	Resurface runway 13L-31R	P	$1,650,000			$1,650,000
	Reconstruct runway 13R-31L	P	$6,025,000			$6,025,000
	Rehab. runway 13R-31L	P	$776,000			$776,000
	Reconstruct taxiway A-3	P	$1,185,000			$1,185,000
	Widen taxiway B-2	E	$745,000			$745,000
	Terminal building remodel	E	$6,120,000			$6,120,000
	Pavement rehab. (various)	P	$4,083,000	$5,000,000	$5,000,000	$14,083,000
	West side redevelopment	C	$10,670,000			$10,670,000
	Transponder landing system	E	$1,500,000			$1,500,000
	Runway shift	S	$6,200,000			$6,200,000
	Noise remedy program	P	$20,000,000			$20,000,000
	Maintenance facility	P	$379,000			$379,000
	Install REIL runway 13L-31R	E				$0
	Install PAPI runway 13L-31R	E				$0
	New hangars	C				$0
	Airport Master Plan	O		$350,000		$350,000
	FAR Part 150 Update	P		$300,000		$300,000
	Land acquisition	S			$10,000,000	$10,000,000
	Boeing Field Total:		***$65,386,556***	***$5,650,000***	***$15,000,000***	***$86,036,556***
Lake Union	no projects					$0
	Lake Union Total:		***$0***	***$0***	***$0***	***$0***
Martha Lake	no projects					$0
	Martha Lake Total:		***$0***	***$0***	***$0***	***$0***
Pierce County/Thun	Property acquisition - BRL/Twy OFA	S	$210,000	$1,500,000	$2,500,000	$4,210,000
	Realign parallel taxiway	S	$175,000			$175,000
	Hangar access road	C	$30,000			$30,000
	Taxilane rehab./overlay/crack seal	P	$175,000		$50,000	$225,000
	Main apron rehab./overlay/crack seal	P	$220,000		$45,000	$265,000
	T-hangars	C	$400,000	$700,000	$450,000	$1,550,000
	Airport terminal building	C	$90,000			$90,000
	Widen runway	S		$600,000		$600,000
	Obstruction program	S	$60,000			$60,000
	GPS approach	E	$250,000			$250,000
	Approach lighting	E	$100,000			$100,000
	Install REIL	E	$20,000			$20,000
	Pavement maintenance	P	$95,000	$95,000	$150,000	$340,000
	Install AWOS	S		$80,000		$80,000
	New parallel taxiway	C		$725,000		$725,000
	Install taxiway lighting	E		$210,000		$210,000
	Pierce County/Thun Total:		***$1,825,000***	***$3,910,000***	***$3,195,000***	***$8,930,000***
Port Orchard	Runway widening					$0
	Pavement improvements					$0
	Obstruction program					$0
	Port Orchard Total:		***$0***	***$0***	***$0***	***$0***

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
Ranger Creek State	no projects					$0
	Renger Creek State Total:		***$0***	***$0***	***$0***	***$0***
Renton	Drainage improvements	O	$555,556			$555,556
	Taxiway A reconstruction	P	$867,500			$867,500
	Seal and mark pavements	P	$650,000	$650,000		$1,300,000
	Pavement overlay	P	$2,787,500		$2,787,500	$5,575,000
	GPS approach / lighting	E				$0
	New hangars	C				$0
	Renton Total:		***$4,860,556***	***$650,000***	***$2,787,500***	***$8,298,056***
Sea-Tac	Third runway	C	$773,362,000			$773,362,000
	Airfield improvements	C	$248,172,000			$248,172,000
	South terminal expansion	C	$378,372,000			$378,372,000
	Terminal	C	$183,581,000			$183,581,000
	Satellite transit system	C	$161,139,000			$161,139,000
	Ground access	C	$166,909,000			$166,909,000
	Infrastructure	C	$296,488,000			$296,488,000
	Division-wide	O	$50,753,000			$50,753,000
	Noise abatement	P	$90,882,000			$90,882,000
	Miscellaneous projects	O	$195,662,000			$195,662,000
	Airfield improvements	C		$62,400,000		$62,400,000
	Terminal	C		$162,145,000		$162,145,000
	Ground access	C		$548,226,000		$548,226,000
	Infrastructure	C		$85,600,000		$85,600,000
	Division-wide	O		$2,876,000		$2,876,000
	Noise abatement	P		$33,931,000		$33,931,000
	Sea-Tac Total:		***$2,545,320,000***	***$895,178,000***	***$0***	***$3,440,498,000***
Sky Harbor	Obstruction program	S				$0
	Runway extension	E				$0
	Sky Harbor Total:		***$0***	***$0***	***$0***	***$0***
Skykomish State	no projects					$0
	Skykomish State Total:		***$0***	***$0***	***$0***	***$0***

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
Snohomish County/	Land acquisition - easements	S	$1,900,000			$1,900,000
Paine Field	Land acquisition - threshold	S		$900,000		$900,000
	Obstruction program	S				$0
	GPS approach	E				$0
	New hangars	C				$0
	Install REIL runway 11-29	E				$0
	Taxiway lighting	E	$740,000			$740,000
	Safety area (phases 3-5)	S	$6,666,666			$6,666,666
	Runway/taxiway shift	S	$1,456,000			$1,456,000
	Extend parallel taxiway	C	$637,000			$637,000
	West ramp apron	P		$375,000		$375,000
	New hangar	C	$700,000			$700,000
	New taxiway/apron	C	$100,000			$100,000
	Multi-use ramp & car parking	C	$460,000			$460,000
	New exit taxiway	C		$150,000		$150,000
	Pavement rehab./overlay	P	$1,700,000			$1,700,000
	GA terminal/ramp/parking	C	$450,000	$4,050,000		$4,500,000
	Relocate taxiway	E		$1,970,000		$1,970,000
	Multi-use building	C	$1,300,000			$1,300,000
	Airport maintenance facility	P	$1,500,000			$1,500,000
	Paine Field Total:		***$17,609,666***	***$7,445,000***	***$0***	***$25,054,666***
Spanaway	Runway widening	S				$0
	Runway extension	E				$0
	Runway safety area	S				$0
	Obstruction program	S				$0
	Sealcoat runway	P	$12,000			$12,000
	Spanaway Tottal:		***$12,000***	***$0***	***$0***	***$12,000***
Swanson	Taxiway/apron paving	P	$47,000			$47,000
	Parallel taxiway	C		$30,000		$30,000
	Runway widening	S				$0
	Runway safety area	S				$0
	Obstruction/approach program	S	$100,000			$100,000
	Swanson Total:		***$147,000***	***$30,000***	***$0***	***$177,000***
Tacoma Narrows	Land acquisition for runway	E	$1,550,000			$1,550,000
	Acquire land - - compatible land use	P	$650,000			$650,000
	RPZ easement	S	$137,500			$137,500
	Apron lighting	E	$207,000			$207,000
	Runway edge lights/beacon	E	$95,000			$95,000
	Runway safety area	S	$6,000,000			$6,000,000
	West side access road/utilities	C	$552,250			$552,250
	Reconstruct perimeter road	O	$150,000			$150,000
	Runway extension	E	$400,000			$400,000
	FBO taxiway (phases 1&2)	C	$911,500			$911,500
	West side parallel taxiway	C		$940,000		$940,000
	Runway/taxiway overlay	P	$832,000	$230,000		$1,062,000
	New t-hangars plus apron	C	$498,000	$538,000	$641,000	$1,677,000
	New conventional hangars	C	$587,000	$851,000	$744,000	$2,182,000
	Runway / taxiway / ramp slurry seal	P	$826,000	$454,000	$826,000	$2,106,000
	Runway extension	E			$8,000,000	$8,000,000
	Install REIL	E			$115,000	$115,000
	Install VASI	E			$118,000	$118,000
	Tacoma Narrows Total:		***$13,396,250***	***$3,013,000***	***$10,444,000***	***$26,853,250***

Exhibit 9-1 Airport System Capital Improvement Program

Airport	Project	Type *	2000-2004	2005-2009	2010-2020	Total
Vashon	Taxiway reflectors	E	$4,000			$4,000
	Install MIRL	E		$63,000		$63,000
	Runway widening	S				$0
	Runway safety area	S				$0
	Obstruction program	S				$0
	Vashon Total:		*$4,000*	*$63,000*	*$0*	*$67,000*
Will Rogers/ Wiley Post Mem.						
	U.S. customs temporary structure	C	$75,000			$75,000
	Seaplane beaching area	E	$793,750			$793,750
	Will Rogers/Wiley Post Total:		*$868,750*	*$0*	*$0*	*$868,750*

Airport Capital Improvement Program Summary

	2000-2004	2005-2009	2010-2020	Total
System Totals	$2,660,152,445	$924,649,300	$31,426,500	$3,616,228,245
Sea-Tac International Airport:	*$2,545,320,000*	*$895,178,000*	*$0*	*$3,440,498,000*
Rest of Airport System:	*$114,832,445*	*$29,471,300*	*$31,426,500*	*$175,730,245*

Summary of Airport Capital Improvement Program Project Types

Project Type	* Project Type Code		Sea-Tac Airport	General Aviation Airports	Total Airport System
Safety and Standards	S	Costs	$0	$48,519,722	$48,519,722
		% of total	0%	28%	1%
Maintenance and Preservation	P	Costs	$124,813,000	$64,739,167	$189,552,167
		% of total	4%	37%	5%
System Enhancement	E	Costs	$0	$31,002,050	$31,002,050
		% of total	0%	18%	1%
System Capacity	C	Costs	$3,066,394,000	$30,143,750	$3,096,537,750
		% of total	89%	17%	86%
Other	O	Costs	$249,291,000	$1,325,556	$250,616,556
		% of total	7%	1%	7%
TOTALS:			**$3,440,498,000**	**$175,730,245**	**$3,616,228,245**

* Project types:

Safety and Standards projects include runway safety areas, runway widening, and obstruction programs.

Maintenance and Preservation projects include runway, taxiway, and apron overlays: pavement rehabilitation and reconstruction; runway friction surface treatments; crack and slurry sealing; noise studies; and compatible land use programs.

System enhancement projects include runway extensions; lighting and navaids; approach protection; and airport terminals.

System capacity projects include aircraft tie-downs and hangars; passenger terminals; parking and access roads; and air cargo projects.

Other projects include planning and miscelleneous projects.

Exhibit 9-1 displays the regional airport capital improvement program (ACIP), showing projects by type at each airport, and indicating the time frame (short, medium, and long range) for each project. Lastly, the exhibit displays generalized costs for the ACIP.

Due to the uncertainty in forecasting airport activity levels beyond 10 years, and the difficulty in predicting costs associated with facility needs to meet longer range forecasts, most airports in the region have not developed comprehensive capital facility programs beyond 2010. This is true of the figures quoted above for Sea-Tac Airport. For these reasons, the airport capital improvement program costs shown for Phase III (2010-2020) should be considered preliminary. As mentioned above, the projects represented in these figures do not include all projects being planned for the region's airports, but only those projects considered to have significance to the regional airport system.

Because of the magnitude of improvements planned at Sea-Tac International Airport, and because those improvements are funded by the Port of Seattle, the capital improvement program needs for Sea-Tac Airport have been separated from the rest of the airport system (see Exhibit 9-1). The total airport system improvement program is estimated to be $ 3.6 billion for all three phases. Of this total, Sea-Tac Airport comprises $3.4 billion, while the remaining airport system improvements total approximately $176 million. Broken down by phase, the total system improvement program will cost $2.66 billion in phase I (2000-2004), $925 million in phase II (2005-2009) and $31.4 million in phase III (2010-2020). Excluding Sea-Tac, these improvements would total some $115 million in phase I, approximately $29 million in phase II, and $31 million in phase III.

Exhibit 9-1 includes a summary of airport capital improvement program costs by project type (see page 6 of the exhibit). For clarity the system cost information separates Sea-Tac International Airport from the rest of the general aviation airport system. The projects are grouped into five categories: (1) safety and standards; (2) maintenance and preservation; (3) system enhancement; (4) system capacity; and (5) other. For the entire system, capacity projects comprise 86% of the total, with Sea-Tac projects accounting for most of these costs. Other projects comprise 7% of total system improvements, while maintenance and preservation account for 5%, and safety and standards and maintenance and preservation each account for 1%.

When Sea-Tac is separated from the rest of the system, the breakdown of improvement projects changes. At Sea-Tac alone, maintenance and preservation makes up 4% of the total program, other projects comprise 7%, while capacity-related projects account for 89%. For the rest of the general aviation airport system, the capital improvement program costs are distributed more evenly among the five project categories. Safety and standards account for 28% of the total CIP; maintenance and preservation accounts for 37%; system enhancement comprises 18%; system capacity projects account for 17%; and "other" projects account for less than 1% of the total improvement program. The program's emphasis on system preservation and maintenance is apparent in the CIP figures, with more than a third of the total program going to that category of projects. Safety and preservation projects account for 65% of the total airport improvement program, while enhancements and capacity projects together contribute just one third of the total. These figures support the system plan's recommended priorities for system investment, which put safety and standards, and maintenance and preservation as high priorities for system funding.

Implementation Plan

1. Future actions

In addition to the airport capital improvement program (ACIP) projects described above and displayed in Exhibit 9-1, a number of non-project actions are being recommended in this 2000 RASP. They include updated airport master plans and/or airport layout plans, airport compatible land use programs at several airports, analysis of the region's long range air cargo facility needs, and a Global Positioning System ("GPS") feasibility and implementation study at regional airports. While this plan contains several recommended system improvements to address a variety of airport system needs, more detailed project planning and analysis, project design and costing, and environmental impact analysis is required before those improvements can be implemented. The objective of this section of the RASP is to highlight the additional project-defining actions which should be undertaken before actual projects are implemented.

2. Funding options

A variety of funding alternatives are presented here to stimulate discussions and exploration on the part of airport sponsors, state DOT, FAA, the Regional Council, and others in evaluating the feasibility of the airport system improvements included here. Traditional and non-traditional funding sources are included, especially because system needs have historically been greater than system revenues. As is true of many components of the nation's transportation system, available revenues for aviation system improvements have shrink in the past 10 years, and new and innovative financing mechanisms are being sought to bridge the growing gap between system needs and available funds. Several public agencies, user groups, and aviation advocacy groups have identified a variety of innovative financing concepts to help airports meet their financial goals. These are summarized below.

EXISTING FUNDING SOURCES

FAA

FAA funding is available to the region's NPIAS airports to finance AIP-eligible projects. These airports include Sea-Tac International, King County International/Boeing Field, Snohomish County Airport/Paine Field, Renton Municipal, Auburn Municipal, Arlington Municipal, Bremerton National, Tacoma Narrows, Pierce County Airport/Thun Field, Kenmore Air Harbor, Harvey Field, and Vashon Municipal. Funds available at the NPIAS airports include passenger entitlement funds, cargo entitlement funds, passenger facility charges ("PFCs"), grants for airport noise compatibility planning, state apportionment funds, discretionary funding, general aviation airport entitlement funds, cargo-only airport funds, and grants for reliever airports (authorized by the AIP bill adopted by U.S. Congress in spring 2000).

Washington State Airport Aid Program

The State's airport aid program provides grants to smaller airports throughout the state to fund a broad range of projects. State funds generally are not granted to larger general aviation reliever airports, such as Paine Field and Boeing Field, since these airports generate revenues to meet much of their own need, and they receive funding from FAA. Smaller general aviation airports are more dependent on State grants, and may even have difficulty raising the necessary local match (typically 80-90%) required to accept state grants. State airport aid grants have traditionally been dedicated to pavement maintenance and rehabilitation projects; runway, taxiway, and apron programs; airfield lighting and navaids; obstruction programs; airport fencing; roadways; airfield signs; and safety-related projects.

The state's airport aid program is funded primarily through aviation system user fees such as annual aircraft registration fees, pilot registration fees, and taxes collected on the sale of aircraft fuel at the state's airports. While these funds are user-fee based, the majority of revenues collected under these programs are diverted to the state's general fund and to the Department of Revenue to finance a variety of non-aviation programs. At current levels of revenue capture, these airport user-fee programs can not meet the airport system's full funding needs.

POTENTIAL FUNDING PROGRAMS

Several options are available for enhancing aviation system revenues. These include capturing a larger share of existing aviation user fees (such as aircraft and pilot registration fees and aviation fuel taxes) and creating new revenue sources, such as a dedicated aviation fuel tax (as was recently done in Oregon). These initiatives would likely require action by the state legislature. In addition, there a numerous programs across the country that provide food for thought as ideas for enhancing aviation revenues. The National Association of State Aviation Officials (NASAO) has surveyed its membership to collect information on innovative and effective funding and revenue programs. Some take the form of tax relief. The list below highlights these programs as a way to stimulate a dialog on approaches to increase the revenues available to finance the airport system improvements contained in this plan.

Tax Relief for Privately Owned Public Use Airports

Indiana - - all public areas on airports are exempted from property tax.

Maryland - - airfield must be exempt from state and local property tax before a grant is received.

Michigan and Tennessee - - state law exempts airfields from property tax.

Pennsylvania - - state provides grants to airports for taxes paid.

North Dakota - - taxes hangars as real estate and the airfield as farmland.

State and Local Match Programs

Arkansas - - runway improvements are matched at 90/10 or 80/20, and matches 50/50 for hangars with not-to-exceed funding limits.

Florida - - the state funds revenue-producing projects such as fuel farms and t-hangars, plus offers 50/50 seed grants for non-aeronautical projects, such as airport industrial parks.

State-Sponsored AIP Grant for General Aviation Airports

Maine - - offers state-sponsored grants for GA airport projects

Oklahoma - - offers tax credit on aircraft purchase over $5 million.

Kansas - - dedicates $30 million over next 10 years for runway improvements, safety, and economic development. Offers 75/25 match for towns of less than 10,000 people, 50/50 match for larger towns.

Georgia - - installs MALSR and AWOS under state contract.

Pavement Maintenance/Management Programs

Montana - - pavement preservation program uses 25% aviation fuel taxes from air carriers.

Louisiana - - offers 50/50 grants to a $10,000 maximum.

Wisconsin - - grants 100% for runway marking projects and 80% for seal coat and crack sealing.

Oregon - - aviation users developed House Bill 2199, which was approved by the legislature in 1999. The program, which covers 40 airports statewide, is funded by an increase in aviation fuel tax. The bill raised Avgas taxes by 3 cents a gallon in 1999 and another 3 cents in 2000, and raised jet fuel taxes from ½ cent to 1 cent per gallon in 1999. Funding levels will begin at $1.9 million per year in 1999-2001, and is forecast to grow to $2.6 million thereafter. The fuel tax revenues are earmarked for airport pavement projects.

Airport Infrastructure Development Banks

Ohio - - bank provides loans and backs bonds for transportation projects, with $3 million in 1998 and $1 million in 1999 for aviation. Will finance up to 100% of eligible project with maximum term of 25 years at 2/3rds prime interest rate.

Minnesota - - administers hangar construction revolving fund with 80% interest-free loans.

Nebraska - - offers no-interest loans for fuel storage facilities, hangars, and aerial applicator aprons.

Florida - - offers revolving loans for land acquisition.

Virginia - - revolving loan program offers loans for eligible projects once a year base on project ranking system.

Innovative Policy

New Hampshire - - state law requires all airports for sale be offered to the state in first instance.

Chapter 10 - Airport Access Plan

The regional airport system access plan was developed by identifying the components of airport access demand, evaluating the location of these demand components in relation to the region's airports, documenting existing and forecasting airport access demand in these locations, comparing demand with existing and planned airport access routes and modes, and translating that future demand into a set of recommended airport access improvements.

Components of Airport Access Demand

Airport access facilities and services serve a variety of users, including airline passengers, air cargo operators, general aviation airport users, airport employees, and airport businesses. In addition, airport ground access systems serve aerospace businesses such as the Boeing Commercial Airplane Company's aircraft production facilities located adjoining King County International Airport/Boeing Field, Renton Municipal Airport, and Snohomish County Airport/Paine Field. Resources for the 2000 RASP study did not allow for a detailed or comprehensive region-wide analysis of airport access needs. Therefore, this chapter is primarily focused on outlining the major categories of airport access need at Sea-Tac International Airport, King County International Airport/Boeing Field, Snohomish County Airport/Paine Field, and Renton Municipal Airport. These four airports accommodate virtually all the region's passengers and air cargo, and a large share of the region's aerospace, airport, airline, and air cargo employment.

In order to identify airport access needs, several measures of airport access demand were examined. These included the following:

* Number of based aircraft
* Annual aircraft operations
* Annual passengers
* Annual air cargo volume
* Airport-related employment (airport, airline, air cargo, air traffic control, aircraft service and repair) located at the region's airports
* Aerospace employment (aircraft, aircraft engine, and aircraft parts production) located at or adjoining the region's airports
* Total employment (within the traffic analysis zones containing or adjoining the region's airports)

Based aircraft, annual aircraft operations, passenger, and air cargo information was derived from a variety of data sources, including FAA 5010 Master Records, airport master plans, WSDOT's *Washington State Aviation System Plan*, and direct contact with airport sponsors. Employment data was derived from the Regional Council's geo-coded employment data base using data from the Washington Employment Security Department.

Airport Access Demand from Existing and Projected Airport Activity Levels

The number of aircraft based at an airport, and the amount of aircraft takeoffs and landings affect the level of ground access demand at airports. The following data display existing and forecast conditions related to these indicators at the largest regional airports:

Airport	1999 Based Aircraft	2020 Based Aircraft	1999 Aircraft Operations	2020 Aircraft Operations
Boeing Field	443	514	345,120	375,182
Paine Field	483	639	192,612	235,356
Renton Airport	255	278	100,710	109,482
Sea-Tac Airport	6	6	434,425	532,000
	1,187	1,437	1,072,867	1,252,020

Regional Passenger and Air Cargo Activity

Two major components of airport ground access demand are air passengers and air cargo. Information on existing and forecast passenger and cargo activity has been obtained directly from the Port of Seattle for Sea-Tac Airport and from King County for Boeing Field. Estimates of airport ground access demand, as well as proposed access improvements, were also derived from those sources.

Passenger Forecasts
(includes both enplaning and deplaning passengers)

	1998	2005	2010	2015	2020
Boeing Field	4,026	76,400	154,000	178,600	N/A
Sea-Tac International *	25,863,132	31,400,000	35,800,000	40,200,000	44,600,000
Total	**25,931,638**	**31,476,400**	**35,954,000**	**40,378,600**	**44,600,200**

* *Year 2015 passenger forecast for Sea-Tac Airport was interpolated by PSRC*

Air Cargo Forecasts (U.S. tons)
(includes both enplaned and deplaned cargo)

	1998*	2000**	2005**	2010**	2015**
Boeing Field	142,000	155,364	194,540	243,595	305,000
Sea-Tac Int'l	471,099	559,900	683,100	805,200	N/A
Total:	**613,099**	**715,264**	**877,640**	**1,048,795**	

* *1998 numbers were derived from Sea-Tac Airport Activity Report (1998) and Boeing Field Master Plan Working Paper One (1999).*

** *Forecasts for 2000, 2005, 2010, and 2015 were taken from the "Final Supplemental EIS for the Proposed Master Plan Update Development Actions at Sea-Tac Airport" (May 1997) and the Boeing Field "Master Plan Working Paper One" (September 1999).*

Airport Access Demand from Airport-Related Employment

Three measures of employment were analyzed in determining the airport employment component of airport access demand. These data are displayed in Exhibit 10-1. First, total employment in the vicinity of the region's airports was collected from Regional Council records. These data were derived from the Washington State Employment Security Department (ESD). For each airport, the total employment was reported for traffic analysis zones ("TAZs") which either encompassed or adjoined the airport. Total employment in these zones was used as a general measure of economic activity around each airport, even though it is recognized that some of this employment was not directly related to the airports.

Exhibit 10-1 Airport Related Employment

Airport	Total 1998 Employment	Forecast 2020 Employment	1998 Aerospace Employment *	1998 Airport, Airline and Air Cargo Employment **	Traffic Analysis Zone (s) ***
Paine Field	46,444	49,757	35,078	68	506/522/524
Sea-Tac	25,661	37,259	369	12,090	342/351/355/356 357/358/362
Boeing Field	25,480	33,183	11,230	165	192/193/330
Ft. Lewis	17,307	39,238	0	5	761
Renton	16,925	12,506	15,961	33	309
Auburn	7,220	10,415	130	0	406
Arlington	5,462	7,941	370	10	596
Tacoma N.	3,555	4,002	2	20	749
Martha Lake	3,078	5,540	0	0	515
FirstAir Field	2,917	2,650	85	0	573
Vashon	2,066	2,270	0	0	346
Bremerton	1,773	2,395	0	33	823
McChord	1,390	2,498	0	0	758
Spanaway	1,230	2,003	0	1	715
Sky Harbor	1,114	1,500	0	0	601
Swanson	920	1,018	0	0	772
Thun Field	803	2,206	0	4	767
Crest	647	966	0	11	427
Harvey Field	611	707	0	24	567
Darrington	566	573	0	4	600
Apex	528	589	0	0	815
Port. Orchard	487	379	0	13	832
Kenmore Air	350	502	0	0	232
Amer. Lake	260	313	0	0	737
Totals:	**166,794**	**220,410**	**63,225**	**12,481**	

* Aerospace employment includes the following standard industrial classification ("sic") categories:
- 3721: aircraft manufacturing
- 3724: aircraft engine and engine parts manufacturing
- 3728: aircraft parts and sub-assemblies

** Airport, airline, and air cargo employment includes the following "sic" categories:
- 4512: Scheduled air passenger and air freight transportation
- 4513: Air courier services
- 4522: Non-scheduled air passenger and air freight transportation (charter flights)
- 4581: Airports, flying fields, airport terminals, air traffic control, air freight handling, aircraft service and repair

*** Employment located in traffic analysis zones (TAZs) encompassing or adjoining the airport

source: Washington Employment Security Department

As shown in Exhibit 10-1, total 1998 employment in traffic analysis zones encompassing or adjoining the region's airports was 166,794. Of this, Paine Field had the highest total, with 46,444 followed by Sea-Tac with 25,661 and Boeing Field with 25,480. Fort Lewis placed fourth, with 17,307, and Renton was fifth, with total employment of 16,925. Auburn, Arlington, and Tacoma Narrows airports had fairly high numbers of employees on and near those airports. Also included in Exhibit 10-1 are Regional Council employment forecasts for the year 2020 for the transportation analysis zones encompassing and adjoining the region's airports. Total employment at and near the region's airports is forecast to increase from 166,794 in 1998 to 220,410 in 2020. This is a total increase of 32% for an average annual growth rate of 1.3%.

The second measure of airport access demand related to employment is total aerospace employment located on or adjacent to the region's airports. This includes the manufacture of aircraft, aircraft engines, and aircraft parts. The vast majority of this employment type (standard industrial classification codes 3721, 3724, and 3728) occurs at Boeing Company facilities on and adjoining Paine Field, Boeing Field, and Renton Airport. These three airports, with total combined aerospace employment of 62,269, account for nearly all aerospace employment adjoining the region's airports (63,225). Only four other airports (Sea-Tac, Auburn, Arlington, and FirstAir Field) had any reported aerospace employment.

The third component of airport-related employment includes jobs more directly related to airports. These include employment for scheduled passenger and cargo airlines; freight forwarders and handlers; aircraft repair, servicing, and cleaning; air traffic control; aircraft charters and sightseeing; and airport operators. These jobs would include airport management and operations, airline and air cargo personnel, FAA air traffic control staff, and employees related to servicing and repair of aircraft while on the airport. Whereas total employment and aerospace employment includes jobs that might be located either on or off the airport itself, airport, airline, and air cargo employment in these categories tends to be located on the airport. Total airport, airline, and air cargo-related employment at the region's airports was 12,481 as of 1998. Of this, nearly all was located at Sea-Tac Airport, where airport-related employment totaled 12,090.

Aerospace is the major single component of total employment at three of the four airports. At Renton Airport aerospace jobs comprise 94% of total employment, at Paine Field they comprise 75%; and at Boeing Field they comprise 44%. At Sea-Tac Airport, airport-related employment is the single largest component of employment, comprising 47%, while aerospace employment (1%) is negligible.

Regionally Significant Transportation Routes and Services Serving the Region's Major Airports

Seattle-Tacoma International Airport

Several regionally significant transportation facilities serve Sea-Tac Airport and the vicinity. These include SR-518, a 4-6 lane limited access freeway connecting the airport area with I-5 to the east, and SR-509, a four-lane freeway connecting the west side of the airport with downtown Seattle. In addition, SR-99/International Boulevard provides direct access to the airport terminal area. International Boulevard is a 6-lane arterial with high occupancy vehicle (HOV) lanes on each side.

In addition to these surface highways, the airport is served by numerous regional express bus routes operated by Sound Transit. A regional light rail route is currently being planned and designed by Sound Transit. The light rail line will serve the east side of the airport and will include an airport station to be located in the vicinity of the proposed new north passenger terminal and/or the planned future ground transportation center. Regional bus service operated by Metro is available to the airport. Major routes serving the passenger terminal include 174 and 194 (serving downtown Seattle), and 340 serving

Shoreline, north King County, Bothell, and the east side. In addition, Sound Transit now operates two routes serving the airport: 570 connecting to downtown Seattle, and 574 serving Tacoma.

Snohomish County Airport/Paine Field

Several major routes serve the Paine Field area, including SR-526, SR-525, Airport Road, and the recently completed Paine Field Boulevard. SR-526 is a 4-6 lane limited access freeway providing access to the north end of Paine Field and the Boeing Company's 747 / 777 assembly plant to the north. SR-526 provides direct access to Paine Field via a full interchange at Airport Road at the northeast corner of the airport. SR-525, also known as Mukilteo Speedway, is a 3-lane arterial that connects the west side of Paine Field with SR-99 and I-5 to the south and with Mukilteo to the north. Airport Road, a five lane arterial, is provides several entrances to Paine Field, serving the east side of the airport, and connecting to SR-526 to the north and SR-99 to the south. Paine Field Boulevard is a recently completed 4-lane arterial serving the northwestern quadrant of the airport, connecting SR-525 and SR-526.

Several Community Transit commuter bus routes serve the Paine Field/Boeing Plant vicinity: 207 serves Smokey Point, 217 and 227 serve Arlington, 247 serves Stanwood, and 727 serves Gold Bar. Each of these routes provides service via SR-526, Seaway Boulevard, Airport Road, and 94th Street S.W. In addition, King County Metro operates the following Boeing Metro Custom bus routes serving the Boeing Everett Plant: 949, 950, 951, 952, and 965. Everett Transit also provides local bus service serving the Boeing Plant. This service includes routes 2, 3, 8, and 25. Routes 2, 8, and 25 use Casino Road to access the Boeing Plant, while route 3 serves Airport Road along the east side of Paine Field.

King County International Airport/Boeing Field

Boeing Field is located near the west side of I-5, and is served by two I-5 interchanges at S. Boeing Access Road to the south and Albro Place to the north. East Marginal Way, a five lane arterial, provides access along the west side of the airport, serving airport users, major Boeing Company facilities, and the Museum of Flight. On the east side, Airport way provides a four lane arterial serving the main terminal building, airport offices, and several major airport tenants.

Several King County Metro bus routes serve Boeing Field and adjoining Boeing Company facilities. These include route 60, 130, 154, 170, 173, and 174. Sound Transit's proposed "Link" light rail and "Sounder" commuter rail systems will provide a combined Boeing South Access Road station located south of Boeing Access Road and east of Airport Way. This station, south of the airport, will be the closest light or commuter rail station to Boeing Field and the Boeing Company's aerospace facilities located on the west side of the airport.

Renton Municipal Airport

Renton airport is bounded on the north by Lake Washington, on the east by the Cedar River, on the south by Airport Way, and on the west by Rainier Avenue South. The airport's two primary entrances are from Airport Way and Rainier Avenue South. Both Airport Way and Rainier Avenue South are six-lane arterials. Access between the airport and the nearest interstate freeway (I-405) is via these two arterials plus Logan Avenue South through downtown Renton.

Limited bus service is available at Renton Airport. The Renton Transit Center serves 15 transit routes, and is located at S. 2nd Street, approximately 1 mile south of the airport. Several bus routes serve the Renton Boeing plant, located on the east side of the airport. These include routes 110, 167, and 340. Sound Transit also serves the Renton Boeing Plant with route 565 and 970.

Airport Trip Generation Data Produced by the Regional Travel Demand Model

The Regional Council uses its regional travel demand model as a major technical tool in planning for the regional transportation system. The model uses population, employment, and land use data (existing and forecast); trip generation data; information about regional travel patterns, mode choice, and travel behavior; distributes trips by mode choice; assigns trips by mode to the regional transportation network; and models the performance of the regional transportation system. The model produces output for each of 832 regional traffic analysis zones (TAZs) showing AM peak hour, PM peak hour, and average daily trips to and from each TAZ.

Much of the information discussed above regarding airport activity levels and employment on and around the region's airports is included in the regional travel model. Data about existing (baseline) traffic is collected from a variety of sources, and provides a wealth of knowledge about the region's current travel behavior. Future forecasts of population, employment, and other trip generators is combined with assumptions about mode choice, trip generation rates, and the affects of cost, to produce estimates of future traffic and how it will be accommodated on the regional transportation system.

In order to simulate the regional transportation network, the travel demand model simulates both trip ends. To accomplish this, the model uses both trip generation and trip attraction rates. Residential trip ends are modeled primarily as trip generators. For residential trips, the model produces five types of home-based trips: work trips, shopping trips, school trips, college trips, and other trips. Non-residential trip ends are modeled as both trip generators and trip attractors. These are grouped into six employment categories: (1) retail; (2) financial, insurance, real estate, and other service employment; (3) manufacturing; (4) wholesale, transportation, communication, and utilities; (5) government; and (6) education. Airports are typically included in the "transportation" category, while Boeing and other related aerospace employment is normally classed as "manufacturing." In addition, the model uses a post-distribution process for special trip generators. Key among these is Sea-Tac Airport. In order to capture the unique trip-generating nature of the airport, estimates of trip making activity to and from Sea-Tac Airport were developed using historical data and future forecasts provided by the Port of Seattle. Airport trip generation rates were based on average weekday trips, not weekend or seasonal averages.

The regional travel demand model produced the following trip generation numbers for the four airports in the region with the greatest access demand (Sea-Tac, Boeing Field, Paine Field, and Renton). These trips include all airport, aerospace, airport-related, and other trips not related to airports or aerospace are included because all these trips are generated within the airport traffic analysis zones (TAZs), and contribute to access needs in the vicinity of the airports.

	Existing 1998 Trips		Forecast 2020 Trips	
Airport	Average Daily	Peak Hour *	Average Daily	Peak Hour *
Sea-Tac	231,816	54,034	327,081	77,220
Boeing Field	132,696	30,076	168,382	38,502
Paine Field	295,190	67,913	344,051	79,767
Renton	97,192	22,170	77,896	18,035
Totals:	756,894	174,193	917,410	213,524

* *Combined AM and PM peak hour trips*

According to the regional travel demand model, these four airports, combined with other trip generators contained in their traffic analysis zones (TAZs), currently generate over 750,000 daily trips and 175,000 peak hour trips. In the case of Sea-Tac Airport, the airport alone generates about half the total trips generated within the relevant traffic analysis zones (see below). The remaining trips can be attributed to residents, hotels, and businesses not directly associated with the airport. For the combined four airports, the current 750,000 daily trips are forecast to increase to over 900,000 daily trips and 213,000 peak hour trips by the year 2020. This level of activity, in terms of both average daily traffic and peak hour trips, places significant demands on the surface transportation system. These airports generate a high percentage of demand during peak hours (23% of total daily demand for the region). When combined with the large overall numbers of trips, these peaking characteristics create both demand for and opportunities to provide alternative forms of transportation, such as transit, car pools and van pools, TDM and ITS, and other approaches to address demand. As described above under existing transportation services and below under planned improvements, these four airports are already engaged in significant roadway and multi-modal transportation improvement programs in coordination with local government, transit agencies, the State DOT, and the Regional Council.

For the regional airport system, the analysis contained in the regional travel demand model is combined with site specific airport master planning to develop recommendations for roadway and other airport access improvements serving the access needs of the region's airports. This information and the related recommendations is summarized in this chapter. While not an exhaustive or comprehensive traffic analysis, the information generated by the travel model is useful in planning for the surface access needs of the region's airports, and integrating these needs into the regional transportation system plan.

Planned Seattle-Tacoma International Airport Access Improvements

For Sea-Tac Airport, baseline and future airport access forecasts were derived from the *Sea-Tac International Airport Master Plan* (1994) and the *Final Supplemental EIS for the Proposed Master Plan Update Development Actions for Seattle-Tacoma International Airport* (May 1997). These included access demand generated by passengers, air cargo activity, and airport, airline, and related employees. In 1994, the airport generated 72,510 average annual daily trips ("AADT"). According to the Final Supplemental EIS, Appendix D (Table D-2), this number is forecast to increase to 141,100 average annual daily trips (AADT) by the year 2020. When non-airport trips are added, the total traffic generated within the Sea-Tac Airport area (seven TAZs) increases to 327,000 daily trips in the year 2020. The following percentages show seven major trip generators at the airport, average daily trips forecasts for the year 2010, and the percentage of the airport total for each:

Trip generator	Daily Trips	Percent of daily trips
Passengers	88,700	78.3 %
Passengers (off-site parking)	1,320	1.2 %
Airport employees	7,200	6.4 %
Air cargo	7,490	6.6 %
Airfield operations	1,740	1.8 %
Maintenance	2,010	5.5 %
General aviation & other	300	< 1 %
Totals	113,290	100 %

To accommodate this airport access demand growth to the year 2010, and mitigate the impacts of airport growth on surrounding communities, the following airport access improvement projects are being

advanced by a cooperative group of sponsors including the Port of Seattle, the State DOT, King County, adjoining cities, Sound Transit, and the Regional Council. These access improvements include:

* SR-509 extension project
* SR-518 corridor study from I-5 to SR509
* South Access Roadway project
* Improvements along SR-99/International Boulevard from S. 153rd Street to S.170th Street
* Sound Transit's *Link* Light Rail connection to the airport plus additional regional Sound Transit express bus routes serving the airport
* Interchange near S. 20th/SR-518 for access to air cargo complex
* Relocation of S. 154th/156th around the end of the new runway
* Temporary construction of a new interchange off SR-509 and SR-518 for delivery of runway fill
* Proposed intermodal center
* Proposed consolidated rental car facility
* Improved access and circulation roadway improvements at the main passenger terminal
* Construction of remote employee parking connected by shuttle bus to the terminal area
* S. 28th / S. 24th Avenues improvement program
* "Pay-on-foot" system for pre-paying parking fees
* Commute trip reduction program
* Employee car pool program
* Flex pass program
* AVI program for billing commercial vehicles

The Regional Council has supported most of these projects in its Regional TIP program and in the Metropolitan Transportation Plan (MTP).

The Port of Seattle and the city of SeaTac signed an inter local agreement ("ILA") on September 4, 1997. The agreement provides for coordination of planning, land use and zoning, and transportation in the vicinity of the airport, including financial support for the planning and implementation of transportation improvement projects. The agreement provides specific support for the SR-509 extension project, South Access project, Sound Transit's LINK light rail project, SR-99/International Boulevard improvements, Transportation Demand Management ("TDM") programs, and a pedestrian link between the airport and the SeaTac city center.

Planned King County Int'l Airport/Boeing Field Access Improvements

The September 1999 draft master plan for King County International Airport / Boeing Field does not include any specific recommendations for surface access improvements (see below for projects included in the MTP).

Planned Snohomish County Airport/Paine Field Access Improvements

The July 1995 *Snohomish County Airport/Paine Field Master Plan* anticipates continued strong airport growth, which will generate increased surface access to and near the airport. In addition, the airport master plan refers to forecasts of growth at the Boeing 747/777 assembly plant, TRAMCO's major aircraft maintenance facility, and other employers in the airport vicinity that will all place additional demands on the regional surface access transportation system. The regional travel demand model, as described above, forecasts significant traffic growth in the Paine Field area (three TAZs), from 295,190 daily trips in 1998 to 344,051 in the year 2020. In order to accommodate this level of activity, the airport master plan, as well as other transportation planning documents, identifies several major surface access improvement projects to meet future airport access needs and those of the greater airport area. These

projects, which are also supported by Snohomish County, the WSDOT, and the Regional Council, include the following:

* New arterial roadway (to be called Paine Field Boulevard) to connect SR-525 near Harbour Point Boulevard N. with SR-526 near 40th Avenue W (this project was completed in 1999)
* Widening of Airport Road between SR-526 and I-5 to an ultimate 7-lane section, including one new high occupancy vehicle (HOV) lane in each direction (this project was underway between the main airport entrance and SR-526 in 1999)
* New four-lane east-west roadway connecting 112th Street SW and SR-525 (Mukilteo Speedway)
* Upgrades to SR-525 (Mukilteo Speedway) between SR-99 and SR-526
* Additional turn lanes, traffic signals, and intersection design improvements at the following intersections: Airport Road and 100th Street SW, Airport Road and Beverly Park-Edmonds Road, Airport Road and 112th Street SW, and Airport Road and Pacific Highway (SR-99).
* Eventual grade separation of the Airport Road/SR-99 intersection
* Improvements to the I-5/128th Street SW interchange

With proposed improvements to all major existing arterial streets on the west and east sides of the airport, plus two new arterial roadways, numerous major intersection improvements planned, and new HOV lanes, the access improvement program for Paine Field is ambitiously seeking a broad range of upgrades to match forecast needs.

Planned Renton Airport Access Improvements

The airport master plan anticipates traffic volumes on Rainier Avenue South will increase by 40% between 1993 and 2013, while volumes on Airport Way are expected to double in the same time frame. The city of Renton is planning multi-modal improvements to accommodate this and other traffic growth in the airport vicinity, including improved transit service, new HOV facilities, Transportation Demand Management (TDM) programs, and Commute Trip Reduction (CTR) programs.

Metropolitan Transportation Plan (MTP) / Transportation Improvement Program (TIP)

The Puget Sound Regional Council is mandated to develop and maintain both the MTP and the TIP. The MTP is the region's long range multi-modal plan for providing transportation improvements in support of the region's *Vision 2020* growth management plan. The current MTP was adopted in 1995, and is currently being updated for adoption in Spring 2001. The regional TIP is the ongoing process that provides state and federal funding to projects that implement the MTP.

The following transportation projects are contained in the 1995 MTP, and will provide improved access to the region's four major airports:

Sea-Tac International Airport (vicinity)

* SR-509 from 1st Avenue South Bridge to Des Moines Memorial Way S. - - Widen for two new HOV lanes
* SR-509 from Des Moines Memorial Way S. to I-5 - - New 4-6 lane limited access freeway (SR-509 extension)
* SR-518 from I-5 to SR-509 - - Major widening for two new HOV lanes
* South Access Project from SR-509 extension to airport terminal - - New arterial
* S. 188th Street from International Boulevard (SR-99) to 16th Avenue S. - - Minor widening

* International Boulevard (SR-99) from S. 170th to S. 188th - - Major widening for two HOV lanes
* S. 176th Street from International Boulevard to Military Road - - Minor widening
* Military Road South from S. 160th Street to S. 186th Street - - Minor widening
* Sound Transit "LINK" Light Rail connection to the airport

King County International Airport/Boeing Field (vicinity)

* East Marginal Way S. from Boeing Access Road to Tukwila north city limit - - Major widening from 4 to 6 lanes

* Sound Transit commuter and light rail systems will pass the airport, with a combined commuter rail and light rail station (with park and ride lot) located at Boeing Access Road at the south end of Boeing Field. This station provide access to the regional commuter and light rail systems, but because of its location, will require a bus connection to provide convenient access to major activity areas at Boeing Field or to Boeing Company's employment center on the west side of the airport.

Snohomish County Airport/Paine Field (vicinity)

* Airport Road from SR-99 to SR-526 - - Major widening for two new HOV lanes
* SR-525 (Mukilteo Speedway) from SR-99 to SR-526 - - Major widening to 5 lanes
* Beverly Park-Edmonds Road/112th Street SW from SR-525 to 3rd Avenue SE - - Major widening to 5 lanes
* Evergreen Way from 112th Street SW to Airport Road - - Major widening to 3 lanes
* 112th Street SW-Beverly Park Road Corridor from SR-525 to SR-527 - - Major widening to 5 lanes
* 100th Street SW from Airport Road to Evergreen Way - - Major widening to 3 lanes
* SR-99 from SR-525 to Evergreen Way - - Major widening for HOV lanes

Renton Municipal Airport (vicinity)

* Downtown Renton transit signal priority system
* Bronson Way from I-405 to S.E. 2nd Street - - Major widening from 4 to 6 lanes
* Sound Transit regional express bus service connecting the Renton Transit Center and I-405
* Sound Transit light rail, commuter rail, or other rail technology (long range) serving downtown Renton and connecting with the regional light rail/commuter rail network

Future Issues and System Planning Needs

While significant amounts of funding will be spent on the projects identified above, and many of these projects will result in improved access to the region's busiest airports, there are additional issues that can be addressed at the regional level. These include more integrated planning for the region's airport access needs, adoption of a multi-modal approach that provides airport assess alternatives, more cost-effective project planning and implementation to stretch available funding further, more environmentally sound solutions to providing access to airports, and recognition of the emerging issue of air quality and its affect on planning for airport access. An August 2000 report by the U.S. General Accounting Office entitled *Aviation and the Environment* includes the results of a survey of the 50 busiest commercial service U.S. airports. The survey asked airport sponsors about the key environmental concerns and challenges associated with existing airport operations and future growth of the airport system. Nearly 40% of the

airports listed air quality as a major concern in planning for future airport growth. When asked what were the most critical issues related to air quality, 82% reported the growing demand for parking was either a major or moderate concern; 76% listed the high number of auto trips to and from the airport; 54% said road congestion was limiting airport growth; and 46% were concerned about the lack of funds for transit serving airports.

While these issues may be most critical at many of the nation's top 50 commercial service airports, including Sea-Tac, they're also relevant to the region's busiest airports that have significant levels of aviation activity and support major amounts of airport and aerospace-related employment. Sea-Tac Airport is beginning to address each of these issues with a program that includes additional parking, ground access improvements, transportation demand management (TDM) and intelligent transportation system (ITS) programs, and coordinated planning for new and expanded transit services provided by Sound Transit. Over time these programs promise to improve access by addressing demand with a multi-modal approach, and providing access choices for both air passengers and airport-related employees.

This type of approach is needed at the regional level, and can be integrated into both the ongoing MTP and WTP (Washington Transportation Plan) planning programs. Similar to the multi-year process that has been addressing the region's freight mobility issues, the first step in beginning to address the region's airport access needs is raising the region's consciousness of the airport system, its economic importance to the region, and how it connects with the rest of the regional transportation system. Additional work in this arena should begin to identify the more specific access needs related to air cargo activity at both Sea-Tac Airport and Boeing Field, and then start to identify multi-modal options and needs serving Paine Field and Renton Municipal Airport. The next step is to merge these needs with those of the neighboring communities and the region as a whole to increase the value of investments in the surface transportation system.

In addition to planning and implementation of airport access improvement projects, future planning efforts should begin to identify specific airport access system performance measures to evaluate the benefits of investments in access projects. These measures could assess how access improvements are benefitting the region's air travelers, air cargo shippers and their customers, general aviation users, airport and aerospace employees, and could also measure environmental indicators, such as air quality reduction and congestion relief.

Chapter 11 - Agency and Public Involvement

Agency and public involvement was accomplished through a Regional Airport System Plan advisory committee, which provided continuing advice and comments throughout the airport system planning process. The committee was formed at the beginning of the planning effort in August 1998. Members included representatives from the FAA, WSDOT, Airport Owners and Pilots Association (AOPA), Washington Pilots Association, several airport sponsors, the U.S. Air Force, local planning agencies, airport user groups, Boeing, and the University of Washington. The following people were members of the RASP Advisory Committee (a more detailed list is attached):

Member	Agency
Stan Allison	WSDOT Aviation Division
John Anderson	Auburn Municipal Airport
Tom Ballard	Pierce County
Rikki Birge	Crest Airpark
Jess Browning	University of Washington (Global Trade and Transportation Logistics)
Steve Butler	City of SeaTac
Dan Cardwell	Pierce County Planning and Land Services
Jim Combs	Washington Pilots Association (WPA)
Ray Costello	Aircraft Owners and Pilots Association (AOPA)
John Current	FAA
King Cushman	Puget Sound Regional Council
Rod DeVol	Snohomish County Airport/Paine Field
Cory Duskin	Arlington Municipal Airport
Frank Figg	Boeing Commercial Airplane Company
Jamelle Garcia	Auburn Flight Services
Kandace Harvey	Harvey Field
Clare Impett	King County International Airport/Boeing Field
Nancy Jensen	NW Section, Ninety Nines
Stephen Kiehl	Puget Sound Regional Council
Steve Lancaster	City of Tukwila Department of Community Development
Ralph Lawson	Spanaway Airport
Mike Lunenschloss	Washington Seaplane Pilots Association
Jack McGoldrick	Washington Pilots Association
Cayla Morgan	FAA
Jonathon Morrow	USAF
Rob Putnam	Arlington Municipal Airport
Jeff Robb	Port of Bremerton/Bremerton National Airport
Fred Salisbury	Port of Bremerton/Bremerton National Airport
John Sessions	Washington Seaplane Pilots Association
Theresa Smith	WSDOT Aviation Division
Bob Snyder	Pierce County Airport/Thun Field
Cynthia Stewart	King County International Airport/Boeing Field
Mary Vargas	FAA
Dave Waggoner	Snohomish County Airport/Paine Field

In addition to formal advisory committee members, the following people served as alternates or participated in committee meetings as interested parties:

Peter Beaulieu	Puget Sound Regional Council
Dick Brandenburg	Port of Bremerton
Bill Brubaker	WSDOT Aviation Division
Carol Key	FAA
Ron Seymour	Port of Seattle
Michelle Whitfield	WSDOT Aviation Division
Julie Rodwell (alt.)	City of SeaTac

Committee meetings were held throughout the RASP planning process between August 1998 and December 2000. Approximately two weeks prior to committee meetings, committee members were mailed a meeting packet containing minutes from the previous meetings, the agenda for the upcoming meeting, a draft report chapter for review and comment and discussion at the upcoming meeting, and various support materials. Committee meetings were held on the following dates:

December 3, 1998
April 1, 1999
September 30, 1999
October 20, 1999 (sub-committee meeting)
January 27, 2000
June 7, 2000
September 28, 2000

In addition to the formal advisory committee meetings and other informal meetings with many committee members, the RASP team held three airport "fly-in" tours to collect information about system airports and to discuss issues with airport sponsors. The tours were conducted using a Cessna 205 supplied and piloted by Dave Waggoner, manager of Snohomish County Airport/Paine Field. The fly-in tours took place on August 26, 1999, September 8, 1999, and September 22, 2000. The following airports were included in the fly-in tours: Harvey Field, Arlington Municipal Airport, Darrington Municipal Airport, Bremerton National Airport, Tacoma Narrows Airport, Pierce County Airport/Thun Field, Renton Municipal Airport, and Crest Airpark.

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Puget Sound Regional Council
PSRC

MEMORANDUM

To: RASP Advisory Committee, Airport Sponsors
From: Stephen Kiehl
Subject: Draft *2001 Regional Airport System Plan* Report
Date: March 20, 2001

Enclosed with this April 4, 2001 RASP Advisory Committee agenda package is a draft of the *2001 Regional Airport System Plan* report. The report incorporates many of the comments received over the past two years during our RASP Advisory Committee meetings, through the mail, on the phone, and during our airport site visits. It also reflects several changes to the system which have occurred over the course of the study process. Notable among these are the loss of Lester State Airport and Martha Lake Airport.

You'll note the Airport System Capital Improvement Program (Exhibit 9-1 on page 9-2 of the report) includes numerous projects with no cost estimates. In most cases these projects were identified as needs during the regional airport system planning process, and no cost estimates have been prepared. If you have comments about these projects, including cost information, please let us know by April 20, 2001 so we can include them in the final report.

Also included in this package is a Regional Airport Pavement Management Program summary, which highlights the findings of the pavement study prepared by WSDOT Aviation Division. We've attached this brief report to facilitate discussion at the next RASP advisory committee meeting. After the committee has reviewed the pavement report findings we will incorporate them into the final RASP report.

The next meeting of the RASP Advisory Committee is scheduled for April 4, 2001 from 1-3 p.m. in the Regional Council's 5th Floor Conference Room. Please note this is a different room than the earlier RASP committee meetings. At the April meeting we'll discuss the results of the regional airport pavement management program, your comments on the preliminary draft RASP report, how the RASP fits into the 2001 Metropolitan Transportation Plan ("Destination 2030"), and possible future committee activities. Thanks ahead of time for reviewing the preliminary draft report. If you have questions or comments on the report before the meeting please contact me by phone at 1-206-464-6715, by FAX at 1-206-587-4825, or via E-mail at skiehl@psrc.org. We hope to see you at the next meeting.

Enclosures: Draft RASP Report
Summary of Regional Airport Pavement Management Program
April 4, 2001 RASP Advisory Committee Meeting Agenda

REGIONAL AIRPORT SYSTEM PLAN
TECHNICAL ADVISORY COMMITTEE

Wednesday, April 4, 2001
1:00 - 3:00 p.m.

Puget Sound Regional Council
1011 Western Avenue
Seattle, Washington
5th Floor Conference Room *(note new location)*

1:00 p.m. 1. **Call to Order and Introductions** - *King Cushman and Dave Waggoner*

1:10 p.m. 2. **Discussion**: Pavement Management Program; integrating the results into the RASP* - *Steve Kiehl*

2:00 p.m. 3. **Discussion**: Comments on Preliminary Draft RASP Report* - *Committee*

2:20 p.m. 4. **Information**: Draft *Destination 2030* (update of Metropolitan Transportation Plan) - *King Cushman*

2:40 p.m. 5. **Other Business**: Future Activities of the PSRC Aviation Program - *Steve Kiehl*

2:55 p.m. 6. **Next Meeting**

3:00 p.m. 7. **Adjourn**

* Supporting material enclosed

Sign language and communication material in alternate formats can be arranged given sufficient notice by calling Grace Foster at (206) 464-7090. TDD/TTY: (206) 464-5409

Summary of Regional Airport Pavement Management Program

March 20, 2001

This report summarizes the information and findings contained in the *Washington State Aviation Pavement Management Program for the Puget Sound Region Airports*, prepared by the Washington State Department of Transportation Aviation Division. The technical analysis was done by the State's consultant, Pavement Consultants Inc. The goal of the program is to provide the latest technical information regarding the airport system's pavement condition and future maintenance needs, including related funding requirements. The information is intended to help airport sponsors identify, plan for, and fund their airport pavement needs. In addition, the program is intended to provide pavement needs and funding information that will inform funding agencies and the state legislature.

Background

In the Fall of 2000, the WSDOT Aviation Division finished its statewide airport pavement management program, which was conducted by Pavement Consultants, Inc. (PCI). The program evaluated existing conditions and future maintenance needs for pavements at the state's public use airports. As a subset of the statewide program, PCI has prepared an analysis of 13 airports in the Puget Sound region. The goal of the regional analysis is to document the condition of airport pavements in our region and help us define the region's airport pavement maintenance needs. The regional airport pavement analysis was delivered to PSRC in January 2001.

This summary also includes information obtained from the WSDOT's statewide pavement management program as well as the individual airport pavement management reports for the 13 airports included in the regional analysis. The regional study used the same methodology, assumptions, analysis, and funding scenarios as were used for the statewide program. These are described below.

Program Development Process

The following outlines the basic steps in the pavement management program process:

Pavement inventory - included records review, defined pavement features, and developed the pavement network.

Pavement inspection - consisted of field inspecting pavement sections and quantified the amount and severity of defects observed, including probable cause of the distress.

***MicroPAVER* implementation** - pavement inspection data were entered into the *MicroPAVER* program and analyzed using the *MicroPAVER* computer software. The micropaver program generates pavement condition index (PCI) ratings (between 0 and 100) for the airport pavements being evaluated.

Report generation and interpretation - this task produced the graphic and written contents of the airport pavement management program report.

Puget sound region budget scenario evaluation - evaluates the impacts on pavement condition for various funding scenarios. These were the same as those evaluated for the statewide program.

Airports Included in the PSRC Regional Airport Pavement Management Program

Arlington*
Bremerton National*
Darrington
King County Int'l/Boeing Field*
Renton*
Spanaway
Tacoma Narrows*
Auburn*
Crest Airpark*
FirstAir Field
Pierce County/Thun Field*
Snohomish County/Paine Field*
Swanson

* *Asterisk means airport is among the region's top ten GA airports in terms of number of based aircraft or aircraft operations (analysis excluded Harvey Field)*

Summary Results of Analysis for 13 Regional Airports (see Table 1 - attached)

- Total area inspected: 29.662 million square feet
- Total number of pavement sections inspected: 766
- Average pavement age at inspection: 18.00 years
- Youngest pavement age is at Darrington (4.00 years)
- Oldest pavement age is at Spanaway (36.71 years)
- Regional weighted average PCI: 76.19 - Pavement condition rating: Very good
- Statewide weighted average PCI: 73.06 - Pavement condition rating: Very good
- Highest PCI rating was at Darrington (99.25) - Pavement condition rating: Excellent
- Lowest PCI rating was at Spanaway (48.65) - Pavement condition rating: Fair
- Pavement condition for the region was generally higher than for the rest of the state. The following compares pavement condition rating results for the region (13 airports) versus the rest of the state:

Pavement Condition Rating	Region	State
Excellent	42.35 %	39.01 %
Very good	20.71 %	15.27 %
Good	20.92 %	20.17 %
Fair	8.13 %	12.89 %
Poor	4.61 %	4.66 %
Very poor	2.66 %	5.74 %
Failed	0.62 %	2.26 %

Comparison of Airport Pavements with Averages for the Region

The following pavements are below the regional average PCI for the pavement branch shown (see attached table for complete information for all airports and pavement branches):

Airport	Airport Pavement Branch	Airport Pavement Condition Index (PCI)	Regional Average PCI *
Arlington	Apron	67.66	75.25
Bremerton	Runway	64.19	79.54
Crest	Apron	61.00	75.25
Crest	Taxiway	66.02	71.69
FirstAir Field	Apron	52.17	75.25
FirstAir Field	Runway	46.72	79.54
FirstAir Field	Taxiway	56.20	71.69
Boeing Field	Runway	66.06	79.54
Boeing Field	Taxiway	71.08	71.69
Renton	Taxiway	62.87	71.69
Paine Field	Apron	73.24	75.25
Spanaway	Apron	31.00	75.25
Spanaway	Runway	63.69	79.54
Spanaway	Taxiway	39.56	71.69
Tacoma Narrows	Runway	66.29	79.54

* *Regional average pavement condition indices for the three basic pavement branches are 79.54 for runways, 71.69 for taxiways, and 75.25 for aprons.*

Pavement Maintenance Funding Scenarios

Four funding scenarios (including state and federal funds) were evaluated for the period 2001-2008:

1. **Unlimited budget** - this scenario assumes no limit on budget. This would improve the state's airport pavement condition index above existing levels.

2. **$3,200,000 annual budget** - this scenario is based on existing federal and state funding levels. This scenario would result in decreasing PCIs at the state's airports.

3. **$4,500,000 annual budget** - this scenario reflects a possible increase in the state's budget due to an increase in funds available for airports from the gas tax. While providing some additional funds, this scenario would still result in decreasing PCIs for the state airport system.

4. **$10,000,000 annual budget** - this scenario was based on maintaining the existing average PCI for the state airport system. By investing $10,000,000 per year in the state's pavement maintenance program, the average PCI for the state's airports would remain at the existing 73-75 level.

The following data displays four scenarios with varying levels of the annual investments for airport pavement maintenance for the entire state and for the Puget Sound region (13 airports). It also shows the additional amount of money ("Regional Unfunded Need") that, under ideal conditions, would need to spent over and above a scenario's specified budget to address the state and regional pavement needs.

Budget Scenario		Statewide Total	Regional Total	Regional Unfunded Need
1.	Unlimited budget	$ 81,050,000	$ 30,332,944	$ 0
2.	$3,350,000 annual budget	$ 26,800,000	$ 13,635,605	$ 14,501,712
3.	$4,200,000 annual budget	$ 33,600,000	$ 13,993,986	$ 14,258,979
4.	$10,000,000 annual budget	$ 80,000,000	$ 28,598,100	$ 149,079

Conclusions and Next Steps

- The majority of pavements at the region's airports are in very good or excellent condition.
- Regional airport Pavement Condition Indices (PCIs) are slightly higher than the average for public use airports statewide.
- In most cases, the region's privately owned airports have lower pavement condition indices than public airports.
- Airport capital improvement programs for many of the region's airports (see *2001 RASP Report*, chapter 9, exhibit 9-1) show the need for significant investment in pavement maintenance projects that is consistent with the levels recommended in the State's Pavement Management Program.
- While the region's existing airport pavements are in relatively good condition, existing funding levels will not keep pace with future pavement maintenance needs.
- In order to maintain the existing condition of the region's airport pavements, considerable additional funding will be required. At the 13 airports included in the regional pavement analysis, existing funding levels will meet just under half the amount required to maintain existing pavement conditions. Over the next 8 years, the region would need to generate over $14 million in additional funds to maintain and preserve the existing pavements at their current level (PCI = 76.19).
- Airport sponsors, the Regional Council, State DOT Aviation Division, FAA, and others should work together to document the importance of airports to the state and the region, identify the airport system's pavement management funding needs, and pursue existing and new funding sources.
- The State's Pavement Management Program has established an excellent baseline of information, and will be an extremely valuable ongoing resource to assist airport sponsors in identifying and planning for their pavement needs. Airport sponsors should work closely with the State DOT Aviation Division and their pavement management consultants in developing their ongoing airport specific pavement maintenance and management programs.

Table 1 - Summary of Puget Sound Region Airport Pavement Management Program Findings

						Recommended
	Weighted Average PCI (2000)				Average Age	5-Year Pavement
Airport	Apron	Runway	Taxiway	Total	of Pavements	Maintenance Costs **
Arlington	67.66	97.40	73.38	77.14	18.09	$2,267,613
Auburn	84.13	80.34	77.86	80.90	22.06	$521,597
Bremerton	78.29	64.19	82.92	74.01	20.96	$1,355,178
Crest	61.00	78.39	66.02	70.81	16.42	$181,928
Darrington	99.00	100.00	98.16	99.25	4.00	$20,084
FirstAir Field	52.17	46.72	56.20	50.01	14.69	$198,053
King County Int'l/Boeing Field	81.65	66.06	71.08	72.30	18.61	$7,190,844
Pierce County/Thun Field	80.06	87.00	86.64	83.99	15.03	$479,240
Renton	85.64	94.67	62.87	80.25	18.27	$1,275,221
Snohomish County/Paine Field	73.24	91.21	72.39	76.76	14.50	$4,669,291
Spanaway	31.00	63.69	39.56	48.65	36.71	$138,308
Swanson	100.00	98.00	-	98.16	2.00	$11,722
Tacoma Narrows	84.36	66.29	73.20	77.12	26.34	$898,453
Regional Totals *	75.25	79.54	71.69	76.19	18.00	$19,207,532

* Regional weighted average PCI numbers for apron, runway, and taxiway are arithmetic averages for the 13 regional airports (calculated by PSRC).
Total weighted average PCI was calculated by Pavement Consultants, Inc.

** Based on the $10 million per year budget scenario, which would maintain the state's airports at it's existing average PCI of 73-75.

Source: Washington State Aviation Pavement Management Program, 2000, prepared by Pavement Consultants Inc.