REGIONAL AIRPORT SYSTEM PLAN
1988-2020
Air Transportation Element
of the Regional Transportation Plan

September 1988

Mayor Gene Lobe, City of Bremerton, President, PSCOG
Curtis Smelser, Executive Director

This report was prepared under the technical guidance of the AIR TRANSPORTATION ADVISORY COMMITTEE, subcommittee of the Standing Committee on Transportation:

Councilmember Darlene McHenry, City of Issaquah, Chair

Jack Addington
Tacoma Narrows Airport

Ken Attebery
Port of Bremerton

Marsha Bathke
Plateau Preservation Society

Neil Bennett
Air Transportation Association

Dr. Ronald Boyce
Seattle Pacific University

Tim Brooks
Kenmore Air Harbor

Ray Costello
Aircraft Owners & Pilots Association

Bill Dolan
Paine Field

Bill Duchek
City of Seattle

Linn Emrich
Skyport Airport

Bill Hamilton
Washington State Department of Transportation, Aeronautics

Kandace Harvey
Harvey Airfield

Frank Jessee
Airport User

Daniel Kenyon
Washington Pilots Association

Marc Krandel
Snohomish County

Jerry Lenzi
Washington State Department of Transportation

Rose Loper
Boeing Company

Del Moss
Tulalip Tribes

Thom Myers
Arlington Airport

Mary Helen Roberts
CABLE

George Saito
Federal Aviation Administration

Lois Schwennesen
King County

Lang Sligh
Langley Associates, Inc.

Don Smith
Boeing Field

Burr Stewart
Port of Seattle

Clyde Stricklin
Kitsap County

Hal Woosley
Bellevue Chamber of Commerce

Rosemary Zeutschel
Northeast King County Coalition of Community Clubs

This report was prepared under the policy guidance of the:

STANDING COMMITTEE ON TRANSPORTATION
(July 1988)

King County Executive Tim Hill, Chair

Bruce Agnew
Congressional Staff

Commissioner George Barner, Jr.
Thurston County

Gene Baxstrom
Legislative Transportation Committee

Councilmember George Benson
City of Seattle

Ron Bockstruck
Washington State Department of Transportation, District 1

Councilmember Bill Brubaker
Snohomish County

Mayor Nan Campbell
City of Bellevue

Councilmember Brian Corcoran
Snohomish County

Commissioner Pat Davis
Port of Seattle

Councilmember Morrie Dawkins
City of Bremerton

Councilmember Margaret Doman
City of Redmond

Representative Ruth Fisher
District 27

Councilmember Helen Frederick
City of Fife

Councilmember Mabel Harris
City of Tukwila

Mayor M.J. Hrdlicka
City of Lynnwood

Councilmember Bruce Laing
King County

Mayor Rita Matheny
City of Marysville

Councilmember Darlene McHenry
City of Issaquah

Councilmember Ed Morrow
City of Everett

Senator Gary Nelson
District 21

Admiral Harold Parker
Washington State Department of Transportation, Marine Division

Representative Mike Patrick
District 47

Councilmember Rose Marie Raudebaugh
Town of Fircrest

Councilmember Jim Ryan
City of Gig Harbor

Representative Karen Schmidt
District 23

Councilmember Tom Stenger
City of Tacoma

Councilmember Jim Street
City of Seattle

Mayor Alice Tawresey
City of Winslow

James Toohey
Washington State Department of Transportation

Councilmember Hank Waibel
City of Bremerton

Councilmember Jeanette Williams
City of Seattle

PSCOG Grand Central on the Park • 216 First Avenue South • Seattle, WA 98104 • 206/464-7090
Puget Sound Council of Governments

RESOLUTION NO. A-88-13

A RESOLUTION of the Puget Sound Council of Governments adopting the revised Regional Airport System Plan, 1988-2020, as the interim air transportation element of the Regional Transportation Plan

WHEREAS, the Puget Sound Council of Governments provides a forum for cooperative decision-making by the region's elected officials in order to bring about a cooperative, continuous, and comprehensive planning process; and

WHEREAS, the Puget Sound Council of Governments has responsibility for carrying out regional transportation planning including planning for airport facilities, as stated by policies in the Goals and Policies for Regional Development, adopted in February 1977; and

WHEREAS, the Puget Sound Council of Governments has carried out an analysis of air transportation demand and airport facility needs for the central Puget Sound region coordinated through the Air Transportation Advisory Committee and has documented the conclusions and recommendations in the revised Regional Airport System Plan, 1988 - 2020, July 1988; and

WHEREAS, the revised Regional Airport System Plan, 1988 - 2020, has undergone a review and public hearing process coordinated by the subregional councils and the Standing Committee on Transportation, and the substantive issues and concerns raised during the review process have been addressed by appropriate revisions to the draft plan; and

WHEREAS, the revised Regional Airport System Plan is an interim plan which recommends alternatives for further analysis and recommends a decision making process for selecting a preferred alternative as expeditiously as possible;

NOW, THEREFORE, BE IT RESOLVED, that the Puget Sound Council of Governments hereby adopts the Regional Airport System Plan, 1988 - 2020, consisting of conclusions and recommendations set forth in the attached Executive Summary as the interim air transportation element of the Regional Transportation Plan for the central Puget Sound region.

Adopted by the Assembly this 29th day of September, 1988.

Mayor Gene Lobe
President, PSCOG

ATTEST:

Curtis R. Smelser
Executive Director, PSCOG

ABSTRACT

REPORT TITLE:	Regional Airport System Plan 1988-2020, Air Transportation Element of the Regional Transportation Plan
PROJECT TITLE:	Regional Airport System Plan
SUBJECT:	Plan for Region's Airport System
DATE:	September 1988
SOURCE OF COPIES:	Puget Sound Council of Governments Information Center 216 First Avenue South Seattle, Washington 98104 (206) 464-7532
ABSTRACT:	The Regional Airport System Plan is one element of the Regional Transportation Plan, which addresses the multi-modal transportation needs of the region from 1988 to 2020. The Regional Airport System Plan identifies the airport facility needs for the region and makes recommendations for meeting them. It sets forth general policies to guide the development and operation of a system of public use airports for the benefit of the people of the region. It also establishes a process for revising the air carrier element of the Regional Airport System Plan.
FUNDING:	Preparation of the Regional Airport System Plan was financed by appropriations from member jurisdictions of the Puget Sound Council of Governments and grants from the Federal Aviation Administration of the U.S. Department of Transportation.

FOREWORD

The Puget Sound Council of Governments (PSCOG) is a voluntary association of local governments in King, Kitsap, Pierce, and Snohomish counties, created to provide a forum for regional decision-making. The primary goals of the PSCOG are to guide the growth and development of the region, and to seek solutions to problems that cross jurisdictional boundaries. PSCOG membership currently includes 49 cities and towns, three Indian tribes and the four counties. The PSCOG's business is conducted by local elected officials representing the member agencies.

The Regional Airport System Plan has been a multi-year planning effort addressing the region's air transportation and airport facility needs. It was initiated as part of the PSCOG fiscal year 1985 work program. The first phase consisted of a series of technical studies on such topics as helicopter service needs, seaplane facility needs, sport aviation issues, special needs of privately owned airports, aviation growth forecasts, and demand/capacity relationships. The results of these studies fed into a local government workshop held in June 1986 for the purpose of exploring land use issues unique to airport facilities.

The second phase consisted of updating the Regional Airport System Plan itself. Airport system alternatives were taken out for public comment in a series of public forums held in February 1987. Following the evaluation of alternatives, the draft plan was prepared and distributed in October 1987 to initiate the review and adoption process. This process began with a preliminary review of the plan by the PSCOG subregional councils and the Standing Committee on Transportation (SCOT) in October and November 1987. Distribution of a draft environmental impact statement in December 1987 was followed by a public review process in accordance with the State Environmental Policy Act (SEPA). Public hearings on the DEIS were held in January and February 1988.

In response to the results of the hearings, revisions were made to the draft plan and are contained in this document. The Final Environmental Impact Statement and the Revised Draft Plan were endorsed by the subregional councils, SCOT and the Executive Board in June and July 1988. Adoption by the PSCOG Assembly occurred September 29, 1988. As described above, the review and adoption process encompassed a 12-month period. The new plan replaces the earlier Regional Airport System Plan adopted by PSCOG in 1982.

This project has been conducted under the guidance of the Air Transportation Advisory Committee (ATAC). The ATAC is a subcommittee of the SCOT. It brings together the interests of airport operations, land use planning, airport users, business,

and the community. The ATAC reviewed the technical products and assisted in the formulation of conclusions and recommendations, which were forwarded to the subregional councils and SCOT for approval. This adopted plan includes changes to the first draft that were recommended by ATAC, as modified by SCOT.

The technical work for this project was performed by the PSCOG staff with the assistance of a consultant team led by Reid, Middleton and Associates. The other members of the consultant team included Bell-Walker Engineers, George Frost Associates, Triangle Associates, Robert Brown, and Rodwell Research.

LIST OF TABLES

LIST OF FIGURES

TABLE OF CONTENTS

Executive Summary

REGIONAL AIRPORT SYSTEM PLAN 1988-2020
AIR TRANSPORTATION ELEMENT OF THE
REGIONAL TRANSPORTATION PLAN
September 1988

EXECUTIVE SUMMARY

PURPOSE AND SCOPE

The purpose of the Regional Airport System Plan (RASP) is to identify and select solutions to airport facility needs. It sets forth general policies that guide the development and operation of a system of public use airports for the benefit of the greater metropolitan area encompassed by King, Kitsap, Pierce, and Snohomish counties. The Regional Airport System Plan is one element of the PSCOG Regional Transportation Plan, which addresses multi-modal transportation needs of the region to the year 2020.

The plan contained herein updates the 1982 adopted RASP. It is an interim plan in that it presents alternatives and recommends a process leading to the selection of preferred long range alternatives for air carrier and general aviation facilities.

WHAT CHANGED SINCE THE PLAN WAS ADOPTED IN 1982?

Although the airports in the region have not changed substantially for many years, the Regional Airport System Plan is updated at frequent intervals to reflect the changing conditions of air travel within the region and the changing nature of the aviation industry itself. This plan differs from the one adopted in 1982 in the following ways:

- Population and economic growth forecasts for the region have been updated, extending to the year 2020.
- Forecasts of air carrier and general aviation demand have been updated and extended to the year 2020.
- Sea-Tac is expected to reach its capacity before the end of the planning period.
- Implementation of the process (established in the 1982 RASP) that could have led to development of a new general aviation airport did not proceed.
- The Bellevue, Issaquah and Duvall airfields have closed. The Cedar Grove airfield is facing potential closure.

- Some privately owned public-use airports have changed their status to private restricted use.
- The reliance on capacity provided by privately owned airports has become more critical while their availability more uncertain.
- Policy recommendations related to helicopter, seaplane, and sport aviation facilities have been added.
- Master plans have been updated for Sea-Tac, Boeing Field, Tacoma Narrows Airport, Bremerton National Airport, Thun Field and Harvey Airfield; updates are in progress for Renton Municipal Airport and Arlington Municipal Airport.
- Based on the adopted "General Aviation" role for Paine Field (re: Airport Commission Resolution, April 11, 1978) and the 1979 mediated agreement with airport communities, residential and commercial development have been permitted adjacent to the airport, potentially inhibiting the expansion of its role.

Many of the study findings and recommendations contained in this plan are a result of the changes that have taken place within the larger context of the nation's aviation industry. Some of the more important or visible changes within the industry are as follows:

- Deregulation of the air carrier industry has resulted in a hub-and-spoke patterned air transportation network, increased volume of operations, and fluctuating price and service levels;
- A stabilized growth in the nation's general aviation fleet size;
- An emerging sport aviation industry;
- An expanding potential for helicopter operations;
- A strong commitment to noise and flight track mitigation programs.

PRINCIPAL CONCLUSIONS LEADING TO THE AIR CARRIER SYSTEM RECOMMENDATIONS

1. Sea-Tac, under its currently adopted master plan, will reach maximum capacity shortly after the year 2000; it will be unable to accommodate the growth in air passenger demand as now projected to the year 2020.
2. Certain airports in the region have an existing runway/taxiway system and instrument landing system capable of serving at least part of the air carrier fleet (multi-engine prop, turboprop, and jet aircraft used by airlines). These airports -- Boeing Field, Paine Field,

Bremerton National and McChord Air Force Base (AFB) -- are candidates for a potential future air carrier satellite role, requiring no major runway expansions.

It is recognized that the role of Paine Field in serving air carriers will be limited by the terms of the "Modified General Aviation Role" being considered by Snohomish County.

3. Boeing Field's potential role as an air carrier satellite may be limited because it shares the same terminal airspace with Sea-Tac.

4. The use of McChord AFB would be subject to approval by the U.S. Department of Defense on joint use. The conditions for joint use are defined in Air Force regulations.

5. The potential role of Paine Field as an air carrier satellite will be governed by the 1979 mediated agreement (or its successor) and policies contained therein, on the role of Paine Field.

6. The management of the regional air carrier airport system will likely require institutional changes and/or new interlocal agreements. This will be a necessary part of selecting the preferred alternative.

DEFINITION OF TERMS USED IN AIR CARRIER SYSTEM RECOMMENDATIONS

Air Carrier: The commercial system of air transportation consisting of the certificated air carriers, air taxis (including commuters), and various charter operations.

Air Taxi (including Commuter): A classification of air carriers that transport persons, property, and mail using small aircraft (under 30 seats or a maximum payload capacity of less than 7,500 pounds). In addition, a commuter performs at least five scheduled round-trips per week between two or more points.

Certificated Air Carrier: An air carrier holding a Certificate of Public Convenience and Necessity issued by the U.S. Department of Transportation to conduct scheduled services. These carriers operate large aircraft (30 seats or more or a maximum payload capacity of 7,500 pounds or more).

Dependent Runway: A runway that interacts with adjacent runways; that is, take-offs and landings are staggered because the separation between runways is not sufficient under FAA standards for independent operation.

Instrument Landing System: A set of navigation instruments used to guide aircraft on the final portion of the landing approach under limited visibility conditions.

Reliever Airport: Airports that are intended to reduce congestion at large air carrier airports by providing alternative landing areas for general aviation aircraft.

Satellite Airport: Generally refers to an airport that has air carrier service, but operates in a subsidary role to the area's primary air carrier airport, usually at a lower volume of operations and serving smaller aircraft.

AIR CARRIER SYSTEM RECOMMENDATIONS

1. It is recommended that PSCOG, in cooperation with the Port of Seattle and other appropriate agencies, proceed expeditiously with the detailed evaluation and selection of a preferred regional air carrier system alternative, in accordance with the generalized decision process shown in Attachment A.

2. It is recommended that implementation timing decisions on the air carrier system preferred alternative be based on regional projections of air carrier passenger demand and aircraft operations.

3. It is recommended that Renton Municipal, Paine Field, and Bremerton National airports take near-term actions to encourage use by corporate, training, and other general aviation aircraft, which can divert flights from Boeing Field during instrument flight (bad weather) conditions, to the extent consistent with each airport's currently adopted master plan.

4. It is recommended that PSCOG, in cooperation with Snohomish County, the Port of Bremerton, and the Port of Tacoma, take steps to influence appropriate land use and transportation plans to preserve a potential satellite air carrier role for Paine Field, Bremerton National and McChord AFB, pending completion of detailed site-specific evaluation and selection of a preferred regional air carrier system alternative.

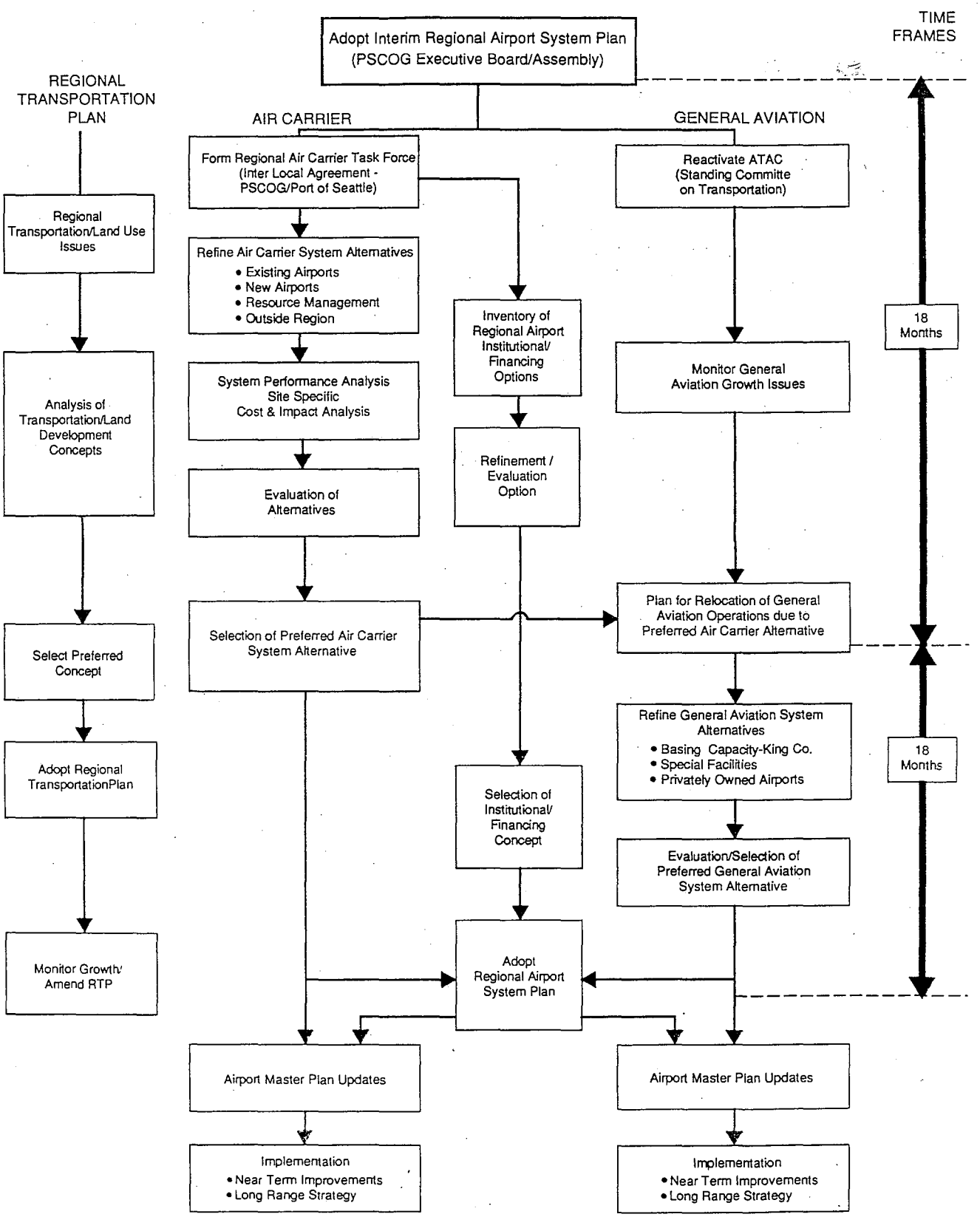
   It is recognized that the role of Paine Field in serving air carriers will be limited by the terms of the "Modified General Aviation Role" being considered by Snohomish County.

5. It is recommended that local land use plans and zoning codes prevent further encroachment and incompatible development around area airports.

6. It is recommended that the Port of Seattle and King County, in cooperation with PSCOG and other appropriate jurisdictions, continue to give high priority to studies to determine the operational feasibility of expanding Sea-Tac's capacity, to determine the future role of Boeing Field and its relationship to Sea-Tac, and to determine reliever airport needs.

ATTACHMENT A

Regional Airport System Alternatives Refinement Process



7. It is recommended that the investigation of institutional and financing options for the management of the regional airport system proceed in parallel with the technical evaluation of alternatives so that the selection of a preferred alternative and the identification of the implementing authority occur concurrently.

8. It is recommended that the following air carrier alternatives be selected for further detailed site-specific analysis to support the selection of a preferred alternative.

- Satellite Airports - Existing Locations

  Development of satellite airports by upgrading one or two existing general aviation or military airports. Candidates within the PSCOG region include Bremerton National, McChord AFB, and Paine Field *(subject to terms of "Modified General Aviation Role")*. Potential candidates outside the PSCOG region may include such airports as Olympia and Skagit Regional.

- Satellite Airports - New Locations

  Development of satellite airports at one or two new locations (could include locations outside the PSCOG region).

- Maximize Air Carrier Capacity of Sea-Tac

  Through the leadership of the Port of Seattle investigate all options for expansion within the existing Sea-Tac property.

- New Primary Air Carrier Airport

  Development of a new primary air carrier airport with capacity potential to serve the long range (through 2020) air carrier demand (could include locations outside the PSCOG region).

- Resource Management

  Optimization of regional air carrier capacity through resource management, with no major airport expansions. Elements to include but not be limited to:

  - Use of airports outside the region, such as Olympia or Skagit Regional (Bayview), for satellite air carrier operations to the extent permitted under their currently adopted master plans.

  - Use of Boeing Field to serve air carrier operations, potentially displacing some of the general aviation now served there.

- Joint management and operation of Boeing Field and Sea-Tac.
- Limited commuter service at several airports (such as the existing San Juan Airline service to Paine Field) to the extent permitted by currently adopted master plans.
- Use of an airport outside the region, such as Grant County Airport (Moses Lake) or Portland International, as a hub for international flights, with express ground transportation or air shuttle to the central Puget Sound region.

PRINCIPAL CONCLUSIONS LEADING TO GENERAL AVIATION RECOMMENDATIONS

1. In 1985 there were about 3,550 based general aviation aircraft in the central Puget Sound region; the collective capacity potential for the region's 22 public use airports is 5,230 with buildout of existing facilities (no major expansions). By the year 2020, the regional based aircraft fleet is projected to grow to 3,730 under the low forecast, and to 6,230 under the high forecast.
2. The potential based aircraft capacity shortfall is concentrated in King County, ranging from near zero under the low forecast to 1,000 based aircraft under the high forecast; Kitsap, Pierce and Snohomish counties appear to have adequate based aircraft capacity through the planning period.
3. The need for reliever airport capacity for general aviation is greatest in King County because of air traffic congestion in the Sea-Tac/Boeing Field airspace.
4. About one-fourth of the region's public use based aircraft capacity is provided by privately owned airports and seaplane bases. Actions by local and state government to preserve these facilities for public use could mitigate the need to develop new general aviation airport capacity with public resources.
5. The demand for helicopter services is expected to grow faster than other elements of air transportation, because of technological advancements and because of congestion in surface transportation. The greatest demand will be for air taxi services and corporate transportation to central city locations and other major activity centers. Reliable public use facilities do not currently exist in central city locations.
6. Seaplane service is a specialized industry unique to the Northwest and Alaska. Local and state government actions to support the continued operation of existing facilities could help preserve this specialized form of transportation.

7. Sport aviation is a popular form of recreation in the central Puget Sound region that has unique impacts and special locational requirements. It needs recognition in local comprehensive land use plans, recreation plans, and airport master plans in order to enhance safety, minimize airspace conflicts and minimize adverse community impacts.

DEFINITION OF TERMS USED IN GENERAL AVIATION RECOMMENDATIONS

Based Aircraft: Refers to general aviation aircraft located permanently or semi-permanently at an airport, usually where storage, maintenance, fuel and other support services are available.

General Aviation: Refers to all elements of aviation except air carrier and military. It includes private business, corporate and personal travel with airplanes (including seaplanes) and helicopters; recreational and sport aviation; and some charter, air taxi and commercial delivery services.

General Utility Airport: A general aviation airport capable of accommodating aircraft up to 12,500 pounds gross weight with a runway length in the 3,000 - 4,000 foot range. Generally for use by single engine and light twin engine aircraft.

Heliport: A small landing area suitable for landing and take-off and temporary parking of helicopters. Heliports may be located at existing airports, on rooftops, or in open areas next to hospitals, meeting sites, or industrial areas. They may be equipped for refueling and have passenger facilities and aircraft parking spaces.

Helistop: A small landing area suitable only for drop-off and pick-up of passengers and cargo by helicopter. No parking or fuel facilities are provided.

Seaplane Base: A waterfront facility suitable for the operation of seaplanes. The facility usually has docks for temporary moorage of visiting or based seaplanes, ramps and equipment for launching and retrieving seaplanes, and amenities for passengers and pilots.

Sport Aviation: The use of gliders, parachutes, balloons, and ultralights for recreation.

GENERAL AVIATION RECOMMENDATIONS

1. It is recommended that the decision-making process for the implementation of general aviation system recommendations follow the time frames shown in Attachment A.

2. It is recommended that local governments actively support preservation of existing public use general aviation airports.

3. It is recommended that local land use plans/zoning codes prevent further encroachment and incompatible development around area airports.

4. It is recommended that local jurisdictions support the establishment of an airport overlay zone surrounding the boundaries of general aviation airports to avoid incompatible land use development (refer to the model overlay zone in Appendix B of RASP).

5. It is recommended that local jurisdictions recognize the transportation resources provided by privately owned public use general aviation airports by supporting economic incentives such as property tax exemptions and other options to enhance their viability as transportation facilities.

6. It is recommended that, where appropriate, local governments consider acquisition of privately owned public use airports threatened with closure.

7. It is recommended that the process of assessing the feasibility of constructing additional general aviation facilities in King County, as recommended by the 1982 RASP, proceed in order to facilitate future implementation, should additional loss of general aviation airport capacity occur over the next 10 years.

8. It is recommended that the Port of Seattle, in assessing the operational feasibility of expanding Sea-Tac's capacity, adopt a regional perspective to address the impacts on general aviation.

9. It is recommended that the following general aviation system alternatives be retained in the RASP for further analysis and refinement, based on changing conditions in the general aviation industry and/or stabilization of growth outlook.

   - Maintain Viability of Existing General Aviation Airports.
   - Expand Capacity of Selected Existing General Aviation Airports.
   - Expand Capacity by Development of New General Aviation (general utility class) Airport.

10. The following recommendations are for Special Air Transportation Facilities.

    - The PSCOG supports a cooperative effort to provide helicopter landing facilities in central city locations, if warranted by growth in demand and subject to environmental compatibility.

- The PSCOG believes that the use of local ordinances, such as the model ordinance in Appendix A of the RASP, and other operations management measures will be needed in order to serve increased demand for helicopter operation with minimal community impacts.
- The PSCOG believes that the protection of privately owned public use airport facilities, through such means as zoning for land use compatibility, economic incentives and liability insurance reforms, must be considered by local and state governments.
- The PSCOG supports preservation of existing seaplane services and their required operating facilities, in conjunction with cooperative efforts to reduce negative impacts of seaplane operations on communities.
- The PSCOG supports a cooperative effort to provide adequate physical and operating facilities for sport aviation activity, providing adverse community impacts are mitigated.

I. Introduction

I. INTRODUCTION

PURPOSE AND SCOPE

The purpose of the Regional Airport System Plan is to address airport facility needs. It sets forth general policies that guide the development and operation of a system of public use airports for the benefit of the greater metropolitan area encompassed by King, Kitsap, Pierce, and Snohomish counties. The plan contained herein covers the period 1988-2020.

The airport facilities included in the plan range from the largest air carrier airport, which at present is Seattle-Tacoma International (Sea-Tac), to the smallest general aviation airports, and include heliports, seaplane bases, and sport aviation facilities. The plan defines the role of each airport facility in providing air transportation services through the planning horizon, which is the year 2020. It is concerned primarily, though not exclusively, with public use airport facilities, whether they be publicly or privately owned.

This plan is intended to provide policy guidance to local land use and capital improvement decisions related to airports. It promotes cooperation and wise use of resources in the development, management, and operation of the region's airport system.

The Regional Airport System Plan is one element of the PSCOG Regional Transportation Plan, which addresses multi-modal transportation needs of the region to the year 2020.

FEDERAL AND LOCAL PLANNING MANDATES

Regional airport system planning is part of a multi-tiered process of planning for a national system of public use airports. Historically there has been a national plan for air transportation and airports since the 1940's. The Federal Airport Act of 1946 established the requirement for the formulation and annual revision of the five-year National Airport Plan (NAP). The Act of 1946 also created the Federal-aid Airport Program (FAAP) in order to bring about, in conformity with the NAP, the establishment of an adequate nationwide system of public airports. The passage of the Airport and Airway Development Act of 1970 (Public Law 97-258) resulted in the repeal of the NAP and FAAP and established requirements for a coordinated National Airport System Plan (NASP) and the Airport Development Aid Program (ADAP). The Airport and Airway Improvement Act of 1982 (Public Law 97-248) required the publication, by September 3, 1984, and every two years thereafter, of a National Plan of Integrated Airport Systems (1), and established the Airport Improvement Program (AIP).

As shown in Figure 1, regional and state airport system planning, mandated by the Airport and Airways Improvement Act of 1982, are building blocks of the National Plan of Integrated Airport Systems (NPIAS). Publicly owned airports in the central Puget Sound region are eligible for inclusion in the NPIAS and federal funding under the national Airport Improvement Program, provided that they contribute to the national air carrier and commuter airline system, or to the general aviation and reliever system. Privately owned airports that are open to public use are eligible for federal funding if they are designated as general aviation reliever airports.

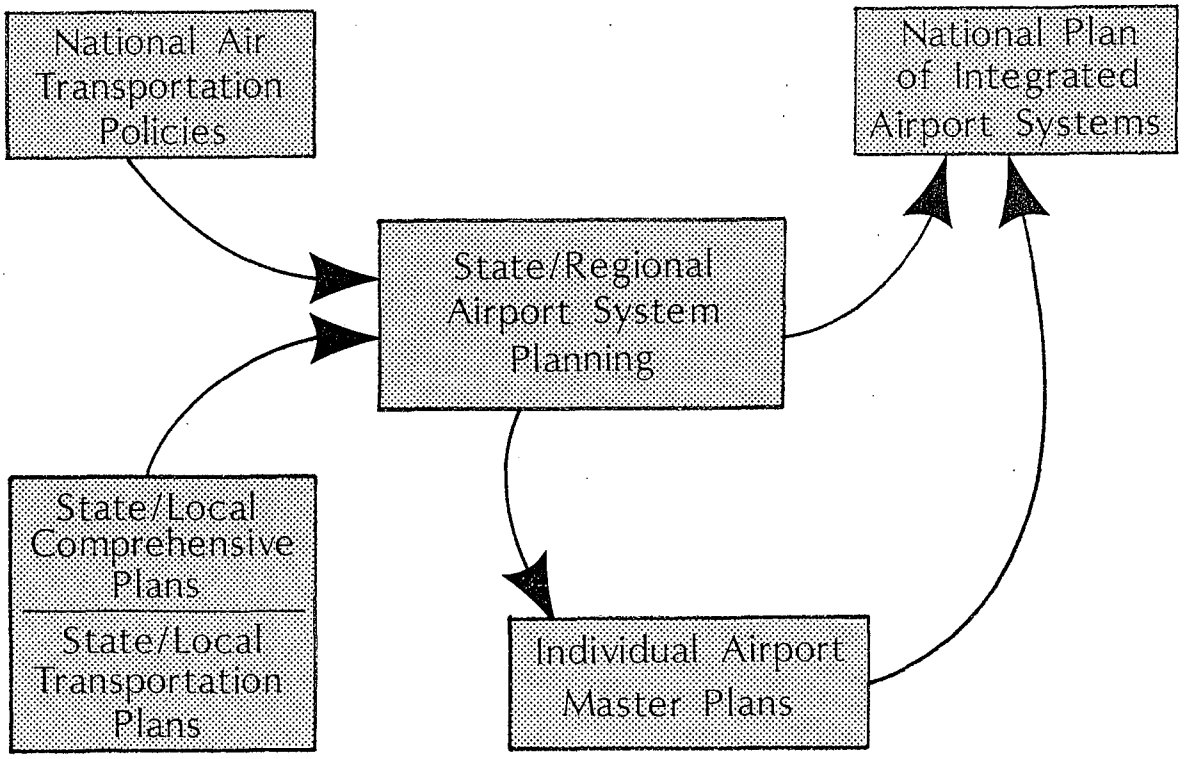
State airport system planning addresses statewide airport facilities needs for input into the NPIAS. It also addresses issues concerned with aircraft and pilot registrations, safety programs, search-and-rescue needs, and eligibility for state funding.

Regional airport system planning provides an important link with local governments who make the land use decisions. It addresses the air transportation needs of urban areas with a common population and economic base, and the balancing of those needs with land use and community impacts.

As also shown in Figure 1, state/local comprehensive plans and state/local transportation plans provide a context for airport system plans. Airport system plans provide a context for master plans for individual airports. Airport master plans, approved by the Federal Aviation Administration (FAA) and the local airport sponsor, are a requirement for funding eligibility under the NPIAS.

HISTORY OF THE REGIONAL AIRPORT SYSTEM PLAN

The first airport system plan for the central Puget Sound region was completed in 1969. It was funded by an Urban Planning Assistance Program grant from the U.S. Department of Housing & Urban Development, and prepared by a consultant under contract to PSCOG (then the Puget Sound Governmental Conference). The Air Transportation System Advance Plan (ATSAP), as it was called, was a very ambitious plan reflecting the rapid growth of the Seattle area, the airline industry and general aviation throughout the 1960's (2). With a planning horizon of the year 2000, it called for improvements to existing airports in the region, the construction of a second regional air carrier airport and general aviation airports, and the formation of a Regional Airport District. The ATSAP was completed and fully documented but not adopted as an airport system plan for the region.



PSCOG	THE BUILDING BLOCKS OF THE AIRPORT PLANNING PROCESS	Figure 1

In 1974 PSCOG received a grant from the FAA to develop a new regional airport system plan. This plan had a horizon year of 1990 and was based on scaled back forecasts of air carrier and general aviation demand. It concluded that Sea-Tac, if developed to its potential, had sufficient capacity to serve the region's air carrier needs through the planning period. The plan recommended one new general aviation airport on the Eastside in King County. The 1975 draft plan was tabled when PSCOG discontinued its airport system planning program the following year.

In 1979 PSCOG received a grant from the FAA to update the 1975 plan and present it for adoption. The updated plan again concluded that Sea-Tac had sufficient capacity to serve air carrier needs to the year 2000, and it recommended a new general utility airport be constructed by 1990 to serve general aviation in the King-Snohomish County area.

The new airport recommendation was controversial. After a lengthy period of review and deliberation, however, the plan was adopted in February 1982 (3).

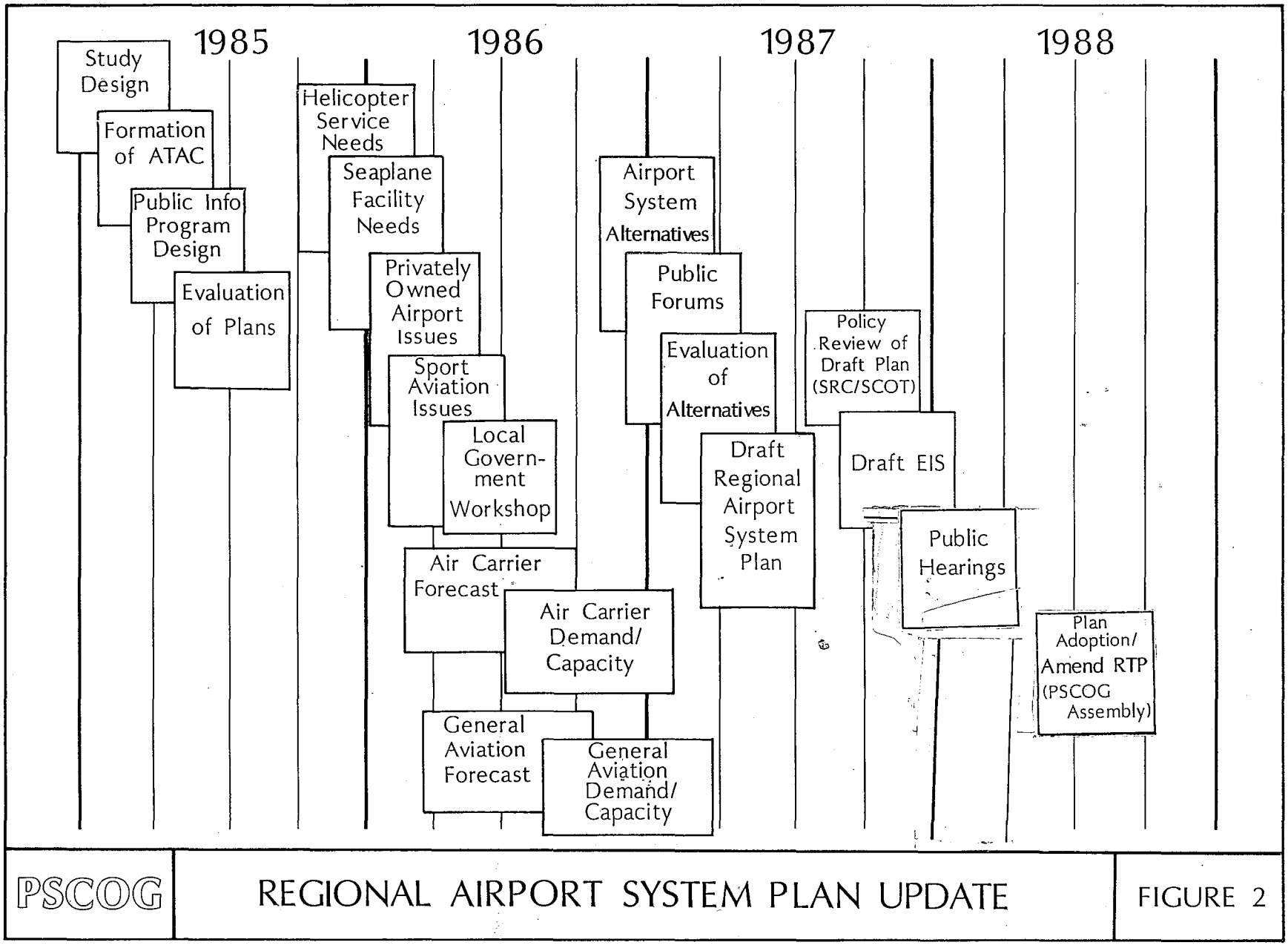
THE PLAN UPDATE PROCESS

The Project

A project to update the currently adopted plan was initiated in 1985 as a concurrent effort with updating the Regional Transportation Plan and extending it to the year 2020. The intent was both to broaden the scope of the Regional Airport System Plan and to update the forecasts and inventory to 2020. The first phase of the project addressed the special issues related to helicopter, seaplane, and sport aviation facilities, and privately owned airports. The second phase consisted of updating the demand/capacity analysis for air carrier and general aviation facilities. Alternatives for providing airport facilities out to the year 2020 and for mitigating the impacts of airport operations were formulated and evaluated to arrive at a recommended plan. The two-year process of plan development is illustrated in Figure 2.

Technical Advisory Process

Technical coordination and consultation was provided by the Air Transportation Advisory Committee (ATAC). The Committee met bi-monthly on the average through the plan update process. It reviewed technical reports, conclusions and recommendations prepared by the project staff. When necessary special task forces were formed to do concentrated work on special aspects of the plan.



PSCOG

REGIONAL AIRPORT SYSTEM PLAN UPDATE

FIGURE 2

The ATAC membership numbered 27, with representatives from the cities, counties, port districts, and private entities who owned and operated airports; from county planning departments that were making land use decisions about airports; and from the business community, general public, and airport user groups. The ATAC was chaired by an elected official who is a member of PSCOG's regional Standing Committee on Transportation (SCOT).

Decision-Making Process

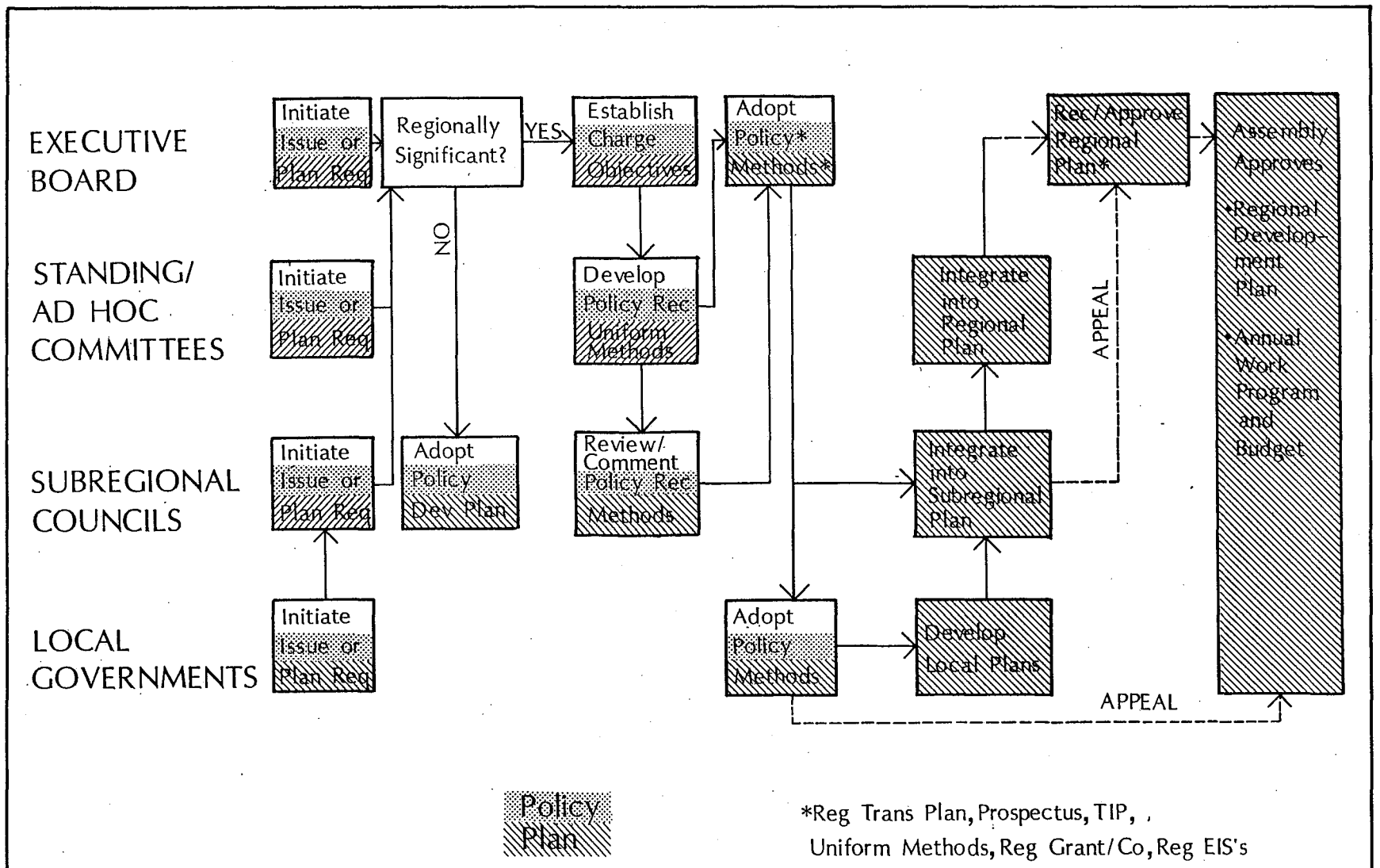
Policy direction was provided by the SCOT, the four PSCOG subregional councils and Executive Board. These policy bodies were briefed periodically by ATAC and the project staff as the plan was developed. The process of adopting the plan was in accordance with the regional decision making process shown in Figure 3.

A public information program was maintained throughout the plan development through newsletters and press releases. There was steady media coverage in response to the newsletters and as various issues surfaced. A local government workshop was held in 1986, and a series of public forums was held in February 1987 to receive comment on the plan alternatives prior to their evaluation. Public comment on the draft plan was received through distribution of a Draft Environmental Impact Statement in December 1987 and a series of six public hearings in January and February 1988. The public comments were considered by the PSCOG policy bodies as the plan proceeded through the adoption process.

WHAT CHANGED SINCE THE PLAN WAS ADOPTED IN 1982?

Although the airports in the region have not changed substantially for many years, the Regional Airport System Plan is updated at frequent intervals to reflect the changing behavior of air travelers and the changing nature of the air transportation industry itself. This plan differs from the one adopted in 1982 in the following ways:

- Population and economic growth forecasts for the region have been updated, extending to the year 2020.
- Forecasts of air carrier and general aviation demand have been updated and extended to the year 2020.
- The Bellevue, Issaquah and Duvall Airfields have closed. The Cedar Grove Airfield is facing potential closure.
- Some privately owned public-use airports have changed their status to private restricted use.



PSCOG

REGIONAL DECISION MAKING PROCESS

Figure 3

- Implementation of the process (established in the 1982 RASP) that could have led to development of a new general aviation airport did not proceed.
- Sea-Tac is expected to reach its capacity before the end of the planning period.
- Policy recommendations related to helicopter, seaplane, and sport aviation facilities have been added.
- The reliance on capacity provided by privately owned airports has become more critical while their availability more uncertain.
- Master plans have been updated for Sea-Tac, Boeing Field, Tacoma Narrows Airport, Bremerton National Airport and Thun Field; updates are in progress for Renton Municipal Airport, Harvey Airfield, and Arlington Municipal Airport.
- Based on the adopted "General Aviation" role for Paine Field (re: Airport Commission Resolution, April 11, 1978) and the 1979 mediated agreement with airport communities, residential and commercial development have been permitted adjacent to the airport, potentially inhibiting the expansion of its role.

Many of the study findings and recommendations contained in this plan of 1988 are a result of the changes that have taken place within the larger context of the nation's aviation industry. Some of the more important or visible changes within the industry are as follows:

- Deregulation of the air carrier industry, which in turn has resulted in a hub-and-spoke patterned air transportation network, an increase in the volume of operations, and fluctuating price and service levels;
- Stabilized growth in the nation's general aviation fleet size;
- Emerging sport aviation industry;
- Emerging role of helicopters;
- Establishment of noise and flight track mitigation programs.

OUTLINE OF THE REPORT

In Chapter II an inventory of the various components of this region's airport system is given. Six elements of the regional system are introduced; namely, air carrier airports, general aviation airports, privately owned public use airports, helicopter facilities, seaplane bases and sport aviation facilities. In Chapter III, regional air travel demand is compared to the supply or capacity of facilities in order to

measure the performance of this region's airport system. This exercise is undertaken for all six elements of the system mentioned above and for both current and future time periods.

Alternatives for meeting future capacity and service needs are introduced in Chapter IV. Chapter V contains an evaluation of the air carrier and general aviation system alternatives, and a discussion of policy options and implementation guidelines for special air facilities -- heliports/helistops, seaplane bases, privately owned airports and sport aviation facilities.

Chapter VI of this report contains a summary of financing requirements and funding strategies. This discussion relates to all elements of the region's airport system. The final chapter contains the plan recommendations.

II. Components of the Regional Airport System

II. COMPONENTS OF THE REGIONAL AIRPORT SYSTEM

OVERVIEW

The Regional Airport System Plan addresses the broad range of airport facilities that serve air transportation needs. Included are airports that have commercial air carrier service, general aviation airports, seaplane bases, heliports, and sport aviation facilities. Of primary interest are those airports that are open to public use, whether they are publicly or privately owned. The plan development process, however, must also include airports that are not open to public use but do consume airspace and land space, and must operate compatibly with the public use facilities. These include military airfields and private restricted use airport facilities which are used only by permission from the owner.

In the four-county planning area there are about 150 known aircraft landing areas of all types. All landing areas are required to be registered with the FAA, so that their locations are known and their use of the airspace can be monitored in relation to all other aircraft operating areas. Of the 150 areas, 30 are public use facilities that serve most of the aircraft operations in the region. They include Sea-Tac, the region's air carrier airport; five medium-to-large scale general aviation airports, which can serve both large and small aircraft; and 24 general aviation airports, seaplane bases, or heliports, which serve light aircraft operations. There are also two active military airfields in the region. The public use and military airports are listed in Table 1, indicating the owner/operator and the responsible land use jurisdiction for each airport. The location of each is shown in Figure 4.

The numerous other airport facilities in the region are not open for public use. Based on 1986 inventory documented in Reference 4, there are about 37 land-based airfields that are private use, consisting of residential airparks and landing strips on farms or other private property. There are about 26 heliport/helistop facilities that are separate from helicopter landing areas at existing airports. These facilities serve private business and industry, hospitals, recreation areas, the news media, and other specialized uses.

A third category of private use facilities is seaplanes. The facilities consist of docks, ramps, and storage areas at waterfront locations. According to the 1986 inventory (4) there are only two private use seaplane bases in the region, the other active bases being public use. Other seaplanes not operating from established bases operate from private waterfront homes much the same as pleasure boats.

TABLE 1

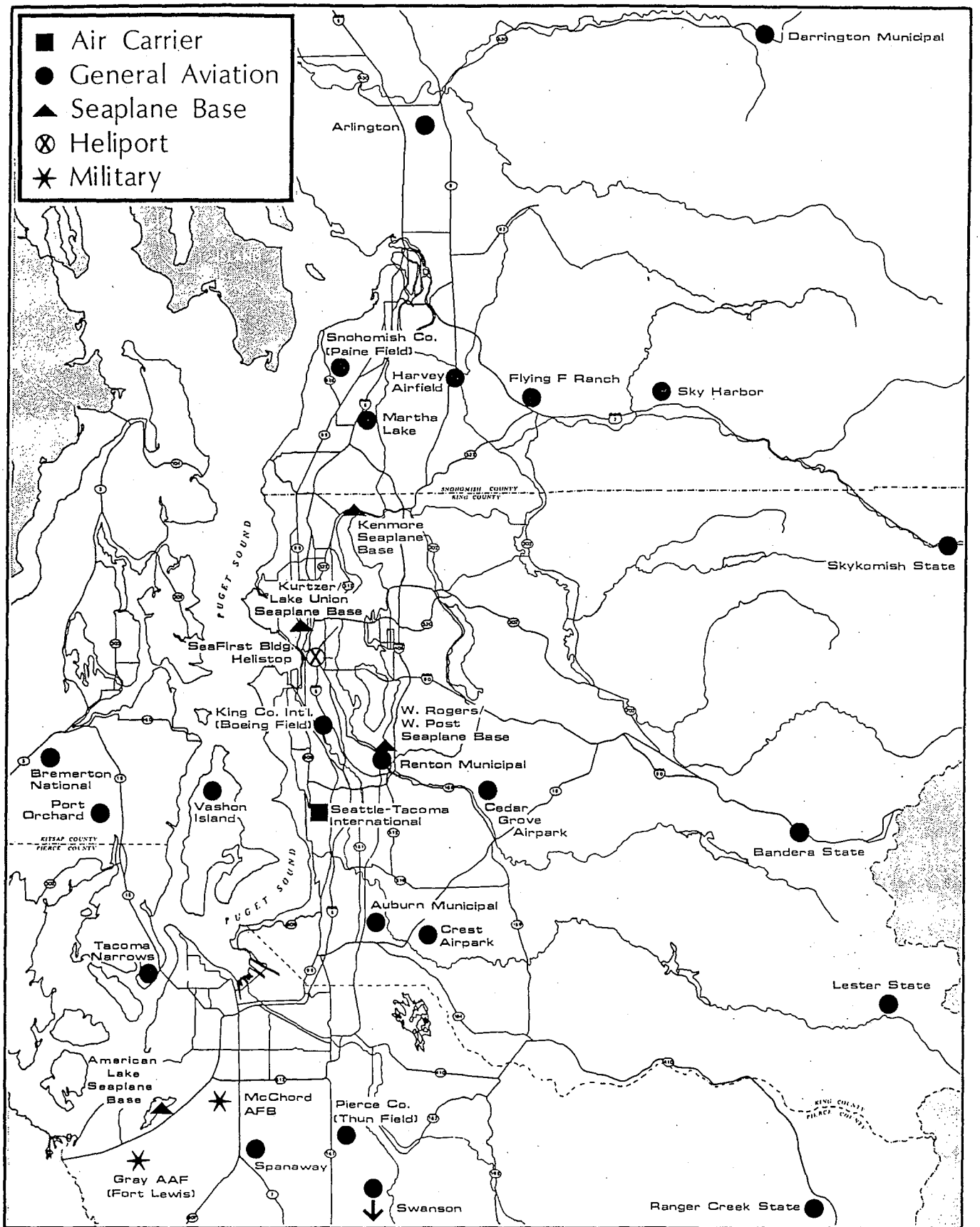
EXISTING AIRPORTS

Public Use

Airport	Owner/Operator	Land Use Jurisdiction
Auburn Municipal	City of Auburn	City of Auburn
Bandera State	WSDOT	King County
Cedar Grove	Private	King County
Crest Airpark	Private	King County
Kenmore Air Harbor	Private	City of Kenmore/ King County
King Co. International (Boeing Field)	King County	King County
Kurtzer Flying Service	Private	City of Seattle
Lake Union Air Service	Private	City of Seattle
Lester State	WSDOT	King County
Renton Municipal	City of Renton	City of Renton
Seattle-Tacoma International	Port of Seattle	King County
Skykomish State	WSDOT	King County
Vashon Island	King County	King County
Will Rogers/Wiley Post	City of Renton	City of Renton
Sea-First Bldg. Helistop	Private	City of Seattle
Bremerton National	Port of Bremerton	Kitsap County
Port Orchard	Private	Kitsap County
American Lake	Private	Pierce County
Pierce Co. (Thun Field)	Pierce County	Pierce County
Ranger Creek State	WSDOT	Pierce County
Spanaway	Private	Pierce County
Swanson	City of Eatonville	Pierce County
Tacoma Narrows	City of Tacoma	Pierce County
Arlington Municipal	City of Arlington	City of Arlington
Darrington Municipal	City of Darrington	City of Darrington
Flying F Ranch	Private	Snohomish County
Harvey Airfield	Private	City of Snohomish/ Snohomish County
Martha Lake	Private	Snohomish County
Sky Harbor	Private	Snohomish County
Snohomish County (Paine Field)	Snohomish County	Snohomish County

Military

McChord Air Force Base	USDOD	Pierce County
Gray Army Airfield	USDOD	Pierce County



PSCOG

EXISTING PUBLIC USE AND MILITARY AIRPORTS

Figure 4

AIRPORTS OF NATIONAL INTEREST

Publicly owned airports in the central Puget Sound region are eligible for federal funding under the national Airport Improvement Program (AIP) provided that they contribute to the national air carrier and commuter airline system, or to the national general aviation and reliever system. Privately owned airports that are open to public use are eligible for federal funding if they are designated as general aviation reliever airports.

Airports eligible under the AIP are identified by their inclusion in the National Plan of Integrated Airport Systems (NPIAS). The existing NPIAS airports in the central Puget Sound region are listed in Table 2. Opposite each airport is listed its functional role and its current and future service level. The functional role refers to the general design and size of the facility and what types of aircraft it can accommodate. Transport airports are capable of handling airliners, business jets, and large or small propeller driven aircraft. General utility airports are capable of handling small business jets and most single engine and light twin engine propeller aircraft. Basic utility airports are limited to single engine and light twin-engine propeller aircraft.

The service level of each airport is identified as commercial service, reliever, or general aviation. Sea-Tac is a primary commercial service with scheduled and non-scheduled airline operations and designated a major hub in the national airport system. The NPIAS designates other airports as having potential for commercial service in the future. This generally refers to smaller scale local or regional commuter airline and air taxi and charter services.

Reliever airports indicated in Table 2 are so designated because they provide alternative locations for general aviation operations and supplemental commercial service operations when conditions become congested at the primary commercial service airport. Airports designated as service level general aviation are primarily serving the private business, personal travel, and recreation uses of aircraft.

In addition to the existing airports listed in Table 2, the NPIAS identifies future new facilities where there is an apparent need. In this region, for example, the NPIAS identifies the potential need for two new general aviation airports, two heliports, and a seaplane base. The inclusion of new or existing facilities in the NPIAS does not denote a federal responsibility to fund an improvement project, nor does it imply federal or local approval of the project. Each project must go through the proper approval process and comply with requirements for environmental and public review.

TABLE 2

AIRPORTS OF NATIONAL INTEREST

Existing	NPIAS Designation		
	Functional Role	Current Service Level	Future Service Level
Seattle-Tacoma Int'l.	Transport	Commercial Service-Primary	Commercial Service-Primary
King Co. Int'l. (Boeing Field)	Transport	Reliever	Reliever
Snohomish Co. (Paine Field)	Transport	Reliever	Reliever
Renton Municipal	Transport	Reliever	Reliever
Bremerton National	Transport	General Av.	Commercial Service-Other
Tacoma Narrows	Transport	General Av.	Commercial Service-Other
Auburn Municipal	General Utility	Reliever	Reliever
Arlington Municipal	General Utility	General Av.	General Av.
Crest Airpark	Basic Utility	Reliever	Reliever
Harvey Airfield	General Utility	Reliever	Reliever
Pierce Co. (Thun Field)	General Utility	General Av.	General Av.
Vashon Island	Basic Utility	General Av.	General Av.
Kurtzer Flying Service	Seaplane Base	General Av.	General Av.
Kenmore Air Harbor	Seaplane Base	General Av.	General Av.
New			
Sea-Tac	Heliport	---	Reliever
Seattle Downtown	Heliport	---	Reliever
Seattle	Seaplane Base	---	General Av.
Bellevue Vicinity *	General Utility	---	General Av.
Enumclaw Vicinity *	Basic Utility	---	General Av.

Source: 1984-93 National Plan of Integrated Airport Systems (NPIAS).
* New or public acquisition of privately owned airport.

AIRPORTS OF STATE INTEREST

In addition to the NPIAS airports listed in Table 2, other airports are of state interest and candidates for inclusion in the Washington State Airport System Plan (5). These airports generally fall into three categories:

- State owned airports, which are under the control of the Washington State Department of Transportation. The state owned facilities in this region are in mountain passes and serve as emergency airfields, recreation sites, fire-fighting posts, instructor-pilot training facilities, and air search-and-rescue control points.
- Municipally owned airports, which are the responsibility of a city, county, or port district, and serve general aviation users.
- Privately owned public use airports.

Any of the public use airports in this region listed in Table 1 are candidates for inclusion in the state system. A final determination of state system airports will be made as part of the state plan update process, which is proceeding concurrently with the update of the Regional Airport System Plan.

Airports included in the Washington State Airport System Plan are eligible for funding under a state aid program that receives revenues from the aviation fuel tax. State funds have traditionally been used to fund half of the local match requirement for federal grants, and also for funding airport improvements that are not eligible for federal funding.

AIRPORTS IN THE REGIONAL AIRPORT SYSTEM

The airports listed in Table 1 make up the regional airport system. The public use airports have differing but complementary roles in serving the wide range of air transportation needs for the central Puget Sound region. The physical characteristics and current activity level of each airport are given in Reference 6. Future changes in the role of individual airports and related physical improvements will be addressed in subsequent sections of this plan.

In the following chapter, the current and future performance of this region's aviation system is measured. Six elements of the system are considered: air carrier airports, general aviation airports, helicopter facilities, seaplane bases, privately owned airports and sport aviation facilities.

III. Forecasts of Regional Airport System Performance

III. FORECASTS OF REGIONAL AIRPORT SYSTEM PERFORMANCE

FORECASTS OF AIR CARRIER SYSTEM PERFORMANCE

Future air carrier traffic levels had last been estimated in 1980 as part of the Regional Airport System Plan. The time horizon for that plan was 2000; in this update the time horizon has been extended to the year 2020, which necessitates a reestimation of future traffic demand levels. The reestimation of traffic levels and update of the RASP is timely in light of the changes that have occurred within the airline industry during the past several years.

Deregulation has had a major impact on many aspects of the airline industry, including route structure, level of service, air fares and composition of the airline industry itself. Several of these factors in particular have been influential in generating higher regional traffic volumes within the past few years. Real air fares have continued to decline with the advent of deregulation. This decline, coupled with the robust growth of the commuter airline market, has given consumers an increasing choice of lower cost destinations. In addition, as the commuter airline market has increased, average aircraft size has decreased, resulting in few passengers per operation and thus the occurrence of more operations.

The revised air carrier demand forecasts reflect the above changes and are discussed in the following paragraphs. To put these forecasts into context, the methodology used to generate these forecasts is first briefly reviewed. For a detailed discussion of the historical data base, the development of the forecast equations and the assumptions used in the analysis, the reader is referred to the accompanying technical report (6).

Forecasting Methodology

The projection of air carrier demand is undertaken via a two-step process. The first step involves estimating air carrier passenger and freight demand. Step two involves translating passengers and tons of freight into number of aircraft operations.

To develop the initial passenger and freight demand forecasts, a regression model is used. The approach is as follows: using a historical data series (from 1958 to 1985), the relationship between air passenger and freight demand and factors that influence this demand is established. In this study, the factors or variables that were found to have the greatest influence on demand are air fares, regional population and regional economic growth (6). The relationship between demand and these explanatory variables is measured by the coefficients of elasticity that are generated as part of the multiple regression

analysis. The coefficients define the rate of change in the demand for a one percent change in a given explanatory variable.

After development of these coefficients, demand is projected into the future based upon alternative scenarios for the explanatory variables. Alternative scenarios are developed given the uncertainty with regard to the degree of growth that these explanatory variables will experience in future years. By employing alternative explanatory variable scenarios in our projections, we are able to forecast two levels of demand: a low growth or conservative level and a high growth or optimistic level of demand.

Using the passenger and freight demand forecasts, estimates are made of the required aircraft operations both on an annual basis and for typical peak hours. Both high and low growth operations forecasts are generated based, again, on different scenarios for the explanatory variables. The variables used to estimate operations demand are enplaned passengers, average and available seats per aircraft, and utilization of the aircraft (6).

Once operations forecasts have been estimated, they are then related to the capacity of facilities at Sea-Tac to identify future areas of congestion, and to develop alternatives for resolving this congestion.

Demand Forecasts

As seen in Table 3, total annual air carrier passengers are projected to increase from 11.5 million passengers in 1985 to 18.7 million passengers by the year 2000 under the low scenario. Under the high scenario, passenger demand is predicted to reach 25.2 million by the year 2000. By the year 2020, passenger growth is projected to increase to 27.6 million passengers annually under the low-growth scenario and 44.5 million passengers under the high-growth scenario. These figures represent annual compound growth rates of between 3.2 percent and 5.1 percent during the 1986 to 2000 time period as compared to an annual compound growth rate of 5.9 percent actually experienced at Sea-Tac from 1981 to 1985. The annual compound growth rate is projected to level off during the 2000 to 2020 time period, ranging from 2.0 percent to 2.9 percent for the low and high growth scenarios, respectively.

The number of annual operations (aircraft landings and departures) is to a large extent a function of the number of passengers traveling into and out of the region. Most freight or cargo traffic travels in the lower hold of the passenger aircraft, with all-cargo operations representing only a small percentage of total operations. Freight demand is thus estimated as part of the operations demand forecast.

TABLE 3

FORECASTS OF AIR PASSENGERS IN THE CENTRAL PUGET SOUND REGION

Year	Regional Population	Regional /Income Capita ($1982)	Air Passenger Yield ($1982)	Annual Originations	Total Connections	Total Enplanements	Total Passengers
1981	2,321.3	12,852.0	.1299	3,451.9	1,114.1	4,566.0	9,132.0
1982	2,330.8	12,733.0	.1177	3,487.1	1,156.2	4,643.3	9,286.6
1983	2,345.3	12,696.0	.1119	3,790.3	1,283.7	5,074.0	10,148.1
1984	2,370.4	12,910.0	.1087	3,893.0	1,353.6	5,246.6	10,493.3
1985	2,412.1	12,993.0	.1098	4,237.4	1,504.3	5,741.7	11,483.5
High Forecast							
1986	2,434.3	13,214.0	.1049	4,650.0	1,660.0	6,310.0	12,620.0
1990	2,522.9	14,136.0	.0992	5,674.0	2,066.0	7,740.0	15,480.0
1995	2,750.0	15,379.0	.0972	7,169.0	2,691.0	9,860.0	19,720.0
2000	3,051.1	16,731.0	.0965	9,086.0	3,517.0	12,603.0	25,205.0
2010	3,613.3	19,417.0	.0965	13,442.0	5,490.0	18,932.0	37,864.0
2020	4,175.6	19,417.0	.0965	15,527.0	6,717.0	22,244.0	44,488.0
Low Forecast							
1986	2,434.3	13,188.0	.1082	4,449.0	1,572.9	6,028.0	12,056.0
1990	2,522.9	13,997.0	.1077	4,920.0	1,823.3	6,666.0	13,332.0
1995	2,750.0	15,079.0	.1077	5,775.0	2,219.1	7,825.0	15,650.0
2000	3,051.1	16,244.0	.1077	6,896.0	2,448.0	9,344.0	18,687.0
2010	3,613.3	18,852.0	.1077	8,798.0	3,192.0	11,990.0	23,980.0
2020	4,175.6	18,852.0	.1077	10,168.0	3,609.0	13,777.0	27,554.0

*All figures are in thousands except income per capita and yield.

Forecasts for annual air carrier operations are given in Table 4 and graphically displayed in Figure 5. In 1985, annual regional air carrier operations totaled 219,000. Operations are forecast to increase to 287,000 by the year 2000 under the low growth scenario and 443,500 by the year 2000 under the high growth scenario. These figures represent an annual compound growth rate of 4.5 percent for the high forecast and 1.6 percent for the low forecast. The figures are in line with the growth in operations forecast by the FAA for this region. The FAA projections are for an annual growth rate of 2.3 percent until the year 2000. From the year 2000 to 2020, total operations are projected to grow between 1.5 percent and 2.8 percent annually. This equates to 389,600 annual operations for the low growth forecast by the year 2020 and 768,000 annual operations for the high growth forecast.

Note that in addition to considering passenger-related factors, these forecasts also include projections for the 4.8 percent (in 1985) of operations that are categorized as all-cargo operations. Given the uncertainty regarding the continued growth in all-cargo operations, two scenarios on future growth were developed for generation of the forecasts. The reader is again referred to Reference 6 for a detailed description of the assumptions underlying these scenarios. As a final note, the operations projections contained in Table 4 only represent scheduled (as well as significant charter) carrier operations. General aviation and military operations are not part of the forecasts.

Demand/Capacity Relationship to 2020

Peak Hour Air Carrier Demand. The purpose of generating the above demand forecasts is to determine if the capacity of the facilities at Sea-Tac are adequate to accommodate the growth in passengers and operations. When undertaking such an evaluation, the relevant demand figure to use is peak hour demand, since peak hour demand defines the ultimate capacity requirements of any facility. For this study, the peak hour demand was defined as the peak hour of the average day of the peak month at Sea-Tac. The peaking factors were taken from the 1985 Sea-Tac Master Plan (7), since these figures represent the most current documented factors. For passenger calculations, the percent of annual passengers represented by the peak hour was taken to be 0.0437 percent. For operation calculations, the percent of annual operations represented by the peak hour was taken to be 0.0238 percent.

Using these factors, equivalent peak hour passenger and operations demand for different time periods is shown in Figure 5.

TABLE 4

ANNUAL REGIONAL AIR CARRIER OPERATIONS
HISTORICAL AND FORECAST SERIES

Year	Total Enplane -ments	Average Seats/ Aircraft	Avg. Thru Seats	Avg. Avail Seats	Load Factor	Enplane -ments /Depar -ture	Total Pass. Depar- tures	Total Pass. Oper.	All Cargo Oper.	Total Oper.
1979	4,920.4	163.0	15.3	147.7	0.54	79.4	61,946	123,892	4,712	128,604
1980	4,607.9	161.0	16.3	144.7	0.48	69.5	66,278	132,556	4,822	137,378
1981	4,567.1	158.0	17.1	140.9	0.48	67.2	67,987	135,974	5,236	141,210
1982	4,644.2	156.0	17.9	138.1	0.46	63.7	72,883	145,766	6,806	152,572
1983	5,075.6	139.0	17.2	121.8	0.46	56.3	90,090	180,180	8,252	188,432
1984	5,248.3	137.0	18.4	119.0	0.47	55.8	94,093	188,186	8,598	196,784
1985	5,743.5	125.0	17.8	107.3	0.52	55.0	104,344	208,688	10,338	219,026
High Forecast										
1986	6,310.0	124.0	17.6	106.4	0.52	55.3	114,105	228,210	11,845	240,055
1990	7,740.0	127.1	19.1	108.3	0.52	56.3	137,477	274,956	15,917	290,873
1995	9,860.0	133.0	20.0	113.1	0.52	58.8	167,653	335,306	23,545	357,851
2000	12,603.0	138.7	20.8	117.9	0.52	61.3	205,569	411,137	32,376	443,513
2010	18,932.0	138.7	20.8	117.9	0.52	61.3	308,801	617,603	48,635	666,238
2020	22,244.0	138.7	20.8	117.9	0.53	62.5	355,978	711,956	56,066	768,022
Low Forecast										
1986	6,028.0	124.0	17.6	106.4	0.52	55.3	109,005	218,011	10,992	229,003
1990	6,666.0	127.1	19.1	108.3	0.54	58.5	113,949	227,897	11,491	239,388
1995	7,825.0	133.0	20.0	113.1	0.56	63.3	123,618	247,236	12,466	259,702
2000	9,344.0	138.7	20.8	117.9	0.58	68.4	136,608	273,216	13,776	286,992
2010	11,990.0	138.7	20.8	117.9	0.63	74.3	161,373	322,746	16,273	339,019
2020	13,777.0	138.7	20.8	117.9	0.63	74.3	185,481	370,963	18,704	389,667

FIGURE 5: 1986 FORECAST OF ANNUAL
AIR CARRIER OPERATIONS

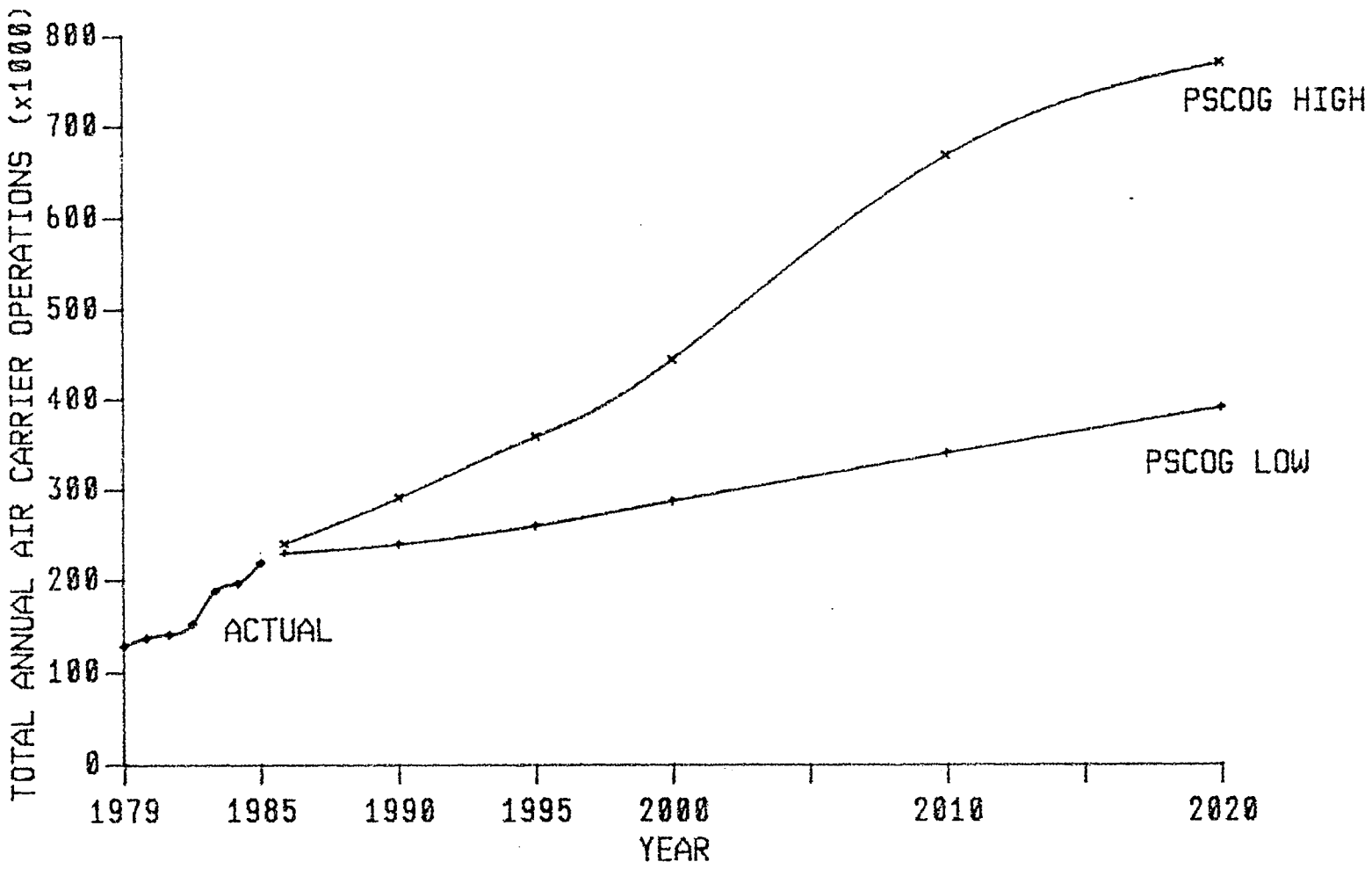


TABLE 5

PEAK HOUR DEMAND AT SEA-TAC

Year	No. of Passengers	No. of Operations
1985	5,026	52
2000	9,592	87
2020	15,754	138

Source: Reference 7.

Given that peak hour demand figures are used in facility planning, it would be helpful if peak hour demand was not significantly higher than the demand that existed during other time periods. If, for example, demand was very high for one month out of the year and for the other months demand was very low, it would be difficult to provide for cost-effective facility planning. Fortunately, the demand at Sea-Tac is relatively constant throughout the year (7).

In the following section, this peak hour demand is compared to the capacity of facilities at Sea-Tac for different time periods.

Demand/Capacity Analysis. Capacity at Sea-Tac can be categorized as either landside or airside capacity. Landside capacity is composed of the vehicular circulation and parking operations as well as various functions within the terminal building, such as ticketing, baggage claim, security and concessions. Sea-Tac's airside capacity takes over starting with the apron-gate area, continuing through the taxiway system and ending with the terminal airspace.

Airside Demand and Capacity. The FAA's Airport Capacity and Delay Advisory Circular (8) provides measurement criteria for determining the theoretical airspace capacity of an airport. Using this document as a guide, both the 1983 Airspace Study (9) and the 1985 Master Plan (7) concluded that the peak hour IFR (Instrument Flight Rules) capacity of Sea-Tac would be exceeded by the year 2000. IFR conditions (poor visibility) typically occur 10 to 15 percent of the time during a given year.

The above studies also concluded that VFR (Visual Flight Rules) peak hour capacity would be sufficient to accommodate demand through the year 2000. However, demand estimates extended to the year 2020 (as part of the RASP) indicate that VFR peak hour

demand will have exceeded peak hour capacity by the year 2010 (6).

Note that the above figures represent theoretical limits to Sea-Tac's peak hour capacity. The amount of delay and congestion, however, depend on the rate of demand at times close to the peak hour. As overall demand grows and as the level of demand throughout the day approaches the peak hour demand, Sea-Tac's facilities will start to lose their ability to handle the peak demand times (normally, service is spread or delayed until nonpeak time periods). When traffic is consistently heavy and approaches the upper limits of capacity, the level of service rapidly deteriorates and delays and congestion become intolerable. For this reason, airports are not designed to operate near their capacity (10).

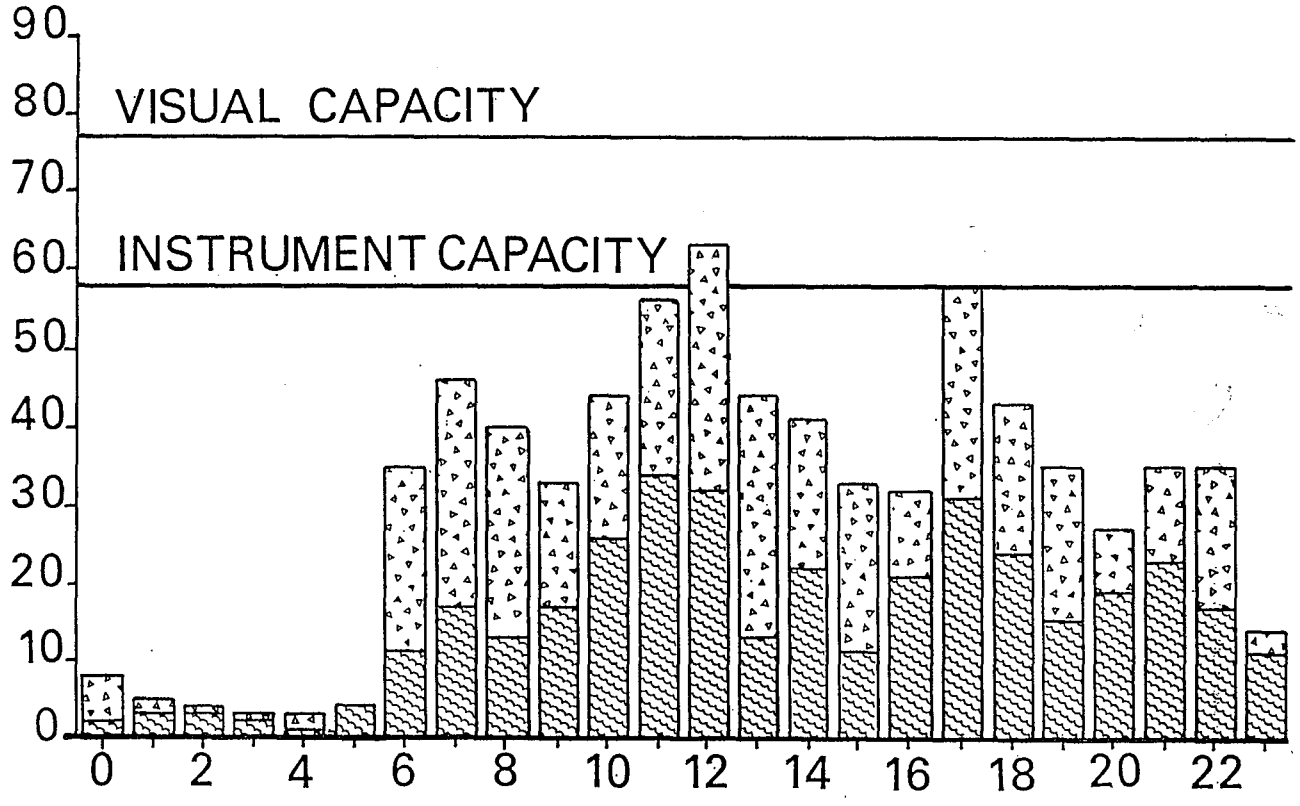
To illustrate the above point, the hourly distribution of operations at Sea-Tac for March 1987 is given in Figure 6. Theoretical capacity limits for VFR and IFR conditions are also given. As seen in this figure, actual demand levels for both VFR and IFR conditions have already surpassed the 1990 forecasts contained in the 1983 Airspace Study and thus IFR capacity is currently being strained at peak periods throughout the day as seen in Figure 6.

Landside Demand and Capacity. The landside capacity for Sea-Tac is documented in the 1985 Master Plan Working Paper Alternatives Evaluation (11). The authors of this document concluded that the peak hour landside capacity limits of Sea-Tac will be strained by the year 2000. As a result of this conclusion, alternatives for expansion of Sea-Tac were proposed. The adopted Master Plan now contains a program to expand Sea-Tac's facilities incrementally to provide sufficient capacity beyond the year 2000. Comparison of the expanded Sea-Tac capacity to the demand forecasts was undertaken for one of the parameters of landside capacity, gate requirements. The analysis indicated landside capacity will be adequate until the year 2010 (6). At that point, peak hour landside demand will exceed the design capacity of that system.

Summary of Air Carrier Demand/Capacity Analysis. The previous analysis has indicated specific time frames beyond which demand at Sea-Tac will exceed capacity. These figures are obviously study estimates since the exact time period depends on the amount of delay passengers are willing to tolerate. It has been suggested that IFR capacity will frequently be strained by the year 2000 and will be the first limiting factor. However, prior to the year 2000, it could very well be that passengers, via the airlines, will collectively decide delays have become intolerable, and will seek alternatives to the existing system.

FIGURE 6

HOURLY DISTRIBUTION OF OPERATIONS SEA-TAC (MARCH 1987)



SOURCE: Port of Seattle

The point is that for the first time capacity at Sea-Tac will be strained within the study horizon and will not be able to adequately serve the demand. The citizens of the central Puget Sound region must determine if and/or what role other airports within the region should have in accommodating this excess demand. The underlying assumption in such a determination is that the growth in air passenger travel demand is of economic benefit and significance to the region.

Alternatives for accommodating the growth in air passenger travel demand are introduced in Chapter IV.

FORECASTS OF GENERAL AVIATION SYSTEM PERFORMANCE

As part of the RASP update, the relationship between demand and capacity at publicly used general aviation airports was examined.

The first step in this investigation was undertaken by Reid, Middleton and Associates, one of the consultants to the PSCOG for the RASP study. Their work focused on developing regional demand projections out to the year 2020 for general aviation based aircraft and operations.

The results of their study, together with the results of the based aircraft allocation analysis, are contained in the technical report (6). Major points of those analyses are discussed in the following sections.

Forecasting Methodology

National as well as local planning efforts typically use the variable "based aircraft" as a surrogate for or indicator of general avaiation activity. Several primary sources of data are used to develop regional projections of general aviation based aircraft. The FAA Aviation Forecasts - Fiscal Years 1986-1997 document (12) coupled with the population projections prepared by PSCOG (13) are two of the most important. The FAA aircraft registrant data, 5010 forms, and based aircraft registration information obtained from the Washington State Department of Transportation - Division of Aeronautics are also used to develop the forecasts.

The 1986-1997 FAA forecasts were used to provide rates of growth for aircraft types. These data were extrapolated to the year 2020 and adjusted for projections of population growth for King, Snohomish, Pierce and Kitsap counties. Note that the future population rate is expected to grow most rapidly in Kitsap and Snohomish counties. However, looking at the volume of population rather than the growth rate indicates that over half of the population increase is projected to be in King County alone, especially in the fast growing Eastside and southeast county areas. Thus, the number of based aircraft spaces demanded by

King County residents will continue to be higher than the number of spaces demanded by other county residents.

Within each county, the allocation of based aircraft to individual airports was undertaken in two steps. First, the aircraft were sorted by fleet mix (propulsion types) and allocated based on the 1985 market share of each airport, and without consideration of each airport's capacity. The results were then compared to estimates of ultimate or maximum based aircraft capacity for each airport. This maximum based aircraft capacity was determined in a separate analysis to estimate the space available for additional based aircraft within airport property boundaries (within limits allowed by zoning) if any. In the future, maximum based aircraft capacity may differ than actual or effective capacity depending on the influence of noise abatement programs, the mix of aircraft types and so on. Note that once allocations are computed, a demand/capacity ratio was determined.

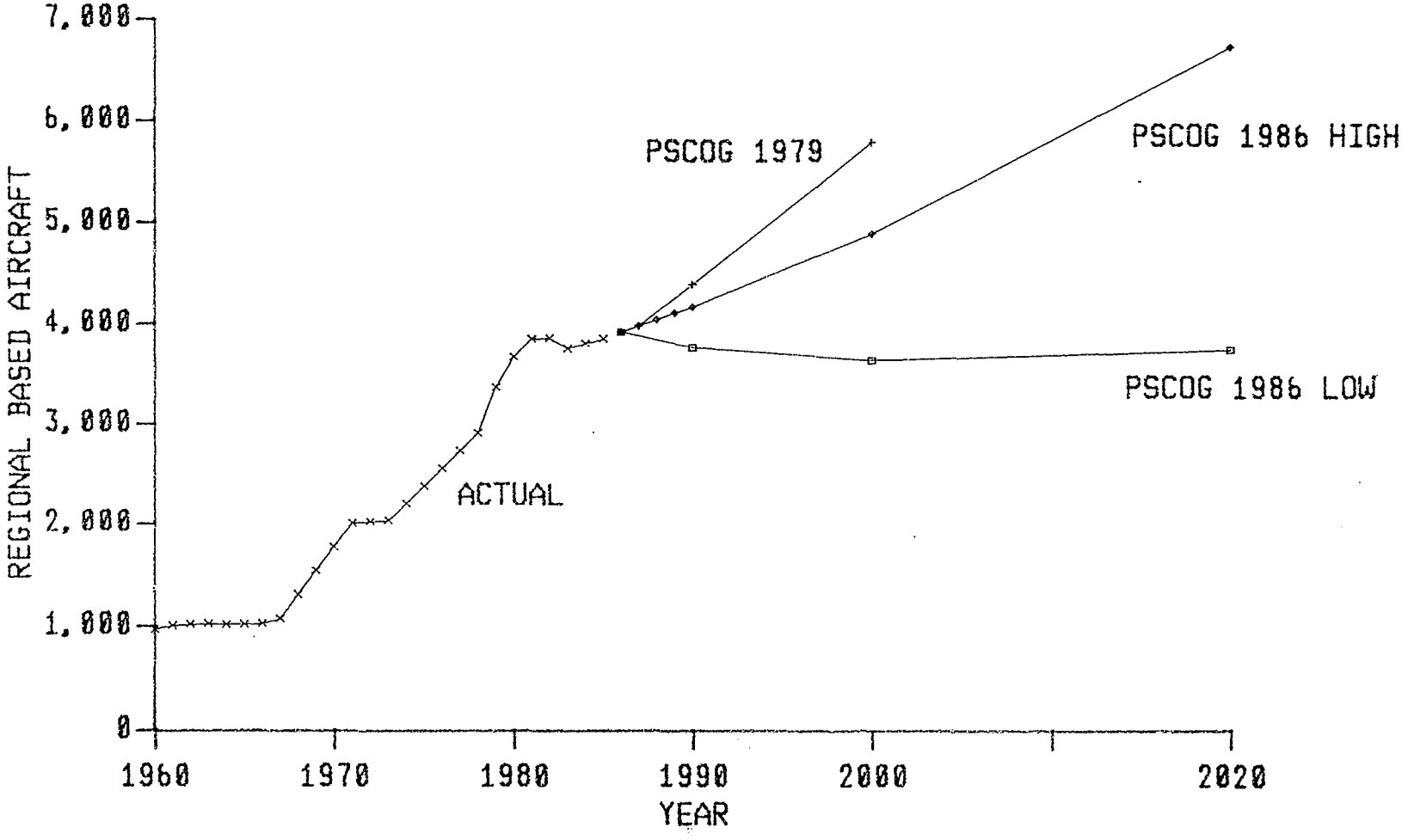
In cases where the demand significantly exceeded airport capacity, the excess aircraft were reallocated to nearby airports. The 1990 adjusted allocation became the basis for regional market shares for allocating the year 2000 based aircraft forecast, while the 2000 adjusted allocation became the basis for allocating 2020 demand.

Demand Forecasts

As discussed in the technical report (6), the growth in general aviation activities during the last several years has not kept pace with the significant growth that was experienced during the 1960's and 1970's. Economic factors are assumed to be the principal reason for the recent slump, including the dramatic increases in product liability insurance and operating (particularly maintenance) costs.

Given FAA projections on a continuation of these high costs into the future, two alternative demand forecasts were generated as seen in Figure 7. Again, these demand forecasts are a basic indicator of general aviation activity. Both forecasts are considerably lower than the forecasts contained in the 1982 RASP, which were calculated prior to the economic downturn. The first demand forecast generated for the current study assumes that the growth in based aircraft demand will keep pace with the growth in population. It assumes that the ownership rate per capita will remain constant; it is termed the high forecast. Based on revised FAA projections regarding aircraft demand at the national level, a low forecast has been generated and reflects regional based aircraft demand that in 1997 is 16 percent lower than the high forecast. Demand forecasts for each airport are contained in the technical report (6) and summarized in the following section.

FIGURE 7: COMPARISON OF HISTORICAL AND FORECAST BASED AIRCRAFT



Demand/Capacity Relationship to 2020

General aviation based aircraft demand is compared to capacity by market area in Table 6. Both high and low demand forecasts are given for three future years - 1990, 2000 and 2020. For the low demand scenario, it is projected that existing capacity will be sufficient to accommodate the demand for based aircraft. Under the higher growth scenario, the forecasts indicate that existing capacity will not be able to accommodate demand within the King County market area by 2020, with marginal problems in Pierce County as well.

Note that several underlying assumptions for both scenarios are that existing private airports currently open to public use will retain that status; that any future air carrier activity at general aviation airports will not affect the general aviation aircraft capacity of these airports; and that proposed changes to terminal control area boundaries by the FAA will not affect the capacity of general aviation airports.

The above assumptions imply that the forecasts were developed using existing operating and industry conditions. The status quo was used because of the difficulty of quantifying other types of conditions. For example, the FAA has just recently proposed changes in the terminal control area boundaries for congested areas. Whether the boundaries will change, much less what the impacts would be, is not known at this stage.

Another point to keep in mind with Table 6 is that there is existing pressure to move general aviation activity out of the congested airspace areas, namely, the airspace around Sea-Tac and Boeing Field. Thus, while county totals indicate there will be sufficient capacity at least through 1990, many of the smaller airports in King County are already accommodating Boeing Field's general aviation traffic as Boeing Field begins to handle more and more of the larger, commercial activity. Problems exist with this situation because these smaller airports, particularly the privately owned public use facilities, are experiencing financial difficulties (due in large part to skyrocketing insurance costs) and land use pressures. This leads one to question their ability to provide continued and/or future support as reliever facilities. A detailed discussion of the problems facing private airports appears later in this chapter. Within the context of the issues discussed above, alternatives for the general aviation system are discussed in Chapter IV.

TABLE 6

COMPARISON OF GENERAL AVIATION BASED AIRCRAFT DEMAND TO MAXIMUM, IDEAL EXISTING AIRPORT CAPACITY BY SERVICE AREA

1990

General Aviation Market Service Area	Unconstrained Based Aircraft Demand		Maximum, Ideal Capacity of Existing Airports	Unmet Demand
	Low Forecast	High Forecast		
King	1714	1840	1775	0 to 65
Snohomish	1161	1249	2052	None
Pierce	486	520	771	None
Kitsap	215	234	632	None

2000

General Aviation Market Service Area	Unconstrained Based Aircraft Demand		Maximum, Ideal Capacity of Existing Airports	Unmet Demand
	Low Forecast	High Forecast		
King	1739	2157	1775	0 to 382
Snohomish	1178	1466	2052	None
Pierce	492	602	771	None
Kitsap	218	282	632	None

2020

General Aviation Market Service Area	Unconstrained Based Aircraft Demand		Maximum, Ideal Capacity of Existing Airports	Unmet Demand
	Low Forecast	High Forecast		
King	1789	2979	1775	14 to 1154
Snohomish	1212	2021	2052	None
Pierce	505	814	771	0 to 43
Kitsap	226	411	632	None

Footnotes: Reference (6) and Chapter III of the RASP document the factors and assumptions used in developing this table. Major factors and assumptions include:

1. Existing private airports that are currently open to public use will maintain that status (page 12).
2. Any future air carrier activity at general aviation airports will not affect the general aviation aircraft capacity of these airports.
3. The proposed changes to Terminal Control Area boundaries by the FAA will not affect the capacity of general aviation airports (page 29).
4. Maximum based aircraft as well as operational capacity may differ from actual or effective capacity in the future depending on noise abatement programs, the mix of aircraft types, etc; (for example, there is a trend developing at some airports to base the larger sized aircraft which will in turn displace greater numbers of small aircraft. One large aircraft occupies more than one small aircraft basing space).
5. High demand forecast - based on FAA national forecasts published in 1986. Assumes a constant Puget Sound ownership rate per capita.
   Low demand forecast - based on (revised) FAA national forecasts published in 1987.

HELICOPTER FACILITIES AND SERVICES

Helicopters provide specialized air transportation serving a variety of purposes: business, air taxi and charter services, air ambulance service, and traffic reporting.

The demand for helicopter services is expected to more than double over the next fifteen years. Based on national and regional forecasts developed by the FAA, there will be about 220 helicopters based in the central Puget Sound region by the year 2000, compared with 85 helicopters today. The largest share of the helicopter fleet is anticipated to be in commercial service and business travel.

The role of helicopters in the region is expected to be changing and growing over the next 20 years. Lower operating costs, higher speeds, expanded maneuverability, greater reliability and lower noise levels brought about by rotorcraft technological advances are reasons the role of helicopters will change and grow.

National forecasts of helicopter activity assume the initiation of scheduled helicopter services at both Portland and Seattle-Tacoma airports. Although the Northwest Mountain Regional Office of the FAA did not anticipate this service initiation until 1990, private entrepreneurs have already begun offering air taxi-type service from Seattle. In addition, the FAA forecasts assumed a seating capacity of nine passengers per helicopter; given the technological and other advances currently taking place in the market, the seating capacity per helicopter is expected to be at 18 by the year 2000.

Tables 7 and 8 indicate the projected growth of based helicopters in the central Puget Sound region and categorical users of helicopters in U.S. totals.

The demand for helicopter services exists but facilities do not. There are currently no downtown heliports in the central Puget Sound region that are open for unrestricted public use, and helicopter operators are limited in choices for landing sites near major destinations, particularly in central business districts. However, locational opportunities do exist near the urban centers of Seattle, Bellevue, Tacoma, Bremerton and Everett.

Three such opportunities near downtown Seattle are located several hundred feet south of the Kingdome, and are close to the south end of the Metro transit tunnel. Other opportunities include the state convention center and the proposed ferry terminal expansion. Bremerton could be served by a combination heliport and seaplane barge located near the ferry terminal.

TABLE 7

PROJECTIONS OF TOTAL BASED HELICOPTERS IN THE CENTRAL PUGET SOUND REGION

Year	Based Helicopters
1985*	85
1990	117
1995	160
2000	220

* 1985 figure based on FAA records for the region.

TABLE 8

HELICOPTER USE CATEGORIES

Category	# in Service	% of Total
Commercial*	3,350	47%
Corporate	1,572	22%
Civil Government	936	13%
Air Commuter	26	4%
Aerial Application	793	11%
Instructional	428	6%
U.S. TOTAL	7,134	100%

* Refers to compensated uses.

Bellevue, which is the fourth largest city in the State of Washington, has no aviation facilities. Bellevue was listed as a high priority origin and destination by the helicopter operators that were surveyed. Two locational opportunities near SE 8th Street would be close to downtown and to most of the new office buildings in the area.

A helistop near the Tacoma Dome has been under consideration by city and Dome officials with the assistance of the Washington State Department of Transportation Aeronautics Division.

A heliport could be developed atop the parking garage at Sea-Tac Airport. Such a facility is part of the Sea-Tac Airport Layout Plan and would be much more convenient and usable than the existing helipad, which is located a substantial distance from the terminal. If an elevated structure is used, the loss of auto parking spaces would be minimal. A heliport serving Everett has been designated at Paine Field on the current Airport Layout Plan. This site is eight miles from the downtown, and it is within reasonable commuting distance to the high-tech corridor in north King County and Snohomish County.

Industrial areas, with freeways and railroad tracks, can accept helicopter flights without undue community concern. Residential areas, on the other hand, should be avoided by helicopters and operation techniques should be employed as much as possible to minimize rotorcraft noise. In addition, all aspects of helicopter safety should be considered in community planning for new helicopter facilities.

Present emergency medical helicopter operations in the region appear to be cost-effective. Military Assistance for Safety and Traffic (MAST), the U.S. Coast Guard, the U.S. Navy and the Snohomish County Sheriff's Office provide an effective network of emergency medical and search and rescue helicopter service for the central Puget Sound region.

A national study sponsored by the Helicopter Association International during 1982 and 1983 found that once heliports had been established, no serious objections to their operations or community compatibility had been filed. Business travel to urban centers remains the primary flight purpose. Funding support to develop heliports is available at both federal and state levels. In order to qualify for federal funds, a heliport must be recognized in the National Plan for Integrated Airport Systems. State revenues administered through the Washington State Department of Transportation Aeronautics Division can also be applied towards heliport development.

Demand for heliports at urban activity centers exists and is increasing. Appropriate facilities do not exist. The linking of Seattle, Bellevue, Tacoma, Everett and Bremerton to each other and to Sea-Tac is becoming increasingly important as surface congestion grows. It is desirable for the region to have a

system of public-use heliports and the institutional coordination to manage their use. Downtown heliports and helicopter flight patterns are land use issues that properly remain at the local and regional levels. This plan presents helicopter facility alternatives within the context of local land use controls and local discretion regarding locational opportunities.

SEAPLANE OPERATIONS AND FACILITIES

Seaplanes provide convenient air travel directly to water related destinations difficult to access by other modes of transportation except for helicopters. This comparative convenience of travel by seaplane is attributable to total travel times, and costs of each transportation mode available. The destinations with demonstrated demand for seaplane operations within the four-county study area include Tacoma, Bremerton, Hood Canal, Seattle, and Everett. Demonstrated demand outside the study area primarily relates to Washington coast sites, the San Juan Islands and Canada/Vancouver Island destinations. It is anticipated the demand for seaplane facilities will continue to increase over the study planning period in response to existing travel patterns and the significant costs associated with upgrading facilities for other transportation modes.

Seaplane operations is a unique industry, but in terms of the future market, lack of facilities constrains seaplane demand throughout the four-county region. However, results of the PSCOG survey indicate seaplane operators anticipate a growing industry that can provide economical, convenient service to locations not adequately served by other transportation modes.

The most critical factor facing the seaplane industry is the preservation of existing facilities. This is particularly true for the Kenmore and Lake Union facilities; for example:

- Kenmore Air Harbor is significantly affected by expansion of boat marinas. Without adequate control, the conflict between marina boat activity and seaplane operations poses a major threat to the Air Harbor.
- Lake Union seaplane facilities face an economic threat due to the escalating value of waterfront property near the center of a metropolitan city.

The seaplane operations in the four-county area add to the economic well-being of the Northwest and should become a primary preservation issue for the local area. Their operation is a part of the Northwest heritage, and seaplane services add a unique dimension to the quality of life in the metropolitan areas of the central Puget Sound region.

Because there are limited opportunities for additional seaplane facilities in the Lake Washington and Lake Union area,

preservation of existing facilities in the King County area becomes a high priority concern. In some areas of the region, anchoring a floating barge offshore where pier or gangway rights can be obtained can facilitate seaplane service in the area.

Improvements to seaplane aircraft are the result of the design advancements of general aviation aircraft. The advancements in float design, propellers, and turbine engines produce, for the pilot, more efficient, economical flight operation and, for the public, a less noisy aircraft. Advancements in aircraft design, materials and equipment will continue to increase flight efficiency and reduce community impacts. However, flight activity, coordinated between the operator and the community, will continue to be the most effective improvement to future seaplane operations in the urban areas of Tacoma, Bremerton, Seattle and Everett.

This plan outlines program alternatives and decision-making guidelines for addressing the needs of both the seaplane industry and seaplane base communities and their local governments.

PRIVATELY OWNED AIRPORTS

Privately owned public use airports provide a significant share of the general aviation facilities and services in the central Puget Sound region. Many are included with specific use classifications in the regional airport system.

As a group, the privately owned public use airports provide at least one-third of the region's hangar, tie-down and maintenance facilities for based aircraft. These facilities serve aviation and air transportation needs at little or no cost to the taxpayer, while contributing to general tax revenues in the form of aviation fuel tax, vehicle registration fees and taxes, property taxes, and sales taxes. They also provide both employment and recreational opportunities.

Over the past 10 years several privately owned public use airports in the region have closed. Reasons for these closures include changes in land use, especially in those areas around the airport, often creating incompatible circumstances between the airport users and those using the surrounding land. Airport standards are often applied to all airports regardless of size. This will create unreasonable burdens for smaller public use airports. Both insurance costs and property tax increases affect the ability of general purpose airports to survive. Finally, there is lack of understanding and appreciation as to the benefits of privately owned airports open to the public.

There are a number of actions that can be taken by local and state governments to affect the ability of these private airports to remain in existence. This could include the development of land use and zoning techniques designed to ensure more compatible

land uses surrounding airports. In addition, there are a number of airport related ordinances regarding noise insulation, hold harmless agreements, avigation and hazard easements, and coordination that could be initiated by local governments. Specific issues pertaining to privately owned airports in the central Puget Sound region are summarized below:

Land Use

- In recent years privately owned general aviation airports open to the public have faced increasing pressure from surrounding land uses due to increased development and heightened concerns over noise and safety. Even though the airport was probably "there first" the surrounding residents often view the airport as a community nuisance or threat to the livability of their community.

- Although most local jurisdictions have comprehensive plan and zoning policies that support and encourage compatibility between airports and their surroundings, incompatible land uses and conflicts do exist. What is needed in these cases are specific land use and zoning mechanisms that address these conflicts and allow for a more compatible existence.

- Federal aviation regulations outline a system of "imaginary surfaces" around airports to protect aviation users and the public. However, it is up to the local jurisdiction that has land use regulatory control below that surface to implement regulations on that land. Again, there are mechanisms that can be implemented to bring about more compatible land uses.

Cost and Revenue Issues

- Insurance costs are rapidly increasing for all aspects of aviation. This results in an increased financial burden for airport owners. The lack of limits to liability awards in court is a primary reason for this increase.

- A similar increase is also seen in property taxes. As the land surrounding an airport increases in value and use a resulting increase also takes place on the airport property. Some airports in this region have received tax relief under the state's Open Space Taxation Act. This assesses property at its current value and prevents further increases on the valuation of the land. While the existing Open Space Taxation Act has been used by some airports, it does not adequately address the need for tax relief for public use portions of privately owned airports.

Government and Community Support Issues

- There is a lack of appreciation of the benefits of privately owned public use airports to the community and the region as a whole. This contributes to the lack of tolerance for the noise and safety issues related to the airport. In addition, the transportation emergency and business services provided are not readily seen or appreciated by the general public.

- There is no clear consensus as to the current inventory of privately owned airports open to the public. This includes agreed upon figures and documentation regarding numbers of airplanes, the percentage of private versus public (commercial) airplanes, hangar space and vacancy, and general airport usage. In addition, there is no consensus on the future supply and demand estimates for privately owned airports. The result of this lack of consensus is that governmental officials, community residents, and airport owners often disagree on the current and future need for airports.

- There is a perception in many communities that federal aviation regulations and covenants associated with airport land use are not enforced. The lack of visible enforcement programs has created a sense of frustration in many people that increases opposition to new aviation proposals.

It is imperative that central Puget Sound region officials recognize the value of privately owned airports open to public use as a transportation resource. These airports provide aircraft basing capacity and operations facilities through entrepreneurial efforts, as well as contributing to the region's overall tax base. Protection of these existing facilities will preclude the need for public sector involvement in providing such facilities. Suggestions in furthering the protection of these facilities are discussed in subsequent sections of the document.

SPORT AVIATION

Sport aviation in the form of ballooning, gliding, sky-diving, and ultralight flying presents some unique land use issues for local governments and some unique operational issues for airport managers. Local governments need to be concerned because sport aviation is generally not addressed as a recreational activitiy in parks and recreation plans or as a land use in comprehensive plans and zoning ordinances. There is a public interest because sport aviation activities, if conducted improperly, can put innocent bystanders at risk and/or cause community unrest. If conducted properly such activity can be a benefit to the community and a positive element in the region's outdoor recreation market. Existing general aviation airports have in some cases been able to accommodate sport aviation activities, but in many cases have not because of differences in vehicle operating characteristics and limited space.

Gliders and parachutes (for sky-diving) are the most familiar forms of sport aviation. Ballooning used to include only the most adventuresome aviators but has recently become more widely popular. Ultralights, the newest sport aviation vehicle, are very light weight and relatively low cost. They carry one to two passengers and fly at lower altitudes and slower speeds than conventional small aircraft. There are currently 10 locations in the rgion where sport aviation activities are known to occur regularly. Most of these are general aviation airports that also serve sport aviation uses. Most of the organized ultralight flying now occurs at Arlington Ultralight Center. Most glider flying has been from Issaquah Skyport, which has closed, and Arlington Airport. Most parachuting occurs at Harvey Airfield and, until recently, Issaquah Skyport. Balloons are launched regularly from Harvey Airfield but also operate (with permission) from such other open areas as vacant lots, farmer's fields and public parks. With the closure of the Issaquah Skyport, some displacement and re-shuffling of activity to alternative locations in the region will occur.

While most sport aviation activity is currently accommodated at general aviation airports or specialized airfields, there is potential for developing an all-purpose sport aviation facility. Developing such a facility with ample room for gliding, sky-diving, ballooning and ultralights, as well as spectators, would require 65 to 100 acres. A smaller scale facility for just ultralights and balloons would require 40 to 70 acres. Sport aviation can, of course, continue to occur at existing airports, but this has to be done selectively because of differences in vehicle operating characteristics and flight patterns. Sport aviation facilities, whether they are at existing airports or exclusive locations, can have a positive economic and social impact on the community. The negative impacts of noise and aircraft overflight can be mitigated through the resolve of user groups and local governments.

The outlook for sport aviation is mixed. Ballooning appears to be a strong growth market for the next few years, while ultralight flying, gliding and sky-diving will fluctuate in the uncertain insurance and regluatory climate. Ultralights, after a wave of popularity in the early 1980's, have settled down to a sustained level of interest. But ultralights have also provided an excitement and stimulus to aviation design. Manufacturers and innovators will strive to introduce new designs that will make aviation available to lower and middle income groups. The growth in sport aviation, as with many other industries, will be constrained by the high cost (or unavailability) of liability insurance, and by limited sport aviation facilities.

Government agencies need to be concerned about sport aviation because sport aviation tends to be left out of local plans, be they economic, recreational or comprehensive. Although a small segment of the total outdoor recreational market, sport aviation deserves attention in much the same fashion as off-road vehicles

and marinas. Like any other outdoor recreation, sport aviation can be a source of tourist dollars, as well as enhance the region's quality of life for its residents.

IV. Regional Air Carrier and General Aviation System Alternatives

IV. REGIONAL AIR CARRIER AND GENERAL AVIATION SYSTEM ALTERNATIVES

AIR CARRIER ALTERNATIVES

Based upon the demand/capacity analysis findings, both short-term and long-term alternatives were developed to address air carrier requirements in the central Puget Sound region. The short-term alternative is targeted at reducing the delays and congestion experienced by aircraft during Instrument Flight Rules (IFR) or poor weather conditions. It is relatively low cost and could be implemented within a short time frame. It will be needed prior to the year 2000.

The long-term alternatives were formulated in anticipation of airside and landside capacity shortfalls under Visual Flight Rules (VFR) conditions. A longer time frame is associated with these alternatives, that is post-2000 given current demand levels, although initial incremental decisions in their regard should be made earlier.

Short-term Air Carrier Alternative

Sea-Tac and Boeing Field are in such close proximity that during many IFR conditions, their airspace capacities are effectively reduced to that of one airport. Thus, an aircraft approach to Boeing Field prevents the simultaneous approach of an aircraft destined for Sea-Tac and vice versa. This situation results in a substantial reduction in the utilization of Sea-Tac's capacity with corresponding costly delays to air carrier flights.

The objective in implementing the short-term alternative is to improve the combined capacity for air carrier and general aviation operations under IFR conditions, which occur about 10-15 percent of the time in this region during any given year. By encouraging alternate locations for corporate, training and other general aviation operations during IFR conditions, the Sea-Tac/Boeing Field airspace is more available for use by air carrier (mostly scheduled airline) operations. Four airports in the region could serve as alternate locations for corporate aircraft and other general aviation operations that use small-to-intermediate size jet and/or multi-engine aircraft. These are Bremerton National, Paine Field, Tacoma Narrows, and Renton Municipal. These airports now have at least minimal instrument landing systems, weather reporting capability, and terminal facilities. The facilities as they are or with minor upgrading could serve the needs of the short-term alternative.

Long-term Air Carrier Alternatives

Basic Alternatives. Airspace congestion has increased dramatically in the past few years with the advent of airline deregulation.

Peak demand scheduling and frequency of flights give an airline the competitive edge over others within a given market. The effects of deregulation have been felt at all major airports across the country, and Sea-Tac is no exception. In the 1983 Airspace Study conducted by the Port of Seattle and King County, it was projected that annual operations at Sea-Tac would reach 208,000 by the year 2000 (9). Similar forecasts were prepared by the PSCOG in the 1982 RASP and by the Washington State DOT in the 1980 State Airport System Plan. In fact, this level of annual operations was surpassed just two years after completion of the Airspace Study, when in 1985 annual commercial operations at Sea-Tac reached 215,858 -- 15 years ahead of schedule.

When congestion and delays at existing airports reach intolerable levels and when demand management techniques have been exhausted, there are three very general long term options for increasing capacity. Construction of a new and bigger airport is an obvious and direct way to increase capacity. Another alternative is to try to maximize use of the existing primary air carrier airport by building new runways and other facilities. A final option is to make use of other, usually smaller, airports within the region as satellite facilities to handle the primary airport's overload. Given these broad options, the following long term alternatives were formulated for the central Puget Sound region:

- Satellite Airports - Existing Locations

  Development of satellite airports by upgrading one or two existing general aviation or military airports. Candidates within the PSCOG region include Bremerton National, McChord AFB, and Paine Field. Potential candidates outside the PSCOG region may include such airports as Olympia and Skagit Regional.

- Satellite Airports - New Locations

  Development of satellite airports at one or two new locations (could include locations outside the PSCOG region).

- Maximize Air Carrier Capacity of Sea-Tac

  Through the leadership of the Port of Seattle investigate all options for expansion within the existing Sea-Tac property.

- New Primary Air Carrier Airport

  Development of a new primary air carrier airport with capacity potential to serve the long range (through 2020) air carrier demand (could include locations outside the PSCOG region).

- Resource Management

  Optimization of regional air carrier capacity through resource management, with no major airport expansions. Elements to include but not be limited to:

  - Use of airports outside the region, such as Olympia or Skagit Regional (Bayview), for satellite air carrier operations to the extent permitted under their currently adopted master plans.
  - Use of Boeing Field to serve air carrier operations, potentially displacing some of the general aviation now served there.
  - Joint management and operation of Boeing Field and Sea-Tac.
  - Limited commuter service at several airports (such as the existing San Juan Airlines service to Paine Field) to the extent permitted by currently adopted master plans.
  - Use of an airport outside the region, such as Grant County Airport (Moses Lake) or Portland International, as a hub for international flights, with express ground transportation or air shuttle to the central Puget Sound region.

Scope of Satellite Air Carrier Role. The term "satellite air carrier airport" generally refers to an airport that has air carrier service but operates in a subsidiary role to the area's primary air carrier airport (Sea-Tac for the central Puget Sound region). A wide spectrum of service levels can fall within the satellite role. At the lower end of the spectrum is the type of service that now exists at Paine Field in Snohomish County. San Juan Airlines provides five daily departures and arrivals with 15-passenger aircraft. This at the most could total 55,000 annual passengers (arrivals and departures) and less than 4,000 annual aircraft operations (take-offs and landings).

The satellite airport role assumed in the RASP alternatives is toward the upper end of the spectrum. It was assumed that the region could need one or two satellite air carrier airports with an ultimate capacity of 10 million annual passengers each, and approximately 150,000 - 200,000 annual operations. This represents that level of demand projected for 2020 under the high forecast scenario. It was used as the "worst case" for purposes of estimating capital costs. As a comparison, Sea-Tac's ultimate capacity under the currently adopted master plan is estimated to be 25 million annual passengers and 350,000 annual operations.

The airports identified in the RASP as candidates for a satellite air carrier role -- Bremerton National, Paine Field, and McChord AFB -- have existing master site plans that would have to be updated and revised if the satellite role were adopted. McChord

AFB is now exclusively used for military operations. Its use as an air carrier satellite would be subject to development of a specific site plan and reaching agreement on joint use with the U.S. Department of Defense.

Bremerton National Airport is the most receptive to assuming an expanded air carrier role. The Port of Bremerton has stated its objectives of re-establishing commuter air service and attracting more diverse uses of the airport. The port has large land holdings that can serve as buffers for neighboring communities, helping to mitigate noise and overflight impacts.

During the 1970's Snohomish County went through an extensive process of role determination for Paine Field. This involved consideration of the aviation needs that could be served by Paine Field, environmental analysis of several role alternatives, and mediation with the airport communities. This process resulted in the adoption of a "General Aviation" role for the Paine Field Community Plan, by resolution of the Board of County Commissioners on April 11, 1978, and subsequent adoption of Mediation Panel Recommendations on January 23, 1979. The consideration of a satellite air carrier role for Paine Field will be limited by the mediated agreement. The extent to which "air taxi and commuter service" are allowed under the adopted role will be subject to further analysis in the next phase of RASP alternatives refinement.

Commuter Airline Role. As defined by the FAA, a commuter air carrier is an air taxi operator that provides at least five round-trips per week between two or more points according to published flight schedules. The category "air taxi" refers to air carriers that transport, in accordance with Federal Air Regulation (FAR) Part 135, persons, property and mail using small aircraft, that is, under 30 seats or a maximum payload of less than 7,500 pounds.

Several airlines have begun as commuters by the above definitions but through mergers and acquisition of larger aircraft in response to market demand have moved into the "Certificated Air Carrier" category, which refers to air carriers holding a Certificate of Public Convenience and Necessity issued by USDOT to conduct scheduled services interstate. Certificated air carriers must operate in accordance with FAR Part 121.

There are also several categories of charter operations (non-scheduled) that comprise the rest of the general air carrier classification.

In general, commuter airlines serve shorter and lower density routes, and act as feeder services to major hub airports for connecting with national and international flights. Commuter airlines also provide direct intercity service where these is sufficient market demand, or where, under deregulation, major airlines have cut back service.

Joint Use of Military Airports. The National Plan of Integrated Airport Systems recognizes the potential resource for civilian air transportation offered by military airports. A potential joint use airport is an existing military installation that, if favorable disposition could be obtained from the U.S. Department of Defense, could accommodate full or partial civil activity, thereby negating need for substantial development at existing and/or new locations. McChord Air Force Base is a potential joint use airport in this region.

The U.S. Air Force is required under its own Regulation 5510 to consider proposals for joint use from civilian entities. If it can be determined that the civilian facility and aircraft operations are compatible with the military mission that must be served by the base, then joint use can occur.

The process for considering joint use is initiated by the appropriate civilian entity. In the case of McChord AFB, the initiating entity could be the PSCOG, the Port of Tacoma, Pierce County, or some combination. The initiating entity would develop a conceptual site plan and operations plan for civilian use of the airport. This proposal is transmitted to the local base commander, who initiates a review by the regional office of the FAA, for air traffic considerations, and conducts his own review with regard to the military mission of the base. Both sets of comments are transmitted to Air Force headquarters, where the final decision is made. The above mentioned regulations specify the criteria that will be used in evaluating the joint-use proposal.

GENERAL AVIATION ALTERNATIVES

As reflected in the 1982 Regional Airport System Plan, the focus of concern within the aviation community in the late 1970's and early 1980's was on the need to accommodate the increasing levels of general aviation traffic. During that same time period, the capacity of Sea-Tac appeared adequate to handle the projected demand for air carrier travel.

In the ensuing years, with deregulation and continued low oil prices, the air carrier issues have become more prominent and the needs of the industry have become critical as well.

As seen in the previous section, many of the solutions for meeting future air carrier requirements are composed of elements of the general aviation system. If or when air carrier activity begins at Bremerton National or Paine Field, the ability of these airports to simultaneously handle growing levels of general aviation activity will deteriorate. More immediate problems exist with the current general aviation system, as discussed in the report. To resolve these immediate concerns and also to plan for potential air carrier facility requirements, the following alternatives have been developed:

- **Implement policies to maintain the viability of existing public use airports** through public assistance in the form of:

  - support on master plan development,
  - aid in meeting noise compatibility requirements,
  - implementation of effective tax relief measures,
  - establishment of airport overlay zones,
  - implementation of building, zoning and land use codes to preserve the compatibility of land uses within airport-impact areas,
  - public acquisition of private airports faced with closure due to financial considerations.

- **Expand Capacity of Selected Existing Facilities** - Expansion of selected existing airport facilities would allow maximum utilization of existing airports. One possible solution to achieve this objective would be to construct multi-level aircraft storage facilities. This option is best suited for airports that have a low aircraft utilization rate so that the additional basing capacity would not generate pressure on operations capacity. Another option for getting the most out of existing airports would be to consider a major expansion of an existing public use airport or moderate expansion of two or more airports, either by a local government or a private developer.

- **Expand Capacity by Development of a New General Aviation Airport** - Development of a new airport is the alternative proposed by the previous Regional Airport System Plan. As adopted in 1982 and revised for this update, the plan recommends a process consisting of the following steps:

  - Carry out the assessment of airspace demand and airspace management necessary to determine the need for a new general utility class airport in the central Puget Sound region, focusing immediate attention on King County.

  - As necessary, based on the above, assess the land use, environmental and economic feasibility of locating a new airport in the region, focusing immediate attention on King County.

  - Subject to a finding of feasibility, a public agency and/or private party should develop an action plan for acquisition of a site and development of the airport.

  - In the event that a new general utility airport is built, local officials should ensure that its use and size are not expanded beyond the FAA general utility design category.

V. Evaluation of Air Carrier and General Aviation System Alternatives

V. EVALUATION OF AIR CARRIER AND GENERAL AVIATION SYSTEM ALTERNATIVES

EVALUATION OF AIR CARRIER ALTERNATIVES

Evaluation Methodology and Criteria

Evaluation of the regional air carrier system alternatives involves identifying, clarifying and quantifying the issues and impacts associated with each of the proposals. To this end, the evaluation contained in the following paragraphs is an abbreviated summary of the key issues that should be considered by interested parties. For each alternative, the major differentiating impacts are highlighted and the winners and losers associated with each alternative are identified.

The criteria used to evaluate the alternatives are the following:

1. Capacity requirements
2. Public cost of upgrading existing facilities or constructing new facilities
3. Noise impacts
4. Airspace safety and congestion
5. Accessibility
6. Economic development and activity
7. Environmental impacts

Note that the following evaluation findings do not include the alternatives introduced as a result of the public review process on the first Draft RASP. All alternatives contained in the adopted plan will be subjected to detailed site-specific analysis in the next phase of RASP refinement.

Evaluation Findings

The air carrier alternatives were described in detail in Chapter IV. There are four very general options for increasing the capacity of major air carrier airports when demand management techniques have been exhausted: expand the existing facility, construct a new facility, utilize existing smaller airports as satellite airports, or develop satellite airports at new locations. Each of the options is appealing for different reasons. Construction of new airports, either primary or satellite, would provide the opportunity to ensure compatible land uses between an airport and its neighbors. Using regional airports as satellites would increase the utilization of existing facilities and resources. Expanding the existing primary airport (Sea-Tac) also encourages the utilization of existing resources

as well as continuing "one-location" operations and maintaining a concentration of impacts.

A summary of the major differentiating impacts, winners and losers is given in the following pages. A detailed discussion of the impacts is given in the technical report (6).

ALTERNATIVE 1: CONSTRUCTION OF NEW SATELLITE AIR CARRIER AIRPORT(S)

Differentiating Impacts

- At an economic disadvantage due to inherent difficulty in capturing true market share.
- Opportunity to plan for compatible land uses between airport and neighbors.
- Major environmental impacts, particularly during construction.
- Contrary to existing subregional plans which encourage the utilization of existing facilities prior to the development of new facilities.

Advantages

- Passengers and businesses local to the satellite airport.
- Reduction in regional airspace and landside congestion.

Disadvantages

- Connecting passengers due to dispersed operations.
- Reduced accessibility for majority of Puget Sound population.
- Would require large tract of land in a sparsely populated area; strongly opposed by rural residents.

ALTERNATIVE 2: DEVELOPMENT OF SATELLITE AIRPORTS AT EXISTING LOCATIONS

Differentiating Impacts

- At an economic disadvantage due to inherent difficulty in capturing true market share.
- Bremerton National is least accessible to Puget Sound population.
- Joint use of McChord Air Force Base is possible, subject to negotiation and favorable decision by U.S. Department of Defense.

- Could provide for substantial economic impact in Kitsap, Pierce and Snohomish counties.

Advantages

- Passengers and businesses local to the satellite airport.
- Reduction in regional airspace and landside congestion.

Disadvantages

- Connecting passengers due to dispersed operations.
- Role change from general aviation to regional satellite airport strongly opposed by most surrounding communities.

ALTERNATIVE 3: MAXIMIZE AIR CARRIER CAPACITY OF SEA-TAC

Differentiating Impacts

- Comparable in cost to the satellite airport alternatives.
- Dependent third runway (within existing airport property) provides most but not all of the capacity needed through the planning period.
- Would require expansion of existing noise impact area resulting in increased costs for noise mitigation.
- Location is most accessible to majority of the region.

Advantages

- Passengers and businesses for two reasons - convenience of centrally located operations and most accessible to majority of population.
- Communities other than around Sea-Tac because noise impacts are constrained to one location.

Disadvantages

- Passengers (through user fees) because it is a high cost alternative.
- Passengers and businesses because of continuing congestion and delay, unless runways are realigned.
- Noise-impacted communities adjacent to Sea-Tac.

ALTERNATIVE 4: CONSTRUCTION OF A NEW PRIMARY AIR CARRIER AIRPORT

Differentiating Impacts

- The highest capital cost alternative.

- Greatest potential for increasing overall landside and airside capacity.
- Opportunity to plan for compatible land uses between airport and neighbors.
- Major environmental impacts, particularly during construction.
- Contrary to existing subregional plans, which encourage the utilization of existing facilities prior to the development of new facilities.

Advantages

- Passengers and businesses - single airport location.
- Existing noise-impacted communities at Sea-Tac.

Disadvantages

- Would require large tract of land; limited availability so would involve obtaining undeveloped, sparsely populated acreage; strongly opposed by rural residents.
- Reduced accessibility for majority of Puget Sound population.

Based upon the above findings, recommendations have been formulated and are contained in the following chapter.

EVALUATION OF GENERAL AVIATION SYSTEM ALTERNATIVES

There are 18 public use general aviation airports in this region in addition to the airports discussed within the context of the air carrier alternatives. Several of these airports are privately owned and provide facilities for basing aircraft and associated services at little or no cost to the public.

General aviation airports around the country are all experiencing enormous increases in costs, particularly with liability insurance. Publicly owned airports can normally absorb these added costs because they operate within the larger budget of the county, city or port district. Many privately owned (and publicly used) airports are finding these increased costs an unbearable financial drain. If steps are not taken to protect the transportation resource that these facilities represent, many more may go the way of Enumclaw and Wax Orchard (private airports that recently changed their "public-use" status to private use).

Options have been developed to help prevent the further loss of general aviation airport capacity. If all these options were implemented and effectively utilized, they would have the effect of preserving and maintaining the region's existing facilities. Finanical support as well as support on land use issues are the

two areas that were discussed as most useful for maintaining the existing system.

Financial support would involve assistance with master plan development as well as aid in meeting noise compatibility requirements. This support should originate at the local, state and national (FAA) levels.

At the local and state levels, implementation of effective tax relief measures are needed for the public use portions of privately owned airports. The basic components of implementing tax relief measures are discussed in Chapter VII. A major form of support for private airports would be the actual acquisition of the facility by a public sponsor in the event that the airport faced possible closure due to financial problems. This measure is currently being considered by King County in the case of the Cedar Grove Airport. Public acquisition of a private airport not only "saves" that existing facility, but it also could serve the dual purpose of ensuring that capacity exists to alleviate the airspace congestion at larger airports.

Cost estimates for capital expenditures at existing general aviation facilities were developed by the consultant team for three different time periods to the year 2020. Costs were developed for airport improvements, expansion and maintenance. Following the development of these costs, financing needs were compiled and funding sources and the availability thereof were identified. Results of both the cost and financing investigations are contained in the technical report (6).

On the land use side, explicit building, zoning and land use codes need to be implemented at the local level to preserve the compatibility of land uses within the airport-impact areas. One specific measure is the airport overlay zone, a model of which is given in Appendix B.

Maintaining the existing system of general avaition facilities through implementation of the above measures will not only serve the region's transportation needs, but it will also continue to generate substantial economic benefits to the region. For example (14), since an airport is an essential form of business transportation, the presence of an airport and the type of services it provides are important considerations in the siting of business and industrial facilities. Airports are magnets for distribution centers, warehouses, office parks, hotels and other development. In addition to attracting business to a community, airports generate direct economic impacts as a consequence of activities carried out at the airport by airlines, airport personnel, fixed base operators and other tenants with a direct involvement in aviation.

In addition to their role as general aviation facilities, there will be pressure on the general aviation system of airports to

take on more of an air carrier and business jet reliever role as traffic and subsequent congestion continue to grow at Sea-Tac.

The larger general aviation airports within the region, namely Bremerton National, Tacoma Narrows, Paine Field and Renton Municipal, are the most reasonable choices for the reliever role, given their size and location. Their reliever responsibilities will in turn impact the other general aviation airports as they start handling more of the smaller aircraft traffic. In fact, the airspace associated with Sea-Tac and Boeing Field is becoming so congested at times now that there has been discussion of the need to move general aviation outside the urban area (15). Suitable facilities must exist to allow such a transition. The alternatives that would provide such facilities in the future were introduced in Chapter IV: expansion of the capacity of existing general aviation facilities and/or development of a new general aviation airport. As with the air carrier alternatives, there are tradeoffs in using existing versus developing new facilities. The most obvious tradeoff is environmental: a new airport allows the community or region to better plan for compatible land uses (particularly noise) between the airport and its neighbors while expansion of existing facilities may only exacerbate the incompatibilities. Both alternatives involve negative environmental impacts during the construction of new facilities.

Land for a new airport site is scarce and becoming scarcer -- a program for landbanking of potential sites would help preserve this option. One drawback with a new airport site is that because available land is in limited supply in the urban area, the location of a new facility would probably be less accessible than an existing facility to most of its users. Significant economic benefits would accrue to the location that chooses to develop an airport -- whether it's a new facility or an existing airport.

Finally, any expansion of the general aviation system would need to occur outside of the Sea-Tac/Boeing Field airspace in order to fulfill its reliever role.

POLICY OPTIONS AND IMPLEMENTATION GUIDELINES FOR SPECIAL AIR FACILITIES

In examining the facility and operational needs of the more specialized facilities of air transportation -- heliports/helistops, seaplane bases, privately owned airports and sport aviation facilities -- this plan recognizes that, while promoting regional policies to address capacity needs is an appropriate and necessary role for PSCOG to play, land use and program related decisions fall to the discretion of local jurisdictions. The following paragraphs propose regional policy statements, supplemented by implementation guidelines.

Regional policy statements provide broad guidance for the central Puget Sound region in terms of the physical and operating requirements to serve the specialized modes of air transportation. Supplementing these policy statements with a set of implementation guidelines is intended to provide local jurisdictions with options for addressing regional air transportation facility needs at the local level. Selecting any one (or more than one) of the proposed alternatives is expected to advance regional objectives for serving air transportation needs within the discretion of local governance.

Implementation guidelines furnish a general overview of how local jurisdictions might select and pursue an option for dealing with site selection for a helipad, facilitating the peaceful coexistence of a seaplane base and community, or the development of a sport aviation facility as an alternative to the more traditional community recreational facilities of golf courses or race tracks. Of particular note, too, are the options available to local governments in preserving existing privately owned airports, and mechanisms for ensuring that these private sector resources are protected from being encroached upon by incompatible development. With foresight and planning, local governments can preserve the valuable resource of a privately owned airport open to public use while still maintaining desired community lifestyles.

Helicopter Facilities

There is growing demand for helicopter services in the central Puget Sound region and inadequate facilities to serve this demand. The advance siting of new helipads can preclude helipad development from occurring at unsuitable locations in the future. Adequate landing facilities are necessary to maintain the availability of this form of transportation.

The greatest demand for helicopter facilities is in central city locations throughout the region. Generally, demand for helicopter service includes origin and destination requests to and from central cities. Currently there is one public use helipad available in downtown Seattle.

In conjunction with the need for helicopter landing facilities is the need for improved helicopter operations management. This is particularly critical because of the need to access city center locations, and thus the potential exists for community disruptions. One innovative program that has been successful in other parts of the country is a "Fly Neighborly" program; this is a cooperative program based on the pilot's use of flight techniques that minimize intrusion on communities. Another option would be mandated helicopter corridors, using enforcement and punitive mechanisms. Site selection for helicopter landing facilities plays a key role in creating opportunities for satisfactory management of helicopter operations.

Regional Policy Statement on Helicopter Facilities

Demand for helicopter services in the central Puget Sound region is expected to double over the next 15 years. Adequate physical facilities for helicopter service do not currently exist in the region, particularly in central city locations. The PSCOG supports a cooperative effort to provide helicopter landing facilities in central city locations, if warranted by growth in demand and subject to environmental compatibility. Local governments have the option of helping to define and shape how helicopter demand will be served in the future by taking a more active role in making decisions regarding helicopter facilities and operations.

Implementation Guidelines - Helicopter Facilities

Option I

Designate location and provide public funding for a public use helistop in a central city location.

Why choose this option?

- Maximum local control over the physical siting of the facility.
- Maximum local control over the operational characteristics of the facility.

What kind of circumstances lend themselves to this option?

- Where the local jurisdiction wishes to locate a public use helistop in its central city in advance of market demand inducing the private sector to develop such a facility.
- Where the local jurisdiction wishes to exercise the greatest degree of local control over the facility by holding public ownership.

Basic components for implementing this option:

- Take council action in favor of a publicly owned helicopter landing facility in the city.
- Secure financing for property acquisition, facility construction, and operating costs; depending on local circumstances, this could require the issuance of debt in some form, for example, revenue bonding to be repaid from revenues generated through landing fees.
- Identify land use constraints and/or opportunities in terms of site selection for the facility. Undertake facility site selection process (see Table 9); consult with residents, business community and helicopter users in locating an appropriate site for helipad development; review land use/zoning requirements.

TABLE 9

DOWNTOWN HELISTOP
LAND AREA REQUIRED IN SQUARE FEET

Parameter	Ground Level	Rooftop	Shoreline	Offshore
Terminal (ft^2)	1,000	---	1,000	1,000
Auto Parking for Employees (10 spaces)	3,250	3,250	3,250	3,250
Auto Parking for Passengers (100 spaces)	32,500 (optional)	---	---	---
Helicopter Maneuvering Area	20,000	20,000	20,000	---
Access Road (500' x 40')	20,000	---	20,000	20,000
Fuel and Maintenance Facilities	---	---	---	---
TOTAL LAND AREA	76,750 (1.7 acres)	23,250 (.5 acre)	44,250 (1.0 acre)	24,250 (0.6 acre)

Sources: References 16 and 17.

- Conduct public and environmental review processes.
- Requires city departmental or contracted project management oversight (PMO) and -- eventually -- operations oversight.

Option II

Designate suitable location for a helistop; encourage the private sector to take over development and operation of the facility.

Why choose this option?

- Facilitates new landing capacity for helicopter services without putting financial burden on the municipality.
- Encourages private sector development without accelerating, through public intervention, actual construction of the facility.
- Permits significant local government discretion in heliport site selection, and some local government control (through permitting process) in certain aspects of facility design, construction and operations.

What kinds of circumstances lend themselves to choosing this option?

- Where a local jurisdiction wants to facilitate the development of a helistop, but does not want to assume the financial or operating responsibility for such a facility.
- Where a local jurisdiction wants to preclude helistop development from occurring in an undesirable location by designating the more suitable location in advance.

Basic components in implementing this option:

- Undertake facility site selection process, consulting with residents, business community, helicopter users, and potential private sector developers.
- Review land use/zoning requirements and possible incentive mechanisms for private sector facility development.
- Publicize the helipad development opportunity available to the private sector.
- Conduct ongoing liaison and coordination with private sector developers.

Regional Policy Statement on Helicopter Operations

Helicopter traffic will increase as these services are more widely utilized for intercity travel in the region. The PSCOG believes that the use of local ordinances such as the model ordinance in Appendix A of the RASP, and other operations management measures will be needed in order to serve increased demand for helicopter operation with minimal community impacts.

Implementation Guidelines - Helicopter Operations

Option I

Develop a program based on the "Fly Neighborly" concept.

Why choose this option?

- Establishes a cooperative program between helicopter operators, local government, aviation officials, and the public.
- Minimal costs associated with the program.
- Good potential for achieving minimal impacts on communities from helicopter operations.

What kind of circumstances lend themselves to this option?

- Where a cooperative environment exists between the community at large, governmental representatives, and helicopter operators.
- Where financial resources are limited but there is a desire to implement a program to reduce helicopter operations impacts.

Basic components for implementing this option:

- Take council action in support of pursuing a "Fly Neighborly" type of program.
- Hold meetings with helicopter operators, federal aviation representatives, community groups, and others to formulate the details of a "Fly Neighborly" program for the city.
- Determine a mechanism for reporting program violators; determine any punitive actions to be taken against violators.
- Determine strategies for program implementation, review, and evaluation; publicize the program to the helicopter user community.

Option II

Through local action in cooperation with federal aviation officials, mandate the use of specific air corridors by helicopter operators.

Why choose this option?

- Where these is a perceived need for a mandated program of air corridor use.
- Where the necessary financial resources are available to ensure program compliance through regulation.
- Where a voluntary program is not feasible.

Basic components of implementing this option:

- Council action to pursue implementing a program of mandated helicopter air corridors.
- Coordination with federal aviation officials, helicopter operators, and the community to define acceptable air corridors.
- Determine a mechanism for rigorous program enforcement and punitive measures to be taken against violators.
- Develop local regulation or ordinance pertaining to the use of defined corridors by helicopter operators.
- Publish and publicize regulation; conduct ongoing program enforcement activities.

Privately Owned Airports

In recent years privately owned general aviation airports open to the public have faced increasing pressure from surrounding land uses due to increased development and heightened concerns about noise and safety. Even though the airport was probably "there first" the surrounding residents often view the airport as a nuisance or threat to the livability of their community.

In contrast, the owners of general aviation airports often feel constraints from local governments as to how they may use their airport property in order to provide the best general airport services and facilities.

Problems have intensified in recent years because uses sensitive to aviation noise have moved nearer to these airports and air traffic volumes have tended to increase. In some communities, delays or cancellations of plans to expand existing airports or build new airports have occurred. Although aviation noise is due to airplane operations, inappropriate development approved near airports contributes to the impact by increasing population density in the vicinity of these facilities.

Most local jurisdictions have comprehensive plan policies and zoning regulation that support and encourage compatibility between airports and their surroundings. However, there are a number of privately owned airports open to the public that are experiencing difficulties because of incompatible land uses.

What is often lacking in these cases is specific zoning ordinances that address these conflicts and allow for a more compatible existence.

Not only does this desire for compatible existence apply to surrounding land uses but also the uses on the airport property. Whether it is the development of additional hangar space or public services facilities such as a restaurant, the general aviation airport owner often is frustrated by the lack of surety as to what he can or cannot do with his property.

It should also be noted that these issues apply to general aviation airports that service seaplanes, helicopters, and recreational uses (that is, skydivers, balloons, ultralights and gliders). Because seaplanes and helicopters tend to be located in denser urban areas the land use issues are different. However, recreation airport uses are similar to privately owned general aviation airports because of their location in rural or semi-rural areas.

Privately owned airports provide aircraft basing capacity and air transport operations at little or no public cost. They are a valuable resource that may be lost if steps are not taken to protect their role in providing air transportation services.

Regional Policy Statement on Privately Owned Airports

Privately owned airports that are open to public use provide about one-third of this region's basing capacity for general aviation. The PSCOG believes that the protection of privately owned public use airport facilities, through such means as zoning for land use campatibility, economic incentives and liability insurance reforms, must be considered by local and state governments.

Implementation Guidelines - Support for Privately Owned Airports

Option I

Implement an airport overlay zone.

Why choose this option?

- Facilitates compatible development for both airports and communities by predetermining the area around airports to be protected.

What kind of circumstances lend themselves to this option?

- Where an airport exists and pressures of urban development are beginning to surface in the immediate vicinity.
- Where the local jurisdiction wants to preclude incompatible development around the airport.

Basic components for implementing this option:

- Local government policy action favoring implementation of an airport overlay zone.
- Components of the ordinance (see Appendix B):
  - Establishes appropriate regulations to protect air space, approaches, and property of the airport, and protects property within the defined airport vicinity.
- Scope of the overlay zone:
  - Defines protected operational airspace and delineates protected landside areas.
  - Defines regulatory/enforcement mechanisms, variance provisions, and responsibilities of the airport owner and the local jurisdictions.
  - Defines acceptable land uses within the airport zone.
- Local implementation procedures:
  - Public process
  - Passage of the ordinance
  - Ordinance enforcement

Option II

Protect solvency of existing privately owned airports open to public use: restrict new airports.

Why choose this option?

- Maintains and encourages the public use role of and basing capacity provided by existing privately owned airports.
- Restricts new airports to avoid community conflicts and additional "competition" for existing airports.

What kind of circumstances lend themselves to this option?

- Where private airports serving the public are financially threatened, and the loss of such facilities is undesirable to local government and the public; development of additional facilities also being undesirable.

Basic components of implementing this option:

- "Protecting solvency" means shielding the facility from competing interests, elevating the role of the airport in the community, and preparing to assist with governmental intervention to protect the airport if necessary.

Option III

Protect solvency of existing airports: no position on new airport development.

Why choose this option?

- Maintains and encourages the public use role of and basing capacity provided by existing privately owned airports with no position on new airports.

What kind of circumstances lend themselves to this option?

- Where private airports are threatened and the local jurisdiction wishes to protect the resource, while not necessarily precluding the competitive environment and community impacts of possible new airport development.

Basic components of implementing this option:

- Same as above, but with no restrictive posture toward new airport development and potentially no government intervention if an airport becomes financially unable to survive.

Option IV

Seek property tax relief for privately owned airports serving the public.

Why choose this option?

- Provides pro-active governmental support for the transportation role of privately owned airports open to public use; provides property or "open space" tax relief for aeronautical areas.

What kind of circumstances lend themselves to this option?

- Where local governments wish to provide specific tax burden relief for private airports serving the public.

Basic components of implementing this option:

- Local government action to achieve property tax exemptions for the public use areas of privately owned airports.
- Recognition and classification of aviation facilities in land use/zoning plans and in the local tax codes.
- Local support for state level tax exemptions for public use areas and services provided by privately owned airports.

Option V

Seek to update state/national insurance requirements to assist in economic solvency of general aviation facilities that are threatened by increased insurance costs.

Why choose this option?

- To enable a private facility open to the public to remain a public facility without undue insurance rate increases.

What kind of circumstances lend themselves to this option?

- Where private facilities, such as Enumclaw and Wax Orchard, have been forced, through increased insurance costs, to close their doors to the public.

Basic components for implementing this option:

- Local government interaction with state/national insurance commissions for an update to the insurance system.
- Efforts by airport owners for encouraging their users to use stringent safety measures.

Option VI

Acquire privately owned public use (or former public use) airports that are threatened with closure.

Why choose this option?

- Maintains general aviation aircraft basing capacity provided by existing airports.
- May preclude need to find location for new airport in the future.
- Makes use of an established airport location.
- Provides more direct control of general aviation facilities by local governments.

What kind of circumstances lend themselves to this option?

- Threatened closure of existing public use airport.
- Economic incentives and liability insurance reforms are not present to attract private sector investment.
- Airport is in location with good potential for land use compatibility and minimum community impacts.

Basic components of implementing this option:

- Decision by governmental entity that the general aviation need justifies a full investigation of the feasibility of public acquisition and ownership.

- Master planning study to evaluate financial and environmental feasibility and to prepare a site plan.
- Public review process (under SEPA) on acquisition.
- Finalize master plan funding, and airport operations plan.
- Acquire airport; initiate operations under public ownership.

Seaplane Facilities

Seaplane operations provide transportation and tour services throughout the Northwest. In the central Puget Sound region, seaplane bases are located on Lake Union, Lake Washington, and American Lake.

The seaplane industry is not experiencing significant growth, but existing facilities are feeling pressures from urban development. Potential solutions to some of the pressures being felt by seaplane operations could include a base consolidation effort by federal, state, and local officials in cooperation with seaplane operators. The consolidation of operations in the King County area in particular would certainly restrict origin and destination choices on the part of seaplane clients, and would impact the base area community while relieving impacts on those communities where seaplane operations are terminated. The most attractive feature of a consolidated seaplane base may be the relative ease of protecting the facility from future encroachment. Typical space requirements for such a base are given in Table 10.

Seaplane services is a unique industry with a stable market. Protecting existing facilities in the region and fostering a peaceful coexistence between seaplane operations and affected communities are the priorities in addressing this mode of air transportation within the context of the Regional Airport System Plan.

Regional Policy Statement on Seaplane Base Facilities

Seaplane service is a specialized industry unique to the Northwest. The PSCOG supports preservation of existing seaplane services and their required operating facilities, in conjunction with cooperative efforts to reduce negative impacts of seaplane operations on communities.

Implementation Guidelines - Seaplane Facilities and Operations

Option I

Implement a trial seaplane base overlay zone to protect existing facilities.

TABLE 10

SPACE REQUIREMENTS FOR SEAPLANE FACILITIES

Water Area for Take-Off and Landing Operations	5,000' x 500'
Ramps/Piers/Floating Docks	6,200 ft^2
Aircraft Service/Tie-Down/ Storage Area	83,500 ft^2
Administration Building/ Common Use Area/ U.S. Customs Service	3,000 ft^2
Access Road/Parking	56,000 ft^2
TOTAL AREA (excluding operations area)	148,700 ft^2 (3.4 Acres)

Sources: References 17 and 18.

Why choose this option?

- Attempts to protect existing facilities by using the overlay zone concept.
- May be effective where new shoreline development is occurring or pending in the vicinity of an existing seaplane base.
- Where local government wishes to embark on a cooperative effort to protect the facility within the context of making shoreline development decisions.

Basic components of implementing this option:

- Council action to support the implementation of a trial seaplane base overlay zone in cooperation with other shoreline communities, federal and state aviation officials, and seaplane base operators.
- Pursue the same steps as with airport overlay zones (see Privately Owned Airports section).

Option II

Promote local and state actions to protect existing seaplane bases through ordinance and legislative action where possible.

Why choose this option?

- Where implementation of an overlay zone concept is not feasible, this alternative suggests local governments take policy actions in support of protecting seaplane bases in the vicinity, and support state legislative action to protect these facilities.

What kind of circumstances lend themselves to this option?

- Where a local jurisdiction is not in a position to take unilateral action to protect the facility through zoning mechanisms or other measures, and there does not exist consensus among all shoreline communities to take protective actions for the seaplane base.

Basic components of implementing this option:

- Council policy action in support of protecting the existing seaplane base facility.
- Appropriate indications of support of the facility forwarded to neighboring communities and legislative bodies.
- Coordination with and community support for the facility as a unique resource.

Option III

Develop a cooperative public information program sponsored by seaplane operators to explain what seaplanes do and who regulates them; create a dispute board composed of base operators, citizen representatives, local elected officials, and federal or state aviation officials to resolve disputed issues as needed.

Why choose this option?

- Promotes cooperative efforts between community and seaplane operators in resolving disputed issues.
- Encourages seaplane operators to make use of operational techniques that incur minimal impacts on communities while educating the community as to the purposes served by seaplane operations.
- Establishes a formal mechanism for communication between the community at large and seaplane base operators.

What kind of circumstances lend themselves to this option?

- Where a lack of communication and understanding exists between seaplane base operators and the community.
- Where disputes have occurred in the past with no local mechanism for dispute resolution.
- Where seaplane operations can be improved to minimize impacts on shoreline communities through cooperative efforts between operators and the affected community.

Basic components of implementing this option:

- Convene local elected officials of shoreline communities, seaplane base operators, aviation officials, and community representatives to create an advisory council.
- Define the parameters of the advisory council's responsibility and the public information program to be established, and level of operating budget available to the council.
- Municipalities endorse the establishment of the advisory council and its membership; advisory council is given its mandate.

Sport Aviation

Sport aviation activity includes ballooning, gliding, parachuting, and ultralight piloting. These are very specialized recreational forms of aviation, but such activities are important within the context of the Regional Airport System Plan because they utilize airspace and require unique physical facilities.

It is common for local jurisdictions to have some level of sponsorship in community recreational facilities such as golf courses, race tracks, trails and parks, but sport aviation fields have typically not been included in these municipally sponsored facilities. Sport aviation activity, however, has been increasing, and the sport requires special physical facilities.

Sport aviation activity currently takes place at some general aviation airports where the physical layout of the facility permits compatible use by light aircraft and sport aviation aircraft. In terms of physical space for sport aviation, the development of a specialized sport aviation activity center would be ideal. This type of facility could include a spectator area and designated areas for the different types of sport aviation activity; a suggested design layout for such a facility is included in this report for information and guidance purposes.

Aviation as a recreational activity is somewhat unique to the Northwest; the sport aviation modes of ultralights, balloons, gliders, and parachutes make up a growing segment of this recreational activity in the central Puget Sound region. Sport aviation can be an attractive spectator as well as participatory sport, and the economic and recreational potential of developing a sport aviation facility merits some consideration by local jurisdictions.

Regional Policy Statement on Sport Aviation

Sport aviation is a growing recreational activity in the central Puget Sound region and has special physical and operating requirements. Insofar as sport aviation is like other public recreational activities, the PSCOG supports a cooperative effort to provide adequate physical and operating facilities for sport aviation activity, providing adverse community impacts are mitigated.

Implementation Guidelines - Sport Aviation Facilities

Option I

Designate suitable areas that can accommodate sport aviation activity with acceptable community impacts (typical physical requirements are given in Table 11).

Why choose this option?

- Defines an area for recreational sports involving aviation.
- Provides the community with a unique recreational center, attracting both the spectator and the participant.

TABLE 11

SPORT AVIATION FACILITIES LAND REQUIREMENTS IN ACRES

Element	Full Service Facility (Balloons, Gliders, Ultralights, Sky-diving)	Limited Facility (Balloons, Ultralights)
Access Road/ Auto Parking	14.3	6.8
Spectator Areas	5.2	3.9
Administration Bldg/Operations Buildings	0.5	0.3
Runway/Safety Area/Clear Zones Apron	74.4	42.6
Sky Divers Drop Zone/Training Area/Chute Packing Area	6.5	---
Balloon Operations Area	2.4	2.0
TOTAL LAND AREA	103.3	55.6

Sources: References 17 and 19.

What circumstances lend themselves to this option?

- Where a jurisdiction wants to provide for unique recreational activity in the community and wants to identify the location for this activity.
- Where a jurisdiction wants to preclude sport aviation activity from taking place in a less suitable location.
- Where the local jurisdiction wishes to provide a framework for a potential revenue-generating recreational center.

Basic components of implementing this option:

- Council action to support the development of a sport aviation facility.
- Undertake site selection process, consulting with sport aviators, community representatives, developers and the business community.
- Determine the financing and construction strategies to be used in developing such a facility.

Option II

Designate suitable existing airports that can accommodate sport aviation activities without adversely impacting general aviation operations and the community.

Why choose this option?

- Utilizes existing general aviation resources that can accommodate increased levels of activity without negatively impacting current operations.
- Is potentially less expensive to expand an existing airport to accommodate sport aviation activity than to construct a new facility.
- May aid in the economic solvency of general aviation facilities.
- Is in consonance with general aviation proposed airport overlay zone ordinance.

What kind of circumstances lend themselves to this option?

- Where an existing airport in the community has the capacity to expand to accommodate sport aviation activity.
- Where an existing airport already has some level and types of sport aviation activity occurring.
- Where the existing aviation facility is ideally located and the expansion and increased activity levels would not negatively impact the community.

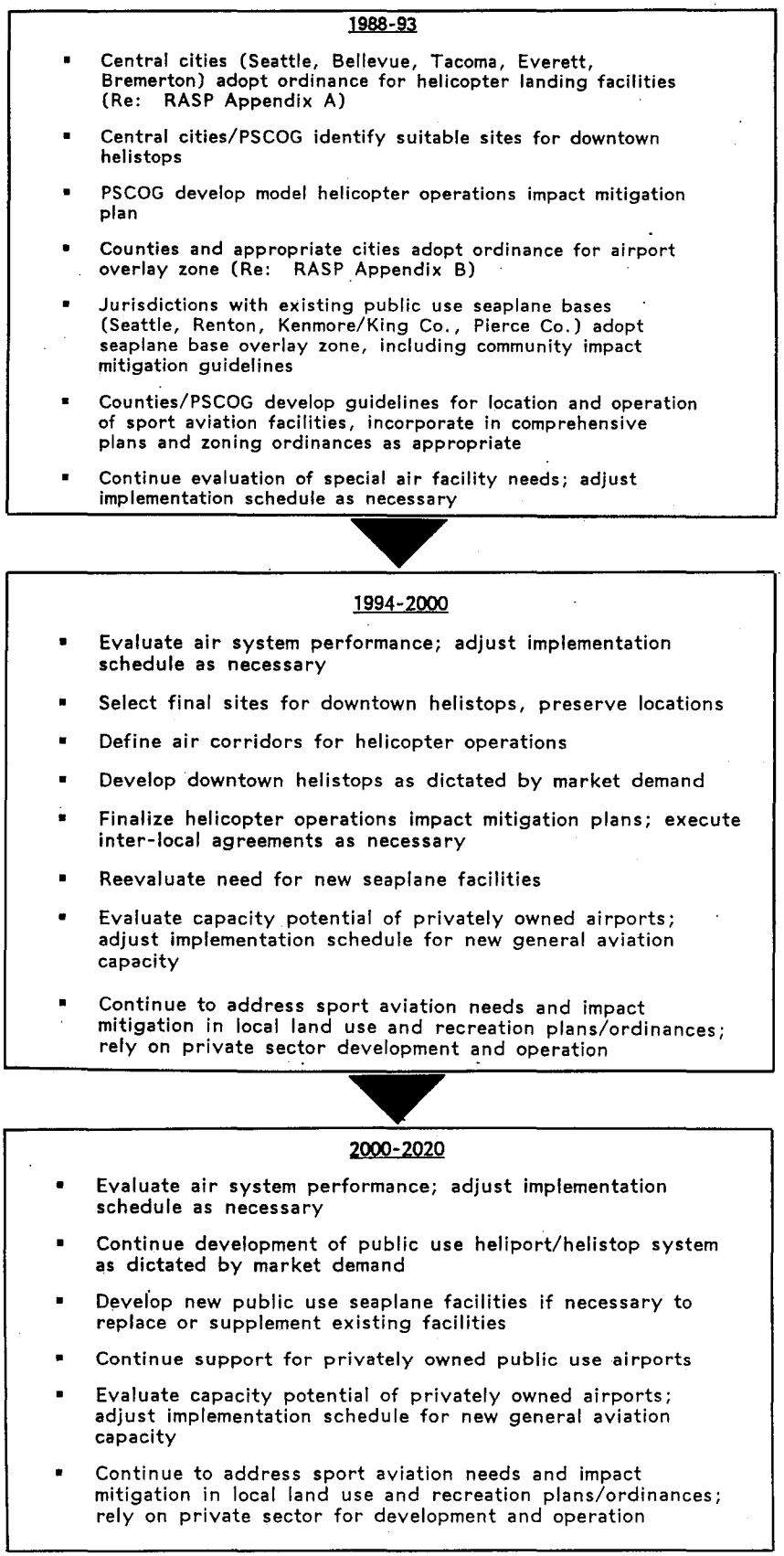
Basic components of implementing this option:

- Consultations with airport owners (if private), aviation user community, developers, and community at large.
- Undertake site design and secure financing arrangements for the improvements; develop land use agreements.
- Conduct environmental and public review processes.

Implementation of Special Air Facility Recommendations

The decision-making process for the special air facilities will occur incrementally over time. The development of the facilities and the initiation of new service rest largely with the private sector. Local governments and port districts can prepare for responding to these initiatives by following the foregoing implementation guidelines. The recommended phasing over time is illustrated in Figure 8.

FIGURE 8
PHASED IMPLEMENTATION OF SPECIAL AIR FACILITY RECOMMENDATIONS



VI. Financial Requirements and Strategies

VI. FINANCIAL REQUIREMENTS AND STRATEGIES

INTRODUCTION

In Chapters IV and V, four principal air carrier alternatives, three general aviation alternatives and various special purpose facility options were formulated. For the purpose of developing cost estimates during evaluation, the alternatives were defined as follows:

Air Carrier

Alternative 1 - Develop Two New Satellite Air Carrier Airports of 10 Million Passenger Capacity Each

Alternative 2 - Develop Two Satellite Air Carrier Airports of 10 Million Passenger Capacity Each by Expanding Existing Airports

Alternative 3 - Maximize Air Carrier Capacity of Sea-Tac

Alternative 4 - Develop a New Primary Air Carrier Airport

Along with each of these alternatives goes the continued improvement of Sea-Tac up to a capacity of approximately 20-25 million passengers each year, and the diversion, when necessary, of IFR general aviation traffic from the Sea-Tac/Boeing Field airspace to other suitable airports.

General Aviation

Alternative 1 - Bring Existing Airports up to Full Capacity

Alternative 2 - Expand Five Existing Airports to Handle 100 Based Aircraft Apiece

Alternative 3a- Public Acquisition and Expansion of a Private Airport

Alternative 3b- New Airport for 500 Based Aircraft

Suboptions

Suboption 1 - Seaplane Base

Suboption 2 - Helistop

Suboption 3 - Sport Aviation Field

CAPITAL COSTS FOR THE REGIONAL AIRPORT SYSTEM ALTERNATIVES

Table 12 summarizes the capital costs of the air carrier alternatives over three phases of the study period. Table 13 does the same for the remainder of the system alternatives. In each case, the capital cost elements that are common to all alternatives are identified separately from those that are unique to a given alternative.

COMPARISON OF AVAILABLE FUNDS TO NEEDS

Both costs and revenues are difficult to project through the entire planning period. This section examines the principal funding sources and compares them with needs for a representative air carrier alternative (#4) and a representative general aviation alternative (#2). A detailed discussion of the analysis is contained in Reference 20. A summary of the results is given in Table 14.

In terms of the general aviation system, it seems likely that needs can be met, subject to full participation by the private sector. Special major projects will be wholly able to access discretionary funding from FAA. The likely continued strength of the Aviation Trust Fund is an important assumption.

In terms of the air carrier situation, the financial needs are much greater, and conventional funding sources are insufficient. Moreover, the Port of Seattle, which currently provides most of the air carrier funding in the region, does not have jurisdiction or funding powers over the entire four-county market area. Jurisdictional considerations and funding considerations will be inextricably linked in the air carrier situation.

Many options exist for increasing air carrier funding, especially if the new Airport Improvement Legislation permits major hubs to develop their own funding through a passenger tax, fee, head tax or other charge (previously prohibited). These options are briefly discussed in the following section.

TABLE 12

AIR CARRIER SYSTEM ALTERNATIVE CAPITAL COSTS

(1986 dollars in millions)

Description	Near Term 1987-1992	Medium Term 1993-2000	Long Term 2001-2020	Total 1987-2020
A. Common to All Alternatives				
Existing Improvement Plans at Sea-Tac	194.0	156.0	NA	350.0*
Divert GA IFR Traffic from Boeing Field	0.6	0.6		1.2
SUBTOTAL	194.6	156.6	NA	351.2
B. Alternatives				
Alternative 1 Two New Satellite Airports		540.1	540.1	1,080.2
Plus A Above	194.6	696.7	540.1	1,431.4
Alternative 2 Expand Existing GA Airports		509.0	509.0	1,018.0
Plus A Above	194.6	665.6	509.0	1,369.2
Alternative 3 Maximize Capacity of Sea-Tac		300.0	553.1	853.1
Plus A Above	194.6	456.6	553.1	1,204.3
Alternative 4 New Airport		300.0	1,300.0	1,600.0
Plus A Above	194.6	456.6	1,300.0	1,951.2

* No additional costs assumed beyond completion of currently adopted master plan.

Source: References 6 and 8.

TABLE 13

GENERAL AVIATION SYSTEM ALTERNATIVE CAPITAL COSTS

(1986 dollars in millions)

Description	Near Term 1987-1992	Medium Term 1993-2000	Long Term 2001-2020	Total 1987-2020
A. Common to All Alternatives				
Bring Existing Airports Up to Full Capacity/ Standards	39.5	29.9	18.8	88.2
Seaplane base(s)			3.4	3.4
Heliport(s)		1.8*	1.2**	3.0
Sport airpark		1.2	2.1	3.3
SUBTOTAL PUBLIC AIRPORTS	39.5	32.9	25.5	97.9
Private NPIAS Airports	4.8	2.4	1.9	9.1
Private Non-NPIAS Airports	4.7	4.6	4.7	14.0
SUBTOTAL PRIVATE AIRPORTS	9.5	7.0	6.6	23.1
TOTAL A	49.0	39.9	32.1	121.0
B. Alternatives				
Alternative 2: Expand Capacity at Five Airports		1.0	4.0	5.0
Plus A Above	49.0	40.9	36.1	126.0
Alternative 3a: Public Acquisition of Private Airport		2.0	4.3	6.3
Plus A Above	49.0	41.9	36.4	127.3
Alternative 3b: New Airport		3.0	8.1	11.1
Plus A Above	49.0	42.9	40.2	132.1

*3 heliports @ .6m
**2 heliports @ .6m

Source: References 6 and 20.

TABLE 14

REPRESENTIVE COMPARISON OF AVAILABLE FUNDS TO NEEDS

(1986 dollars in millions)

	Near Term 1987-1992	Medium Term 1993-2000	Long Term 2001-2020	Total 1987-2020
Air Carrier				
Needs (Table 12, Alt. No. 4)	$194.6	$456.6	$1,300.0	$1,951.2
Available				
FAA	36.5	58.4	146.1	241.0
Port	98.5-112.5	157.6-180.0	394.0-450.0	650.1-742.5
Subtotal	135.0-149.0	216.0-238.4	540.1-596.1	891.1-983.5
Net Surplus (Deficit)	(45.6-59.6)	(218.2-240.6)	(703.9-759.9)	(967.7-1060.1)
Cumulative Surplus (Deficit)	(45.6-59.6)	(263.8-300.2)	(967.7-1060.1)	

NOTE: No private sector funding assumed for air carrier facilities.

General Aviation				
Needs (Table 13, Alt. No. 2)	49.0	40.9	36.1	126.0
Available				
FAA	16.1	25.7	64.2	106.0
State				
Basic	0.4	0.7	1.8	2.9
Special	0.5	0.8	2.0	3.3
Local	4.0	3.0	2.0	9.0
Private	6.7	8.1	12.8	27.6
Subtotal	27.7	38.3	82.8	148.8
Net Surplus (Deficit)	(21.3)	(2.6)	46.7	22.8
Cumulative Surplus (Deficit)	(21.3)	(23.9)	22.8	

Source: References 6 and 20.

REGIONAL AIRPORT SYSTEM FINANCING STRATEGIES

It appears the major funding shortfall in the future will be associated with the air carrier system. However, general aviation funding may also need extra effort. General aviation development can be substantially assisted by the private sector if the conditions are right. In future work, it could be valuable to establish in more depth a model program for public/private sector cooperation and joint financing at a publicly owned airport. Model leases developed at one "demonstration" airport could then be used for educating public officials at the other airports, the state and FAA, as well as prospective lenders. In other ways, some private sector philosophy could be injected; for example, many publicly owned airports are capable of generating more revenue in aviation and non-aviation areas than they currently do. As airports become scarcer and scarcer commodities, all pricing should reflect this. Market rates for airport facilities will assist local operators to develop a surplus for capital purposes.

Air carrier options for generating more capital also require attention. One possibility (assuming favorable federal legislation) is a much higher head tax than is needed just to replace federal dollars at Sea-Tac. The analysis contained in Reference 20 assumed a head tax sufficient only to replace the $7 million - $8 million a year currently received by Sea-Tac in AIP funds. Such a tax would be about $1.40 per passenger, using 1985 data. But, a head tax of, say, $7 per enplaned passenger would yield over $35 million per year (in 1985). These are "hidden" taxes that the typical air traveler would likely pay without noticing. Such a tax would yield $280 million in 1993-2000 and a further $700 million in 2001-2020.

Another possibility would simply be to charge sales tax on tickets sold to passengers boarding at Sea-Tac. At 7.9 percent, this would yield about $36 million also.

Airline landing fees could be raised, under present airline lease agreements. It is unlikely the airlines would accept the degree of increase needed to pay for a new airport. Airline leases mostly expire in the early 21st Century and more options for changes in airline contribution will be available at that time.

Since Sea-Tac is clearly a metropolitan airport and serves a much greater market than just King County, an examination was made of the effects of a port levy on the other three counties -- Pierce, Kitsap and Snohomish. Table 15 shows that, using the 40.829¢ per $1,000 assessed value currently applied by the port in King County, the yield from the other three counties would be about $14 million per year, or $112 million from 1993-2000 and $280 million from 2001-2020. Additional counties could be added beyond these three (some counties already support their own port districts, for example, Pierce).

Finally, voter-approved general obligation bonds could cover some of the cost. In all likelihood, all these funding mechanisms, or variations of them, will be used in combination to come up with the needed funds.

TABLE 15

ASSESSED VALUE AND THEORETICAL LEVY YIELD
Pierce, Snohomish and Kitsap Counties

	Assessed Value (Current Tax Year)	Levy Yield @ 40.829¢/$1,000*
Pierce County	$14,900,587,263	$ 6,083,761
Snohomish County	13,797,720,142	5,633,471
Kitsap County	5,433,718,921	2,218,533
	34,132,026,326	13,935,765

*Port's current aggregate rate in King County.

Source: County Assessors' Offices, Port of Seattle Budget.

VII. Regional Air Carrier and General Aviation Conclusions and Recommendations

VII. REGIONAL AIR CARRIER AND GENERAL AVIATION CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION

Regional air travel projections generated as part of the RASP update indicate that Sea-Tac will be unable to accommodate future passenger demand levels, given its capacity under the currently adopted master plan. Alternative measures to alleviate this problem have been developed and evaluated in the preceding chapters. Given the projections that Sea-Tac has sufficient capacity to handle demand levels for the next 10 to 15 years, one could argue that the region does not have to decide right now how best to accommodate this future demand. However, the eventual outcome requires a series of incremental decisions and commitments before it can be successfully implemented. It is timely to provide the initial policy guidance in this regard.

PRINCIPAL CONCLUSIONS LEADING TO THE AIR CARRIER SYSTEM RECOMMENDATIONS

1. Sea-Tac, under its currently adopted master plan, will reach maximum capacity shortly after the year 2000; it will be unable to accommodate the growth in air passenger demand as now projected to the year 2020.

2. Certain airports in the region have an existing runway/taxiway system and instrument landing system capable of serving at least part of the air carrier fleet (multi-engine prop, turboprop, and jet aircraft used by airlines). These airports -- Boeing Field, Paine Field, Bremerton National and McChord Air Force Base -- are candidates for a potential future air carrier satellite role, requiring no major runway expansions.

3. Boeing Field's potential role as an air carrier satellite may be limited because it shares the same terminal airspace with Sea-Tac.

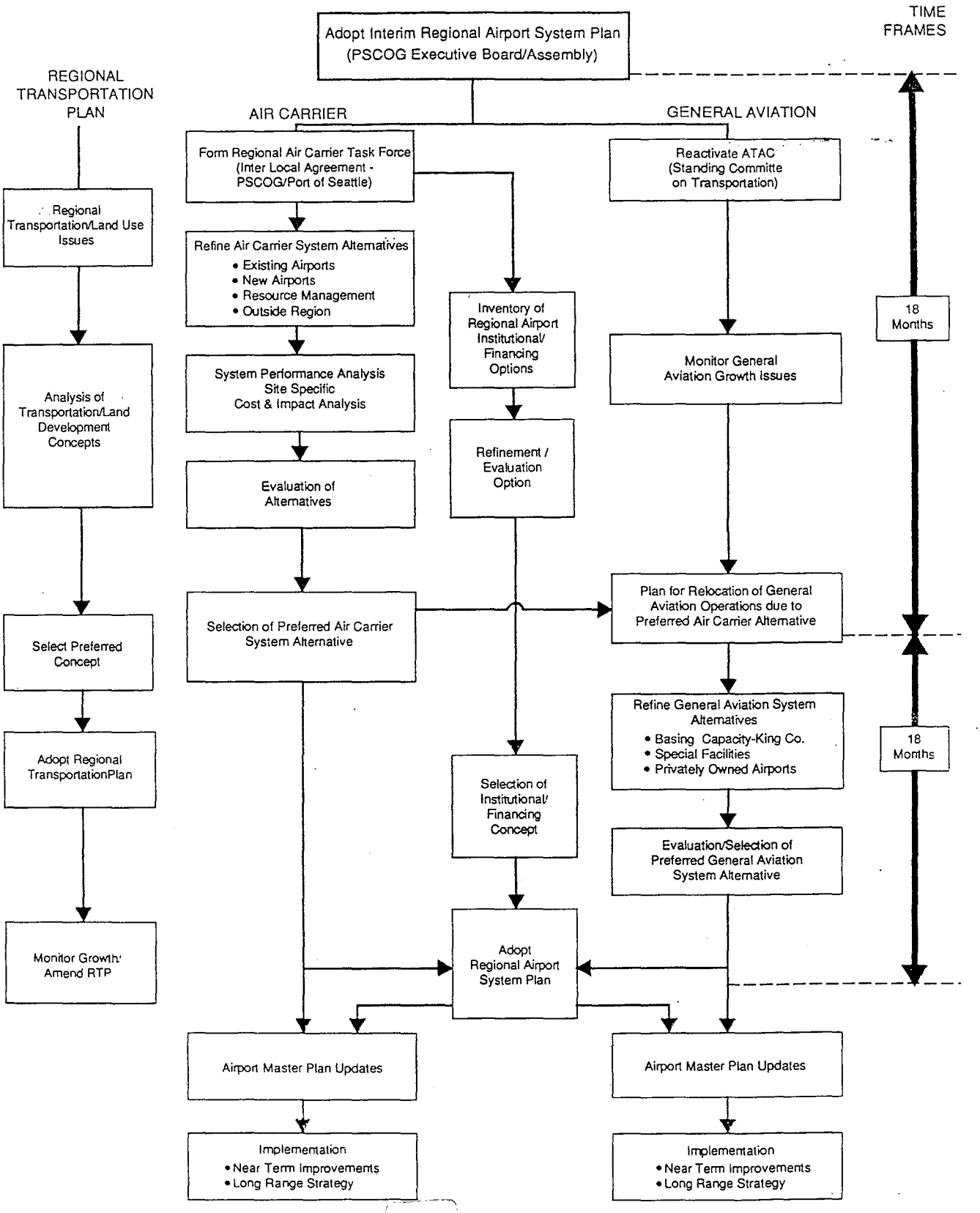
4. The use of McChord AFB would be subject to approval by the U.S. Department of Defense on joint use. The conditions for joint use are defined in Air Force regulations.

5. The potential role of Paine Field as an air carrier satellite will be governed by the 1979 mediated agreement, and policies contained therein, on the role of Paine Field.

6. The management of the regional air carrier airport system will likely require institutional changes and/or new interlocal agreements. This will be a necessary part of selecting the preferred alternative.

FIGURE 9

Regional Airport System Alternatives Refinement Process



AIR CARRIER SYSTEM RECOMMENDATIONS

1. It is recommended that PSCOG, in cooperation with the Port of Seattle and other appropriate agencies, proceed expeditiously with the detailed evaluation and selection of a preferred regional air carrier system alternative, in accordance with the generalized decision process shown in Figure 9.

2. It is recommended that implementation timing decisions on the air carrier system preferred alternative be based on regional projections of air carrier passenger demand and aircraft operations.

3. It is recommended that Renton Municipal, Paine Field, and Bremerton National airports take near-term actions to encourage use by corporate, training, and other general aviation aircraft, which can divert flights from Boeing Field during instrument flight (bad weather) conditions, to the extent consistent with each airport's currently adopted master plan.

4. It is recommended that PSCOG, in cooperation with Snohomish County, the Port of Bremerton, and the Port of Tacoma, take steps to influence appropriate land use and transportation plans to preserve a potential satellite air carrier role for Paine Field, Bremerton National and McChord AFB, pending completion of detailed site-specific evaluation and selection of a preferred regional air carrier system alternative.

5. It is recommended that local land use plans and zoning codes prevent further encroachment and incompatible development around area airports.

6. It is recommended that the Port of Seattle and King County, in cooperation with PSCOG and other appropriate jurisdictions, continue to give high priority to studies to determine the operational feasibility of expanding Sea-Tac's capacity, to determine the future role of Boeing Field and its relationship to Sea-Tac, and to determine reliever airport needs.

7. It is recommended that the investigation of institutional and financing options for the management of the regional airport system proceed in parallel with the technical evaluation of alternatives so that the selection of a preferred alternative and the identification of the implementing authority occur concurrently.

8. It is recommended that the following air carrier alternatives be selected for further detailed site-specific analysis to support the selection of a preferred alternative.

   - Satellite Airports - Existing Locations

     Development of satellite airports by upgrading one or two existing general aviation or military airports.

Candidates within the PSCOG region include Bremerton National, McChord AFB, and Paine Field. Potential candidates outside the PSCOG region may include such airports as Olympia and Skagit Regional.

- Satellite Airports - New Locations

Development of satellite airports at one or two new locations (could include locations outside the PSCOG region).

- Maximize Air Carrier Capacity of Sea-Tac

Through the leadership of the Port of Seattle investigate all options for expansion within the existing Sea-Tac property.

- New Primary Air Carrier Airport

Development of a new primary air carrier airport with capacity potential to serve the long range (through 2020) air carrier demand (could include locations outside the PSCOG region).

- Resource Management

Optimization of regional air carrier capacity through resource management, with no major airport expansions. Elements to include but not be limited to:

  - Use of airports outside the region, such as Olympia or Skagit Regional (Bayview), for satellite air carrier operations to the extent permitted under their currently adopted master plans.
  - Use of Boeing Field to serve air carrier operations, potentially displacing some of the general aviation now served there.
  - Joint management and operation of Boeing Field and Sea-Tac.
  - Limited commuter service at several airports (such as the existing San Juan Airline service to Paine Field) to the extent permitted by currently adopted master plans.
  - Use of an airport outside the region, such as Grant County Airport (Moses Lake) or Portland International, as a hub for international flights, with express ground transportation or air shuttle to the central Puget Sound region.

PRINCIPAL CONCLUSIONS LEADING TO GENERAL AVIATION RECOMMENDATIONS

1. In 1985 there were about 3,550 based general aviation aircraft in the central Puget Sound region; the collective capacity potential for the region's 22 public use airports is 5,230 with buildout of existing facilities (no major expansions). By the year 2020, the regional based aircraft fleet is projected to grow to 3,730 under the low forecast, and to 6,230 under the high forecast.

2. The potential based aircraft capacity shortfall is concentrated in King County, ranging from near zero under the low forecast to 1,000 based aircraft under the high forecast; Kitsap, Pierce and Snohomish counties appear to have adequate based aircraft capacity through the planning period.

3. The need for reliever airport capacity for general aviation is greatest in King County because of air traffic congestion in the Sea-Tac/Boeing Field airspace.

4. About one-fourth of the region's public use based aircraft capacity is provided by privately owned airports and seaplane bases. Actions by local and state government to preserve these facilities for public use could mitigate the need to develop new general aviation airport capacity with public resources.

5. The demand for helicopter services is expected to grow faster than other elements of air transportation, because of technological advancements and because of congestion in surface transportation. The greatest demand will be for air taxi services and corporate transportation to central city locations and other major activity centers. Reliable public use facilities do not currently exist in central city locations.

6. Seaplane service is a specialized industry unique to the Northwest and Alaska. Local and state government actions to support the continued operation of existing facilities could help preserve this specialized form of transportation.

7. Sport aviation is a popular form of recreation in the central Puget Sound region that has unique impacts and special locational requirements. It needs recognition in local comprehensive land use plans, recreation plans, and airport master plans in order to enhance safety, minimize airspace conflicts and minimize adverse community impacts.

GENERAL AVIATION RECOMMENDATIONS

1. It is recommended that the decision-making process for the implementation of general aviation system recommendations follow the time frames shown in Figure 9.

2. It is recommended that local governments actively support preservation of existing public use general aviation airports.

3. It is recommended that local land use plans/zoning codes prevent further encroachment and incompatible development around area airports.

4. It is recommended that local jurisdictions support the establishment of an airport overlay zone surrounding the boundaries of general aviation airports to avoid incompatible land use development (refer to the model overlay zone in Appendix B).

5. It is recommended that local jurisdictions recognize the transportation resources provided by privately owned public use general aviation airports by supporting economic incentives, such as property tax exemptions and other options, to enhance their viability as transportation facilities.

6. It is recommended that, where appropriate, local governments consider acquisition of privately owned public use airports threatened with closure.

7. It is recommended that the process of assessing the feasibility of constructing additional general aviation facilities in King County, as recommended by the 1982 RASP, proceed in order to facilitate future implementation, should additional loss of general aviation airport capacity occur over the next 10 years.

8. It is recommended that the Port of Seattle, in assessing the operational feasibility of expanding Sea-Tac's capacity, adopt a regional perspective to address the impacts on general aviation.

9. It is recommended that the following general aviation system alternatives be retained in the RASP for further analysis and refinement, based on changing conditions in the general aviation industry and/or stabilization of growth outlook.

   - Maintain Viability of Existing General Aviation Airports.
   - Expand Capacity of Selected Existing General Aviation Airports.
   - Expand Capacity by Development of New General Aviation (general utility class) Airport.

10. The following recommendations are for Special Air Transportation Facilities.

    - The PSCOG supports a cooperative effort to provide helicopter landing facilities in central city locations, if warranted by growth in demand and subject to environmental compatibility.

- The PSCOG believes that the use of local ordinances, such as the model ordinance in Appendix A and other operations management measures, will be needed in order to serve increased demand for helicopter operation with minimal community impacts.
- The PSCOG believes that the protection of privately owned public use airport facilities, through such means as zoning for land use compatibility, economic incentives and liability insurance reforms, must be considered by local and state governments.
- The PSCOG supports preservation of existing seaplane services and their required operating facilities, in conjunction with cooperative efforts to reduce negative impacts of seaplane operations on communities.
- The PSCOG supports a cooperative effort to provide adequate physical and operating facilities for sport aviation activity, providing adverse community impacts are mitigated.

REFINEMENT OF AIR CARRIER AND GENERAL AVIATION ALTERNATIVES

Given the conceptual nature of the study and the time frame within which it relates, a phased approach for the continued refinement and eventual implementation of the air carrier and general aviation recommendations is proposed.

A phased decision-making approach is advantageous for a couple of reasons. It provides direction and guidance for moving forward through the planning process. At the same time, the phased approach ensures that the performance of the regional airport system is continuously monitored with the system needs and requirements being subsequently revised as necessary. The phased approach thus allows regional aviation system development to proceed, but on a path that is flexible and can be altered.

A schedule for the refinement of the air carrier and general aviation recommendations is given in Figure 9.

Appendices

Appendix A
Model Ordinance Provisions Regulating Helicopter Landing Areas

APPENDIX A

MODEL ORDINANCE PROVISIONS REGULATING HELICOPTER LANDING AREAS

SECTION 1. DEFINITIONS

1. APPROACH - DEPARTURE PATH. The flight track of the helicopter as it approaches or departs the takeoff and landing area.

2. HELICOPTER. A rotorcraft that for its horizontal motion depends principally on its engine-driven rotors.

3. HELIPORT. An area of land or a portion of a structure to be used for the landing and takeoff of helicopters on a recurring and frequent basis. Within the context of these regulations, heliports shall be distinguished from other helicopter landing areas on the basis that heliports include facilities for aircraft maintenance, fueling service, permanent helicopter parking areas, terminal/passenger buildings and related improvements for operation of a complete facility.

   a. Public and/or Commercial Heliport

      A heliport that is available for use by the public in general or is available to a restricted class provided compensation is paid for each landing/takeoff therefrom.

   b. Private/Personal Use Heliport

      A heliport facility that is used by the owner (individual, corporation, public agency) or his specific invitees without compensation for each operation, and not available to the general public.

4. HELIPAD. An area of land or a portion of a structure to be used for the landing and takeoff of helicopters for the purpose of picking up or discharging passengers/cargo on a regular and frequent basis. Helipad facilities shall not include permanent aircraft parking positions, fueling services or aircraft maintenance facilities although transient helicopter parking, lighting and related safety/security improvements may be available. Helipad may be Public/Commercial or Private/Personal.

5. INFREQUENTLY USED HELICOPTER LANDING AREA. An area of land or a portion of a structure to be used for the landing and takeoff of helicopters for an indefinite time period and on an infrequent basis. Infrequently Used Helicopter Landing Areas shall be available only for private/personal use and such utilization shall not exceed thirty (30) landings per calendar year.

6. TEMPORARY HELICOPTER LANDING SITES. An area of land or a portion of a structure to be used for the landing and takeoff of helicopters for a limited period of time not to exceed one hundred and eighty (180) consecutive days commencing with the day of the first helicopter landing.

7. EMERGENCY HELICOPTER LANDING AREA. An area of land or a portion of a structure used by a helicopter for takeoff and landing operations while participating in an actual or perceived emergency/disaster, when operating pursuant to the directions of law enforcement, public safety, fire suppression or medical authorities or when going to the immediate aid of any person in peril.

SECTION 2. REGULATIONS GOVERNING HELICOPTER LANDING AREAS GENERALLY

1. No helicopter landing area, of any type, may be lawfully used unless the helicopter, its crew and flight operations thereof comply with all applicable provisions of the Federal Aviation Regulations. Violation of a Federal Aviation Regulation (FAR) while operating from a helicopter landing area, as defined in these regulations, shall automatically void all approvals and permits previously issued or relating to the helicopter landing area.

2. It shall be unlawful to operate a helicopter landing area, or allow its use, without at all times having maintained in full force and effect public liability and property damage insurance in the amount of at least $_____ with respect to Property Damage, and of at least $_____ combined Single Limit Bodily coverage.

3. It shall be unlawful to operate or use any helicopter landing area in a manner contrary to conditions or restrictions imposed by the (name of jurisdiction). If the helicopter landing area owner has not cured or provided adequate assurances within thirty (30) days following notice of an action breaching a condition or restriction, all approvals and permits previously issued or relating to the helicopter landing area shall automatically be voidable at (name of jurisdiction) exclusive option.

4. The use of any helicopter landing area shall be limited to the periods between sunup and sundown daily, unless adequately lighted.

5. Fire suppression equipment shall be provided at heliport and helipad landing areas as determined necessary by the _____.

6. A wind indicating device shall be installed and maintained in working order at all heliports and helipads.

7. Owners of heliports and helipads shall prepare, or cause to be prepared, an annual helicopter landing area audit and shall submit this report to the Planning Director, (name of

jurisdiction). Areas to be evaluated/inspected include: available facilities and equipment (known hazards, barriers, or obstacles), operating procedures, adherence to conditions and restrictions, reported complaints, lighting and marking, communications and related issues.

8. Smoking shall not be permitted within fifty feet (50') of the helicopter touchdown pad when a helicopter is present.

SECTION 3. APPLICABILITY OF ZONING REGULATIONS

1. Establishment of a heliport in any land-use zoning district requires notification of the proposed project, a public hearing, Planning Commission approval and issuance of a conditional use permit.

2. Helipads are established as a use by right of ownership in designated agricultural (list zones), industrial (list zones), and manufacturing (list zones) land-use zoning districts, subject only to a review of construction plans by the Building Inspector and Fire Marshal. In other land-use zoning districts, helipad applicants shall obtain a conditional use permit prior to allowing helipad operations.

3. Infrequently Used Helicopter Landing Areas and Temporary Helicopter Landing Areas may be established in any land-use zone, except residential, provided all applicable federal and state requirements are satisfied, the property owner has granted permission and all operations are conducted with the highest regard for the public's health, safety and welfare.

SECTION 4. SITE SELECTION CRITERIA

1. All helicopter landing areas shall conform, to the greatest degree possible, with site selection criteria set forth below.

   a. The proposed helicopter landing area should be located so as to minimize any adverse affects to adjoining land uses;

   b. Helicopter Landing Area sites shall be located to maximize approach and departure paths over terrain that affords emergency landing areas (open parks, golf courses, industrial areas, highways, freeways and open land). Approach and departure paths over residential development, schools, playgrounds or highly populated areas should be avoided;

   c. No helicopter landing site shall be located within 1,000 feet (measured by air line) of any public or private school boundary maintaining kindergarten classes or any classes in grades 1 through 12, without prior approval of the State Department of Transportation; and

d. Separate approach and departure paths shall serve the touchdown pad, align into the prevailing wind, and be separated by a minimum 90 degree arc.

SECTION 5. DEVELOPMENT CRITERIA FOR HELICOPTER LANDING AREAS

1. Heliport improvements shall, to the greatest extent possible, comply with the following development criteria:

   a. The length and width or diameter of the takeoff and landing area shall be at least 1.5 times the overall length of the largest helicopter expected to use the facility;

   b. The peripheral area is intended as an obstacle-free safety area surrounding the takeoff and landing area. The location should provide at least 1/3 rotor diameter of the largest helicopter that will use the landing area, but not less that 10 feet, horizontal clearance between the takeoff and landing area and buildings, fences, parapets, curbs, and objects which could be struck by main or tail rotors;

   c. Approach and departure paths to the site shall be governed in accordance with FAR Part 77 and shall be obstruction free for a minimum distance of 400 feet from the takeoff and landing area;

   d. A wind indicating device shall be provided and maintained in a working condition at all times;

   e. For nighttime operations, the heliport's landing area shall be provided with adequate lighting;

   f. Heliport facilities shall be marked in accordance with Federal Aviation Administration (FAA) heliport design guidelines;

   g. Surfacing of the heliport's landing surface shall be constructed to minimize blowing any dust, dirt or other objectionable material onto neighboring property;

   h. Every heliport shall be limited in hours of operation to the periods between sunup and sundown daily, unless properly lighted;

   i. Takeoff and landing areas shall be no closer than 50 feet from any property line; any administrative or operations buildings erected on a heliport site shall be located not closer than 15 feet from any property line; helicopter maintenance facilities shall be located not closer than 25 feet from any property line; location and setbacks for buildings storing combustibles shall be approved by the (name of jurisdiction) fire marshal;

j. The exterior edge of the peripheral area shall be fenced or otherwise protected to keep unauthorized persons out of these areas;

k. Adequate fire extinguishers shall be provided as determined by the (name of jurisdiction) fire marshal; and

l. Approved means of communications (telephone, radio, fire alarm box, etc.) shall be available when helicopter operations are in progress.

2. Helipad improvements shall, to the greatest extent possible, comply with the following development criteria:

a. The length and width or diameter of the takeoff and landing area shall be at least 1.5 times the overall length of the largest helicopter expected to use the facility;

b. The peripheral area surrounding the takeoff and landing area shall be a minimum width of 10 feet;

c. Approach and departure paths to the helipad should be planned in accordance with FAR Part 77;

d. A reliable wind indicating device (flag, banner, etc.) shall be available;

e. Adequate lighting shall be available if night operations are anticipated;

f. Helipad markings in accordance with FAA guidelines;

g. Touchdown pad surfaces which minimize blowing dust or debris;

h. Fencing, natural barriers or security procedures that restrict public access; and

i. Adequate fire extinguishers as determined by the (name of jurisdiction) fire marshal.

3. Infrequently Used Helicopter Landing Areas and Temporary Helicopter Areas shall, to the greatest extent possible, comply with the following criteria:

a. Length and width or diameter of the takeoff and landing area shall be at least 1.5 times the overall length of the helicopter using the landing area; and

b. Before each landing, the pilot shall carefully examine the landing area for obstructions, wires, and people on or near the landing area.

SECTION 6. SUSPENSION OF HELICOPTER LANDING AREA APPROVALS

1. Any helicopter landing area permit or approval is automatically and immediately suspended if related approvals by the State of Washington or the Federal Aviation Administration are revoked, withdrawn or suspended.

2. If in the considered opinion of the (title of responsible official) a helicopter landing area or the operation thereof is determined to be a serious and continuing danger to the public health, safety and welfare, the (title of responsible official) may, upon giving notice, immediately suspend any helicopter landing area permit or approval provided by these regulations. Notwithstanding such suspension, the helicopter landing area owner is entitled to a hearing within thirty (30) days upon initiating an appeal of the suspension.

Appendix B
Model Airport Overlay Zone Ordinance

APPENDIX B

MODEL AIRPORT OVERLAY ZONE ORDINANCE

Intent and Purpose. The intent and purpose of the Airport Overlay Zone is to establish appropriate regulations to protect the air space in the vicinity of airports and runway approaches, including those airports operated by the U.S. Armed Forces, to protect the lives and property of airport users, and to protect the property and occupants of land within the vicinity. This overlay zone will regulate and restrict the height of structures and objects, either natural or man-made, and restrict the uses of property in accordance with this title within the boundaries outlined on the _____ County Zoning Maps.

Limitations to Uses. All property, uses and activities within the Overlay Zone shall be subject to the restrictions set forth herein, as well as all restrictions of the underlying zoning classification in which it is located.

Area of Application. All of the lands in unincorporated _____ County lying beneath the approach surfaces, transitional surfaces, horizontal surfaces, conical surfaces, or within noise exposure areas defined as follows, and identified on the _____ County Zoning Map:

1. Height limitation area - all of the land within the following designated areas around the subject airport's primary runway surface, divided into four height limiting categories:

    a. Transition area - slope seven feet outward for each foot upward, beginning at the primary approach surface and extending to a height of one hundred fifty feet.

    b. Horizontal area - one hundred fifty feet above the airport elevation.

    c. Conical area - slopes twenty feet outward for each foot upward, beginning at the periphery of the horizontal area at one hundred fifty feet above the airport elevation and extending to a height of three hundred fifty feet above the airport elevation.

    d. Approach areas:

        1) Precision instrument runway approach area - Slopes fifty feet outward for each foot upward, beginning at the end of and at the same elevation as the primary surface; and extending to a horizontal distance as designated along the extended runway centerline; thence sloping forty feet outward for each foot upward to an additional horizontal distance as designated along the extended runway centerline.

2) Non-precision instrument runway approach area - Slopes thirty-four feet outward for each foot upward, beginning at the end of and at the same elevation as the primary surface; and extending to a horizontal distance as designated along the extended runway centerline.

3) Visual runway approach areas - Slopes twenty feet outward for each foot upward, beginning at the end of and at the same elevation as the primary surface; and extending to a horizontal distance as designated along the extended runway centerline.

2. Land Use Guide Area - All of the land identified as the land Use Guide Area conforms to the Ldn sixty-five composite noise contour established by the existing airport activities or by an approved airport master plan. The Land Use Guide Area shall be generalized to the nearest property line outside the noise contour.

Amendment to Boundaries. Amendments or revisions to the boundaries of the height limitation area or land use guide area identified on the _____ County Zoning Map shall occur in accordance with the procedures for changes in zone classifications, _____.

Restrictions and Regulations.

a. Except as otherwise provided in this Chapter, no structure shall be erected, altered or maintained, and no trees shall be allowed to grow in any zone covered by this title to a height in excess of the applicable height limitation herein established.

b. Notwithstanding any other provision of this title, no use may be made of land or water within any approach area established by this title in such a manner as to create electrical interference with navigational signals or radio communications between the airport and aircraft, make it difficult for pilots to distinguish between airport lights and others, result in glare in the eyes of pilots using the airport, create bird strike hazards, or otherwise endanger or interfere with the landing, take off, or maneuvering of aircraft intending to use the airport.

c. No place of public assembly, including but not limited to, schools, theaters, churches and hospitals, shall hereafter be constructed or otherwise established within the Lane Use Guide Area.

d. Land located within the Land Use Guide Area shall be zoned for uses compatible with airport uses.

e. All new subdivisions within the Land Use Guide Area will be subject to navigation easements which will provide notice of the restrictions to future property owners.

f. All new uses of property within the Land Use Guide Area shall be served notice of noise impact as part of development review.

g. The Land Use Guide Area will not be allowed to expand into established residential areas in order to protect those areas from undue impacts. Expansions of airports may be limited by other conditions within this title.

h. Each airport shall establish noise standards and noise abatement procedures and noise monitoring points and shall be responsible for enforcing such procedures.

i. All airport construction shall be in accordance with an approved binding site plan.

j. Use of an airport for other motor vehicle activities, including but not limited to, motorcycle racing, sports car racing, drag racing, sports car rallies and auto crosses, shall be subject to all applicable provisions of this title.

k. Jet aircraft, including prop-jet aircraft, shall use non-military airports for takeoff and landing only. No jet or propjet training flights shall be allowed, that is, no "touch and go" flights are allowed.

Variances. Any person desiring to erect or increase the height of any structure or allow the growth of any tree, no in accordance with these regulations, will apply for a variance pursuant to subsection ( ). The application shall be accompanied by a determination by airport management and the Federal Aviation Administration or other appropriate Federal Agency as to the effect of the proposal on the operation of the airport.

Appendix C
Glossary of Airport System Planning Terminology

APPENDIX C

GLOSSARY OF AIRPORT SYSTEM PLANNING TERMINOLOGY

This is a glossary of common terminology related to airport planning and operations, provided as an aid to the reader of this document. It is the intent that the definitions contained herein be consistent with those used by the Federal Aviation Administration (FAA).

ACTIVE AIRCRAFT	Aircraft registered with the FAA and reported or estimated to have been flown during the preceding calendar year.
AIR CARGO	All commercial air express and air freight exclusive of air mail and air parcel post.
AIR CARRIER-CERTIFICATED ROUTE	An air carrier holding a Certificate of Public Convenience and Necessity to conduct scheduled services over specified routes and a limited amount of nonscheduled operations.
AIR CARRIERS	The commercial system of for-hire air transportation consisting of certificated route air carriers (domestic or flag), supplemental air carriers (charter all-cargo, travel club), and air taxi (nonscheduled) operations. Domestic carriers are those who operate solely within the contiguous 48 states; flag carriers are those who operate to any point outside the contiguous 48 states. Depending on the type of service and size of aircraft, air carriers must comply with FAR Part 121, FAR Part 125, FAR Part 135, or combinations of these.
AIR DEFENSE IDENTIFICATION ZONE	The area of airspace over land or water within which the ready identification, the location, and the control of aircraft are required in the interest of national security.
AIR NAVIGATION FACILITY (NAVAID)	Any structure or mechanism used by pilots for guiding or controlling flight in the air, or the landing and take-off of an aircraft.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC)	A facility established to provide air traffic control service to aircraft operating on an IFR flight plan within controlled air space and principally during the en route phase of flight.
AIR TAXI	Nonscheduled aircraft operations carrying passengers and/or cargo for compensation. The capacity of air taxi aircraft is limited to 30 passengers and/or 7,500 pounds useful load. Air taxi operators (including helicopter operators) must comply with FAR Part 135.
AIR TRAFFIC	Aircraft operating in the air or on an airport surface, excluding loading ramps and parking areas.
AIR TRAFFIC CONTROL (ATC)	A service operated by appropriate authority to promote the safe, orderly, and expeditious flow of air traffic.
AIR TRAFFIC CONTROL FACILITY	A facility that provides air traffic control services located in the U.S., its possessions and territories, and in foreign countries especially established by international agreement.
AIR TRAFFIC HUB	Air traffic hubs are not airports; they are the cities and Standard Metropolitan Statistical Areas requiring aviation services. Communities fall into four classes as determined by each community's percentage of the total enplaned passengers in scheduled service of the fixed-wing operations of the domestic certificated route air carriers in the 50 states, the District of Columbia, and other U.S. areas designated by the Federal Aviation Administration.
AIRCRAFT	Means a device that is used or intended to be used for flight in the air.
AIRCRAFT APPROACH CATEGORY	A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft shall fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used.

For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, should use the approach Category B minimums when circling to land. The categories are as follows:

1. Category A-Speed less than 91 knots.
2. Category B-Speed 91 knots or more but less than 121 knots.
3. Category C-Speed 121 knots or more but less than 141 knots.
4. Category D-Speed 141 knots or more but less than 166 knots.
5. Category E-Speed 166 knots or more.

AIRCRAFT CONTACTED

Aircraft with which the flight service stations (FSS) have established radio communications contact. One count is made for each en route, landing, or departing aircraft contacted by an FSS regardless of the number of contacts made with an individual aircraft during the same flight. A flight contacting five FSS's would be counted as five aircraft contacted.

AIRCRAFT MIX

The number of aircraft movements categorized by the capacity of the airport or their operational role, and specified as a percentage of the total aircraft movements.

AIRCRAFT OPERATION

There are two types of operations--local and itinerant. Local operations are performed by aircraft which a) operate in the local traffic pattern or within sight of the airport, b) are known to be departing for, or arriving from, flight in local practice areas within a 20-mile radius of the airport, c) execute simulated instrument approaches or low passes at the airport. Itinerant operations are all aircraft operations other than local operations.

AIRCRAFT TYPE

A term used in this publication in grouping aircraft by basic configuration--fixed-wing, rotorcraft, glider, dirigible, and balloon.

AIRFOIL	The shape of a cross-section of a helicopter rotor blade or an aircraft wing.
AIRMAN	A pilot, mechanic, or other licensed aviation technician.
AIRMAN CERTIFICATE	A document issued by the Administrator of the Federal Aviation Administration certifying that the holder complies with the regulations governing the capacity in which the certificate authorizes the holder to act as an airman in connection with aircraft.
AIRPORT	An area of land or water used or intended to be used by aircraft during landing and take-off; includes buildings and facilities, if any.
AIRPORT ADVISORY SERVICE (AAS)	A service provided by flight service stations at airports not served by a control tower. This service consists of providing information to landing and departing aircraft concerning wind direction and velocity, favored runway, altimeter setting, pertinent known traffic, pertinent known field conditions, airport taxi routes and traffic patterns, and authorized instrument approach procedures.
AIRPORT IMPROVEMENT PROGRAM (AIP)	A program initiated under the Airport and Airway Improvement Act of 1982 authorizing the allocation of federal grants for the purpose of airport planning and airport development.
AIRPORT LAYOUT PLAN (ALP)	A graphic presentation, to scale, of existing and proposed airport facilities, their location on the airport, and the pertinent clearance and dimensional information required to show conformance with applicable standards. To be eligible for AIP funding assistance, an airport must have an FAA-approved airport layout plan.
AIRPORT SURVEILLANCE RADAR (ASR)	Radar providing position of aircraft by azimuth and range data. ASR does not provide elevation data. It is designed for range coverage up to 60 nautical miles and is used by terminal area air traffic control.

AIRPORT TRAFFIC CONTROL TOWER (ATCT)	A central operations facility in the terminal air traffic control system, consisting of a tower, including an associated IFR room if radar equipped, using air/ground communications and/or radar, visual signaling and other devices, to provide safe and expeditious movement of terminal air traffic.
AIRPORTS OF ENTRY	Aircraft may land at these airports without prior permission to land from U.S. Customs.
ALTITUDE ENCODING (Automatic Altitude Reporting)	An aircraft altitude transmitted via the Mode C transponder feature that is visually displayed in 100 feet increments on the ground radar scope having readout capability.
ANGLE OF ATTACK	The angle between the relative wind and the chord line of the rotor blade.
ANNUAL SERVICE VOLUME	Estimate of an airport's annual capacity in operations that may be used as a reference in planning the runway system.
APPROACH AREA	The area beyond the end of the runway over which the landing and take-off operations are made.
APPROACH CONTROL FACILITY	A terminal area traffic control facility providing approach control service.
APPROACH CONTROL SERVICE	Air traffic control service provided by an approach control facility for arriving and departing aircraft and, on occasion, tower en route control service.
APPROACH LIGHTING SYSTEM (ALS)	A system of lights placed on the approach to a runway that is used by pilots to identify the runway, particularly during IFR conditions. One type of ALS is the medium intensity approach light system with runway alignment indicator lights (MALSR).
APPROVED INSTRUMENT APPROACH	Instrument approach meeting the design requirements, equipment specifications, and accuracies, as determined by periodic FAA flight checks, and which is approved for general use and publication by the FAA.
APRON	An area intended to accommodate aircraft for purposes of loading or unloading

	passengers or cargo, refueling, parking, or maintenance.
AREA NAVIGATION (RNAV)	A method of using navigation instruments that allows pilots flexibility to fly direct routes between waypoints or offset from published or established routes/airways at specified distance and direction.
AUTOMATED DIRECTION FINDER (ADF)	An aircraft radio navigation system that senses and indicates the direction to a nondirectional radio beacon ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft.
AUTOMATIC PILOT	An aircraft can be controlled about the roll, pitch, and yaw axis by use of an automatic pilot. Information from VOR, ILS, MLS, and other navigation aids can be coupled to the automatic pilot for en route and approach flights.
AUTOROTATION	Rotorcraft flight without engine power, where the air approaching from below the rotor disc keeps the rotor turning up to an operational speed, thereby allowing a power-off emergency landing to be accomplished.
AVERAGE STAGE LENGTH	The average length of a flight from origin to destination in air miles (straight-line distance)
AZIMUTH	Horizontal direction or bearing; usually measured from the reference point of 0 degrees clockwise through 360 degrees.
BASED AIRCRAFT	Aircraft stationed at an airport on an annual basis.
BASIC TRANSPORT AIRPORT	An airport capable of accommodating turbo jet airplanes up to 60,000 pounds gross weight with a runway length in the 4,000 - 5,000 foot range.
BASIC UTILITY AIRPORT	An airport capable of accommodating most single and many of the smaller twin-engine aircraft, about 95 percent of the general aviation fleet. The runway is typically 2,500-3,500 feet in length.

BLADE SLAP	Noise produced when a rotor blade intersects the vortex generated by a previous blade.
CEILING	Height above the earth's surface to the lowest layer of clouds or obscuring phenomena.
CLEAR ZONE	A fan-shaped area extending up to 1/2 mile from the end of each runway that is to remain free of all structural development.
COMMERCIAL PILOT	A commercial pilot may act as pilot-in-command of an aircraft carrying passengers for compensation or hire and act as pilot-in-command of an aircraft for compensation or hire.
COMMERCIAL SERVICE AIRPORT	Any public use airport that receives scheduled passenger service aircraft and annually enplanes 2,500 or more revenue passengers (or is forecast to within the plan period).
CONTROLLED AIRSPACE	Airspace control area designated as a continental control area, control zone, terminal control area, or transition area, within which some or all aircraft may be subject to air traffic control.
CRITICAL AIRCRAFT	The user aircraft that requires the most sophisticated facilities at the airport; the aircraft for which facilities are designed.
CROSSWIND RUNWAY	A runway additional to the primary runway to provide for wind coverage not adequately provided by the primary runway.
dB(A)	A quantity, in decibels, read from a standard sound-level meter that is switched to the weighting network labeled "A". The A-weighting network discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear at moderate sound levels. The A-weighted sound level measures approximately the relative "noisiness" or "annoyance" of many common sounds.
DAY-NIGHT AVERAGE SOUND VALUES (LDN)	A computed measure of the community response to noise levels accounting for

	the loudness of sound, the frequency range of sound, the number of flights, the type of aircraft, flight paths, the distribution of flights during the day, and the difference in sound impact between day and night.
DEMAND/CAPACITY ANALYSIS	An investigation into an airport's ability to safely and conveniently meet present and future aviation demand.
DEPENDENT RUNWAY	A runway which interacts with adjacent runways that is, take-offs and landings are staggered because the separation between runways is not sufficent for independent operation, by FAA standards.
DISTANCE MEASURING EQUIPMENT (DME)	Electric equipment used to measure, in nautical miles, the slant range of an aircraft from a navigational aid.
ENPLANEMENT	A term applying to passengers and cargo which board a departing aircraft; total enplanements include originations, transfers and stop-overs.
FEDERAL AVIATION ADMINISTRATION (FAA)	An agency of the federal Department of Transportation responsible for the promotion, regulation and safety of civil aviation, especially in the areas of air traffic control, navigation aids, aircraft, airports and pilot licenses.
FINAL	Commonly used to mean that an aircraft is on the final approach course or is aligned with a landing area.
FINAL APPROACH COURSE	A straight line extension of a localizer, a final approach radio/bearing, or a runway centerline, all without regard to distance.
FIX	A geographical position determined by visual reference to the surface, by reference to one or more radio NAVAIDs, by celestial plotting, or by another navigational device.
FIXED-BASE OPERATORS (FBO)	A private enterprise engaged in services related to general aviation, such as fuel sales, aircraft maintenance, hangar and apron parking, aircraft rental and sales, flight instruction and crop dusting.

FLAPPING	The up-and-down blade motion about the horizontal hinge at the blade root or about a corresponding flexible portion of the hub.
FLIGHT PLAN	Specified oral or written information about the intended flight of an aircraft that is filed with air traffic control.
FLIGHT SERVICE STATION (FSS)	A facility operated by the FAA used for pilot briefings on weather, airports, altitudes, routes and other flight planning data.
FLOATPLANE	(See Seaplane)
GENERAL AVIATION	That portion of civil aviation that encompasses all facets of aviation except air carriers holding a Certificate of Convenience and Necessity, and military operations.
GENERAL UTILITY AIRPORT	An airport capable of accommodating aircraft up to 12,500 pounds gross weight with a runway length in the 3,000 - 4,000 foot range.
GENERAL TRANSPORT AIRPORT	An airport capable of accommodating all sizes of air carrier and general aviation aircraft. The runway(s) is typically 10,000 - 12,000 feet in length.
GLIDE SLOPE	Electric equipment that emits signals which provide vertical guidance by reference to airborne instruments during instrument approaches, such as an ILS, or visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.
GROUND EFFECT	A beneficial increase in rotor thrust and decrease in drag due to slowing down the inflow through the rotor because of proximity of the ground.
GYRODYNE	A rotorcraft whose rotors are normally engine driven for takeoff, hovering and landing, and for forward flight through part of its speed range, and whose means of propulsion, consisting usually of conventional propellers, is independent of the rotor system.

HELICOPTER	An aircraft lifted by a large motor powered propeller mounted horizontally above the fuselage. Forward motion is achieved by tilting the craft slightly so that the propeller is simultaneously lifting and pulling forward.
HELIPORT	A small landing area suitable for landing and take-off and temporary parking of helicopters. Heliports may be located at existing airports, on rooftops, in open areas next to hospitals, meeting sites, or industrial areas. They may be equipped for refueling and have passenger facilities and aircraft parking spaces.
HELISTOP	A small landing area suitable only for drop off and pick up of passengers and cargo by helicopter. No parking or fuel facilities are provided.
IMAGINARY SURFACE	One of several planes or curved surfaces in space which dimension the safe operating area for aircraft around airports. Ideally there will be no trees, towers, building, et cetera that penetrate these surfaces. When they do, they must be clearly marked and noted on navigational charts.
INSTRUMENT APPROACH	A landing approach made without visual reference to the ground until approach minimums are reached.
INSTRUMENT FLIGHT RULES (IFR)	Rules that govern flight procedures when ceiling and visibility are below 1,000 feet and three miles, respectively.
INSTRUMENT LANDING SYSTEM (ILS)	A set of navigation instruments used to guide aircraft on the final portion of the runway under limited visibility conditions.
INSTRUMENT OPERATION	A takeoff or landing of an aircraft while on an instrument flight clearance.
ITINERANT OPERATION	Itinerant operations are all aircraft takeoffs or landings <u>other than</u> touch and go's and other training manuevers that are conducted within sight of the airport or at practice areas within 20 miles of the airport.

JET ROUTE	A route designed to serve aircraft operations from 18,000 feet to 45,000 feet.
LANDBANKING	The reservation of land through easements or acquisition for future use for a public facility (such as an airport). If a local government wants to purchase land for a future airport purpose, the FAA will work with such a sponsor to help purchase it. Land acquisition is eligible at the 90 percent level under the Airport Improvement Program. Land acquisition grants are given, but the time period isn't open-ended and the money must be refunded to the FAA if the airport is not built.
LOAD FACTOR	The ratio of total weight supported by the wings of an aircraft to its actual weight, at any given time, expressed in units of gravity force, 1G, 2G, etc.; also the percentage of available passenger seats occupied by passengers.
LOCALIZER (LOC)	Providing horizontal guidance to the runway centerline for aircraft during approach and landing by radiating a directional pattern of radio waves modulated by two signals which, when received with equal intensity, are displayed by compatible airborne equipment as an "on-course" indication, and when received in unequal intensity are displayed as an "off-course" indication.
LOCAL OPERATIONS	As pertaining to air traffic operations, aircraft operating in the local traffic pattern or within sight of the tower; aircraft known to be departing for, or arriving from, flight in local practice areas located within a 20-mile radius of the control tower; aircraft executing simulated instrument approaches or low passes at the airport.
LOCALIZER TYPE DIRECTIONAL AID (LDA)	A facility of comparable utility and accuracy to a localizer, but is not part of a complete ILS and is not aligned with the runway.

MAIN ROTOR	The rotor that supplies the principal lift to a rotorcraft.
MICROWAVE LANDING SYSTEM (MLS)	An instrument landing system transmitting in the microwave radio spectrum, which provides lateral and vertical guidance to aircraft having compatible avionics equipment.
MINIMUMS/MINIMA	Weather condition requirements established for a particular operation or type of operations; for example, IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight, et cetera.
MISSED APPROACH	An instrument approach not completed by landing. This may be due to visual contact not established at authorized minimums or instructions from air traffic control, or other reasons.
NATIONAL PLAN OF INTEGRATED AIRPORT SYSTEMS (NPIAS)	A planning document updated periodically that describes the current, 5-year and 10-year requirements of the national airport system as determined by the FAA.
NAVIGABLE AIRSPACE	Airspace at or above the minimum flight altitudes prescribed by the Federal Aviation Regulations (FAR), including airspace needed for takeoffs and landings. Minimum flight altitudes are defined in FAR Part 91.
NOISE EXPOSURE FORECASTS	A method developed by the FAA that summarizes the noise effects of airport operations occurring over a 24 hour period. The level of noise exposure is indicated by sets of contours radiating from the airport runway and the approach/departure paths.
NONDIRECTIONAL BEACON (NDB)	A low or medium-frequency radio beacon that transmits nondirectional signals with a loop antenna so that a pilot can determine his bearing and "home" on the station. (See Nonprecision Instrument Approach.)
NONPRECISION INSTRUMENT APPROACH	An electronic aid designed to provide an approach path for alignment of an aircraft on final approach to a runway. It lacks the high accuracy qualities of the precision approach equipment and does not provide descent guidance. The

	VHF Omnirange (VOR) and the Nondirectional Homing Beacon (NDB) are two examples of the type of equipment used.
NOTICE TO AIRMEN (NOTAM)	A notice containing information concerning the establishment, condition or change in any component of, or hazard in the National Airspace System, the timely knowledge of which is essential to personnel concerned with flight operations.
OBSTRUCTION	An object that penetrates an imaginary surface described in the FAA's Federal Aviation Regulations (FAR), Part 77.
OPERATION	A take off or a landing.
OUTER MARKER (OM)	An ILS navigation facility in the terminal area navigation system located four to seven miles from the runway edge on the extended centerline indicating to the pilot that he/she is passing over the facility and can begin final approach.
POSITIVE CONTROL	Control of all air traffic, within designated airspace, by air traffic control.
PRACTICAL ANNUAL CAPACITY (PANCAP)	The theoretical number of annual operations that can be handled by an airport without exceeding certain delay criteria. PANCAP is calculated by considering types of aircraft using the airport, numbers and types of operations (IFR, VFR, Touch-and-go), and runway/taxiway configurations.
PRACTICAL HOURLY CAPACITY (PHOCAP)	Theoretical number of hourly operations that can be handled by an airport without exceeding certain delay criteria. PHOCAP is calculated by considering the same factors used to calculated PANCAP.
PRECISION APPROACH RADAR (PAR)	Radar equipment in some ATC facilities operated by the FAA, and/or the military services at joint-use civil/military locations and separate military installations, to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but

	is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glide path (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope.
PRECISION INSTRUMENT APPROACH AID	An electronic aid designed to provide an approach path for exact alignment and descent guidance of an aircraft on final approach to a runway. Instrument Landing System (ILS), Precision Approach Radar (PAR), and Microwave Landing System (MLS) are the existing prevision NAVAIDs.
PRECISION INSTRUMENT RUNWAY	A runway having an existing instrument landing system (ILS).
PRIMARY AIRPORT	A commercial service airport having 0.01 percent or more of total U.S. enplanements. Sea-Tac is currently the only primary airport in the central Puget Sound region.
PRIMARY USE	The use category in which an aircraft flew the most hours within a calendar year.
PRIVATE PILOT	A private pilot may not act as a pilot-in-command of an aircraft that is carrying passengers for compensation or hire nor may a private pilot act as pilot-in-command for compensation or hire.
PRIVATE-USE AIRPORT/HELIPORT	An airport that is not open for the use of the general public, or except by prior permission of the owner.
PRIVATELY OWNED AIRPORT/HELIPORT	An airport that is owned by a private individual or corporation.
PUBLICLY OWNED AIRPORT/HELIPORT	An airport that is publicly owned and under control of a public agency.
PUBLIC-USE AIRPORT/HELIPORT	An airport open to the public without prior permission, and without restrictions within the physical capacities of available facilities. May or may not be publicly owned.

RADIO ALTIMETER	Aircraft instrument that makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.
REGIONAL AIRPORT SYSTEM PLAN	A document that address the air transportation and airport facility needs of a metropolitan area. The plan allocates air transportation demand to specific airport facilities, defines their role in the community and recommends general land use planning guidelines to local governments.
REGISTERED AIRCRAFT/ROTORCRAFT	Aircraft registered with the Federal Aviation Administration.
RELIEVER AIPORT	General aviation airports in metropolitan areas that are intended to reduce congestion at large air carrier airports by providing general aviation pilots with alterantive landing areas.
ROTORCRAFT	(See Helicopter)
RUNWAY ALIGNMENT INDICATOR LIGHTS (RAIL)	Sequentially flashing light blinking toward the end of the runway along the extended centerline. These lights are usually located with the Medium Intensity Approach Lighting System.
RUNWAY END INDENTIFIER LIGHTS (REIL)	Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid identification of the approach end of a runway.
SATELLITE AIRPORT	An airport that has scheduled air carrier service, but operates with a lower volume of passengers than the primary international airport in an urban area.
SEAPLANE	An aircraft equipped with floats that enable it to land and take off from water.
SEAPLANE BASE	A waterfront facility suitable for the operation of seaplanes. The facility usually has docks for temporary moorage of visiting or based seaplanes, ramps and equipment for launching and retrieving seaplanes, and amenities for passengers and pilots.
SEPARATION MINIMA	The minimum longitudinal, lateral, or vertical distances by which aircraft are

	spaced through the application of air traffic control procedures.
SHORT TAKEOFF AND LANDING AIRCRAFT (STOL)	An aircraft that, at some weight within its approved operating weight, is capable of operating from a STOL runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards.
SLANT RANGE	The line of sight distance between two points not at the same elevation.
SPORT AVIATION	The use of gliders, parachutes, balloons, and ultralights for recreation.
STALL	The separation of smooth airflow from the surface of the rotor blade or aircraft wing, thereby destroying the lift supporting the aircraft's weight, resulting in descent of the aircraft.
STATE AIRPORT SYSTEM PLAN	A document that outlines the orderly and timely development of a system of airports intended to connect communities of the state with government, transportation and business centers.
STOLPORT	An airport specifically designed for STOL (Short Take-off and Landing) aircraft, separate from conventional airport facilities.
STUDENT PILOT	A student pilot operating under a certificate issued by the FAA; may not operate an aircraft that is carrying passengers, or that is carrying property for compensation or hire.
TAXIWAYS	A defined path, usually paved, over which aircraft can taxi from one part of an airport to another.
TEETERING ROTOR	A two-bladed rotor with a single horizontal hinge for flapping, such as found on the Bell 47 helicopter.
TERMINAL AREA	A general term used to describe airspace in which approach control or airport traffic control service is provided in the vicinity of an airport.

TERMINAL CONTROL AREA (TCA)	Positively controlled airspace with boundaries that surround a high density terminal area.
TERMINAL RADAR SERVICE AREA (TRSA)	Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing and separation on a full-time basis for all IFR and participating VFR aircraft. TRSAs are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory.
T-HANGAR	A T-shaped aircraft hangar that provides shelter for a single plane.
THRESHOLD	The designated beginning of the runway that is available and suitable for the landing of airplanes.
TIE DOWN AREAS	A parking area for securing aircraft; can be overnight (transient operator) or permanent use (in lieu of a hangar).
TOUCH-AND-GO OPERATION	An aircraft operation for practice or testing purposes characterized by a landing touch down and then continuing take-off without stopping.
TRANSIENT	Operations or other activity performed by aircraft not based at the airport.
TRANSLATIONAL LIFT	The additional lift obtained by helicopters because of increased efficiency of the rotor system when transitioning from a hover into horizontal flight, or when hovering into a head wind.
TRANSPONDER	The airborne radar beacon receiver/transmitter portion of the Air Traffic Control beacon system that automatically receives radio signals from interrogators on the ground and selectively replies. Each aircraft transponder is capable of replying to 4,096 codes as selected by the pilot. Provides the air traffic controller positive location and, in some cases, altitude information.
TURBOJET AIRCRAFT	An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT	An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.
ULTRALIGHT VEHICLE	A class of flying craft that is characterized by very light weight construction (254 lb. maximum), and limited range (five gallons maximum fuel capacity). The vehicle may be powered or unpowered and is limited to one occupant (except for training vehicles).
UNICOM	Airport advisory radio station operated by an airport affiliate, but not by the FAA.
VECTOR	A heading issued to an aircraft to provide navigational guidance by radar.
VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE (VOR)	A navigation ground station transmitting signals containing directional information in the very high frequency (VHF) portion of the radio frequency spectrum.
VFR FLIGHT	Flight conducted in accordance with Visual Flight Rules.
VHF COMMUNICATIONS	Provides radio voice communications between aircraft and ground stations, also between aircraft. Very High Frequency (VHF) is limited in range (line of sight) and usually used for air traffic communications.
VISUAL APPROACH AID	Any device, light, or marker used to provide visual alignment and/or descent guidance on final approach to the runway.
VISUAL APPROACH SLOPE INDICATOR (VASI)	A system of lights on the airport that provides descent guidance to the pilot of an aircraft approaching the runway.
VISUAL FLIGHT RULES (VFR)	Rules that govern flight procedures when ceiling and visibility are more than 1,000 feet and 3 miles respectively.
VISUAL SEPARATION	A means employed by ATC to separate aircraft in terminal areas. There are two ways to effect this separation: 1) the tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other, and 2) a pilot sees the other aircraft involved and upon instructions from the controller

	provides his own separation by maneuvering his aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor.
VORTAC	A VOR station providing azimuth and distance measuring transmissions at one site.
VOR/DME	A VOR to which a specific kind of distance measuring equipment (DME) has been added, referred to as VORTAC.
VORTEX	A whirl or powerful eddy of air, like a whirlwind.
VORTICES/WING TIP VORTICES	Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to heavy aircraft can be of extremely high velocity and hazardous to smaller aircraft.
WEATHER RADAR	Provides the flight crew with visual display of weather that could contain turbulence. The system's primary function is to assist in turbulence avoidance, although most airborne radar systems are also capable of terrain mapping.

ACRONYMS

AIP	Airport Improvement Program
ALP	Airport Layout Plan
ALS	Approach Lighting System
ARTCC	Air Route Traffic Control Center
ARTI	Advance Rotocraft Technology Integration
ATAC	Air Transportation Advisory Committee
ATCT	Airport Traffic Control Tower
DARPA	Defense Advance Research Projects Agency
DME	Distance Measuring Equipment
EMS	Emergency Medical Service
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
HAI	Helicopter Association International, Inc.
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMS	Integrated Multiplex System
JVX	Joint-Services Advanced Vertical Lift Aircraft
LDA	Localized Type Directional Aid
LDN	Day-Night Average Sound Values
LHX	Light Helicopter Experimental
LOC	Localizer
MAST	Military Assistance for Safety and Transportation
MLS	Microwave Landing System
NASA	National Aeronautics and Space Administration
NAVAID	Air Navigation Facility
NDB	Nondirectional Beacon
NEPA	National Environmental Policy Act
NOTAR	No tail rotor system development for helicopters
NPIAS	National Plan of Integrated Airport Systems
OM	Outer Marker
PANCAP	Practical Annual Capacity
PHOCAP	Practical Hourly Capacity
R & D	Research and Development
RAIL	Runway Alignment Indicator Lights
REIL	Runway End Indentifier Lights
RTP	Regional Transportation Plan
SAR	Search and Rescue
SCOT	Standing Committee on Transportation
SEPA	State Environmental Policy Act
TCA	Terminal Control Area
VASI	Visual Approach Slope Indicator
VFR	Visual Flight Rules
VOR	Very High Frequency Omnidirectional Range
WSASP	Washington State Airport System Plan

Appendix D
References

APPENDIX D

REFERENCES

1. U.S. Department of Transportation, Federal Aviation Administration, National Plan of Integrated Airport Systems 1984-1993, (Washington D.C.; August 1985).

2. R. Dixon Speas Assoc. for Puget Sound Governmental Conference, Air Transportation System Advance Plan, (Seattle, WA; Sept. 1969).

3. Puget Sound Council of Governments, Regional Airport System Plan, (Seattle, WA; June 1982).

4. Puget Sound Council of Governments, Task 6 Issue Paper - Privately Owned Airports in the Puget Sound Region, (Seattle, WA; May 1986).

5. Washington State Department of Transportation Division of Aeronautics, Draft Element 4 Data Update, Washington State Continuous Airport System Plan, (Olympia, WA; Oct. 1986).

6. Puget Sound Council of Governments, Regional Airport System Plan Technical Report on the Air Carrier and General Aviation Elements, (Seattle, WA; July 1987).

7. Port of Seattle, Final Report, Master Plan Update for Sea-Tac International Airport, (Seattle, WA; Sept. 1985).

8. Federal Aviation Administration, Airport Capacity and Delay Advisory Circular, (Washington D.C.: Sept. 1983).

9. Port of Seattle and King County, Sea-Tac International Airport/King County International Airport Airspace Study, (Seattle, WA; Jan. 1983).

10. de Neufville, Richard, Airport Systems Planning, (MacMillan Press, Ltd; 1976).

11. Port of Seattle, Working Paper, Master Plan Update for Sea-Tac International Airport, Alternatives Evaluation, (Seattle, WA; Dec. 1985).

12. Federal Aviation Administration, FAA Aviation Forecasts, Fiscal Years 1986-1997, (Washington, D.C.; Feb. 1986).

13. Puget Sound Council of Governments, Population and Employment Forecasts, (Seattle, WA; March 1984).

14. Federal Aviation Administration, Measuring the Regional Economic Siginficance of Airports. (Washington, D.C.; October 1986).

15. Puget Sound Business Journal, "Is This Area a General Aviation Backwater?," August 24, 1987.

16. Puget Sound Council of Governments, Task 3 Report - Helicopter Service Needs, (Seattle, WA; March 1986).

17. Reid, Middleton and Associations, Regional Airport System Capital and Operating Costs, Technical Paper. (Edmonds, WA; May 11, 1987).

18. Puget Sound Council of Governments, Task 4 Report - Seaplane Facility Needs, (Seattle, WA; April 1986).

19. Puget Sound Council of Governments, Task 5 Report - Sport Aviation in the Puget Sound Region, (Seattle, WA; May 1986).

20. Rodwell Research, Paying for the Puget Sound Regional Airport System, (Seattle, WA; May 1987).