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FINAL ENVIRONMENTAL ASSESSMENT

PROPOSED CHANGES TO AIR TRAFFIC
ARRIVAL AND DEPARTURE ROUTES AT
SEATTLE-TACOMA INTERNATIONAL AIRPORT
Seattle, Washington

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FINAL ENVIRONMENTAL ASSESSMENT

FOR

PROPOSED CHANGES TO AIR TRAFFIC ARRIVAL AND DEPARTURE ROUTES AT SEATTLE-TACOMA INTERNATIONAL AIRPORT

Seattle, Washington

Prepared by

Federal Aviation Administration
Air Traffic Division
Seattle, Washington

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This environmental assessment becomes a Federal Government document when evaluated and signed by the responsible FAA official.

Temple H. Johnson, Jr.
Manager, Air Traffic Division

Date 3-27-90

For further information contact:

Mr. Richard Prang
Federal Aviation Administration
17900 Pacific Highway South
Mail: C-68966
Seattle, WA 98168

(206) 431-2530

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I. Purpose and Need

The Federal Aviation Administration has proposed alterations to the high-altitude route structure in the airspace delegated to the Seattle Air Route Traffic Control Center (ARTCC) and the connecting arrival and departure traffic patterns serving the Seattle-Tacoma International Airport (Sea-Tac). The purposes of these changes are to reduce congestion, implement static high altitude routes which merge with the national Preferred Route System, and improve efficiency of air traffic operations.

At present, the route structure in the airspace over and east of the Cascade Mountains which serves the Sea-Tac Airport blends aircraft from widely dispersed points of origin and is required to change substantially each time the runway in use changes at the airport, which may occur several times in one day. This has several effects with adverse consequences which extend throughout the National Airspace System. Some of these are:

When landing runways 16L and 16R, aircraft coming to Seattle from points to the southeast, such as Denver, Dallas, and Atlanta are required during their enroute descent to pass through a steady stream of Seattle departures climbing toward such destinations as Minneapolis, Chicago, Washington, and New York. At the same time, these arrivals from the Southeast are being merged into a single arrival stream of aircraft from the Northeast. (See Exhibit 1.) Such crossing and merging of aircraft is less efficient and more difficult to accomplish at high altitude and high speed than if conducted in the latter phase of flight when aircraft are flying at lower altitudes and speeds. The type of RADAR and navigational equipment installed in the airspace within 50 miles of major airports facilitates this crossing and merging process because of its greater accuracy and more frequent information updates.

In periods of high demand, if weather or airport conditions improve, the present high altitude route structure and holding airspace used by the Seattle Air Route Traffic Control Center do not permit that facility to adjust the arrival rate in a timely fashion. In order to provide sufficient room for departure routes and balance workload between control sectors, enroute holding and metering of arriving aircraft must be conducted approximately 130-150 flying miles from the airport in the existing structure. At present, it may take as much as thirty minutes to effect a substantial increase in the metered arrival rate at the airport.

This can account for as many as 20 lost arrival opportunities per event.

Because of the fluid nature of these routes caused by the situation described above, the integration of Seattle into the national Preferred Route System has proved difficult. This causes unnecessary system complexity and controller workload by increasing the number of points of aircraft conflict for aircraft enroute to and from Seattle throughout the National Airspace System.

When adverse weather, such as low ceilings and visibilities, creates a need for instrument approaches to the airport, the arrival capacity of the airport is symmetrical. That is, approximately 36 aircraft per hour can arrive whether runways 16 or 34 are in use. Arrival delays are similar whether landings are conducted to the north or to the south.

In contrast, during periods of peak demand and optimum weather conditions, south arrival rate is much lower (42/hour), than north (56/hour). Delays, when landing south, are significantly greater than when landing north. No reason for this disparity can be found in the layout of the airport; the inefficiencies are caused by the requirement that all turbojet aircraft landing to the south be routed through Elliott Bay, to the northwest of the airport, in a single arrival stream.

Background

Historical Perspective: Air Traffic Operations

Local authorities and the FAA responded to public concern over aircraft noise as early as 1961. Terminal procedures were developed as a cooperative effort between the community, the airport operator (Port of Seattle), the airlines and the FAA. By 1970, arrival and departure route restrictions had become an integral element of Air Traffic Control (ATC) local operating procedures. These procedures required that jet aircraft, arriving and departing Sea-Tac, be routed over Puget Sound to the maximum extent possible consistent with safety. In addition, strict adherence to specified altitudes and routes was required when these aircraft were routed over populated areas. Issues of efficiency were subordinated to noise abatement procedures. These procedures were not rooted in any specific measure of noise, but often involved simply moving the aircraft overflight track away from the complaining group or individual.

Prior to 1979, the demand for Puget Sound airspace and airport resources seldom approached capacity. The FAA's Terminal Air Traffic Control facility (Seattle TRACON), was handling approximately 255,000 instrument operations per year. Those delays which occurred were caused by reduced runway capacity and increased aircraft separation requirements during periods of reduced visibility. Automated radar tracking and flight data processing computers, introduced in the early 70's, had equipped Air Traffic Control with the tools to efficiently handle projected growth.

By 1980, traffic volume was exceeding system capacity in many areas of the country. A coordinated system of traffic flow management between major air carrier airports was implemented. Preferred arrival, departure and enroute tracks were established and volume restrictions applied in highly congested areas. The Pacific Northwest, a historically low-density area, was only slightly affected.

Following deregulation, the air carriers, in response to an expanded marketplace, accelerated the rate at which they added aircraft to the national fleet. Sea-Tac became one of a number of national airline hubs, large regional terminals fed by multiple, converging "commuter" or regional routes which connect with national carriers. Airspace saturation became a reality during high demand periods.

The controllers' strike of 1981 brought mandatory limitations on access to the ATC system through national flow control along with an enhanced flow management system and philosophy. Enroute control sectors were modified to more equally distribute traffic volume and action was taken to reduce and simplify controller workload wherever possible.

In April of 1983, Standard Instrument Departure (SID) routes were implemented in Seattle airspace to feed the modified enroute structure. Studies were under way to develop standardized terminal feeder routes (static flow), essential to traffic volume management, and a single route from the northwest was implemented in March of 1985. The airspace analysis then shifted its emphasis to inbound routes from the east and southeast, but existing terminal procedures could not accommodate changes in this area. The options available were regarded as either too cumbersome, or incompatible with existing "noise abatement" constraints. Revision of East Side routes was dropped from further consideration.

In 1986, it became increasingly clear that a serious decline in safety was likely to occur if action was not taken to alleviate congestion in the Seattle north flow departure situation, particularly in the area of Elliott Bay and in the high altitude routes in Central Oregon. In the latter area, aircraft bound for the Reno, Los Angeles, and Phoenix markets were routinely required to proceed out through Elliott Bay then via Olympia, Newburg and Klamath Falls, crossing through the heavy stream of aircraft inbound to Seattle from the south. To correct this unacceptable situation, these aircraft were redistributed to the east side of the Seattle metropolitan area through expanded use of an existing departure route. Development of new routes for these aircraft was precluded by existing noise abatement restrictions.

Unprecedented growth continued into 1987 and the year ended with total instrument operations of more than 459,000 in the Seattle terminal airspace; 292,042 operations were conducted at the Sea-Tac Airport. Every possible feeder route had been addressed and standardized but the congestion over Puget Sound had only become more acute. By the summer of 1988, Seattle Approach Control had grown to become one of the busiest facilities in the nation but the fundamental procedures framework, unchanged for over fifteen years, could not support increased activity levels.

In the Summer of 1989, Sea-Tac Airport experienced unprecedented delays, 5,409 aircraft experienced a total of 1,303 flight hours of arrival delays in the months of June, July and August. The 12-month total of instrument operations conducted by Seattle TRACON reached 524,072 at the end of the summer. Airport operations were 326,153, an increase of 25% in 33 months.

Current Perspective

Air Carrier Scheduling:

Demand for air traffic service is not spread through the 24-hour day. Airline ticket sales and scheduling respond to people's desire to travel at specific times: departing at the beginning of the business day, arriving home for the evening meal, avoiding the normal hours of sleep, etc.

At several times during the operating day, demand for services alternates between arrival "banks" and departure "banks". This occurs because of the marketing strategy used increasingly by air carrier and air taxi companies over the last decade. Under the "hub-and-spoke" system, large numbers of aircraft, an "arrival bank," arrive at an airport in a brief period, exchange passengers and then leave as another compact "departure bank", creating peaks of demand, and delays.

Airport Configuration:

The Sea-Tac Airport is located twelve miles south of the Seattle central business district. The airport is generally bounded on the north by State Highway 518; on the east by U.S. Highway 99; on the south by South 200th Street and on the west by State Highway 509.

The airport consists of two parallel runways aligned in a north-south direction (158°/338° magnetic). The runway system is oriented to take advantage of the prevailing wind. Runway 16L/34R is the east parallel and Runway 16R/34L the west. The runways are of similar length and both are suitable for use by all aircraft commonly used in air carrier operations.

The greater length of Runway 16L/34R affords no appreciable benefit to arriving aircraft but is significant for departing heavily-loaded long-range aircraft. The airport has a downhill gradient from north to south which, during neutral conditions, causes south heading runways (South Flow) to be preferable. This factor and the prevailing wind account for the use of South Flow procedures approximately 60% of the time.

Runway centerlines are separated by 800 feet, a limiting characteristic during Instrument Meteorological Conditions (IMC) but much less so during Visual Meteorological Conditions (VMC). Airport capacity in terms of aircraft operations (landings and departures) that can be accommodated during a period is dependent on two other basic factors. These are airport facilities, including runways, taxiways and aircraft servicing areas, and the traffic control system's ability to position aircraft to access airport facilities.

Air Traffic Control Improvements:

The ability of the Air Traffic Control system to meet the demand for services is affected by several variables, relatively few of which are under the control of those operating the system.

Variables which are not readily subject to the control of the FAA are weather, scheduling of aircraft, location of the airport, further reduction of separation standards, national demographics and travel marketing.

Variables which can be influenced by the FAA are staffing, employee proficiency, equipment acquisition, airport construction, procedures and routings. (These can be summarized as three factors: people, equipment, space.)

As with any other economic decision, any attempt to increase efficiency or productivity involves manipulating these three factors to assure the best mix. As any one of the factors is increased, the benefit derived from each additional increment decreases. That is, assigning more and more people helps less and less unless you also give them more equipment, and more space in which to perform their work, and so on.

Airport expansion and relocation have been considered repeatedly over the years. In the summer of 1988, the Puget Sound Council of Governments and the Commissioners of the Port of Seattle commissioned a study of alternate sites for the airport, but acknowledged that even if a site were to be found, development and construction lead time would be at least ten years.

While addition of another runway at the present location is feasible, it will probably not improve capacity or efficiency unless route modifications can be made to bring the aircraft to the runway more efficiently.

There have been numerous incremental improvements to air traffic equipment at Seattle TRACON and Seattle ARTCC which have enhanced the ability of the system to handle aircraft, the most significant of these being the installation of the Host Computer system at the Seattle ARTCC, which provided greatly enhanced computer memory and capability.

Seattle TRACON has assumed control of airspace formerly controlled from McChord Air Force Base and realigned sectors to use space and control equipment more efficiently. Seattle ARTCC has established new sectors to the north and northeast of the Seattle terminal airspace.

Controller staffing has been expanded considerably. The Seattle Tower and TRACON increased from 57 in 1984 to 93 at present; Seattle ARTCC from 200 to 243.

Despite these changes, which have improved system safety, working conditions, and efficiency in certain areas, experience has shown that there are certain "bottlenecks" which are not likely to be further improved by addition of people or equipment. These lie in the geographical area of Central Puget Sound, and along those high altitude routes into the Seattle Area from the east and southeast.

High Altitude Issues (Seattle ARTCC):

At present, when a runway change occurs at Sea-Tac, the arrival and departure flows in the enroute structure to the east of Seattle change also. That is, the Seattle ARTCC has to deflect the stream of arriving aircraft from one corner of the terminal airspace to another. For example, when a change is made from a Runway 34 configuration to a runway 16 configuration, the stream of arrivals which had been entering Seattle terminal airspace at a point 30 miles southeast of the Sea-Tac Airport has to be moved to a point approximately 30 miles northeast of the airport.

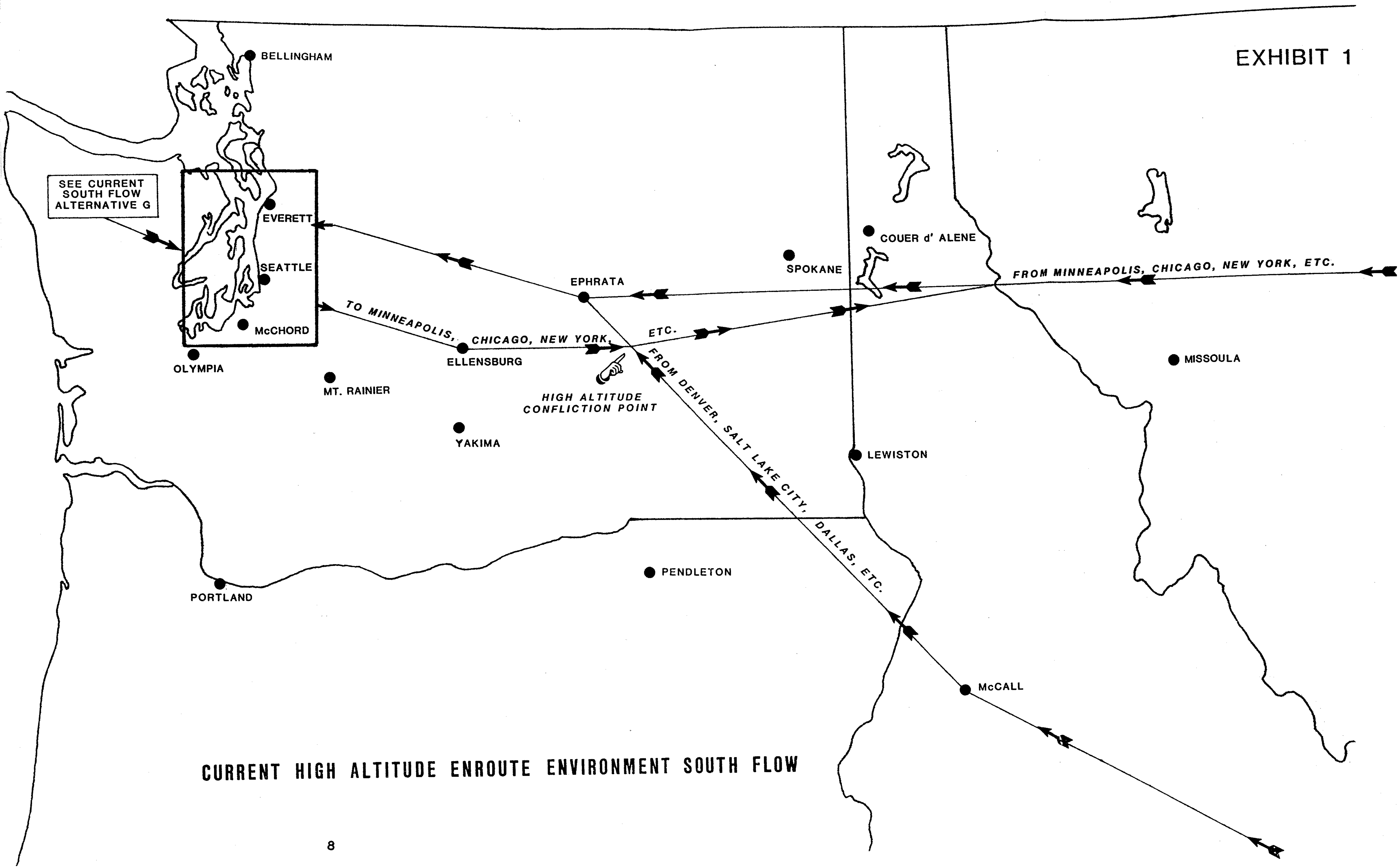
This instability of routes not only has the clear potential for confusion at the time of runway changes, it has the following effects which are less obvious but equally undesirable:

(1) Enroute traffic metering and holding of Seattle arrival aircraft takes place at a point east of Ephrata, approximately 120 miles east of Seattle, in order to avoid areas of potential conflict near the ARTCC-TRACON boundary. This makes it difficult to provide a steady efficient flow, particularly in adverse weather, when weather and airport capacity are changing rapidly.

(2) Two side-by-side arrival flows from the east are not feasible because of insufficient airspace to establish an additional sector in the arrival quadrant (The northeast in a runway 16 configuration.) Having a single enroute sector work two arrival flows leaves unresolved existing workload issues in the sectors immediately east of Seattle TRACON airspace.

(3) In the South flow in particular, there is a continual need to cross aircraft in the departure stream from Seattle to the Upper Midwest and the Northeastern Seaboard through the arrival stream from the Southeastern and South Central U.S. These aircraft are in climb or descent, and closing at speeds approaching 1200 miles per hour. These two busy traffic flows intersect in the area of Eastern Washington and Idaho at a very awkward angle, compounding the already difficult task of the enroute controller. (See Exhibit 1.)

EXHIBIT 1



CURRENT HIGH ALTITUDE ENROUTE ENVIRONMENT SOUTH FLOW

Low Altitude Issues (Seattle TRACON)

At Sea-Tac, when the landing direction is north, maximum efficiency is achieved because aircraft can be positioned to advantage on either side of the parallel final approach courses of both runways. The finals can be entered by aircraft on either side of the course at any point from the outer marker to the south boundary of approach control airspace without transiting another control sector. And more important, the final approach course can be reached from a position in the traffic pattern that allows the pilot and controller to establish spacing relative to other aircraft already on final. During periods of optimum weather, this positioning advantage makes it possible to achieve and sustain an arrival rate (AAR) of 56 aircraft per hour.

In a south flow, however, procedures designed primarily to mitigate aircraft noise in certain locations north and east of downtown Seattle restrict airspace use and preclude efficient positioning of turbojet aircraft for the landing sequence. These procedures (contained in Seattle TRACON Order 7200.1) stipulate that arrivals (turbojet) from the south, east and north " ... shall be vectored over Puget Sound and through Elliott Bay." In addition, aircraft from the east " ... shall be vectored through (westbound to Puget Sound) the final approach at or above 8,000." The effect of these procedures is to afford access to the final approach course for turbojets only through Elliott Bay. The impact of these provisions on arrival efficiency is to limit the AAR in a south flow to 42 during optimum weather conditions.

The dramatic difference between north and south flow AAR's during optimum weather, results from the limited use of airspace east and north of Sea-Tac which precludes the equal concentration of turbojet aircraft on both sides of the final approach course and efficient access to the final. As it is, all turbojet aircraft, irrespective of direction of origin, must be routed to the final on a base leg through Elliott Bay making it difficult to utilize both finals and both runways. This is particularly true in the case of an all-turbojet grouping in the aircraft stream. When two or more turbojets are sequenced from the west side to the final, visual separation is established west of Elliott Bay or before the aircraft turn to final so that the maximum concentration of aircraft on the final can be achieved. However, when visual separation must be established before the turn to final, it is much less efficient because of:

(1) The difficulty of maintaining position visually when the preceding aircraft or the aircraft alongside is maneuvering.

(2) The perspective of the individual pilot which limits his ability to make decisions which maximize system efficiency.

It is difficult to assign a value to decreased efficiency of the operation described, in terms of lost arrival opportunities. However, during evaluations, it appears the interval between aircraft is approximately two miles greater than when the spacing is established by the controller behind or alongside an aircraft already on final. Given a theoretical arrival capacity of 56 per hour, and an actual capacity of 42, this factor must bear a considerable portion of the blame.

High turbojet densities and present south flow procedures require a disproportionate concentration of aircraft in the airspace west and northwest of Sea-Tac. A high concentration of aircraft poses a considerable problem for efficiency by requiring the controller to focus more attention to maintaining required separation between aircraft and less to sequence efficiency.

The division of airspace along the Seattle Runway 16 localizer in the south flow means that in visual approach weather the East Arrival controller must route aircraft under his control through the West Controller's airspace for a significant distance to position the aircraft in Elliott Bay. By continuing this, the FAA is engaging in a practice which increases its exposure to the risk of error and cuts very close to the actions prohibited by FAA Handbook 7110.65, Air Traffic Control, paras. 2-14, and 2-15 (which pertain to coordination between controllers and transfer of control of aircraft). Attempts have been made to alleviate this situation through sectorization, but they have been unsuccessful because of the geographical and operational constraints on the size of the West Arrival sector and the workload of the West Arrival controller. (See Demonstration #13, Appendix A.)

The cumulative effect of all these individual inefficiencies is represented by the difference between the acceptance rates for the two configurations in optimal weather: 42 in the South Flow, and 56 in the North.

Summary

System efficiency is a product of a complex interplay of many factors, some of which are beyond the control of the FAA.

Maximizing efficiency requires the proper mix of those factors which are under the control of the FAA, that is equipment, personnel, and airspace. Large increases have been made in the areas of personnel and equipment. Any further incremental improvement in system efficiency will require better use of the airspace serving the Seattle area.

Any attempt to revise routes and procedures should be made in such a way as to provide for present needs and increased demand, at least to the 56-60 operations per hour theoretically possible without new airport construction. Revisions should be made simultaneously in the terminal and enroute airspace.

II. Alternatives Considered

A. Non-Procedural Changes

Changes which could resolve or alleviate the problems cited above through means other than re-routing aircraft flows, such as capital improvements and air carrier scheduling modifications, are not obtainable within the foreseeable future.

It is not likely that additional runway surface capacity can be available prior to the year 2000. The Port of Seattle, owner and operator of Sea-Tac Airport, has initiated studies of airport expansion (i.e., additional runways) and has commissioned a search for potential sites for a replacement or reliever airport for Sea-Tac. Even if one of these alternatives were selected, the acquisition of property, development, and construction of new facilities would probably require ten years or more.

The FAA does have some authority under the Federal Aviation Act to regulate airline schedules so as to reduce delays and to request that the airlines negotiate among themselves to formulate voluntary agreements regarding scheduling that will aid in the reduction of delays. Nevertheless, it is FAA policy not to take any measures designed to regulate airline schedules absent extraordinary circumstances.

The FAA has opted to invoke its authority to regulate airline scheduling only at "High Density Traffic Airports" - La Guardia, Kennedy, O'Hare, and Washington National- established by rule in 1968. See 14 CFR Sec. 93.121-133. (Originally, Newark Airport was denominated a High Density Traffic Airport. The slot allocation program established for operations at these airports is no longer in effect at the Newark Airport.) The FAA has instituted rules governing the allocation and transfer of slots among the various airlines operating to and from these airports. The slot restrictions in effect at High Density Airports were intended to correct the direct impact that operations at these highly congested airports were having on the National Airspace System. The FAA has initiated discussion among airlines only where airline scheduling practices have created peak demands that exceed airport operating capacity, thereby causing unacceptable operating delays.

In light of the fact that there currently is runway capacity available at Sea-Tac that is not being utilized - even during the peak demand periods given certain flow conditions - there are no extraordinary circumstances here that would warrant invocation of FAA's regulatory powers over airline scheduling. Nor can the FAA justify utilization of its authority to regulate airline scheduling to correct artificial constraints put on the use of the navigable airspace controlled by the Seattle ARTCC and the Seattle TRACON by the current air traffic control procedures.

Furthermore, a change in airline scheduling that might reduce delays to Sea-Tac would not solve the other problems, identified above, that are associated with the Seattle ARTCC's control of air traffic or the concerns about the risk of error in the terminal airspace posed by the use of the Elliott Bay procedures.

B. Procedural Change

Appendix A reports on 13 simulations of air traffic control procedures developed, run and analyzed by personnel of the Seattle TRACON and the Seattle ARTCC to compare various possible methods for routing traffic in the vicinity of the Seattle-Tacoma International Airport. The alternatives explored during these simulations included several which had been developed over the past decade but not implemented, as well as others developed by the team at the time of the simulations in September of 1989. The procedural changes presented below are the result of that developmental process.

Discussion of Procedural Alternatives

Analysis of the simulations and observations which are attached as Appendix A, resulted in the following ranking of alternatives proposed by Seattle ARTCC and TRACON to achieve greater efficiency and safety for traffic enroute to and from the Seattle-Tacoma Airport. These are listed in ascending order of desirability. All of the simulations which are not presented below were regarded as ineffective or unsafe and were not ranked. Please refer to the individual demonstrations in Appendix A for details of the rejected alternatives.

For the "No Change" Alternative (G) and the Preferred Alternative (A), there is a complete description in layman's terms of each of the routes in that alternative. Behind that "colloquial description", there is a corresponding chart which shows those same routes. In the interest of simplicity, Alternatives F through B are accompanied by charts only.

It is not possible to define "flight tracks or flight corridors" as rigid paths in the sky, but rather as representative average flows. The actual path that an aircraft will traverse will vary according to the effects of many factors such as: aircraft type (size, weight, speed, navigational equipment, etc.), meteorological conditions (wind direction and velocity, visibility, ambient air temperature), pilot technique, and operational procedures.

Air traffic considerations can also cause the assignment of aircraft to various departure runways and routes other than those depicted. Some of these variables are: airspace loading, aircraft type, local weather, enroute weather, runway closures, navigational aid outages, and workload balancing.

Alternative G "No Change" (Demonstration #1)

Make no changes in the present routings, airspace and noise mitigation practices.

COLLOQUIAL DESCRIPTION OF ROUTES IN USE AT PRESENT:

LAND NORTH (RUNWAYS 34L/R)

Turbojet aircraft from points of origin to the south (Oakland, San Francisco, Reno, Los Angeles, etc.) are placed in a single stream over Portland, descending to reach an altitude of 10,000' over a point 5 miles north of Eatonville. They then continue directly to the airport, passing over a point 3 miles south of Puyallup at or above 5,000', and Milton at or above 3,000', then continue final descent over Federal Way to the airport.

Turbojet aircraft from Alaska, British Columbia and the Orient are placed in a single stream prior to reaching the Hood Canal Bridge at an altitude of 10,000'. They then proceed across the north end of Bainbridge Island, descending to 5,000'. In the vicinity of Rolling Bay/West Point, they turn south over Puget Sound. Near the middle of Vashon Island, the aircraft descend to 3,000'. Somewhere between the south end of Vashon Island and the McChord Air Force Base, the aircraft turn to the east, joining the Runway 34 final approach course at or above 3,000' and continue final descent to the airport.

Turbojet aircraft from the east (Minneapolis, Chicago, Saint Louis, etc.) pass through the area between the Crystal Mountain Ski Area and Snoqualmie Pass between the altitudes of 13,000' and 10,000'. They are then placed on one of several tracks, depending upon the number of arriving aircraft inbound from the south and the Northwest. The most northerly and direct of these tracks proceeds across Black Diamond and central Auburn, intercepting the Runway 34 final approach course at or above 2,000', in the vicinity of the Sea-Tac Mall, and continuing final approach to the airport. The most southerly of these tracks passes south of Enumclaw and Buckley, and intercepts the Runway 34 final approach course in the vicinity of Graham, at or above 5,000'. The aircraft then continues final descent, passing over Puyallup, Milton, and Federal Way.

LAND SOUTH (RUNWAYS 16L/R)

Turbojet aircraft from the south cross a point 5 miles south of Eatonville between 14,000' and 10,000'. At a point approximately 8 miles east of McChord Air Force Base, these aircraft turn to a northwesterly heading, crossing east of Tacoma and over Dash Point and the west side of Federal Way while descending to 7,000'. Near the north end of Vashon Island, the aircraft descend from 7,000' to 3,000'. At a point abeam Alki Point, the aircraft turn east and enter Elliott Bay; they then comply with the provisions of the Bay

Visual Approach which requires that they intercept the Runway 16 final approach course north of Boeing Field at or above 2,000'

Turbojet aircraft from the northwest (fair weather alternative) cross the Hood Canal Bridge at 10,000', then descend to 3,000' while proceeding across the northern half of Bainbridge Island. After passing the Rolling Bay/West Point area, the aircraft turn left and enter Elliott Bay and comply with the provisions of the Bay Visual Approach which requires that they intercept the Runway 16 final approach course north of Boeing Field at or above 2,000'.

Turbojet aircraft from the northwest (poor weather alternative) cross the Hood Canal Bridge at 10,000', then descend to 3,000 on one of several tracks depending on the number of arriving aircraft from the south or east. The most southerly of these tracks proceeds to and through Elliott Bay as above, terminating in an instrument approach to Runway 16. The most northerly of these tracks proceeds to the vicinity of Everett where the aircraft intercept the Runway 16 final approach course at or above 5000', then continue final descent over Mountlake, Northgate, the University District, Capital Hill and Beacon Hill to the airport.

Turbojet aircraft from the east (fair weather alternative) Cross the area of Mount Index at an altitude between 14,000' and 10,000' westbound, then descend to 8,000' crossing the north end of Kirkland and Kenmore. In the vicinity of Interstate-5, the aircraft descend to 3,000' and when passing Richmond Beach turn south over the water. After passing West Point, the aircraft turn east and enter Elliott Bay to comply with the provisions of the Bay Visual Approach (see above).

Turbojet aircraft from the east (poor weather alternative) cross the area of Mount Index at an altitude between 14,000' and 10,000' westbound, then descend to 5,000'. Depending on the traffic loading from other directions, intercept the Runway 16 final approach course at 5,000' or above between Kenmore and Everett and continue final approach to the airport over Northgate, the University District, Capital Hill and Beacon Hill to the airport.

TAKEOFF NORTH (RUNWAYS 34L/R)

Turbojet aircraft enroute to destinations to the east (Spokane, Minneapolis, New York, Washington D.C., etc.) proceed to the Rainier Valley/Mount Baker areas at an altitude of 4,000' or above then turn to an easterly heading, which takes them over Medina, central Bellevue, climbing to 13,000'. In the vicinity of the east shore of Lake Sammamish, the aircraft then turn more directly toward their destinations, passing between Highway I-90 and the Tolt Reservoir and climb to their intended cruising altitude.

During those late night hours when traffic is light enough to permit: Turbojet aircraft climbing to 15,000' proceed to the Boeing Field area and when leaving 2,000', turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft then turn west, then north, remaining over Elliott Bay until leaving at least 8,000', and passing west of Bitter Lake. After passing that point, aircraft turn to an easterly heading and proceed to their intended destinations.

Aircraft enroute to destinations to the Southeast and Los Angeles (Denver, Dallas, Atlanta, Los Angeles, etc.) will proceed to the Rainier Valley/Mount Baker area at an altitude of 4,000' or above then turn to an easterly heading, which takes them over Medina and central Bellevue, climbing to 13,000'. Approximately two miles west of Lake Sammamish, the aircraft turn to a southerly heading, passing over Renton and Auburn, proceeding to the area of Lake Tapps. Aircraft then turn southeasterly and climb to their intended cruising altitude.

During those late night hours when traffic is light enough to permit: Turbojet aircraft climbing to 15,000' proceed to the Boeing Field area and when leaving 2,000', turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft then turn left to a southerly heading, remaining over Puget Sound until leaving 8,000' and passing a point south of Fauntleroy Terminal, when they turn to a southeasterly heading and proceed toward their destinations.

Aircraft enroute to destinations to the south and southwest (Portland, Northern California, and the Hawaiian Islands) proceed to the Boeing Field, Beacon Hill area, climbing to 13,000' When leaving 2000' (3,000' if there is traffic departing Boeing), turn left roughly parallel to the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft turn left to a southwesterly heading, passing west of Vashon Island, direct to Olympia. In the vicinity of Gig Harbor, these aircraft turn toward their intended destination and climb to their planned enroute altitude.

Aircraft destined to points in Alaska and the Orient proceed to the Boeing Field area, climbing to 13,000'. When leaving 2,000', (3,000' if traffic is also departing Boeing) they turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft then turn left to a westerly heading, until reaching the vicinity of Bremerton where they turn northwest toward Neah Bay and climb to their planned enroute altitude.

TAKEOFF SOUTH (RUNWAYS 16L/R)

Turbojet aircraft enroute to destinations to the north (Vancouver, Amsterdam, London, etc.) climb initially to 9,000', proceed to a point at least five miles south of the airport and 3,000' prior to turning to a heading of 070 degrees which takes them over Auburn. As soon as clear of the overlying stream of northwestbound arrivals, approximately 10 miles southeast of the airport, these aircraft turn to the north and climb to 13,000' while passing over Renton. In the vicinity of Lake Sammamish, they climb to their planned enroute altitude.

Turbojet aircraft enroute to destinations to the east (Spokane, Minneapolis, Chicago, New York, etc.) climb initially to 9,000', proceed to a point at least five miles south of the airport and 3,000' prior to turning to a heading of 070 degrees which takes them over Auburn. As soon as established on the easterly heading, approximately 8 miles southeast of the airport, these aircraft climb to 13,000'.

Turbojet aircraft enroute to destinations to the southeast and Los Angeles (Atlanta, Denver, Dallas, Reno, Los Angeles) climb initially to 9,000' and proceed to a point just south of Federal Way where they turn to a southeasterly heading and climb to 13,000, passing over Sumner and just west of Mount Rainier before climbing to their planned enroute altitude and turning toward their destination.

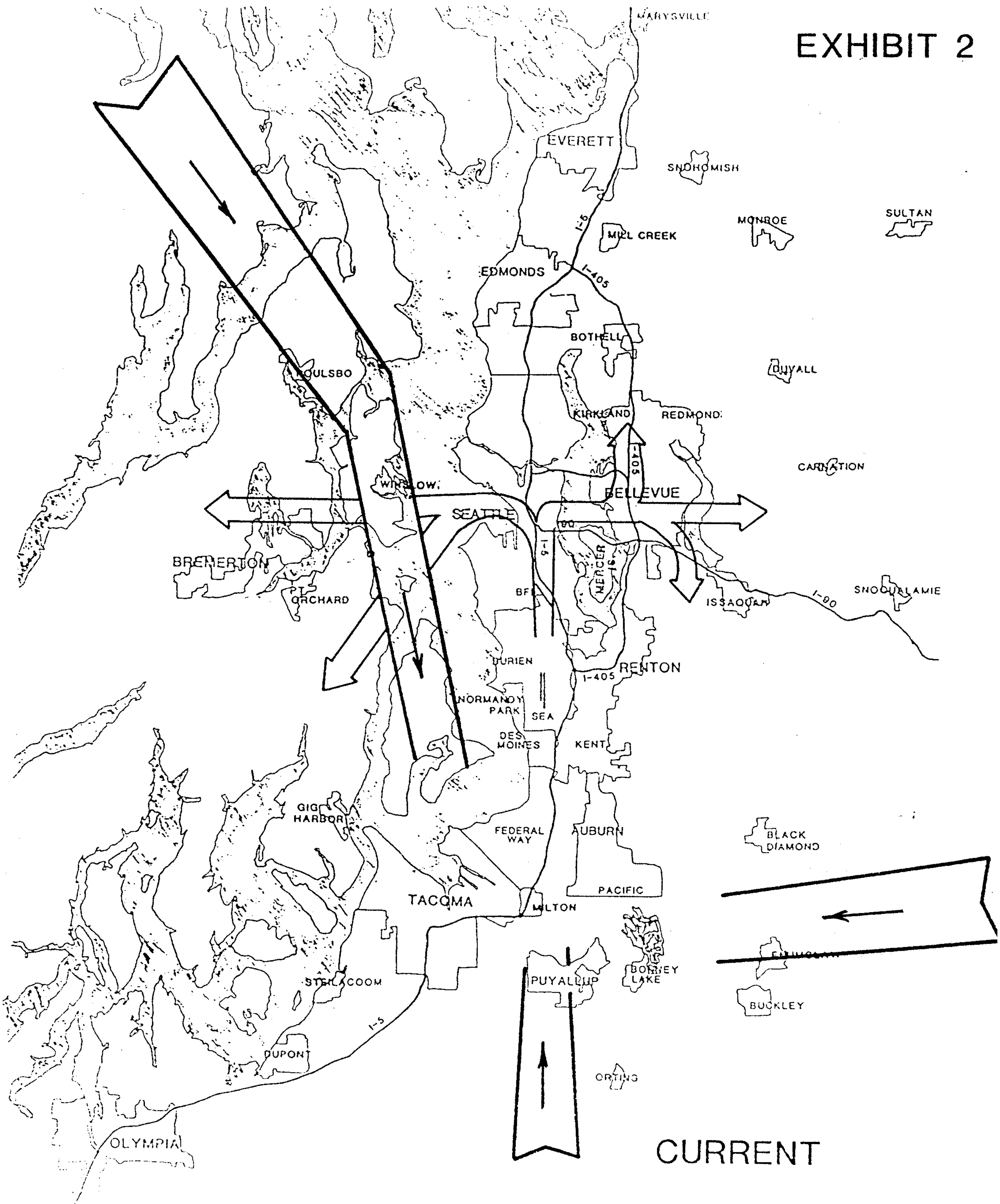
Turbojet aircraft enroute to destinations to the south and southwest (Portland, San Francisco, Oakland, Hawaiian Islands) climb initially to 9,000' and proceed to a point at least 3 miles south of the airport and at least 3,000' where they turn to the southwest, passing over Federal Way and central Tacoma. In the vicinity of Lakewood, when clear of the overlying stream of arrival aircraft, these aircraft climb to 13,000' and proceed to Olympia, where they turn toward their destination and climb to their intended enroute altitude.

Turbojet aircraft enroute to Alaska and the Orient climb initially to 9,000' and proceed to a point at least 3 miles south of the airport and at least 3,000' where they turn to the west, passing over Redondo and Vashon Island. West of Colvos Passage, when clear of the overlying stream of northwestbound Seattle arrivals, these aircraft turn toward Neah Bay and climb to 13,000'. In the vicinity of Hood Canal, they climb to their intended cruising altitude.

NORTH FLOW

RUNWAYS 34

EXHIBIT 2



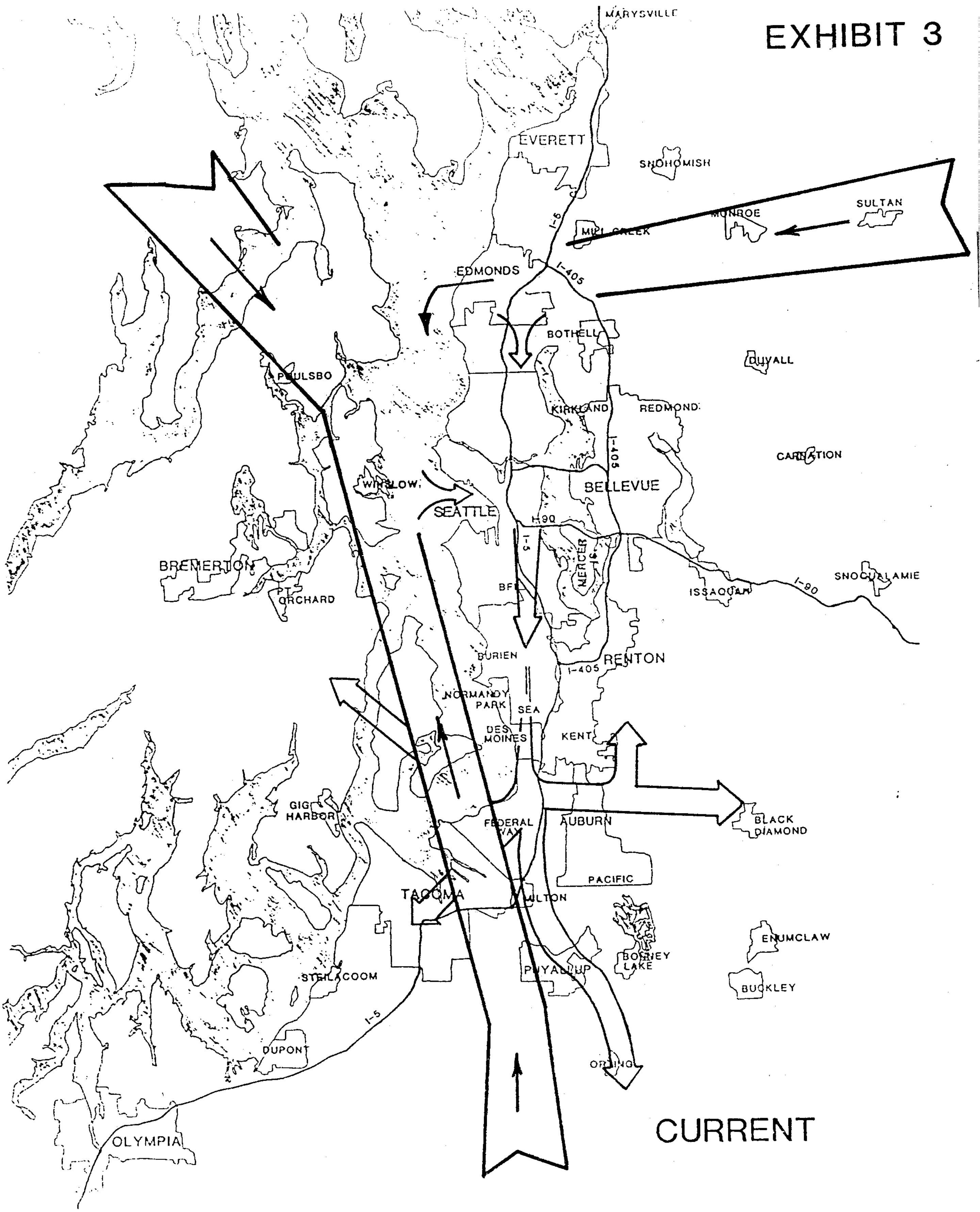
CURRENT

ALTERNATIVE G

SOUTH FLOW

RUNWAYS 16

EXHIBIT 3



CURRENT

ALTERNATIVE G

Alternative F "Straight-In" (Demonstration #2)

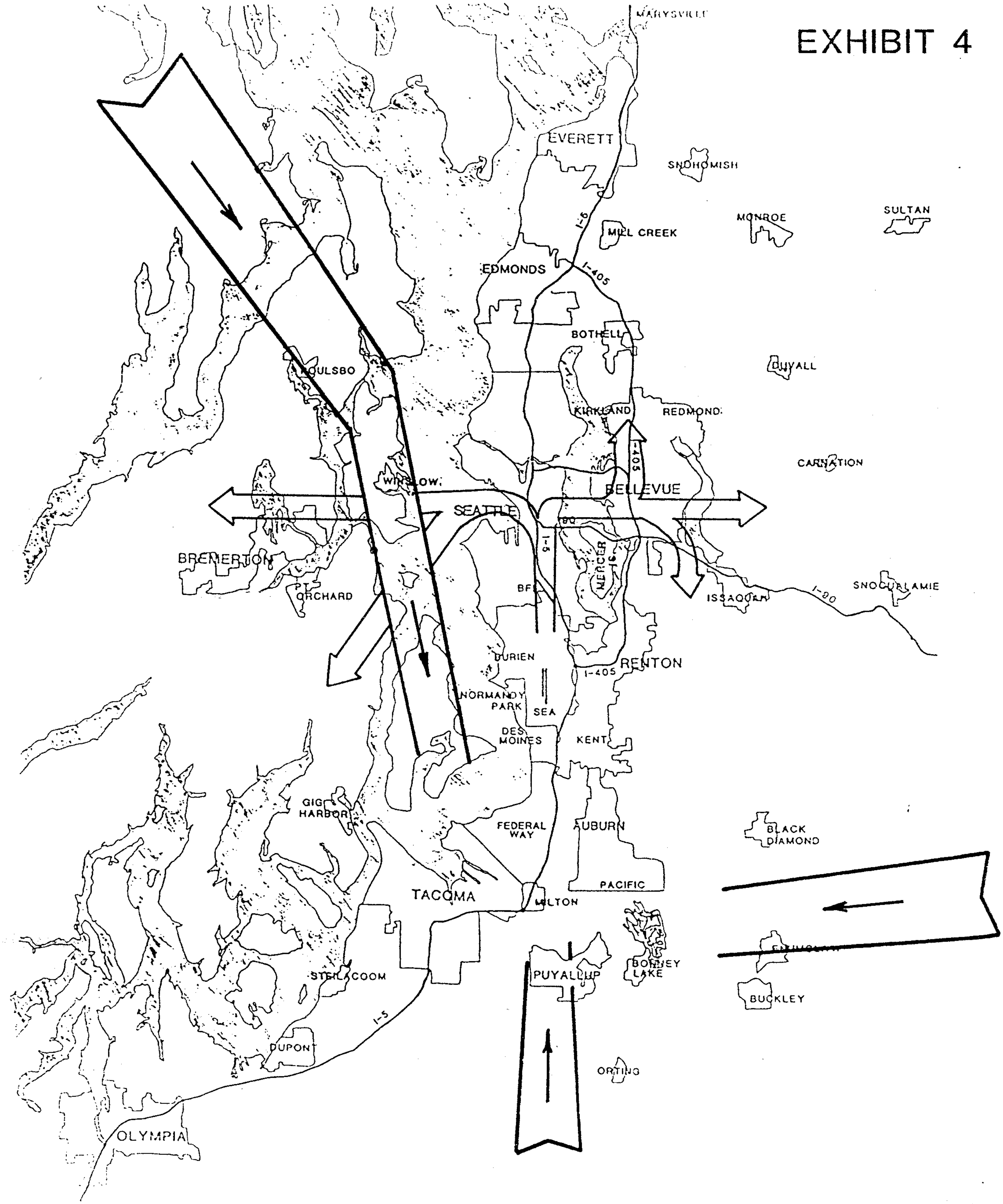
Leave all ARTCC and terminal routings as at present except:

In south flow (runway 16) situation, allow all turbojet aircraft which arrive from the east through the DUVAL gate to turn inbound on the runway 16 final approach course at the SEA 338/17, as is now allowed under certain conditions.

NORTH FLOW

RUNWAYS 34

EXHIBIT 4

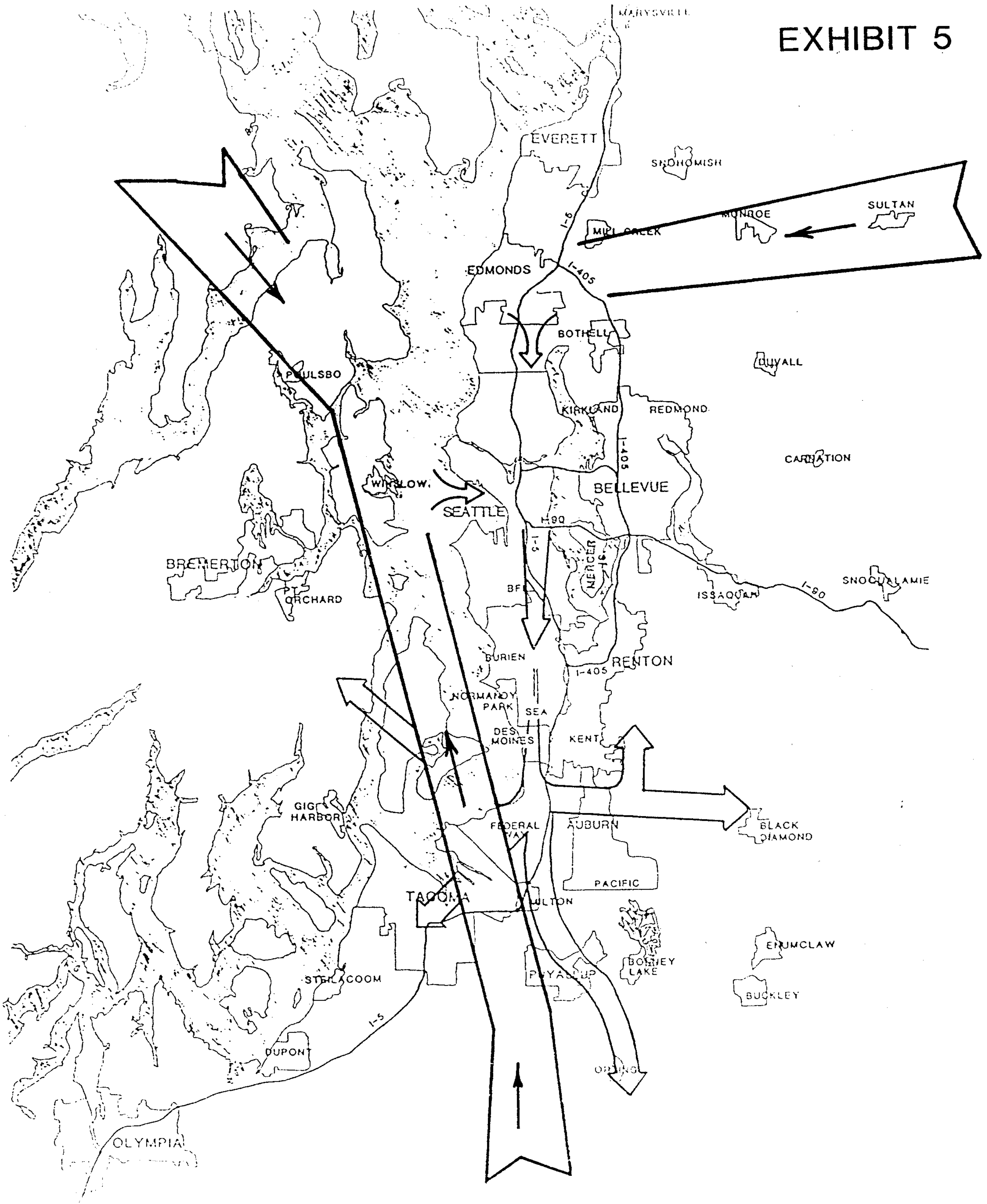


ALTERNATIVE F

SOUTH FLOW

RUNWAYS 16

EXHIBIT 5



ALTERNATIVE F

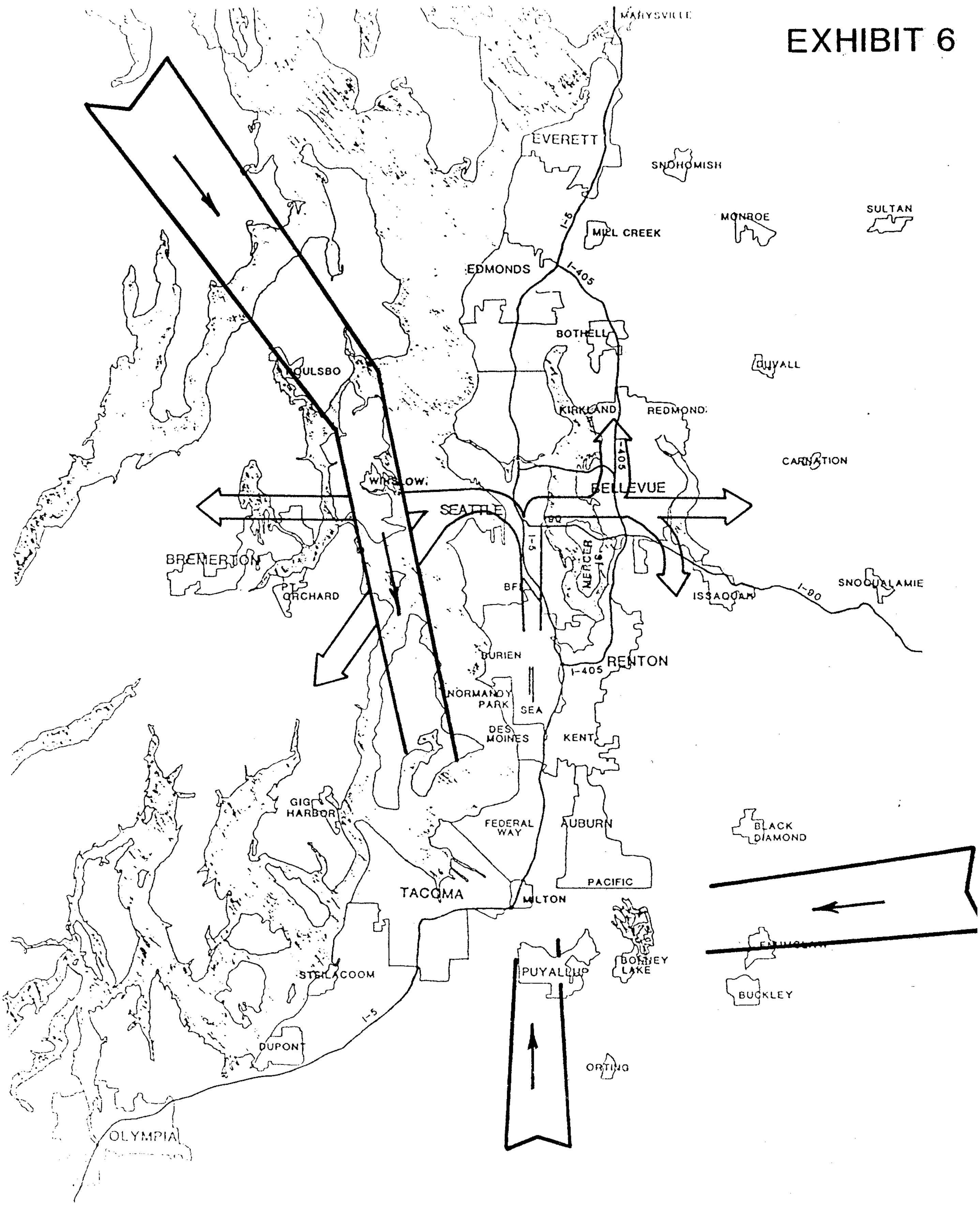
Alternative E "Flip-Flop" (Demonstration #12)

Seattle ARTCC arrival and departure routings would remain unchanged; Eastside gates would change from arrival to departure status with runway change at SEA-TAC.

Seattle TRACON would segregate arrival flows so that most turboprops and FAR 36 Stage III turbojets from the south pass east of the airport, and all FAR 36 Stage I and II turbojets pass west of the airport on downwind. In the south flow it would continue to use Elliott Bay Procedures from the west side of the airport and would keep turbojets high on the east downwind, turning to the base and final legs 17 miles or more north of the SEA VOR, as is presently required.

NORTH FLOW

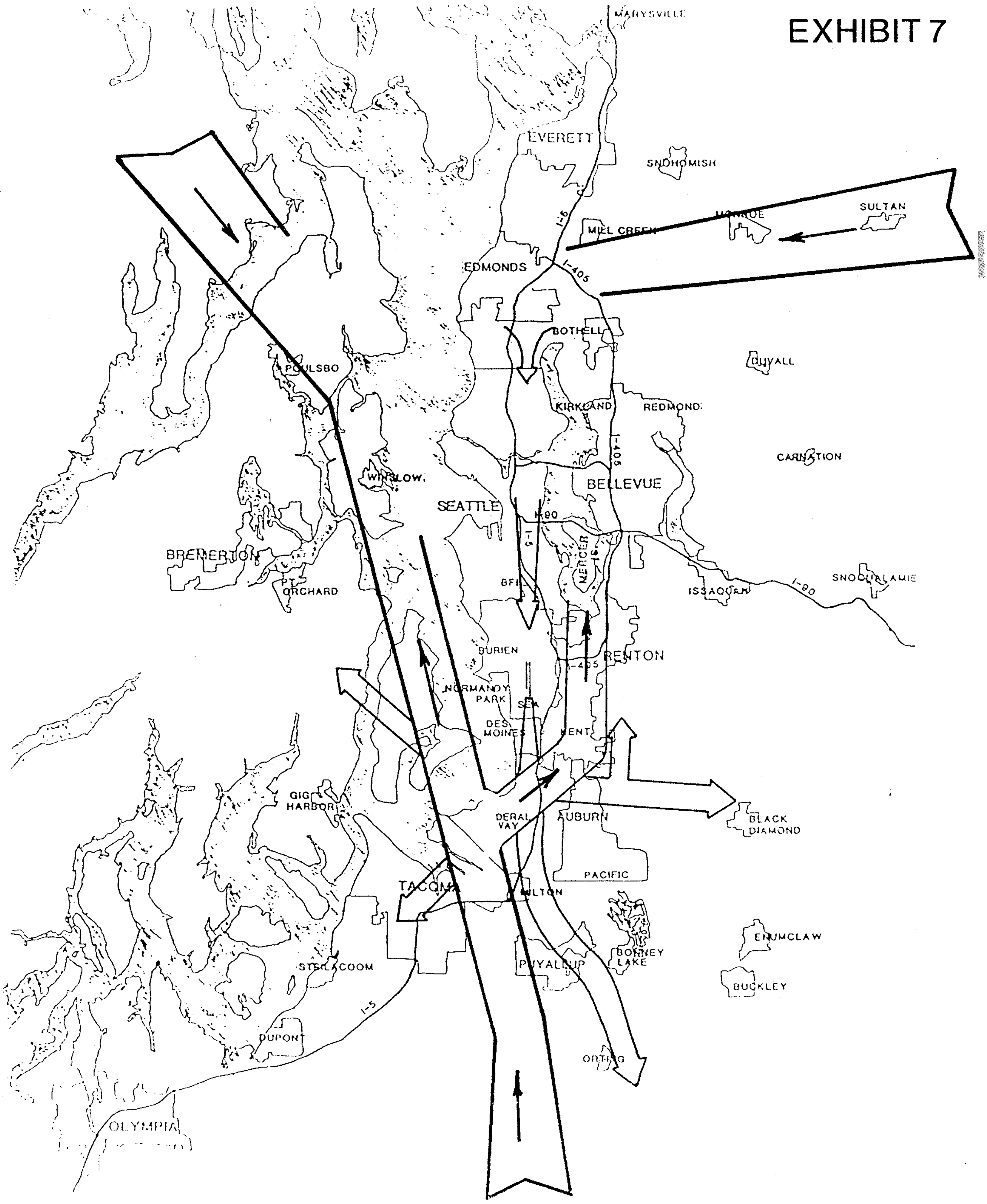
RUNWAYS 34



ALTERNATIVE E

SOUTH FLOW

RUNWAYS 16



ALTERNATIVE E

Alternative D "Far Downwind" (Demonstration #10)

Seattle ARTCC would make changes as summarized in Alternative A.

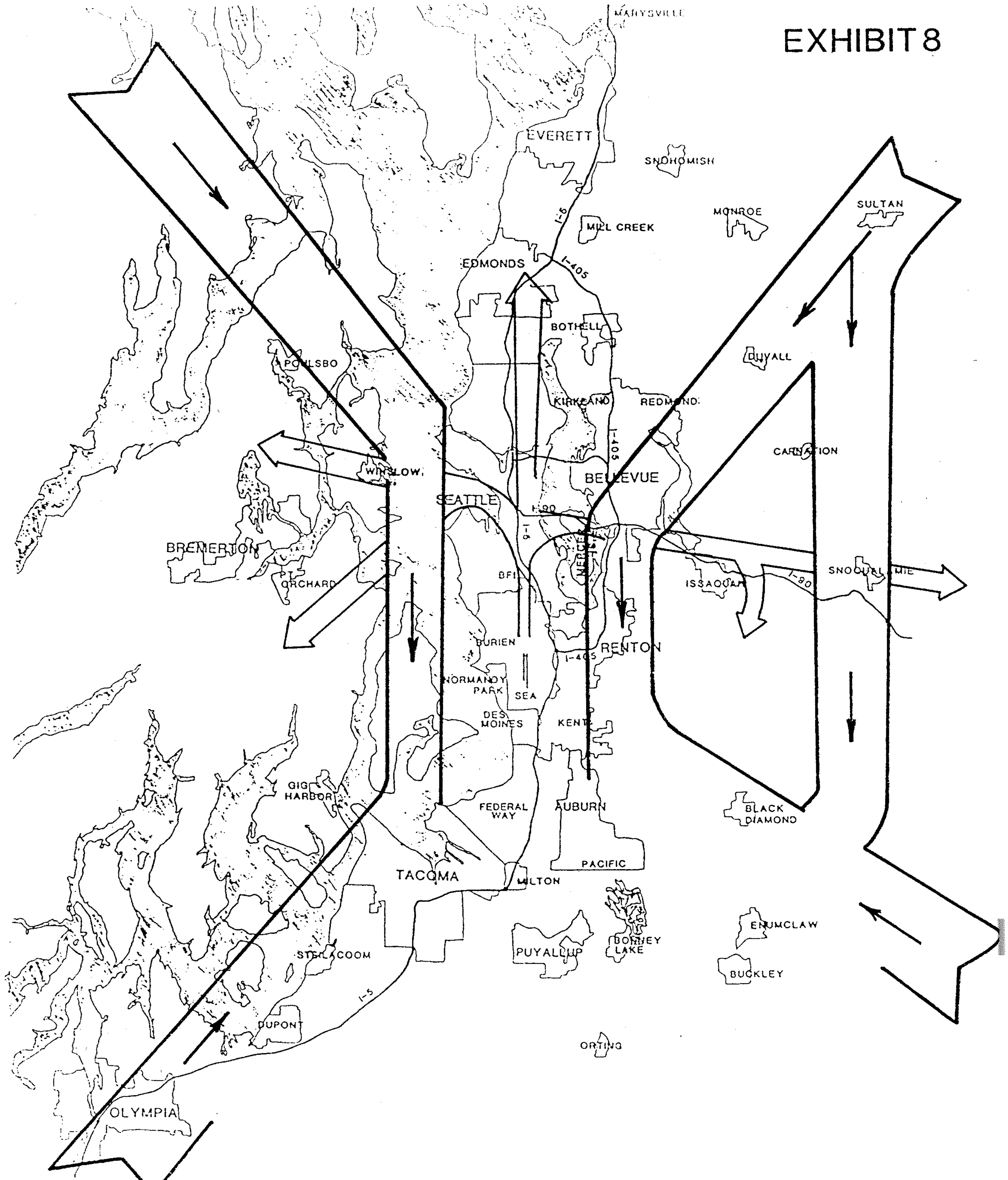
Seattle TRACON would make changes as summarized in Alternative A below, but route all east side turbojets downwind east of the populous area of King County and base leg approximately 17 miles north of the Seattle VOR.

Departing turbojet aircraft turn as needed leaving 3,000' AGL, and proceed via Paine, Tatoosh, or the Seattle 069, 227, 158, or 143 radials, as dictated by their destination.

NORTH FLOW

RUNWAYS 34

EXHIBIT 8

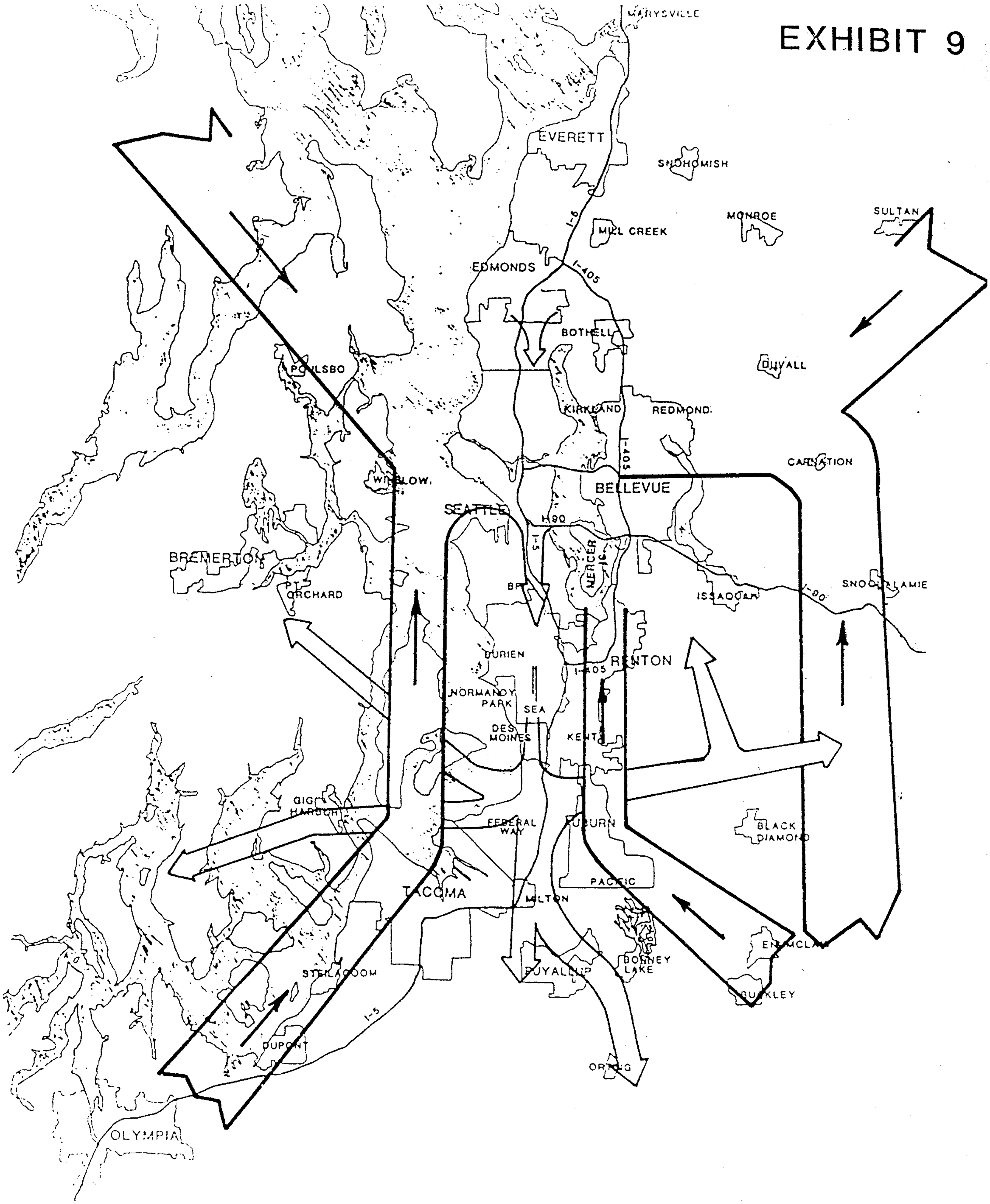


ALTERNATIVE D

SOUTH FLOW

RUNWAYS 16

EXHIBIT 9



ALTERNATIVE D

Alternative C "3-Downwind Option" (Demonstration #10)

Seattle ARTCC would make changes as summarized in Alternative A.

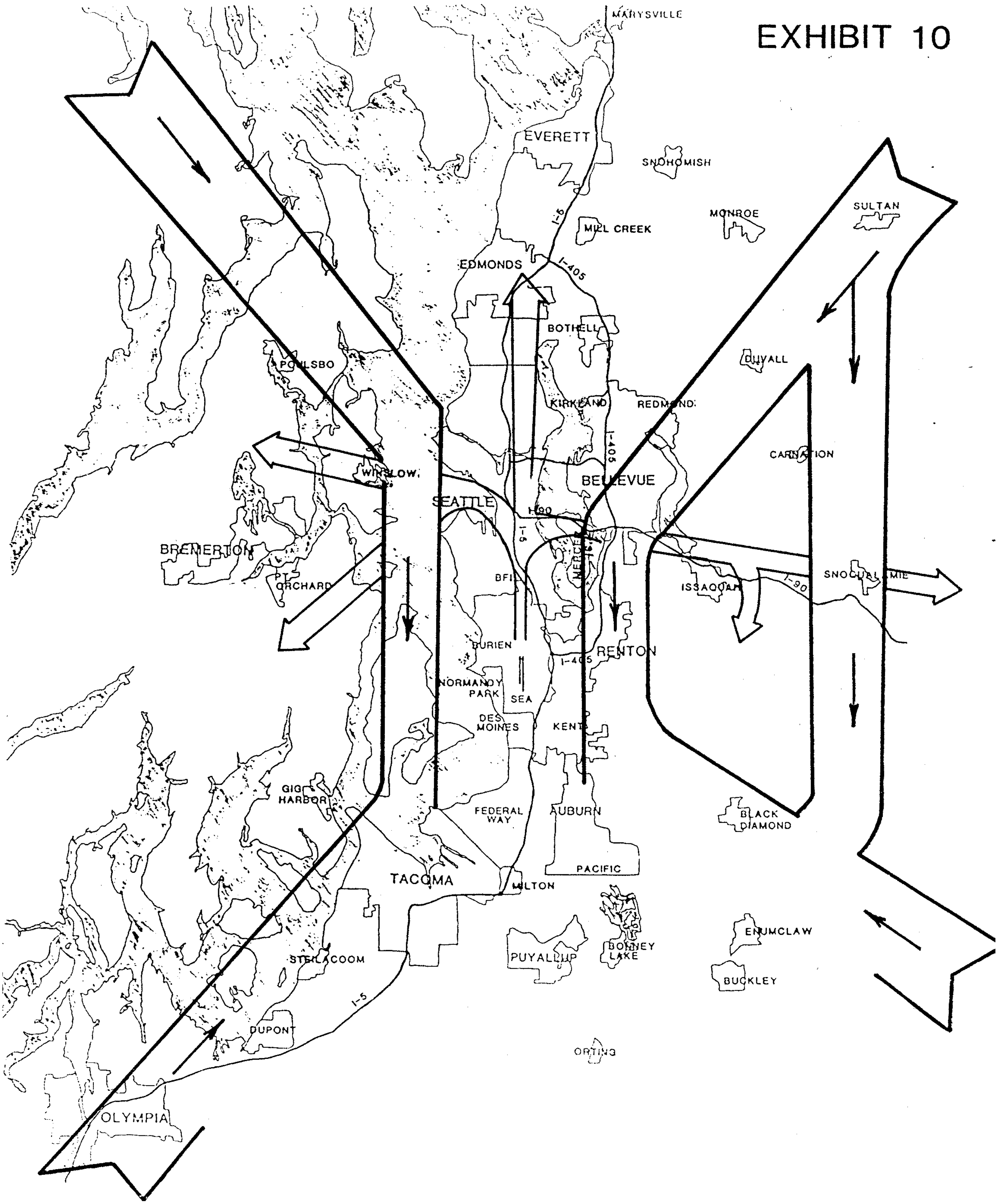
Seattle TRACON would make arrival changes as summarized in Alternative A below, but route all east side noisy jets (those not in compliance with FAR 36 Stage III standards) downwind east of the populous area of King County and base leg approximately 17 miles north of the Seattle VOR.

Departing turbojet aircraft would turn as needed leaving 3,000' AGL, and proceed via Paine, Tatoosh, or the Seattle 069, 227, 158, or 143 radials, as dictated by their destination.

NORTH FLOW

RUNWAYS 34

EXHIBIT 10

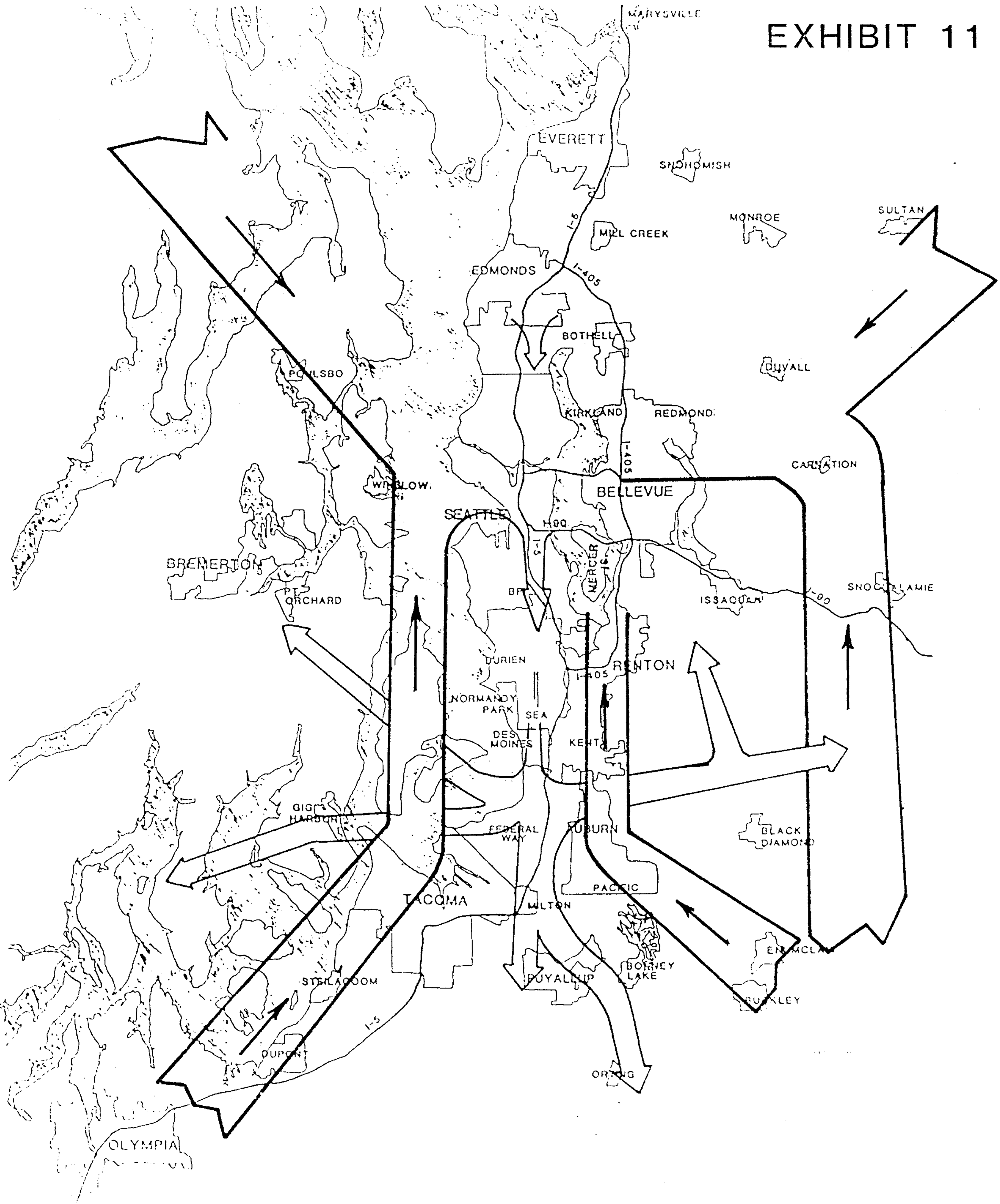


ALTERNATIVE C

SOUTH FLOW

RUNWAYS 16

EXHIBIT 11



ALTERNATIVE C

Alternative B "Modified Price Alternative" (Demonstration #3)

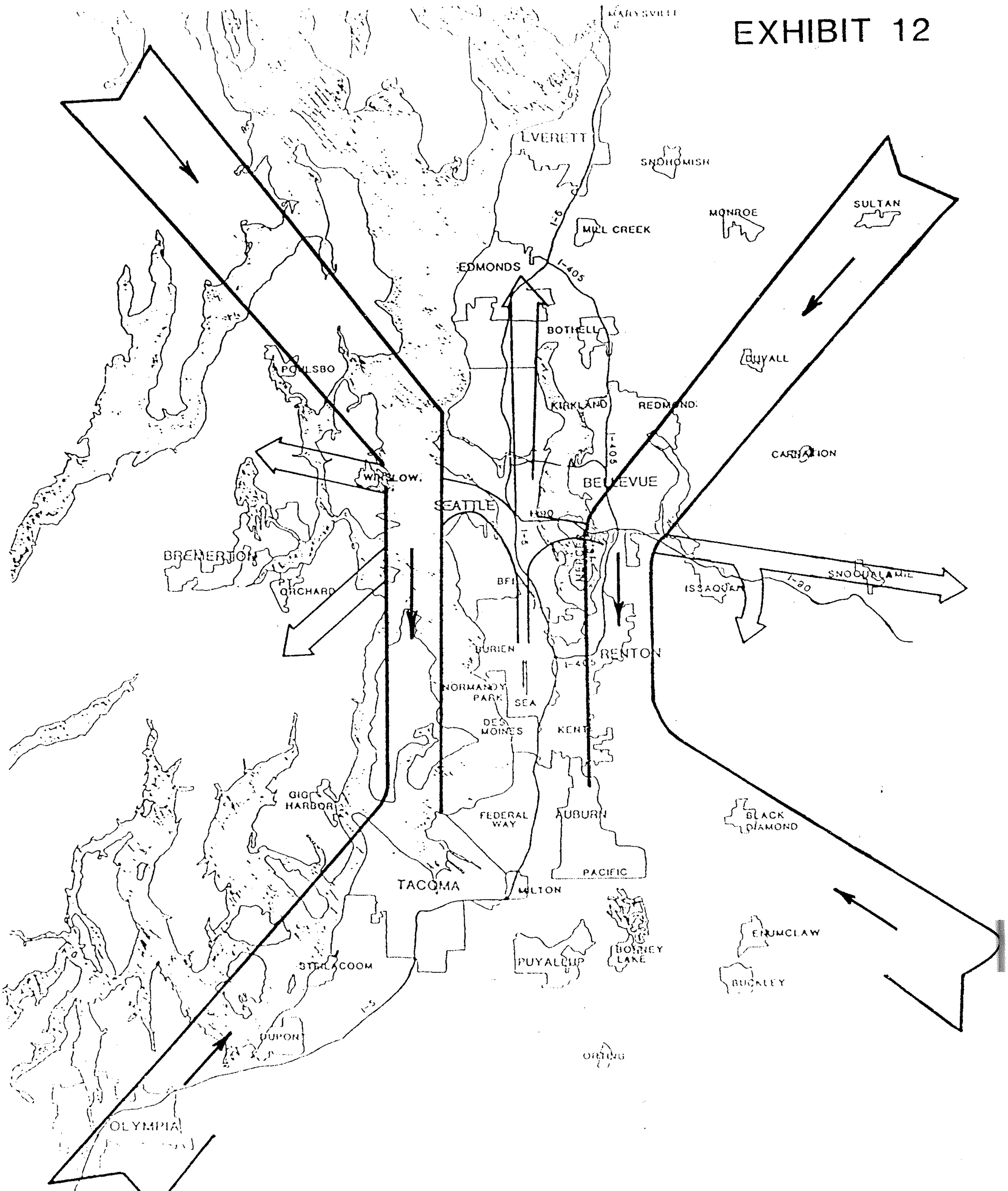
Seattle ARTCC would make changes as summarized in Alternative A.

Seattle TRACON would make arrival changes as summarized in Alternative A, except in the south flow where it would continue to use Elliott Bay Procedures from the west side of the airport and keeps turbojets high on the east downwind, turning to the base and final legs 17 miles or more north of the SEA VOR, as is presently required.

Departing turbojet aircraft would turn as needed leaving 3,000' AGL, and proceed via Paine, Tatoosh, or the Seattle 069, 227, 158, or 143 radials, as dictated by their destination.

NORTH FLOW

RUNWAYS 34

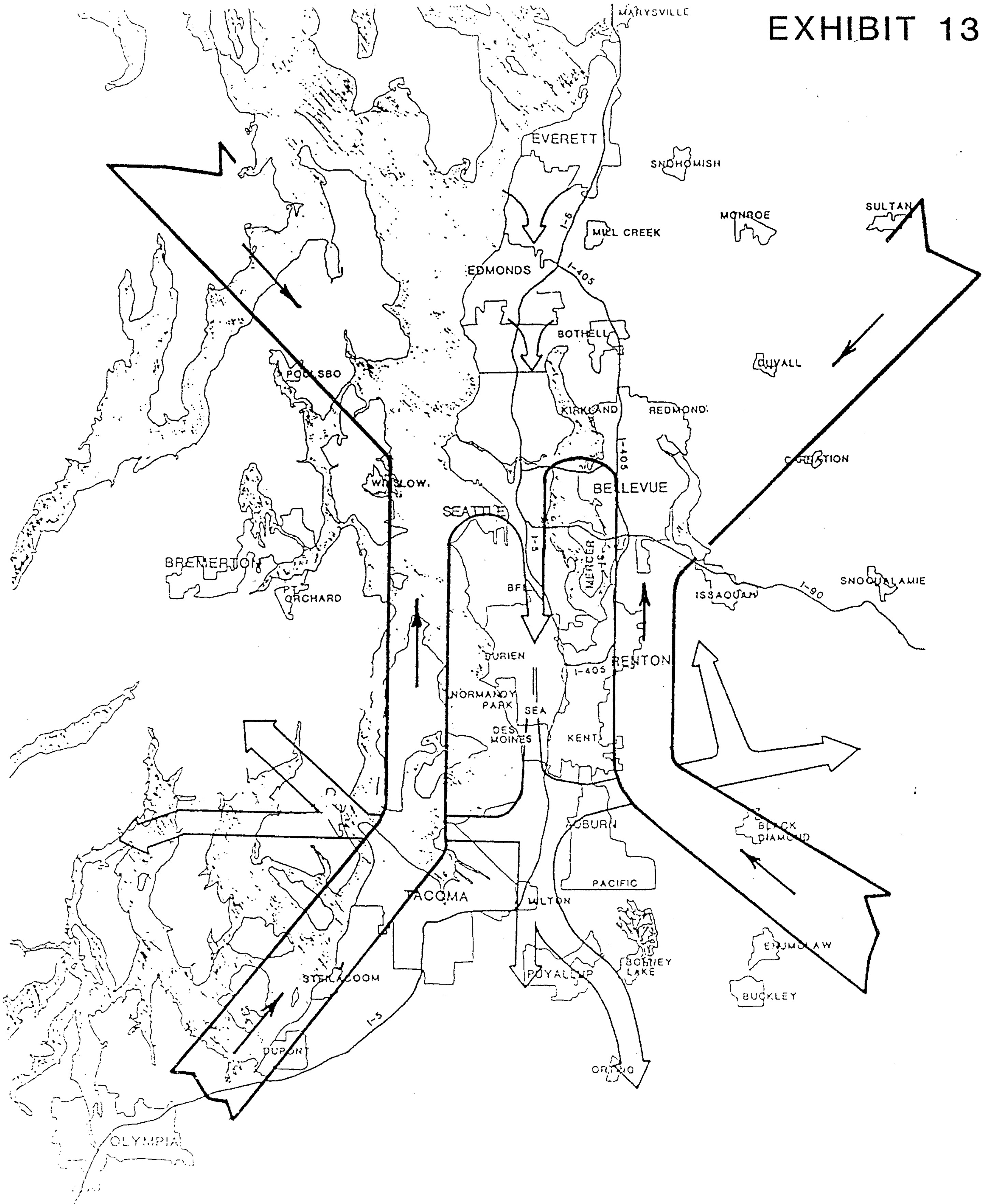


ALTERNATIVE B

SOUTH FLOW

RUNWAYS 16

EXHIBIT 13



ALTERNATIVE B

Alternative A -- The Preferred Alternative (Demonstration #3)

Establishment of the Preferred Alternative would require the following implementing directives:

TECHNICAL DESCRIPTIONS OF ROUTES:

1. Seattle ARTCC shall make route and sector changes needed to eliminate high altitude crossings east of Ephrata, Washington, effecting Seattle arrivals and departures. As a minimum, these changes shall include:

a. Turbojet Arrival Flows: Fixed non-runway sensitive arrival flows will be over the Olympia VORTAC, the JAKSN Intersection (Seattle VORTAC 020 radial/35-mile DME fix), the RADDY Intersection (Seattle VORTAC 101 radial/39-mile DME fix), and JAWBN Intersection (Seattle VORTAC 307 radial/42-mile DME fix).

b. Turbojet Departure Flows: Fixed non-runway sensitive departure flows will be over the Paine VOR, the Tatoosh VORTAC, and along the Seattle VORTAC 069, 143, 158 and 227 radials.

2. Seattle ATCT shall establish turbojet departure flows to join Seattle ARTCC departure flows over the Paine VOR, the Tatoosh VORTAC, and along the Seattle VORTAC 069, 143, 158, and 227 radials. Departure procedures would include, as a minimum:

a. SOUTH FLOW: Traffic permitting, Turbojet aircraft departing Runways 16, shall not be turned (radar vectored) until the aircraft is at or above 3,000 feet MSL and is at least 5 nautical miles south of the airport.

b. NORTH FLOW: Traffic permitting:

1). Turbojet aircraft departing runway 34 and making a right turn east or southeast bound shall be turned off the initial departure course, only after the aircraft is at or above 4,000 feet MSL and has reached the Seattle VORTAC 8-mile DME arc.

2). Maximize use of the Duwamish Industrial Corridor for noise mitigation by assuring that turbojet aircraft departing runway 34 and making a left turn northwest or southwest bound be turned off the initial departure course at Boeing Field/King County Airport and radar vectored over Elliott Bay to join the appropriate departure route.

3). Retain the provisions of Seattle TRACON Order 7200.1 Chapter 2, Section 6, para. c (1) and (2), which describe the rerouting of eastbound departures through Elliott Bay during those late night hours when traffic is light enough to permit safe use.

3. Seattle ATCT shall implement arrival flows in accordance with procedures defined in Seattle Tower Airspace Study "Seattle Arrival and Departures Routes; Simulation, Analysis, Recommendations", under Alternative A (page 43). Turbojet Arrival Flows would be from over the Olympia VORTAC, the JAKSN Intersection (Seattle VORTAC 020 radial/35-mile DME fix), the RADDY Intersection (Seattle VORTAC 101 radial/39-mile DME fix), and the JAWBN Intersection (Seattle VORTAC 307 radial/42-mile DME fix). At a minimum, arrival procedures will include:

a. North and South Flows:

1). For the purpose of noise mitigation, arriving aircraft will be kept as high as possible consistent with optimum descent profiles and operational dictates.

2). To the extent possible, arriving turboprop aircraft will follow the same approximate flight tracks as turbojet aircraft, to reduce adverse noise effects of random routing at low altitudes.

b. South Flow:

1). During south flow visual approach conditions, when there is no conflicting traffic, turbojet arrivals from the Northwest and Southwest arrival fixes will be placed on a right-base leg over Elliott Bay to reduce adverse noise effects on Westside neighborhoods and assure maximum use of the Duwamish River industrial corridor.

2). During south flow operations, turbojet arrivals from the Northeast and Southeast arrival fixes will be positioned so as to be established on the Runway 16 final approach course, no closer to the airport than State Route 520 (11.0 nautical miles north) and no lower than 5,000 feet MSL, to assure a stabilized, low-power approach and minimize flight at low altitude.

3). Traffic permitting, turbojet aircraft on the "Long Leg" tracks, will be turned to a downwind leg at the Seattle VORTAC 101 radial/8-mile DME fix or the 10-mile DME fix on a direct course from the Olympia VORTAC to the Seattle VORTAC, at or above 11,000 feet MSL, as appropriate.

c. North Flow: Traffic permitting, turbojet aircraft on the "Long Leg" tracks, will be turned to a downwind leg at the Seattle VORTAC 020 radial/10-mile DME fix or the Seattle

VORTAC 307 radial/12-mile DME fix, at or above 11,000 feet MSL, as appropriate.

COLLOQUIAL DESCRIPTION OF ROUTES:

Arrival routes would bring arriving aircraft over points approximately 40 miles northeast, southeast, southwest, and northwest of the Sea-Tac Airport. Aircraft would cross those points and proceed as listed below for each of the routes and each direction of landing:

LAND NORTH (RUNWAYS 34L/R)

Arriving turbojet aircraft from points of origin to the south (Portland, San Francisco, Los Angeles, etc.) will be placed in a single stream prior to Olympia. These aircraft will cross Olympia at 12,000', then continue on a single track until north of the Nisqually Delta. They will then be spread across a variety of tracks depending upon the number of aircraft merging from the other three directions at any particular time. The most northerly and direct of these routes will proceed across Lakewood, downtown Tacoma, and Federal Way, joining the Runway 34 final approach course in vicinity of the Sea-Tac Mall, at or above 3,000 feet, then continue final descent to the airport. In periods of high traffic loading, the most southerly track will depart the Fort Lewis area on an easterly heading to join the Runway 34 final approach course in the vicinity of Graham, at or above 5,000', then proceed direct to the airport, passing over Puyallup, Milton and Federal Way.

Arriving turbojet aircraft from Alaska, British Columbia and the Orient will be placed in a single stream prior to a point just west of Port Townsend, at an altitude between 16,000' and 12,000'. They will pass the Hood Canal Bridge, the north end of Bainbridge Island and turn to a southerly heading down Puget Sound, passing between West Point and Winslow, at an altitude of 10,000'. At the north end of Vashon Island, the aircraft will leave 10,000', descending to 3,000'. At the south end of Vashon Island, they will turn to an easterly heading to merge with the stream of aircraft coming from the southwest arrival leg (para. above) and turn to the final approach course in the vicinity of the Sea-Tac Mall, at or above 3,000' then continue final descent to the airport.

Turbojet aircraft from points of origin in the east (Spokane, Minneapolis, Chicago, New York, etc.) will be placed into a single stream prior to a point in the Gold Bar-Sultan area of the Skykomish Valley between 16,000' and 12,000'. They will proceed over Sahalee to Bellevue, at or above 10,000' where they will turn to a southerly heading. Approximately at the north end of Renton, the aircraft will leave 10,000'. They will cross the East Hill of Kent, reaching an altitude of

5,000' in the vicinity of Green River Community College, then turning westbound across Kent to join the final approach course in the vicinity of the Sea-Tac Mall at or above 3,000', then continue final descent to the airport.

Turbojet aircraft arriving from points of origin to the southeast (Denver, Salt Lake, Dallas, Atlanta, etc.) will be placed in a single stream prior to a point just north of the Crystal Mountain Ski Area, crossing that point at 12,000', begin descent, and proceed inbound to approximately 5 miles east of Enumclaw. At that point they will be assigned one of several tracks, depending on the number of arriving aircraft coming from the other three directions. The most direct and frequently used of these tracks will proceed just north of Enumclaw, Lake Tapps, and across Auburn, descending to intercept the final approach course in the vicinity of the Sea-Tac Mall at or above 3,000', then continuing final descent to the airport. In periods of heavy traffic, aircraft will be spread across other tracks. The most southerly of these will pass south of Enumclaw and Buckley, intercepting the Runway 34 final approach course in the vicinity of the town of Graham, at or above 5,000', then continue the final descent across Puyallup, Milton and Federal Way to the airport.

LAND SOUTH (RUNWAYS 16L/R)

Arriving turbojet aircraft from points of origin to the south (Portland, San Francisco, Los Angeles, etc.) will be placed in a single stream prior to Olympia. These aircraft will cross Olympia between 16,000' and 12,000'. They will proceed via Steilacoom to the Ruston area of Tacoma where they will take up a heading of approximately 340 degrees magnetic. The aircraft will cross the south end of Vashon Island at or above 10,000, then continue descending to 3,000' until reaching a point abeam Alki Point. Then they will turn right to enter Elliott Bay. These aircraft will meet all provisions of the Bay Visual Procedure which requires, among other things, that aircraft remain at 2,000' or above until reaching the Runway 16 final approach course, north of Boeing Field/King County Airport.

Arriving turbojet aircraft from Alaska, British Columbia and the Orient will be placed in a single stream prior to a point just west of Port Townsend, at an altitude between 16,000' and 12,000. They will pass Port Ludlow level at 12,000', then descend to 3,000', crossing the north end of Bainbridge Island. At approximately Rolling Bay they will turn to the east through Elliott Bay. These aircraft will meet all provisions of the existing Bay Visual Procedure which requires, among other things, that aircraft remain at 2,000' or above until reaching the Runway 16 final approach course, north of Boeing Field. Those aircraft which are not able to enter Elliott Bay due to traffic entering the Bay from the south will be required to cross the land areas north of the bay at an additional 1,000' of altitude for each three miles north they proceed, as is required by the present procedure.

Arriving turbojet aircraft from points of origin in the east (Spokane, Minneapolis, Chicago, New York, etc.) will be placed into a single stream prior to a point in the Gold Bar-Sultan area of the Skykomish Valley at 12,000', then begin descent. They will then be assigned to one of several tracks, depending upon the number of arriving aircraft which will eventually merge from the other three directions. The most southerly and frequently used of these tracks will proceed to the middle of Lake Sammamish, descending to 5,000' where it will merge with the stream of traffic coming from the southeast (para. below). These aircraft will then turn westbound, crossing Lake Washington at or above 5,000' to intercept the Runway 16 final approach course over the Portage Bay/University District at 5,000', thence continuing the final descent to the airport. In periods of heavy traffic, when the most direct track is not available, aircraft will be assigned others, the most northerly of which will proceed from Gold Bar to the vicinity of Everett at or above 7,000', intercepting the final approach course for Runway 16 prior to continuing its final descent.

Turbojet aircraft arriving from points of origin to the southeast (Denver, Salt Lake, Dallas, Atlanta, etc.) will be placed in a single stream prior to a point just north of the Crystal Mountain Ski Area, crossing that point between 16,000' and 12,000'. They will proceed northwesterly until reaching the East Hill area of Kent, where they will turn north, passing over Lake Youngs at 10,000', then descending to 5,000' while continuing north across Bellevue to the south end of Kirkland, just north of State Highway 520, where they will turn westbound, crossing Lake Washington at or above 5,000, to intercept the Runway 16 final approach course over Portage Bay/University District at 5,000', thence continuing the final descent to the airport.

Establish departure routes from the Sea-Tac Airport as listed below for each direction of takeoff and area of destination:

TAKEOFF NORTH (RUNWAYS 34L/R)

Turbojet aircraft enroute to destinations to the east (Spokane, Minneapolis, New York, Washington, D.C., etc.) will proceed to the Rainier Valley/Mount Baker areas at an altitude of 4,000' or above then turn to an easterly heading, which will take them over Medina and central Bellevue, climbing to 9,000'. When clear of the overlying arrival track, (approximately the east shore of Lake Sammamish), the aircraft will continue there climb to 15,000', and will turn more directly toward their destinations, passing between Highway I-90 and the Tolt Reservoir and climb to their intended cruising altitude. As a result of public comments received on the proposed procedures, the FAA has decided to revise its Preferred Alternative as follows:

> <u>During those late night hours when traffic is light enough to permit:</u> Turbojet aircraft climbing to 15,000' will proceed to the Boeing Field area and when leaving 2,000', will turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft will then turn west, then north, remaining over Elliott Bay until leaving at least 8,000', and passing west of Bitter Lake. After passing that point, aircraft will turn to an easterly heading and proceed to their intended destinations.

<u>Turbojet aircraft enroute to destinations to the southeast and Los Angeles</u> (Denver, Dallas, Atlanta, Orange County, etc.) will proceed to the Rainier Valley/Mount Baker area at an altitude of 4,000' or above then turn to an easterly heading, which will take them over Medina and central Bellevue, climbing to 9000'. When clear of the overlying arrival track, (approximately the east shore of Lake Sammamish), the aircraft will continue its climb to 15,000' and turn to a southerly heading, passing over Issaquah near Maple Valley, and proceeding to the area of Lake Tapps. Aircraft will then turn southeasterly toward Baker or Lakeview, Oregon while climbing to their intended cruising altitude. In addition, the FAA has decided to adopt the following revision to the Preferred Alternative in response to public comment on the proposed procedures:

> <u>During those late night hours when traffic is light enough to permit:</u> Turbojet aircraft climbing to 15,000' will proceed to the Boeing Field area and when leaving 2,000', will turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft will then turn left to a southerly heading, remaining over Puget Sound until leaving 8,000' and passing a point south of Fauntleroy Terminal, when they will turn to a southeasterly heading and proceed toward their destinations.

<u>Turbojet aircraft enroute to Portland, Oregon</u> will proceed to the Boeing Field area and when leaving 2,000' (3,000' when traffic is also departing Boeing), turn left roughly parallel to the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft will turn left to a southwesterly heading, maintaining 9,000'. When clear of the overlying southbound arrival stream in the area of Port Orchard they will turn to the south-southwest and climb to 15,000'. In the vicinity of Gig Harbor, these aircraft will climb to their planned enroute altitude.

Turbojet aircraft destined for points in Northern California and the Hawaiian Islands will proceed to the Boeing Field area and when leaving 2,000' (3,000' when traffic is also departing Boeing), turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft will turn left to a southwesterly heading, maintaining 9,000' until clear of the overlying southbound arrival stream in the area of Port Orchard where they will climb to 15,000'. In the vicinity of Shelton, these aircraft will continue climb to their planned enroute altitude and proceed toward their destinations.

Turbojet aircraft destined for points in Alaska and the Orient will proceed to the Boeing Field area and when leaving 2,000' (3,000' if traffic is also departing Boeing), turn left to roughly parallel the Duwamish River, proceeding to the southeast corner of Elliott Bay; aircraft will turn left to a westerly heading, maintaining 9,000' until clear of the overlying southbound arrival stream in the vicinity of Winslow where they will climb to 15,000'. In the vicinity of Bangor, these aircraft will turn toward Neah Bay and climb to their planned enroute altitude.

Turbojet aircraft destined for points north (Bellingham, Vancouver, London, etc.) will proceed straight out from the airport (338 degrees magnetic), climbing unrestricted to 15,000. They will pass over Boeing Field, Capital Hill, Northgate, and Edmonds. In the vicinity of Everett, they will climb to their planned enroute altitude and proceed to toward their destinations.

TAKEOFF SOUTH (RUNWAYS 16L/R)

Turbojet aircraft enroute to destinations to the north (Vancouver, London, Amsterdam, etc.) will proceed to the Midway area, at least 5 miles south of the airport and an altitude of 3,000' prior to turning left to a northeasterly heading. These aircraft will overfly Auburn climbing to 9,000', when clear of the overlying stream of northbound arriving aircraft, in the vicinity of Black Diamond, these aircraft will climb to 15,000' and turn to the north. In the Preston/Fall City area they will climb to their planned enroute altitude.

Turbojet aircraft enroute to destinations in the east (Minneapolis, Chicago, New York) will proceed to the Midway area, at least 5 miles south of the airport and an altitude of 3,000' prior to turning left to a northeasterly heading. These aircraft will overfly Auburn climbing to 9,000'. When clear of the overlying stream of northbound arriving aircraft, in the vicinity of Black Diamond, these aircraft will climb to 15,000', and turn toward their destinations, passing south of North Bend and just north of Snoqualmie Pass while climbing to their planned enroute altitude.

Turbojet aircraft enroute to destinations to the Southeast and Los Angeles (Atlanta, Dallas, Denver, Reno, Orange County, etc.) will proceed south over Midway and Federal Way, climbing unrestricted to 15,000'. In the vicinity of Milton, the aircraft will turn to a southeasterly heading, passing over Sumner and Orting and just west of Mount Rainier in the area of Lake Kapowsin, the aircraft will climb to their planned enroute altitude.

Aircraft enroute to Portland, Oregon will proceed straight out from Runway 16, passing over Midway, Federal Way, Puyallup, climbing unrestricted to 15,000', or planned altitude (if that is lower). In the vicinity of Eatonville, they will climb to their planned enroute altitude (if that is above 15,000').

Turbojet aircraft proceeding to points in Northern California and the Hawaiian Islands will proceed to a point at least 5 miles south of the airport and 3,000', then turn to a southwesterly heading, passing over Federal Way, Twin Lakes, Dash Point, climbing to 9,000'. When clear of the overlying stream of arriving aircraft, in the vicinity of Gig Harbor, the aircraft will climb to 15,000'. In the vicinity of Shelton, they will turn to the south, toward their destinations and climb to their intended cruising altitudes.

Turbojet aircraft proceeding to Alaska and the Orient will proceed to a point five miles south of the airport and 3,000', then turn to a southwesterly heading, crossing Twin Lakes and Dash Point, climbing to 9,000'. When clear of the overlying stream of arriving aircraft, in the vicinity of Gig Harbor, the aircraft will climb to 15,000' and turn northwesterly toward Neah Bay. In the vicinity of Hood Canal, the aircraft will climb to their intended cruising altitude.

The Preferred Alternative is the only one of the options which offers all of the following advantages :

a. Capacity is symmetrical: arrival rate in optimal weather remains approximately 56 to 60 irrespective of direction of landing.

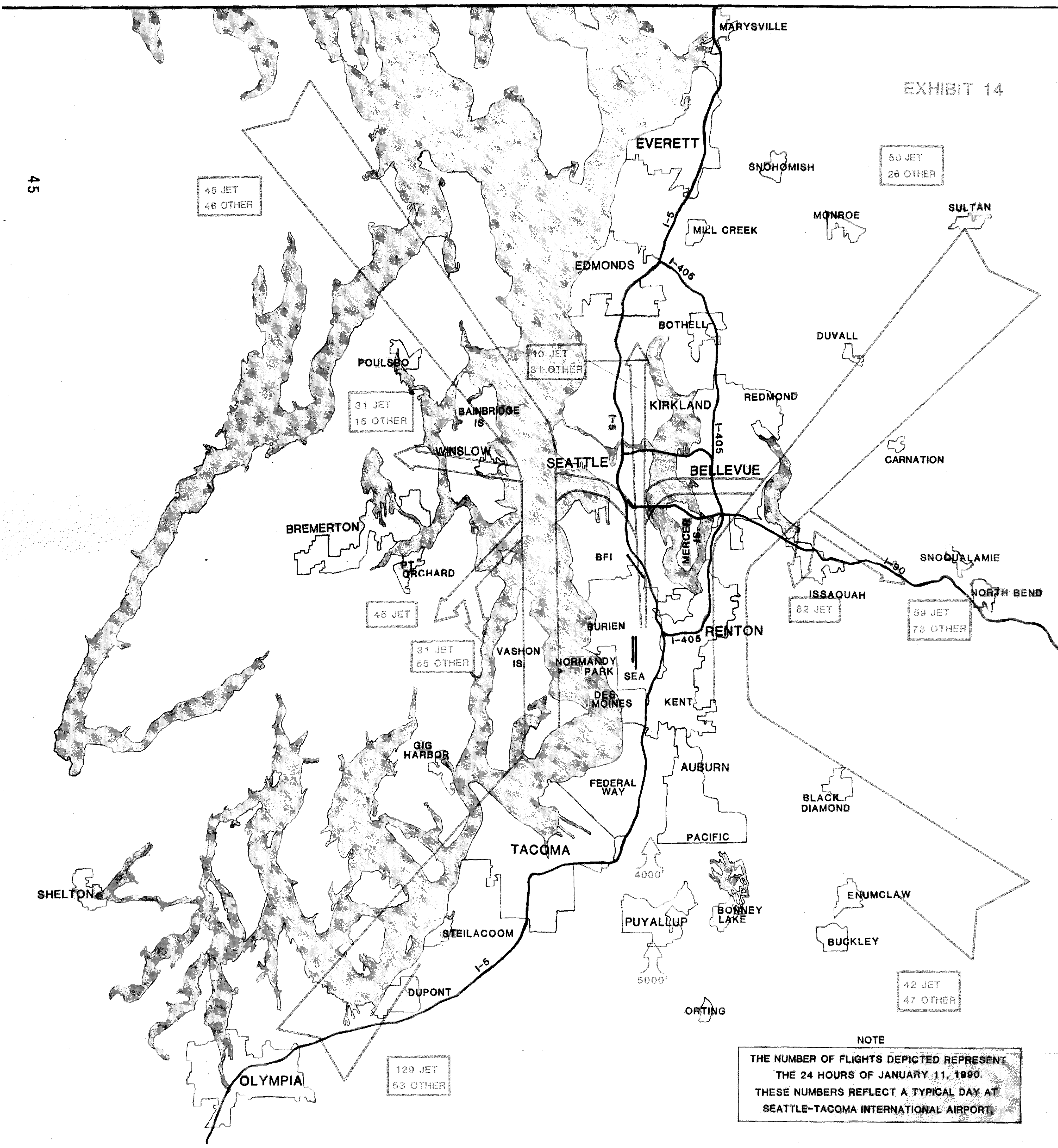
b. Arrival flows are carried on downwind legs on either side of the airport, permitting filling of every arrival opportunity or "slot" with an aircraft.

c. Workload can be balanced between the two arrival feeder controllers, enhancing safety and efficiency.

d. In periods of light and moderate demand, most turbojets should be able to make quiet, low-thrust descent until reaching the final approach course. While the simulation does not provide empirical data with regard to noise levels at any location, the observed ground tracks and altitudes were consistent with a "keep-them-high" noise mitigation strategy.

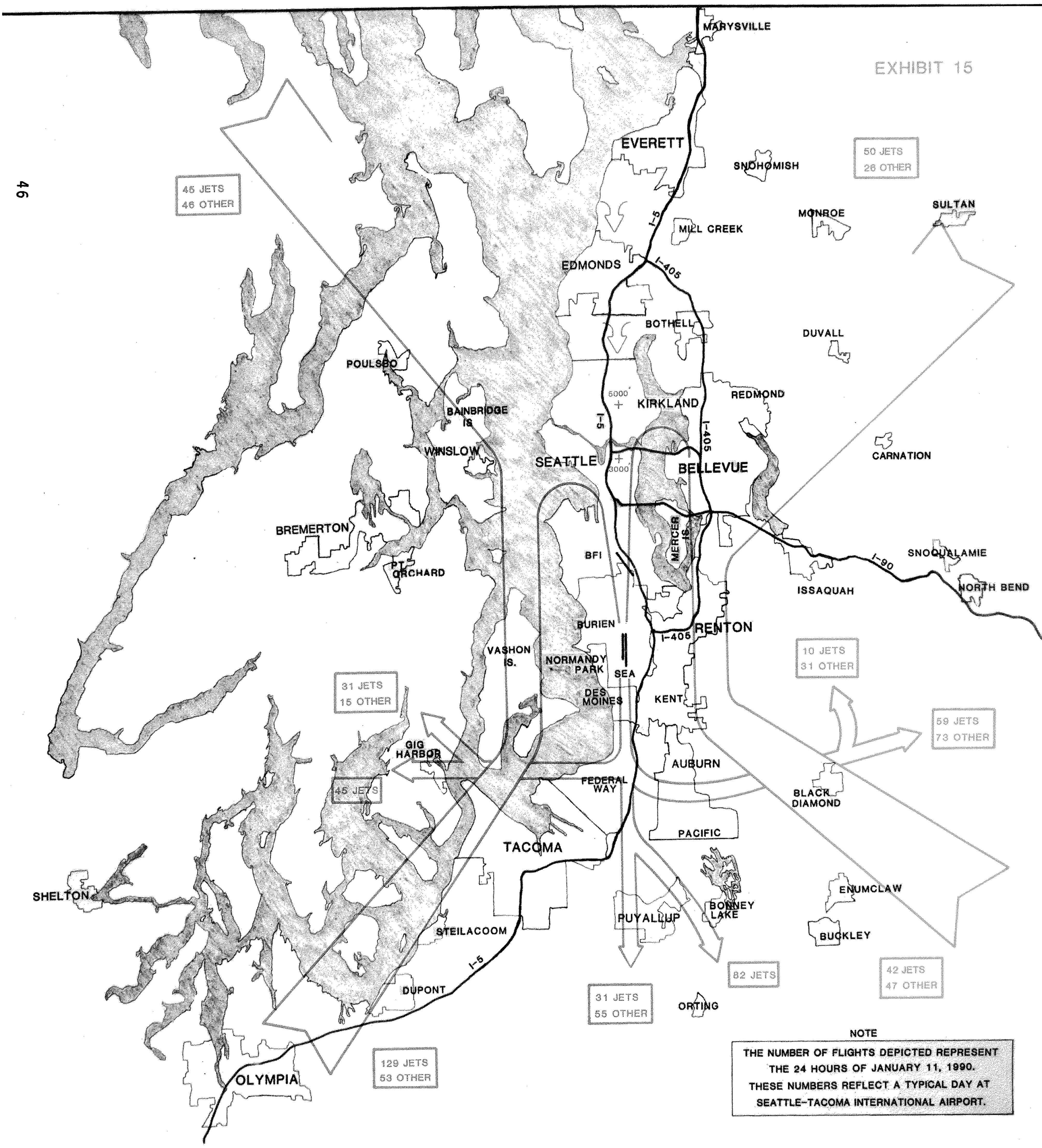
e. This configuration will provide the needed changes in the Seattle ARTCC by stabilizing the route structure at the ARTCC/TRACON boundary, and enhancing the efficiency of arrival metering. It will also reduce exposure to the awkward high altitude crossing of Seattle departure and arrival flows, and facilitate integration of Seattle routes into the national Preferred Route System. (See Exhibit 16.)

NORTH FLOW
RUNWAY 34

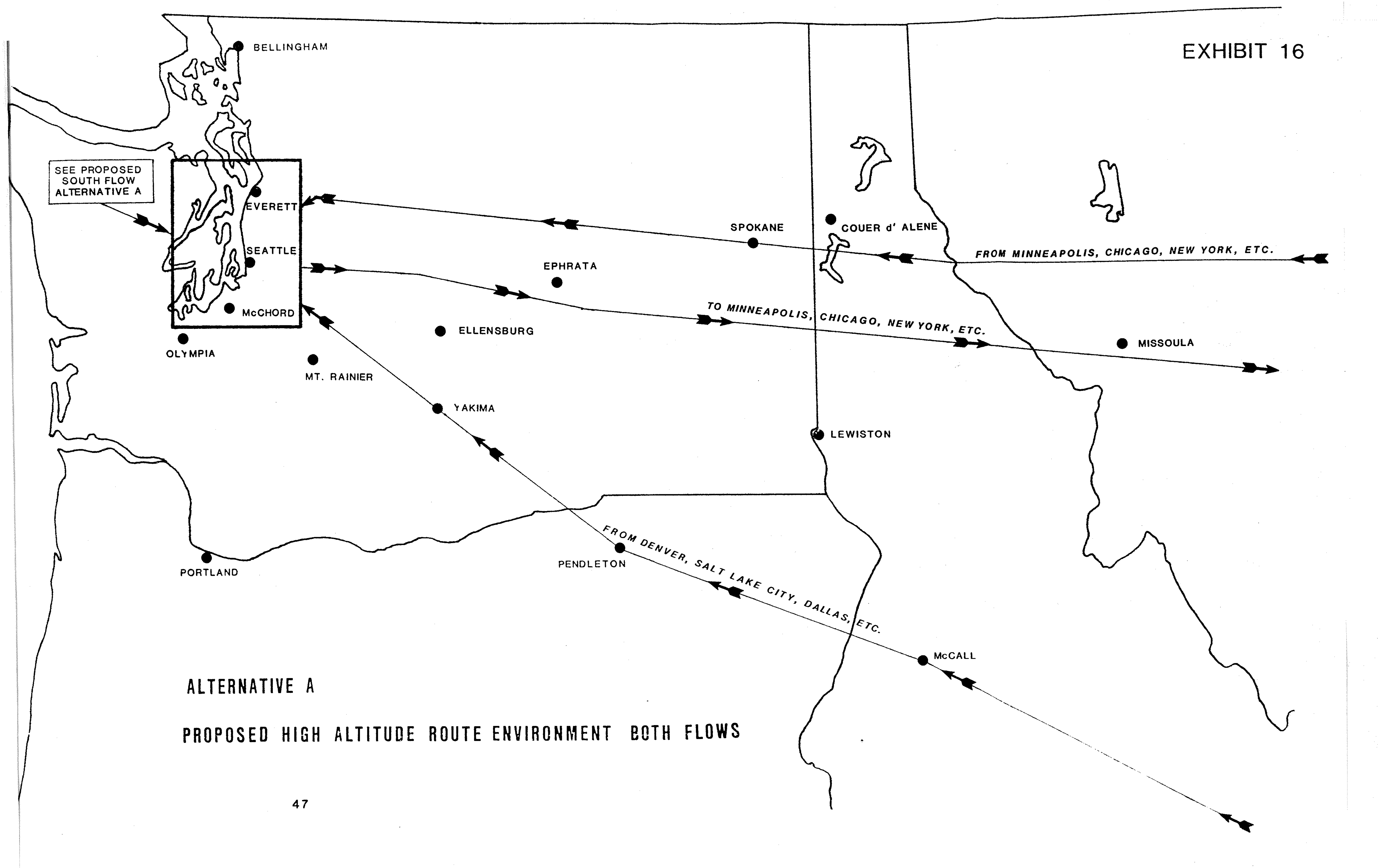


ALTERNATIVE A

SOUTH FLOW
RUNWAY 16



ALTERNATIVE A



ALTERNATIVE A

PROPOSED HIGH ALTITUDE ROUTE ENVIRONMENT BOTH FLOWS

III. Affected Environment

The environment potentially affected by the present and proposed air traffic routings to and from the Seattle-Tacoma International Airport encompasses the entire Puget Sound Basin. The proposed air traffic changes would establish new arrival routes over an area from Olympia to Dash Point (north of Tacoma) and from an area northeast of Duvall to Lake Sammamish (see Exhibits 20 and 22, respectively).

Comparison of Exhibits 19 (current north flow) and 20 (proposed north flow) and exhibits 21 (current south flow) and 22 (proposed south flow) illustrates the general differences between current and proposed air traffic routings.

IV. Environmental Consequences

This section of the environmental assessment presents anticipated environmental impacts associated with alternatives to the proposed action. The discussion to follow* is limited to the topics of noise, energy resources, and air quality. The remaining categories of environmental impacts identified in Attachment 2 to FAA Order 1050.1D were considered but are not specifically discussed below since implementation of the Preferred Alternative is not expected to create any such impacts.

NOISE

Introduction

The noise impacts of aircraft operations at Seattle-Tacoma International Airport in both north and south flow conditions have been assessed for the current and proposed operational scenarios. The standard Federal noise measurement methodology was used which is the Day-Night Sound Level DNL (a 24-hour cumulative measure of noise exposure).

The Day-Night Sound Level (DNL) was developed after years of research by numerous scientific groups as a single number measure of community noise exposure (Reference 5). The DNL and particularly DNL 65 has been adopted formally by the Department of Transportation, the Department of Defense, the Environmental Protection Agency, the Veterans Administration, and the Department of Housing and Urban Development as the metric for assessing the cumulative impact of various sources of noise (Reference 1). Federal Aviation Regulation (FAR) Part 150 Airport Noise Compatibility Planning (Reference 2) also requires the use of DNL and DNL 65 in assessing the noise impact caused by aircraft operations at airports and establishing the threshold level of significant noise impact.

DNL is the average noise level over a 24-hour period, except that noises occurring during night time (10:00 p.m. through 7:00 a.m.) are increased or penalized by 10 dB. This nighttime "weighting" is to account for the added sensitivity to noise during the nighttime hours.

FAR Part 150 also established a set of land use compatibility guidelines for determining the suitability of certain land uses within specific ranges of DNL. Exhibit 17 presents the land use/DNL relationship used in determining whether or not a land use is considered, by the FAA, as compatible with a nearby airport. Exhibit 17 indicates that all land uses in noise environments of DNL 65 or less are compatible with airport operations.

Environmental Impacts

No-Action Alternative

During the past year, the Port of Seattle has completed a re-evaluation of the noise exposure contours produced by the operation of Sea-Tac. That re-evaluation considered updated aviation forecasts, flight paths, and runway use distribution. The results of that re-evaluation were made known during numerous public meetings sponsored by the Port of Seattle regarding the assumptions and results of the study. Exhibit 18 presents the 1988 DNL 80, 75, 70, and 65 Noise Contours for the current operations at Sea-Tac.

The complete assumptions used to produce Exhibit 18 are contained in the 1989 Noise Exposure Map Documentation for Sea-Tac International Airport prepared for the Port of Seattle by Coffman Associates (Reference 3). The FAA Seattle Airports District Office has evaluated the assumptions used and believes them to be reasonable. The FAA therefore believes Exhibit 18 to be the best available data depicting the current (1988) noise exposure contours for Sea-Tac.

Selecting the No-Action alternative would result in continuation of the present environmental impacts shown in Exhibit 18.

Other Alternatives Evaluated

In addition to the No-Action and Preferred alternatives, five other alternatives were evaluated from an environmental perspective. In all cases, alternative arrival and departure route changes occurred beyond either the north or south ends of the existing 1988 DNL 65 noise exposure contour. Therefore, the DNL 65 and greater noise contours would not change.

Given that the DNL 65 and greater noise contours do not change, all locations outside of the DNL 65 contour remain compatible with the airport.

Preferred Alternative

For the proposed changes in north or south flow patterns to affect the noise contours presented in Exhibit 18, the changes would have to take place within the DNL 65 and greater contours since it is aircraft flight in this area that produces the noise depicted by the noise contours. Exhibit 18 presents noise contours using the current operational flows.

Proposed Action-North Flow

In a northerly direction, the DNL 65 contour (from Exhibit 18) ends approximately 6.25 miles north of the north end of the runways. Examining Exhibits 19 (present) and 20 (proposed) one can see that any change in the traffic pattern occurs north of the north end of the DNL 65 contour. Therefore the proposed changes north of the airport will not change the DNL 65 or greater contours.

In a southerly direction, the DNL 65 contour (from Exhibit 18) ends approximately 6.82 miles south of the south end of the runways. Comparing the nearest turns from base leg to final leg of the approach from the south in Exhibits 19 and 20, we see that the turns occur, in both cases, south of Federal Way and south of the south end of the DNL 65 contour. Therefore, the proposed changes south of the airport will not change the DNL 65 or greater contours.

Proposed Action-South Flow

In a southerly direction, the DNL 65 contour (from Exhibit 18) ends approximately 6.82 miles south of the south end of the runways. Examining Exhibits 21 (present) and 22 (proposed) we see that the point where departure turns are initiated is the same for either current or proposed south flow alternatives. Therefore the proposed changes south of the airport will not change the DNL 65 or greater contours.

In a northerly direction, the DNL 65 contour (from Exhibit 18) ends approximately 6.25 miles north of the north end of the runways. Examining Exhibits 21 and 22 we see that the point where arrival turns on to the final approach are initiated is the same for either current or proposed south flow alternatives. Therefore the proposed changes north of the airport will not change the DNL 65 or greater contours.

Conclusion

Given that the DNL 65 and greater noise contours would not change as a result of the implementation of the proposed action, no significant noise impacts are expected to occur. Consequently, all locations outside of the DNL 65 contour would remain compatible with airport operations.

ENERGY RESOURCES AND AIR QUALITY

No-Action Alternative

Continued use of the present arrival and departure routes will result in no change in energy resource consumption or air quality impacts.

Other alternatives considered and the Preferred Alternative

Given that the alternatives under evaluation do not increase the number of aircraft utilizing the airspace controlled by the Seattle TRACON and the Seattle ARTCC, but rather reconfigure the routes by which these aircraft fly in this airspace, the FAA does not expect a significant impact on air quality or the consumption of energy resources to occur under any of the alternatives studied. There are, however, known operational characteristics of turbojet aircraft from which certain conclusions about fuel consumption can be drawn. These conclusions are:

1)Turbojet engines are less efficient at lower altitudes and therefore consume more fuel at these altitudes.

2)Procedures which prolong flight are less desirable from a fuel consumption standpoint.

3)Arrival procedures that require level flight at high power settings, such as those in use now, are undesirable, while arrival procedures predicated on a constant descent profile, such as those proposed, are more fuel-efficient.

4)Departure procedures which restrict turbojet aircraft to lower altitudes for extended distances are inefficient and require more fuel to accomplish.

Optimal turbojet descent and departure procedures are based on the operational conclusions detailed above. Design guidelines for procedural development of fuel-efficient operations are contained in the FAA directive outlining local flow traffic management and optimum descent procedures. (See Reference 4.)

Under the procedures outlined in Alternatives G, F, E, D, C, and, to a lesser extent, B, in moderate to heavy traffic flows, turbojet aircraft would be required to fly longer arrival patterns at low altitudes than those specified under Alternative A, the Preferred Alternative. See discussion accompanying demonstrations 4, 6, 10, and 13 of Appendix A. (This is especially true under the existing procedures as extended low-altitude, level-flight maneuvering of arriving traffic is commonplace during periods when demand exceeds forty-two aircraft per hour.) Implementation of these alternatives then would require turbojet aircraft to burn more fuel in getting to Sea-Tac than would otherwise be required under the Preferred Alternative procedures, which follow the "keep them high" philosophy.

Under Alternatives D and C, departing turbojet aircraft would be restricted to altitudes lower than those specified in the remaining alternatives in order to avoid overlying arrival tracks.

These conclusions are general in nature. It is not expected that any variation in the amount of pollutants emitted by aircraft under the several alternatives posed would be perceptible since emissions will vary from day to day.

LAND USE COMPATIBILITY* WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVELS

Land Use	*Yearly Day-Night Average Sound Level (L_{dn}) in Decibels*					
	Below 65	*65-70*	*70-75*	*75-80*	*80-85*	*Over 85*
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N1)1	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing And Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

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

KEY TO TABLE 1

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

NOTES FOR EXHIBIT 17

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

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

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

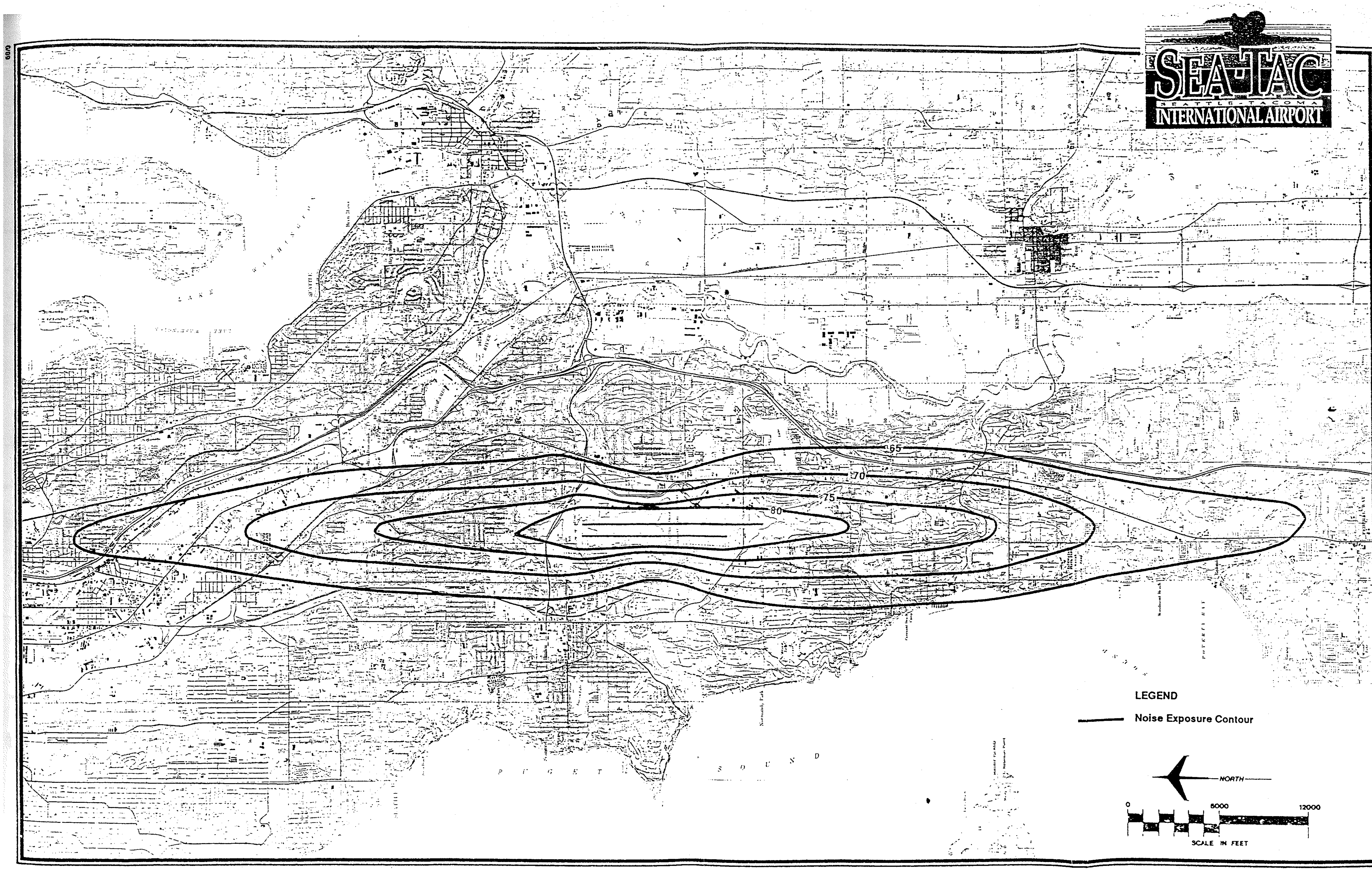
(4) Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

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

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.



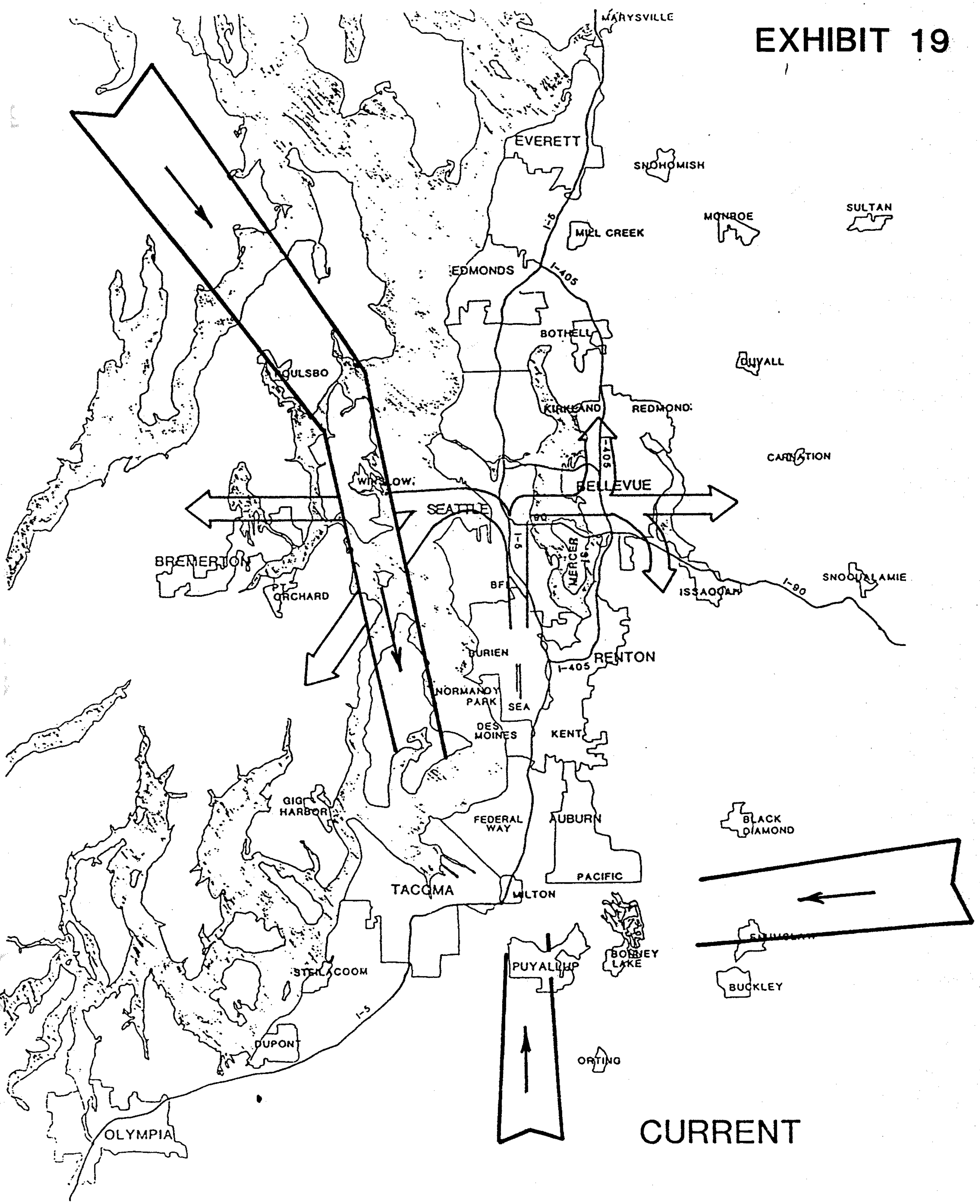
1988 NOISE CONTOURS

EXHIBIT 18

NORTH FLOW

RUNWAYS 34

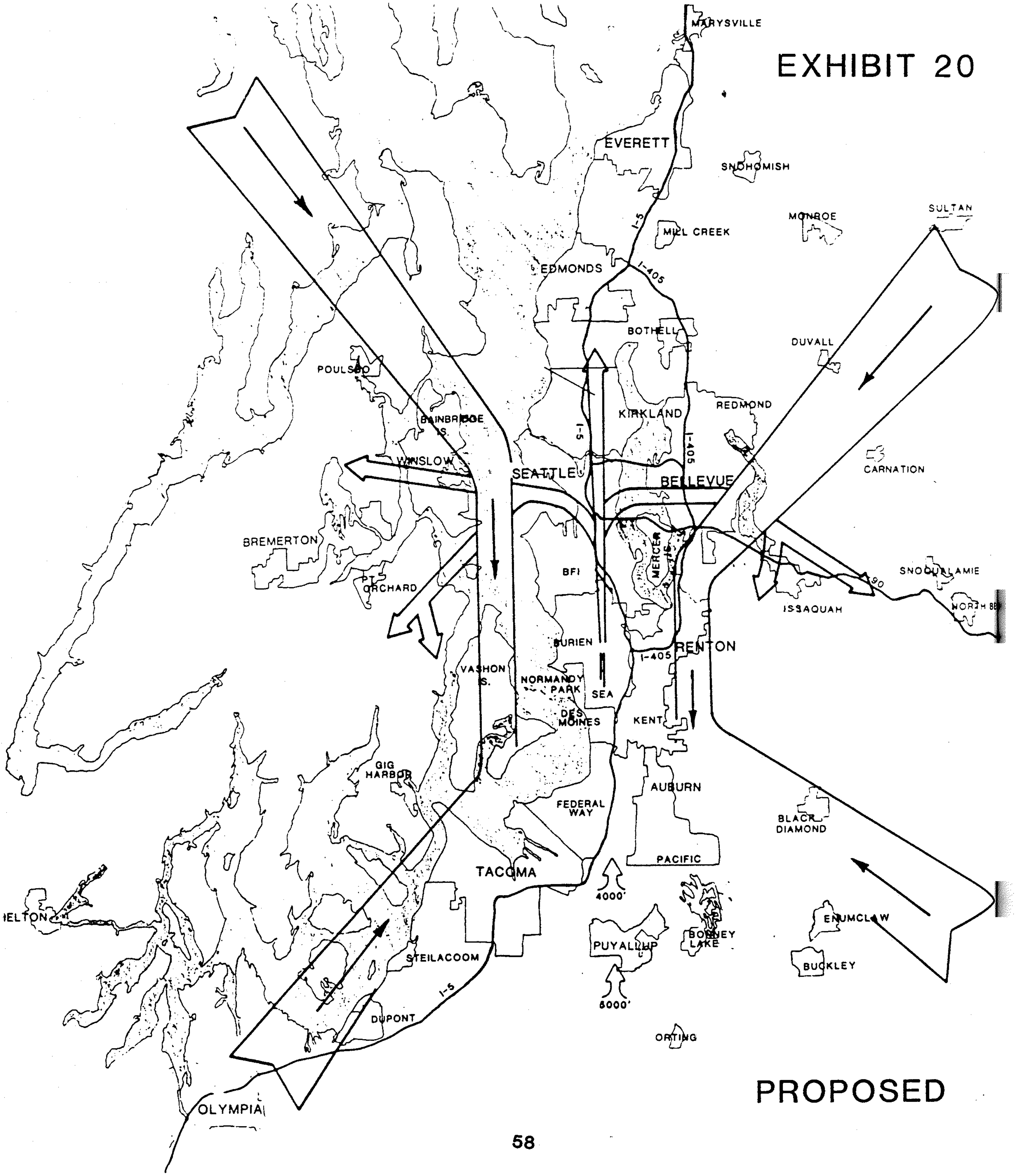
EXHIBIT 19



CURRENT

NORTH FLOW
RUNWAY 34

EXHIBIT 20

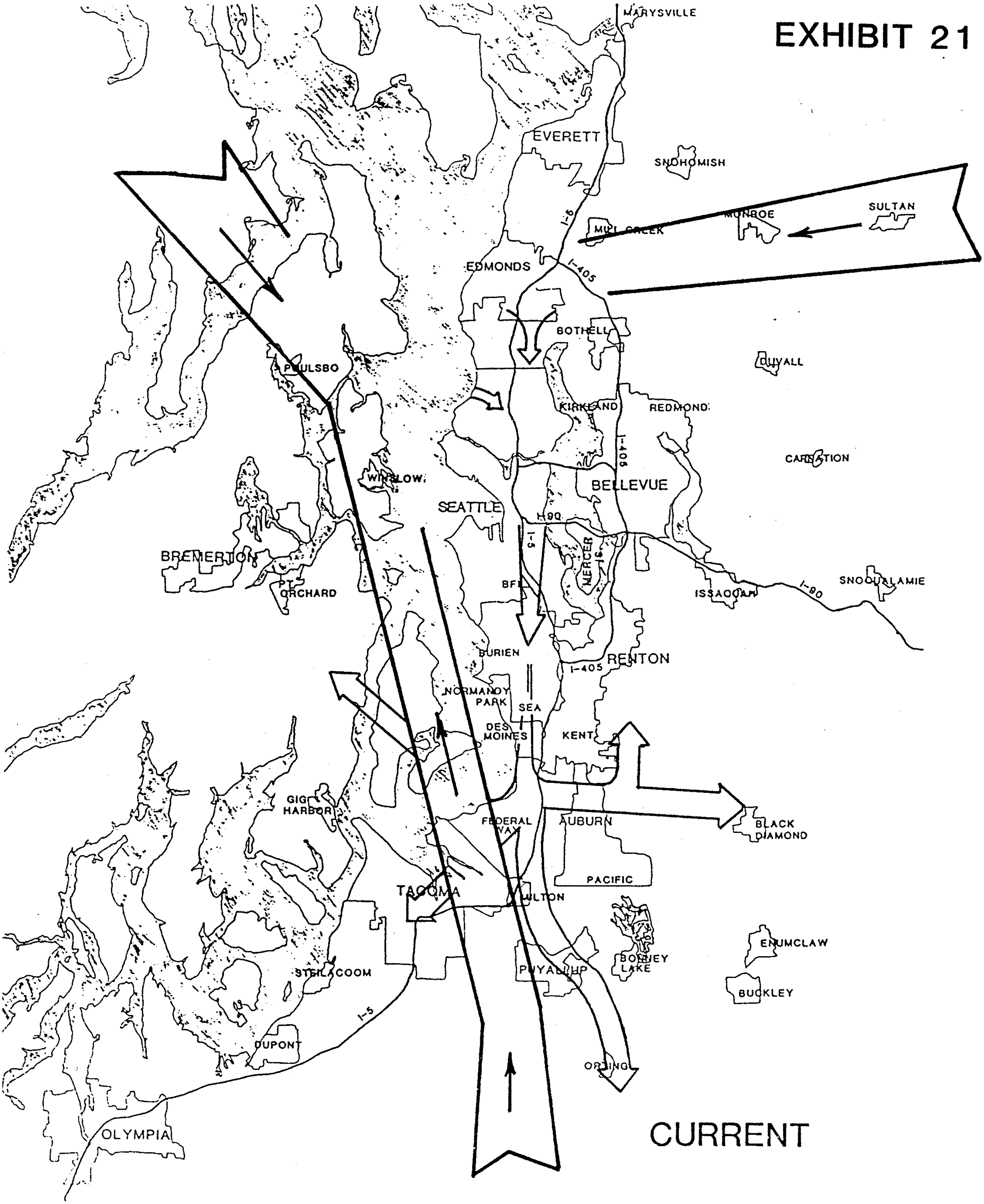


PROPOSED

SOUTH FLOW

RUNWAYS 16

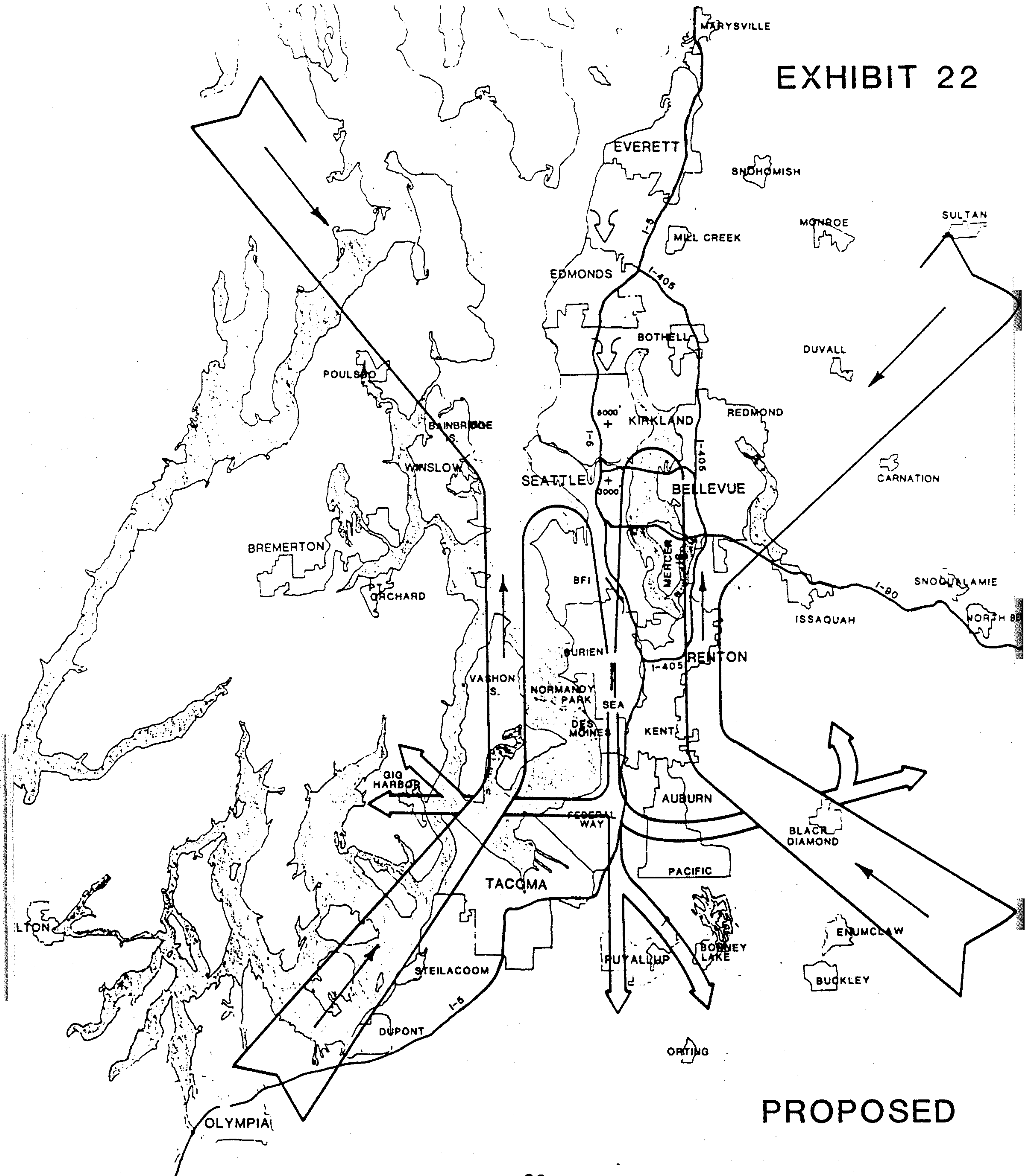
EXHIBIT 21



CURRENT

SOUTH FLOW
RUNWAY 16

EXHIBIT 22



PROPOSED

V. LIST OF PREPARERS AND AGENCIES AND PERSONS CONTACTED

This section lists: 1) those individuals who assisted in the preparation of this environmental assessment and 2) those agencies and persons contacted during preparation of this environmental assessment.

LIST OF PREPARERS

Regina R. Belt, A.B., Mathematics, Smith College, 1977; J.D., The American University, 1981. Prior experience: Two years as general attorney, in FAA's Northwest Mountain Region; four years as trial attorney, U.S. Department of Justice, Land and Natural Resources Division, Washington, D.C. EA responsibilities: Legal review of EA, reading of public comments and preparation of responses thereto.

Richard A. Bosik, Air Traffic Control Specialist assigned to the Air Traffic Division Staff, Northwest Mountain Region. Prior experience: 35 years as an air traffic control specialist, including thirteen years service in towers, TRACONS, and approach controls, four years military tower, approach control, and RAPCON air traffic control, ten years Air Traffic Control Automation and supervision, and eight years procedural development supervision. Holder of commercial pilot certificate with single-engine rating. EA responsibilities: Review of operational feasibility of proposed arrival and departure procedures; text preparation; reading of public comments and preparation of responses thereto.

William T. Butler, B.A., Political Science, University of Colorado, 1972. Air Traffic Control Specialist assigned to the Air Traffic Division Staff, Northwest Mountain Region. Prior Experience: 19 years as an air traffic control specialist, including service in two Air Route Traffic Control Centers, six control towers and approach controls; including eight years experience in development of air traffic control procedures. Holder of private pilot certificate with single-engine airplane land and glider ratings. EA Responsibilities: Review of operational feasibility of proposed arrival and departure procedures; reading of public comments and preparation of responses thereto; and text preparation.

Daniel P. Diggins, B.S., Mechanical Engineering, University of Massachusetts, 1973. Airspace and Procedures Specialist, Seattle Air Route Traffic Control Center (ARTCC), Auburn, Washington. Prior experience: 11 years as an Air Traffic Control Specialist, including three as an Air Traffic Procedures Specialist. Holder of commercial pilot certificate with single- and multi-engine airplane land and instrument ratings; and flight instructor certificate. EA responsibilities: Review of operational feasibility of proposed arrival and departure procedures and text preparation.

Dennis G. Ossenkop, B.S., Interdisciplinary (Engineering, Physics, Mathematics), Portland State University, 1965; M.B.A., University of Puget Sound, 1979. Regional Environmental Officer, Northwest Mountain Region, Airports Division. Prior experience: 3 years with U.S.E.P.A. (environmental evaluation and noise control) and 11 years experience with FAA in development of environmental and noise compatibility program documentation. EA responsibilities: environmental text preparation; reading of public comments and preparation of responses thereto; and text preparation.

Helen M. Parke, B.S., History, Indiana University of Pennsylvania, 1968. Manager of Seattle Air Route Traffic Control Center (ARTCC), Auburn, Washington. Prior Experience: 22 years in Air Traffic Control which includes Manager of the Boeing Air Traffic Control Tower, Operations Specialist in the Northwest Mountain Regional Office, Staff Officer positions at Seattle ARTCC, Staff Specialist, Systems Programs Division, Washington, D.C. and enroute Air Traffic Control Specialist. Holder of commercial pilot certificate with single- and multi-engine airplane land and instrument ratings and flight instructor certificate. EA Responsibilities: Review of public comments and participation in preparation of the Final Environmental Assessment text and response to public comments.

LIST OF AGENCIES AND PERSONS CONTACTED

Aviation Industry and Airport Users:

Jerry Ackerson
George Bagley, Horizon Airlines
Neil Bennett, Air Transport Association
Bill Chatham, Regional Chambers of Commerce
Bill Lax, Federal Express
Harry Lehr, Alaska Airlines
John McNamara, Air Transport Association
Ed Nielson, United Airlines
Michael Oswald, Airline Pilots Association
Art Thomas, Horizon Airlines
Paul Weigand, Puget Sound Power & Light

Bellevue Journal-American

Bogan and Associates

Eastside Caucus:

Sigrid Guyton, Eastside Citizens Against Noise
Ted Misselwitz
Bob Rudolph, Eastside Citizens Against Noise
Paul Sanders

Kitsap County:

Jim Decker, Bainbridge Island, representing County Commissioners

Magnolia Community Club

Mestre Greve Associates/Barnard Dunkelberg & Company/Bogan & Associates, Inc.

Mount Baker Community Club

Northeast District Council

North/Northwest Caucus:
Alan Ament
John Musgrave, Southwest District Council
Don Padelford, Seattle Noise Abatement Group
Paul Purcell

Part 150 Caucus:
Don Bell
Kris Hansen
Irene Jones

Terry Rogers

Pierce County:
Bruce Thun, Manager, Pierce County Airport

Queen Ann Community Council

Ravenna-Bryant Community Council

City Council, City of Seattle

Seattle Community Council Federation

Commissioners, Port of Seattle

Staff, Port of Seattle:

Andrea Beatty-Riniker, Director of Aviation
Gary LeTellier, Deputy Director of Aviation
Diane Summerhays

Seattle Post-Intelligencer

Seattle Times

Snohomish County:

Bill Dolan, Aviation Supervisor

South/Southwest Caucus:

Bob Edgar
Alan Twidt
Bill Whisler, Des Moines City Council
John Whitlock, Vashon Island Community Council

Washington Congressional Delegation:

Senator Gorton
Congressman Chandler
Congressman Miller

Staff members to:

Senator Adams
Congressman McDermott

VI. REFERENCES

1. Guidelines for Considering Noise in Land Use Planning and Control, June 1980, Federal Interagency Committee on Urban Noise.

2. Federal Aviation Regulation, Part 150, Airport Noise Compatibility Planning, January 18, 1985.

3. Seattle-Tacoma International Airport Noise Exposure Map Update, 1989, Coffman Associates, Inc. for The Port of Seattle.

4. FAA Order 7110.88, Local Flow Traffic Management-Optimum Descent Procedures, May 8, 1981.

5. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with An Adequate Margin of Safety, March 1974, United States Environmental Protection Agency.

6. Aviation Noise Abatement Policy, United States Department of Transportation, Federal Aviation Administration (November 19, 1976).

7. Aviation Noise Effects, United States Department of Transportation, Federal Aviation Administration (March, 1985).

8. Impacts of Noise on People, United States Department of Transportation, Federal Aviation Administration (May, 1977).

9. Regional Airport System Plan, Puget Sound Council of Governments (September, 1988).

10. FAA Order 1050.1D, Policies and Procedures for Considering Environmental Impacts (December 5, 1986).

11. Seattle TRACON Order 7200.1, Facility Operations Manual.

12. FAA Handbook 7110.65, Air Traffic Control.

VII. RESPONSE TO PUBLIC COMMENTS

The public comments on the Draft Environmental Assessment received by the FAA are categorized below. The FAA's response to each comment follows the description of the comment. In instances where more than ten commenters made a substantially similar comment, it was noted that "numerous commenters" made the comment. Otherwise, commenters were individually identified in parentheses by source.

The following abbreviations were used to identify the source of the comments received: "PH" denotes a written comment submitted to the FAA at the public hearing held on January 24, 1990; "AEA" denotes a comment made during the announced comment period, i.e., between December 22, 1989 and January 31, 1990; and "PHV" denotes a comment made orally during the public hearing. Comments received prior to, as well as after, the official comment period also were reviewed. All of these comments, however, contained remarks that had previously been included within the categories outlined below, and thus were not identified separately.

All comments received on the Draft Environmental Assessment were reviewed personally by Temple Johnson, Manager of Air Traffic Division of the FAA's Northwest Mountain Region, as well as at least four of the members of the Northwest Mountain Region's staff who aided in the preparation of the Final Environmental Assessment. These were Dennis Ossenkop, Helen Parke, Richard Bosik, Daniel Diggins, William Butler, and Regina Belt, whose areas of expertise are identified in the List of Preparers. All comments were read in their entirety and considered, whether or not they are specifically responded to below.

References made to the "LDN" and "DNL" noise metrics are intended to be interchangeable in this section. FAA Orders contain the Ldn terminology, but current literature on this subject frequently refers to this metric as DNL.

PROPOSED ACTION

C: Three commenters (PH 1, p. 41; PH 4; PH 10) sought better explanation of the routing changes, particularly with regard to the northbound departure traffic.

R: In response to this comment, the FAA revised the text of the Final Environmental Assessment, particularly the description of the individual routes to be flown in the section entitled "Preferred Alternative."

C: One commenter (PHV, p. 20) questioned the ability of Sea-Tac Airport ground facilities to sustain a rate of 56 arrivals per hour.

R: The ability of the airport to accept this many arrivals is demonstrated frequently at present. 56 arrivals per hour is the present rate when Runways 34L and 34R are in use. The idea that the airport will fill up and cease to operate does not allow for the following facts:

1. Even during periods of high arrival loading, some aircraft depart.

2. The problem is not one of hour after hour of 56/hour demand for arrival service, but one of a cyclical system in which delayed arrivals cause deferred departures, which in turn interfere with the next bank of arrivals, both at the terminal facilities and at the runway. In order to function smoothly, arrivals have to be landed in the minimum permissible time, passengers and cargo interchanged, and departures launched as quickly as possible in order to free ground facilities for the next arrival bank.

3. The actual number of aircraft parking spaces available in the terminal and cargo areas is in excess of 85.

C: One commenter (AEA 374, p.6) stated that the description of the proposed action was so vague that a proper determination about the significance of the potential environmental impacts could not be made.

R: In addition to the technical description of each alternative and the Preferred Alternative which appeared in the Draft Environmental Assessment, the Final Environmental Assessment includes a colloquial description of the routes, altitudes and general areas overflown under the existing and proposed procedures.

PURPOSE AND NEED FOR PROPOSAL

C: Several commenters (PH 10; PH 17; PH 42; PH 1, p. 41; AEA 39; AEA 41; AEA 154; AEA 328) questioned the need for the air traffic changes. Moreover, several commenters charged that the conditions under which the disadvantages of using the existing procedures occur would exist only 5% of the time in any given year. These commenters opined that the advantages to be gained from using the proposed procedures were not worth the noise impacts generated by their implementation.

R: The general comment regarding the need for the proposed action overlooks the fact that the proposal under consideration addresses issues which are regional and national in scope as well as those which are centered in the Elliott Bay procedures. The problems encountered at the Seattle ARTCC and in the rest of the National Airspace System can occur 100% of the time. For a complete description of these problems, see the text of the Final Environmental Assessment's "Purpose and Need" Section.

Several commenters developed a statistic which seems to suggest that the proposed procedures are only needed 5% of the time. The FAA's data shows that the wind and weather conditions which presently require the use of the Elliott Bay procedure (landing Runway 16 with weather substantially better than 3,000 foot ceiling and 4 mile visibility) occur approximately 20% of the time. Because of the inability to turn route structures on and off at will, (See "Alternatives" comments and responses regarding preferred routes), an adverse factor which seems small, statistically speaking, can have a disproportionate effect on the national system.

To the extent that these commenters suggest that the noise impacts of the proposal are significant, the FAA disagrees. See the discussion of noise impacts in the Environmental Consequences Section of the Final Environmental Assessment text.

C: One commenter (PHV, p.112) said that Elliott Bay is adequate to handle the traffic because it is wider than the Potomac River which handles more traffic. He further maintains that the curved approach course is not a problem because similar curved approaches exist at Baltimore and Newark.

R: The FAA is unaware of any "curved" approach to the Baltimore Airport, but the examples which we believe the commenter might be citing at Washington National Airport (River Visual Runway 18) and Newark International Airport (Meadow Visual Runway 22L) are examples of procedures which artificially reduce capacity through excessive complexity. The Washington procedure can handle no more than 36 operations per hour. The Newark procedure, which is virtually never used, would accommodate less than 32 operations per hour. Each of these procedures serves only one runway.

The Seattle proposal is designed to create two streams of traffic to serve two parallel runways simultaneously. In addition, it is necessary to remember that the inefficiency of the Elliott Bay procedures is only one of the problems which the Preferred Alternative is designed to rectify. See the discussion of High Altitude Issues in the "Purpose and Need" Section and the "Preferred Alternative" subsection of the "Alternatives Considered" Section of the Final Environmental Assessment text.

C: One commenter (PHV, p.114) asserted that the end of the "cold war" has caused a decline in military traffic, allowing for greater civil use of Puget Sound.

R: The FAA has for more than a decade routed virtually all military instrument traffic around or over the Seattle terminal airspace in order to keep this area available for civil traffic using the Sea-Tac Airport and the nearby satellite airports.

C: One commenter (PHV, p. 31) claimed that the airlines have said that the current delays at Sea-Tac are acceptable.

R: The FAA disagrees. The Air Transport Association (ATA), on behalf of American, Alaska, Braniff, Continental, Canadian Airlines International, Delta, Eastern, DHL, Evergreen, Federal Express, Hawaiian, Northwest, Pan American, Trans World, United, and USAir Airlines, submitted its comments on the Preferred Alternative to the FAA in a letter dated January 18, 1990 (AEA 62). That letter states that the delays at Sea-Tac are not warranted given the Airport's volume of traffic and that delays in fact are reaching unacceptable levels. In short, the ATA expressed support for the Preferred Alternative.

ALTERNATIVES

Non-Procedural

C: Numerous commenters asked that changes in airline scheduling be explored as an alternative. One of these commenters (AEA 302) requested that the FAA present some support for its statement in the Draft Environmental Assessment that Sea-Tac is not a high-density airport. At least two commenters (AEA 294; AEA 328) suggested that time-of-day pricing of airline tickets is a feasible alternative given its success in the energy and telecommunications industries.

R: With respect to the first two of these comments, the reader is referred to the revised text of Section II.A. of the Final Environmental Assessment. With respect to time-of-day pricing, the FAA has no authority to regulate the price of airline tickets. Deregulation of the airline industry in 1978 removed that authority from the federal government.

C: A number of commenters (PH 4; PH 5; PH 17; AEA 331; PHV, pp. 32, 48, 101; AEA 310) requested that the FAA delay implementation of the proposed action until successful conclusion of the mediation process. One of these commenters suggested that mediation was the appropriate forum for altering flight tracks.

R: The Northwest Mountain Region of the FAA became a member of the Mediation Committee - Seattle Tacoma International Airport Noise Abatement (Mediation Committee) voluntarily in an effort to work with the surrounding communities, representatives of the air transportation industry, and the Port of Seattle to formulate methods for reducing noise emanating from aircraft operating to and from Sea-Tac. The FAA has never before participated in negotiations with an airport operator and local communities in an effort to find methods for reducing airport noise.

The FAA's participation in the mediation process is not a legal requirement. Nor does it serve as a substitute for carrying out the FAA's legal mandates, most notably the safe and efficient utilization of the navigable airspace and the requirement to comply with its NEPA procedures when proposing changes to flight procedures. Nothing in the Committee's Groundrules governing the participation of its members alters or attempts to discharge these legal duties of the FAA.

The aim of the Mediation Committee rather is to resolve the overall noise problem stemming from aircraft operations at Sea-Tac. The changes in air traffic control procedures currently under consideration by the FAA, on the other hand, aim to solve an entirely different problem, that relating to the safety and efficiency of the use of the navigable airspace managed by the Seattle Air Route Traffic Control Center and the Seattle TRACON.

Temple Johnson, Manager of the Northwest Mountain Region's Air Traffic Division and the FAA's prime spokesman on the Mediation Committee, has stated that the FAA has worked with the Committee in good faith, and will continue to do so, but that the agency's other obligations, specifically those relating to the management of airspace, cannot be suspended pending a consensus among members of the Mediation Committee whose aim is not to fulfill those agency obligations, but simply to attempt to reach an agreement about reduction of airport noise. The FAA nevertheless may opt to incorporate remedies for perceived noise impacts, agreed upon by the Mediation Committee, into whatever air traffic procedures it adopts.

As of this writing, it is expected that the mediation process will conclude on March 31, 1990.

C: A large number of commenters proposed ideas for reducing airport noise generally, rather than for reducing any potential noise impacts that might be generated by aircraft following the proposed air traffic control procedures. These included: building a new airport (most frequently suggested location was east of the Cascade Mountains); use of larger airplanes on existing routes; technological advances for reduction of aircraft noise; institution of higher landing fees; banning noisy aircraft; utilizing other airports, especially where small aircraft are concerned; imposing a cap on airport growth; instituting a noise budget; accelerating the rate at which aircraft operating to and from Sea-Tac are retrofitted to Stage III specifications; limiting the numbers of aircraft that are not full; imposing a night curfew; and limiting the amount of noise any one airline could generate.

R: Because these suggestions were directed toward reducing noise, including that which already exists, and not toward solving the problems outlined in the Purpose and Need Section of the environmental assessment, they are not addressed in this document and have not been responded to individually. They are, more appropriately, the subject of debate in the aforementioned mediation process or of discussion with the airport operator, the Port of Seattle. As stated above, the FAA continues to be willing to work within the context of the mediation process to achieve the Port's goal of reducing airport noise. None of these suggested non-procedural solutions is within the power of the FAA to implement.

Procedural

C: A few commenters submitted ideas for reducing airport-generated noise through adoption of new flight procedures, namely requiring "noisier" jets to operate over the least populated areas; requiring jets to ascend to greater altitudes before turning; and requiring the use of different power settings on takeoff and landing.

R: It is unclear from these comments whether they are directed to reducing aircraft noise generally, in which case they are not responsive to the proposed action, or are posed as alternatives to the proposed procedures. The first two of these procedures nonetheless are addressed below in this Section. Implementation of the third suggested procedure is not within the control of the FAA. The use of power settings depends on the performance capabilities of each aircraft, daily variables such as weather, temperature, and load, and airline company policy.

C: One commenter (PH 17) requested information on whether or not there will be a continuation of the "night-time curfew for the east turn" and "splitting some of the east turn traffic. Another commenter (PHV, pp. 84-85) suggested splitting nighttime flights. One commenter (AEA 245) opined that failure to do this would alter the North Flow 65 DNL contour. Another commenter (AEA 326, p. 3) pointed out that retaining use of the Elliott Bay procedures at night would contradict the FAA's conclusion that significant noise impacts do not occur outside the 65 DNL contour.

R: In response to public comments, the FAA has opted to retain the provisions of Seattle TRACON Order 7200.1 Chapter 2, Section 6, para. c (1) and (2), which describe the rerouting of eastbound departures through Elliott Bay during those late night hours when traffic is light enough to permit safe use.

Utilization of the current Elliott Bay procedures at night should not be read as an acknowledgement by the FAA that legally significant noise impacts outside the 65 DNL contour would occur under the proposed procedures. Rather, retention of the Elliott Bay procedures at night simply would acknowledge the ability of the FAA to comply, during nighttime periods, with its legal mandate to safely and efficiently control the flow of air traffic and at the same time to diminish the effects of the redistribution of noise expected to result from implementation of the proposed procedures. In following the existing procedures during nighttime hours - when aircraft noise has an admittedly greater potential for disturbance - the FAA would direct aircraft over water, to the extent possible, rather than land, thereby affecting fewer people than if the proposed procedures were used on a twenty-four-hour basis. This does not imply, however, that areas outside the 65 DNL contour either under the existing or proposed procedures are experiencing, or will experience, legally significant noise impacts.

C: A few commenters (PH 5; AEA 238; AEA 241) asked that the use of the procedure be limited to those hours when it is required to enhance airport efficiency and safety. One commenter (AEA 346) proposed alteration of weekend and nighttime patterns to avoid heavily occupied areas.

R: One of the objectives stated in the Draft Environmental Assessment (see "High Altitude Issues", p. 9) was to simplify and stabilize the manner in which the Seattle ARTCC integrates the Seattle traffic with that from other airports in the nation and the region. In order to reduce the number of points of potential traffic conflict in the National Airspace System, it is necessary to maximize the use of a Preferred Route System for safety and efficiency. It is necessary to plan, establish, chart, and use specific routes for each city pair. That is, traffic from the Northeast, Chicago, Minneapolis, etc., should always enter the Seattle Area from the Northeast, irrespective of the runways in use, the weather, or the time of day. These routes are designed to avoid passing through the steady stream of outbound aircraft from Seattle and many other major terminals enroute.

The current routing system requires a specific sectorization of navigable airspace, an automation data base that stores and processes flight plan data, and specific locations of ground-based navigational aids and air-to-ground communication transmitters and receivers. Each revised plan has a different automation base to support a new sector layout along with the associated preferred routings and an amended air-to-ground communication network. To switch systems would require an automation shutdown (approximately 30 minutes) which would "dump" all existing stored data; a startup of the new system (15 minutes); a certification check, which must be done prior to use (20 minutes); and then an input of the flight data which was "dumped" prior to removal of the old data base (20 minutes). During this 85-minute period required for each change of route configuration, which could occur several times per day, the Seattle ARTCC would have to operate without its primary automation system, posing serious adverse effects, not only on the Sea-Tac Airport, but throughout the National Airspace System.

Simultaneous with the automation difficulties, these frequent route changes would require abandonment of the Preferred Route System described above, which would increase the number of points of aircraft conflict all over the nation. This would increase controller workload and make the air traffic control system more complex. Both of these conditions reduce system safety.

The evolutionary process in air traffic control over the last two decades has been to make routings more specific and stable. This suggestion would take a large step away from that trend.

As noted in response to the preceding comment, the FAA, based on public comments received on the Draft Environmental Assessment, has opted to retain the provisions of Seattle TRACON Order 7200.1 that describe the routing of eastbound departures through Elliott Bay during those late night hours in north flow conditions when traffic is light enough to permit safe use of this procedure. The continuation of this procedure is possible only because during those late night hours, traffic is extremely light and the normal procedures can be suspended without encumbering the National Airspace System or creating unsafe conditions.

During the late night hours under discussion, demand for air traffic services is so light that automation systems are routinely turned off for diagnosis, maintenance and modification. Operational functions are combined so that one controller may be providing services normally provided by as many as a dozen controllers. This might mean that a controller would be handling as few as one or two aircraft at a time. Utilization of this procedure would not be possible during weekend daytime hours for the reasons stated above in this response.

C: Two commenters (PH 5; AEA 4) suggested that the downwind leg be moved further east, clear of the "population centers", while not so far that it will cause departures to be held to a lower altitude that might aggravate the noise conditions.

R: In the simulation studies conducted at the Seattle TRACON during September of 1989, several locations for the east side downwind leg were discussed, and two were simulated extensively in addition to that in the Preferred Alternative. The results are found in the Environmental Assessment in Demonstrations 3, 4, 6, and 10. (See Appendix A of this Final Environmental Assessment.) Some of the adverse consequences are:

Demonstrations #4 and #6, which placed the downwind leg approximately 25 miles east of the airport, were rejected completely because they were unsafe. It was found to be nearly impossible to reliably gauge aircraft climb performance to permit the departures to depart above the slow-moving turboprop arrival stream and below the fast-moving turbojet arrival stream.

In Demonstration 10, two eastside downwind legs were created, which segregated some quieter aircraft on a leg 8 miles east and placed noisier ones on a downwind leg 25 miles east. This demonstration, while operationally inefficient, cured the worst safety deficiencies of demonstrations 4 and 6. It confirmed that arrival overflights would introduce noise into new areas which, though they have fewer occupants, can hardly be viewed as unpopulated, such as Issaquah, Cougar Mountain, North Bend, Snoqualmie, Carnation. These areas, as well as Bellevue, Redmond, and Renton, would experience additional departure noise.

Establishment of a downwind leg anywhere east of the one in the Preferred Alternative will result in a "holding down of departing aircraft". For each incremental move of the downwind leg toward the east, the number of departing aircraft held down increases dramatically. That is, if the leg is moved from the vicinity of Highway 405 to the east side of Bellevue, the fastest climbing aircraft may have to level off to avoid climbing through the arrival stream. Moving the downwind leg to the area of Lake Sammamish will cause most aircraft to level off, and so on.

To summarize, the adverse operational consequences of these demonstrations more than offset any noise relief gained, and in several areas an increase in perceived noise would result.

C: Commenter (PH 5) seeks assurances that FAA will include within air traffic and pilot instructions better utilization of the Elliott Bay arrival procedure and the "keep them high" philosophy.

R: The directives used to convey to individual controllers facility policy with regard to local needs are contained in Seattle TRACON Order 7200.1, Facility Operations Manual.

Because the procedure is still the subject of this public process and the Port of Seattle Noise Mediation discussion, the exact language that FAA would insert into that document is not known. However, the specifics of the proposal as shown in "Preferred Alternative" in this Final Environmental Assessment would be adapted into that document upon implementation.

FAA Order 7110.88, entitled "Local Flow Traffic Management and Optimum Descent Procedures" (Reference 4) has the specifics of the national "keep them high" philosophy, which was adapted into the Preferred Alternative.

There is no planned change to the Elliott Bay Procedure for aircraft arriving from the south and northwest. The description of that procedure in present Seattle TRACON Order 7200.1 will remain essentially unchanged except as it pertains to those arrivals from the east. FAA references to better utilization of this procedure stem from the expectation that attempting to place fewer aircraft in the crowded confines of Elliott Bay will assure closer compliance with the procedure for those which do continue to use it.

C: Several commenters (PH 17; AEA 47; AEA 120; AEA 331; et al.) requested that the FAA retain its current 10PM-6AM ban on turbojet east-turn procedures in order to relieve noise on the east side of Lake Washington.

R: It is the FAA's present intent to retain the provisions of Seattle TRACON Order 7200.1 Chapter 2, Section 6, para. c (1) and (2), which describe the rerouting of eastbound departures through Elliott Bay during those late night hours when traffic is light enough to permit safe use. This procedure is presently being reviewed by the Port of Seattle Noise Mediation Committee.

C: Several commenters (AEA 25; AEA 12; AEA 50; AEA 53; AEA 261; AEA 310) requested that noisier departing airplanes be routed over water until they reach 10,000 feet. One Commenter suggested routing "heavier" aircraft over water.

R: There are serious operational reservations to implementing a plan of this sort. The water areas available in the Seattle area are actually quite small, consisting of narrow inland bodies rather than an ocean or Great Lake. Puget Sound is seldom more than eight miles wide and at several points in the Seattle area a bare three miles wide. Lake Washington is so small as to serve no noise abatement purpose. A turbojet operating at 250 knots would cross the lake in a matter of seconds. Establishing separate tracks for "noisier" aircraft which constitute approximately 49% (those which only meet FAR 36 Stage II standards) of the turbojet fleet serving Seattle at the present would require the operation of descending streams of arriving aircraft and climbing streams of departing aircraft within the confines of these very narrow and irregularly shaped bodies of water, a practice which would be inherently unsafe.

C: Numerous commenters from the area immediately east of Lake Washington, many from Medina, sought a revision to the turbojet east turn procedure which would spread the north flow departure tracks over a larger area. Several also demanded that it be "returned to where it used to be." One commenter (AEA 222) suggested that the aircraft be turned at a higher altitude than the present 4,000 feet. Two commenters (AEA 360, AEA 326) suggested the use of several easterly departure routes rotated in sequence.

R: Turbojets proceeding to destinations east or southeast of Seattle are assigned the MOUNTAIN 2 or SUMMA 3 departure procedures. These require aircraft departing runway 34 to proceed straight out from the runway to a point 8 miles north of the Seattle VORTAC (approximately 6 miles from the runway) and then turn right to an easterly heading. This portion of these procedures has been in place for many years. The FAA has offered nonetheless to give careful consideration to any proposal of this sort which might result from the ongoing Port of Seattle noise mediation process.

The perception on the part of some of the commenters that the procedure was changed three years ago may stem from the "scatter plan" which was tested for the Port of Seattle-Community Overflight Committee. This test was conducted for seventeen days during the summer of 1987. At the completion of the test period, however, all routes were restored to their previous locations. The perception of "changed routes" on the east side of Lake Washington may also be rooted in the fact that some aircraft that were departing Sea-Tac through Elliott Bay are now overflying the east side. As the "Background" discussion of the Purpose and Need Section of the Final Environmental Assessment explains, in 1986 the FAA redistributed north flow departures to alleviate a safety problem on high altitude routes in Southern Oregon. Aircraft bound for the Los Angeles, Reno and Phoenix markets were routed over the east side through expanded use of an existing departure route, but no routes were changed. Nor were any new routes created.

C: Several commenters (PH 31; PHV, p. 69; AEA 63; AEA 309; AEA 304) suggested that the FAA use Microwave Landing System technology or raise the angle of the glideslope to aid in reduction of noise during approaches to Sea-Tac.

R: The angle of the glideslope in Instrument Landing Systems (ILS) and Microwave Landing Systems (MLS) is dictated by the flight capabilities of the aircraft which use them. The Seattle Runway 16R glideslope is presently set at the maximum angle permitted under the national standards for this equipment, three degrees above the horizontal. Any steeper descent raises serious issues of passenger comfort and safety of flight. Any benefit to the underlying resident from a steeper glideslope, were new safety standards to be developed, would be slight. In order to create a perceptible change, the aircraft's altitude above the point of observation would have to be doubled.

Microwave Landing Systems are also able to provide curved approach path guidance, but that does not address the need for more efficient use of existing airspace. At present there is a curved path through Elliott Bay to the final approach course, which is flown by visual reference to the ground. The proposal is to add a straight-in traffic flow from the north which merges with the Elliott Bay route near Boeing Field.

C: Commenter (AEA 226) suggested that the FAA continue its use of the Elliott Bay procedures in good weather.

R: The "Preferred Alternative" under consideration by the FAA includes the use of the Elliott Bay procedure, as at present, in good weather with regard to all aircraft entering the Seattle terminal airspace from the southwest and the northwest. Those aircraft arriving from the east and southeast would be routed more directly, in lieu of the present practice which requires that they follow a circuitous route across North Seattle to merge with traffic flows from two other directions in Elliott Bay.

C: At least one commenter (AEA 271) proposed the use of a flight track for north departures that would follow the I-5 corridor until they "are so high they can make their south turn without disturbing anybody."

R: The proposed use of the I-5 corridor for north departure might reduce noise somewhat by overflying the noise produced by heavy vehicular traffic. However, airline crews would have a difficult, if not impossible, task trying to visually observe the freeway while in a "nose high" climbing attitude; they might be directly above the freeway, but not able to see it without lowering the nose of the aircraft. If crews attempted to navigate their aircraft with reference to the freeway they would be required to fly their aircraft "offset" from the freeway to one side or the other to provide either the pilot or copilot the capability to look down, see, and navigate the circuitous freeway route. The proposed procedure would also require almost unlimited flight visibility as airline crews would need to keep the freeway in sight until they were high enough to make the south turn.

C: Some commenters (AEA 242; PHV, p. 87) proposed a deletion of arrival traffic over the East Side since the East Side would continue to experience departure noise under the Four Post Plan. Another (PHV, P. 24) requested relief from departure routes if arrivals would overfly his community.

R: The proposal as presented was designed to improve system efficiency, reduce delays and enhance safety. The Preferred Alternative would balance traffic throughout all quadrants in the Seattle Area. It is true that the East side would experience departure noise when air traffic is in a North flow configuration. This is true today and there would be no change in the Preferred Alternative. Currently the arrivals that would be over the Northeast quadrant are overflying the final approach course to be merged with two other streams of traffic in Elliott Bay. This places that traffic over other communities to the Northwest who are already experiencing considerable activity. If these arrivals are sent to some other quadrant, balance is not achieved. By trying to incorporate this request the FAA would be derogating the intent of the proposal.

Arrival traffic in the Preferred Alternative concept would usually be at idle descent power and at higher altitudes than what is currently happening in Elliott Bay. This would result in a lesser noise impact. The frequency with which Sea-Tac experiences either a North or South flow is contingent on the wind direction and is not artificially determined.

C: One commenter (PHV, p. 79) stated that the alternatives evaluated by Air Traffic were not judged using consistent criteria.

R: The concern was raised at the Public Hearing that none of the demonstrations discussed in the Draft Environmental Assessment were evaluated using the same criteria. This is not the case. Each demonstration was matched against the following parameters:

1. The procedure being tested should be compatible with the Seattle ARTCC "static flow" changes. (See High Altitude Issues in "Purpose and Need".)

2. The volume of traffic handled by the TRACON, split geographically between the East and West controller must be balanced.

3. The objective is to not only match but increase the arrival rate in a South flow to that of a North flow which is currently 56 and projected to be 60.

4. Procedures must comply with separation and procedural standards as outlined in FAA Handbook 7110.65, Air Traffic Control.

5. A successful procedure must minimize points of potential conflict among aircraft.

Unlike a pure scientific laboratory environment, the application of air traffic procedures, by its very nature requires subjectivity. Variables such as type of aircraft, winds aloft, and pilot technique must be considered. Repeating a demonstration but changing one of the variables may alter the outcome to some degree. However, in the overall view, these variables will not significantly effect the success or failure of a demonstration.

C: One commenter (AEA 326) proposed that north departures make "earlier east turns, especially for south-bound traffic."

R: Early turns for north departures proceeding eastbound or southbound would place the departing aircraft in contention with aircraft on the final approach course to runway 31 at Boeing Field. To avoid this condition, the departures would need to proceed straight out to a point just north of Boeing Field prior to making their turn. This would provide the required vertical separation by allowing the departure to climb to an altitude above the Boeing arrivals prior to beginning an east turn.

C: A number of commenters (PH 37; PHV, p. 32; AEA 65; AEA 144; AEA 155; AEA 165; AEA 200; AEA 371; AEA 326) suggested utilizing other airports. One variation (AEA 200) proposed was to have smaller aircraft use other airports.

R: The concept of utilizing other airports in the Puget Sound basin for air carrier, general aviation, and training activities has been under study for the past several years. The most recent study, the Puget Sound Council of Governments' Regional Airport System Plan, September 1988, studied a number of alternatives to meet the current and forecast aviation needs of the basin. Appendix B presents principal conclusions from that study. Another study began in December 1989 called "Flight Plan" is specifically aimed at evaluating the means to meet the long range air carrier airport needs of the Region. The results of this last study are expected by December of 1991.

NOISE

C: One commenter (PHV, p. 36; AEA 374, pp. 11-13) claimed that the FAA had already acknowledged the significance of noise impacts on communities outside the 65 DNL contours because of its decision not to implement the Scatter Plan Test permanently.

R: The FAA disagrees. The Scatter Plan Test that was implemented on a temporary basis during the summer of 1987 was not the result of an FAA proposal. It stemmed from a request from the Sea-Tac Overflight Committee. Once the Test was concluded, it was not submitted to the FAA as a permanent proposal. The FAA did not make any findings as to the significance of any noise impacts of the Scatter Plan Test that may have been generated outside the 65 DNL contour during the test period.

C: Numerous commenters (AEA 229; PHV, pp. 47, 68; AEA 322; AEA 302; AEA 304; AEA 312; AEA 327) asserted that the 65 LDN metric was not an adequate descriptor of the effects of aircraft noise on people's lives. Others (PHV, pp. 63, 121) questioned whether there was a way to equate noise costs with other costs. Some also requested that existing information sources on the impacts of noise be stated.

R: As noted on page 56 of the Draft EA, the use of DNL has long been recognized as the appropriate noise metric for assessing the long term impact of aircraft noise upon humans. The U.S. Environmental Protection Agency recognizes DNL in its document Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (Reference 5 in this final EA) as an appropriate noise metric for assessing noise impacts where the noise environment is characterized by relatively repetitive day-to-day behavior. To account for day-to-day and some seasonal variations, "it has been found useful to measure environmental noise in terms of the long-term yearly average of the daily levels." Reference 1 in this final EA, Guidelines for Considering Noise in Land Use Planning and Control, clearly indicates that DNL is to be used in assessing airport noise impacts. Reference 2, Federal Aviation Regulation Part 150, mandates the use of DNL in computing airport noise contours and assessing noise/land use compatibility.

Regarding the use of DNL 65 as the upper level of significant impact, the November 18, 1976, U. S. Department of Transportation, Aviation Noise Abatement Policy defines significant aircraft noise levels as 30 NEF (Noise Exposure Forecast) [DNL 65 equivalent] or more. EA Reference 1, also classifies DNL sound levels of 65 and above as significant exposure. As noted on page 56 of the Draft EA and page 49 of this doument, five Federal agencies have agreed on this matter.

On the matter of determining the cost associated with various noise impacts, FAA knows of no methods to assess such costs.

For those requesting additional information on the impacts of noise, we have added three references to the list of references.

C: A few commenters (PHV, p. 34; AEA 331, pp. 6-8; AEA 374, pp. 8-9) suggested that significant noise impacts can occur outside the 65 LDN contour and that the FAA therefore should both analyze noise impacts in areas as far beyond Sea-Tac as the 55 DNL contour and use the single event level (SEL) metrics in its environmental analyses. Another commenter (AEA 304, pp. 1-2) claimed that a study using the LEQ metric found that ground traffic noise in the 51-70 DBA range posed certain health risks, and hence that the FAA ought to consider analyzing noise impacts outside of the DNL metric 65 contour area.

R: The first of these suggestions was derived from EPA comments previously submitted on a draft EIS for a proposed runway extension at the Baltimore-Washington International Airport (BWI) and in response to a request by the FAA, published in the Federal Register on November 3, 1988, for public comment on the FAA's Part 150 Noise Compatibility Program. (See 53 Fed. Reg. 44554.)

As the FAA stated in its response to these views on the BWI Draft EIS, documentation of the environmental impacts of airport noise by FAA utilizes the DNL metric. This metric, adopted by the FAA in accordance with the provisions of the Aviation Safety and Noise Abatement Act of 1979, is the single system for determining the exposure of individuals to noise that is generated by airport operations. The DNL metric was developed initially for the EPA as a standard noise descriptor of community noise impacts from a variety of noise sources. It is the most widely recognized method of describing aircraft noise. (As stated in the "Environmental Consequences" Section of the text of this Final Environmental Assessment, DNL has also been adopted by several other federal agencies concerned with evaluating noise impacts.)

In the FAA's view, SEL noise data may be used as a means of evaluating what actions can be taken to reduce the noise generated by single aircraft flyovers, but it is not a useful tool for predicting community reactions to overall aircraft noise. No criteria exist for evaluating the significance of various SEL values or relating them to DNL values for which a standard of significant noise impacts does exist. If a single event noise metric were used to evaluate noise impacts, a location experiencing several very loud events per day might be considered to be more greatly affected than a location having numerous slightly quieter events per day. Assessment of noise impacts must include consideration of total noise exposure, not just the level of single aircraft flyovers. As the EPA stated in selecting DNL as the single-number measure for identification of levels of environmental noise originally:

> the ultimate goal is to characterize with reasonable accuracy the noise exposure of whole neighborhoods (within which there may actually exist a fairly wide range of noise levels), so as to prevent extremes of noise exposure at any given time, and to detect unfavorable trends in the future noise climate. For these purposes, pinpoint accuracy and masses of data for each location are not required, and may even be a hindrance, since one could fail to see the forest for the trees.

EPA, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, Appendix A, p. 7. (Reference 13.)

The comments mentioned above on the Part 150 Program are being considered together with other comments received in that process. In the interim, however, the FAA is bound by its existing regulations--which establish the threshold of significant noise at the 65 DNL contour level--in assessing the compatibility of airport operations and surrounding land uses.

This environmental assessment was prepared to analyze a proposed FAA airspace action. Consequently, the noise analysis of this environmental assessment was prepared in conformity with existing FAA regulations, which require use of the DNL noise metric and set the level of significance for noise impacts at the 65 DNL noise contour. While the FAA recognizes that there may be proponents of many different metrics- including SEL and LEQ - and levels of significance within those metrics, the environmental assessment process for the revision of the Seattle Air Traffic procedures is not an appropriate forum for effecting a change to FAA regulations.

C: One commenter (PH 4) requested that the EA include information on the types of aircraft assumed in the noise analysis.

R: The following aircraft were used in calculating the noise contours shown in Draft EA Exhibit 2 (Exhibit 18 in Final E.A.): 747SP, 747-100, 747-200, 747-300, DC10/L1011/A300, 767/A310, 757/A320, 727Q7, 727Q9, 727Q15, 727Q17, 737-100/200, 707DC8-60/C141, DC8-70, DC9-10/30/50, MD-81/82/83/89, F28/BAC111, BAE146, general aviation jet, DHC6/SA227, DHC7/L188, DHC8, F27/DC3/C130, light turboprop, light twin piston, light single piston.

C: A few commenters (PH 4; PH 5; AEA 196; AEA 280; AEA 374, p. 3) suggested that noise monitoring be conducted to better understand the noise impacts of the proposed action. One commenter wrote twice (AEA 241; AEA 328) to recommend test flights to determine the actual noise impacts of the Preferred Alternative.

R: Noise monitoring for the purpose of verifying aircraft noise parameters used in the FAA Integrated Noise Model is not necessary because FAA has already validated, through hundreds of field measurements, the aircraft noise data used in the model. Monitoring ambient noise levels in areas outside of the DNL 65 contour line would not be useful as those areas are already considered compatible with airport operations.

Establishment of the route structures, charting, personnel training, automation database, procedures and relocated communication facilities needed for operation of any of the alternatives considered (except "do nothing") takes approximately 90 days lead time. While certain portions of this could be expedited for brief test periods, the impossibility of turning these procedures on and off for several weekends to test them is clear. It is for these reasons that the concepts were simulated rather than given "real-time" tests. See also the discussion of part-time implementation in the "Alternatives" subsection above. It should also be noted that although weekends are periods of lower activity than some weekdays, a Saturday or Sunday may still produce in excess of 1,000 airport operations at Sea-Tac.

C: A number of commenters (AEA 331, p. 4) opined that the FAA should have used empirical noise data rather than relying on modeling to predict noise impacts. One (PHV, p. 70) stated that the EA contained information from only two monitoring stations in Seattle, <u>i.e.,</u> Beacon Hill and First Hill and this did not provide adequate noise data.

R: See preceding response regarding noise monitoring.

C: Three commenters (PH 4; PH 1; AEA 373) asked that the Mestre Grieve report be incorporated into the EA.

R: The Mestre Greve Report has not been finalized. The FAA has reviewed a copy of the draft report submitted by this consultant to the Mediation Committee. This draft report appears as an attachment to public comment AEA 331, which is reproduced in Volume II of this Final Environmental Assessment. Since there are no standards for determining the significance of time-above or single-event noise analyses, the FAA has chosen not to incorporate the Mestre Greve noise analysis into the body of the Final Environmental Assessment. Its inclusion would not aid the agency in making the required significance determination regarding noise impacts of the proposed procedures.

C: One commenter (AEA 331) suggested that the FAA failed to use the Integrated Noise Model (INM) to determine noise impacts. Another (AEA 374, p. 3 footnote) suggested that the FAA should have set forth the factors which make up the INM. This same commenter also claimed that the FAA had failed to do computer simulation of noise impacts.

R: Reference number 3 contains all of the information used in the INM run used to calculate the noise contours in Exhibit 2. The information used was the most recent available, 1988 operations data. As noted on page 50 of this document, FAA personnel reviewed and evaluated the INM input assumptions and found them reasonable. Inasmuch as implementation of the proposed action will not increase the overall number of daily operations and all of the arrival and departure flight track changes will occur well beyond the DNL 65 noise contours, there was no reason to actually run the INM because the result would be the same as those shown in Draft EA Exhibit 2.

C: One commenter (AEA 374, p. 7) asserted that the 65 DNL contours generated by the FAA were incorrect because they did not take into account the increased capacity of the Airport owing to the new procedures. Another (AEA 331, p. 5) claimed that the FAA did not independently review the 65 DNL contours submitted by the Port of Seattle.

R: See response above regarding use of the INM.

C: Three commenters (PH 41; AEA 302; AEA 374, pp. 3, 9) wanted to know noise impacts in noise sensitive areas. One of these, the City of Mercer Island, stated that the FAA's regulations do not state that noise sensitive areas exist only within the 65 DNL contours. Others (PHV, p. 34; AEA 327) asked that impacts on areas outside the 55-65 DNL contours be assessed. One of these (PHV, pp. 34-35; AEA 374, p. 4) asserted that a 1.5 DNL increase required preparation of an EIS.

R: FAA Order 1050.1D states that "if the proposed FAA action results in an increase within the 65 Ldn of 1.5 Ldn or greater on a noise sensitive area, it would be necessary to do further analysis as part of the EIS process ...." The preparation of an EIS in instances where a change of 1.5-or-greater Ldn on a noise sensitive area is anticipated presupposes that that change will occur within the 65 Ldn contour or cause the 65 Ldn contour to expand. Land uses in areas outside of the 65 Ldn contour are considered compatible with airport operations.

Since there would be no change to the 65-and-greater Ldn contours associated with Sea-Tac as a result of implementation of the Preferred Alternative, the predicate for preparation of an EIS does not exist. A more detailed assessment of the noise impacts outside the 55-65 Ldn contours would not change this conclusion.

C: One commenter (PHV p. 122) recommended that aircraft cut back on power at 1,000 feet. Another commenter (AEA 310) suggested that, "...jets be higher off the ground to undertake noisy maneuvers such as turns."

R: Noise abatement strategies involving reduced power climbs are in use at many locations by several aircraft operators. United Airlines, Sea-Tac Airport's biggest user has prescribed just such a routine. However, it must be acknowledged that the decision to use such a strategy on any given flight must rest with the flight crew due to the large number of variables, such as type of aircraft, weight, temperature, winds, etc. It should also be noted that the use of reduced power climb slows the rate of climb, and while it does provide some noise relief in the immediate area of the airport, it actually causes a higher level of perceived noise in other areas overflown.

An aircraft in a turn creates no more noise than one flying straight ahead. Whether the aircraft turns at 1,000' or 10,000', it is going to produce noise which is going to be perceived by those being overflown. The issue in most discussions of noise is who will be overflown as a result of the turn.

C: The City of Mercer Island (PHV, p. 35 and AEA 374, p. 23) maintained that the noise impacts of commuter traffic from the Renton and Boeing airports be addressed even though they are outside the 65 DNL contours. Another commenter (PHV, p. 40) stated that the impacts of Boeing Field operations needed to be taken into account.

R: There is virtually no commuter air traffic operating to or from the Renton Municipal Airport or Boeing Field. Neither the 65-or-greater DNL contours for Boeing nor those associated with Sea-Tac will change as a result of implementation of the procedures proposed under the Preferred Alternative.

C: One commenter (PHV, p. 51) stated that Green Lake would be significantly impacted by the proposed procedures.

R: The proposed change, in a north flow condition, would direct a daily average of 10 jets and 31 other aircraft north over the Green Lake area. This small number of overflights will not create an annual average noise exposure of DNL 65 or greater. Both references 1 and 2 categorize parks as being compatible with noise exposure environments of less than DNL 65, therefore the park will not experience a significant noise impact resulting from implementation of the proposed action.

C: At least three commenters (PHV, p. 38; AEA 331, p. 6; AEA 374, p. 4) suggested that FAA procedures dictated that any decrease by 20% of the distance between aircraft and noise sensitive neighborhoods, school and hospitals required a finding of significant impact and thus preparation of an environmental impact statement.

R: This comment relies on statements in FAA guidance taken out of context. Appendix 4 of FAA Order 1050.1D states that the following actions, among others, are categorically excluded from the requirement to prepare an environmental assessment: "Instrument Approach Procedures, Departures Procedures and Enroute Procedures conducted at 3,000 feet or more ABOVE GROUND LEVEL (AGL); Instrument Procedures conducted below 3,000 feet AGL which do not cause traffic to be routinely routed over noise sensitive areas; and modifications to currently approved instrument procedures conducted below 3,000 feet AGL that do not significantly increase noise over noise sensitive areas." The Order goes on to explain that "[a] significant increase in noise is based on a reduction of distance between aircraft and noise sensitive areas of more than twenty percent."

This reduction-in-distance criterion applies to modifications to currently approved instrument procedures below 3,000 feet AGL. It does not apply beyond the 3,000 feet AGL level. Since the procedures proposed in the Preferred alternative do not change instrument procedures below 3,000 feet AGL, this criterion is not applicable.

Appendix 4 of FAA Order 1050.1D also states that the following actions will be the subject of an environmental assessment: "New Instrument Approach Procedures, Departure Procedures, Enroute Procedures, and Modifications to currently approved instrument procedures which are conducted below 3,000 feet ABOVE GROUND LEVEL (AGL) and which will tend to increase noise over noise sensitive areas. ... A significant increase in noise is based on reduction of distance between aircraft noise and noise sensitive areas of more than 20 percent." Again, because the proposed procedures do not affect existing procedures below the 3,000-foot AGL altitude, the reduction-of-distance criterion for determining significance is inapplicable.

C: One commenter (AEA 374, pp. 9-11) stated that the FAA failed to comply with its regulatory requirement to utilize state and local noise standards to determine the significance of noise impacts on the environment. A second commenter (PH 1, p. 23) likewise suggested that maximum permissible noise levels under King County and Washington State laws is 55 dBA and that this level would be exceeded in several communities for certain periods of time each day due to aircraft noise.

R: The Supreme Court ruled, in Burbank v. Lockheed Air Terminal, Inc., 411 U.S. 624 (1973), that the regulation of aircraft noise by state and local governments in furtherance of their police powers is preempted by federal law. Thus, to the extent that Washington and/or King County has used their police powers to create legislation or ordinances prohibiting aircraft from exceeding a specific level of noise, their actions have been federally preempted. In fact, the Washington Department of Ecology and the Seattle City Council have enacted rules establishing maximum permissible environmental noise levels. In accordance with the Supreme Court's ruling though, both sets of rules exempt from their purview sounds originating from aircraft in flight as well as sounds that originate at airports which are directly related to flight operations. Washington Administrative Code 173-60-050 (4)(b); Seattle Municipal Code, Chapter 25.08.530.

If a particular community adopts a significance threshold lower than DNL 65, it is the responsibility of the local land use planning authority to implement measures to adapt local land uses to the community standards.

Contrary to the opinion of the first of these commenters, the FAA is not under an obligation to factor state and local noise standards into its significance determinations in environmental documents. This commenter's reliance on the requirement to "further delineation based on specific local requirements or determinations" was taken out of context. It appeared not in FAA Order 1050.1D, but in the FAA's Advisory Circular entitled Noise Control and Compatibility Planning for Airports (1983). The reference in this guidance to submitters of Part 150 Noise Compatibility Programs to the FAA for approval is in essence a reminder that in preparing such programs an airport sponsor should take into account local determinations as to the compatibility of certain land uses with airport noise. This reminder does not create any obligation on the part of the federal government, however. Rather, under the Part 150 program, the FAA reviews Noise Compatibility Programs to ensure that they reduce areas of land use incompatibility.

C: One commenter (AEA 374, p. 4) asserted that the FAA did not undertake a comprehensive noise analysis owing to its "impossibility" from both a scientific perspective and staffing requirements.

R: The FAA disagrees. In support of this comment, the City of Mercer Island quoted language from a memorandum that did not refer, as the City suggested, to the procedures under consideration in this Environmental Assessment. The comment therefore is not germane to the noise analysis undertaken by the FAA in this instance. The analysis relied upon by the FAA in assessing the noise impacts of the proposed procedures follows the policies of the FAA contained in Order 1050.1D.

AIR QUALITY

C: A number of commenters (PH 4; PH 1, p. 30; AEA 229; AEA 371; PHV, pp. 67-68; PHV, p. 71; AEA 326, p. 4; AEA 374, pp. 24-25) requested a detailed air quality analysis for baseline activity levels and the activity levels after the proposed action is implemented. One of these, the City of Mercer Island, remarked that the EA did not mention EPA or State air quality standards.

R: Inasmuch as implementation of the proposed action would not increase the overall level of flight activity in the Seattle metropolitan area and any (dis)benefit(s) to air quality owing to the "keep them high" strategy of the proposed procedures would be imperceptible, there is no need to conduct a detailed analysis of potential impacts to air quality.

C: Some commenters (PH 41; AEA 39; AEA 67; AEA 290) claimed that the proposed procedures would produce an increase in air pollution.

R: See response above.

LAND USE

C: A few commenters (PH 4; PH 41; PH 1, pp. 20-22; AEA 36) asked that more detail regarding land use and noise compatibility in areas below DNL 65 be provided.

R: Significant noise impacts associated with implementation of the proposed action will remain the same as today because the proposed action will not increase the overall number of daily operations at the airport. Since all land uses outside of the DNL 65 noise contour are already considered compatible with airport operations, more details regarding land uses in areas below DNL 65 would not contribute to the determination of whether or not the proposed action causes significant impacts.

C: One commenter (AEA 302) queried whether the proposed Plan would comply with Title 25 of the Seattle Municipal Code.

R: Since Title 25 of the Seattle Municipal Code contains multiple chapters and the comment did not refer to any particular one(s), it is difficult to know which ones the commenter thought might be implicated. The only apparently pertinent chapters are those which outline the State Environmental Protection Act procedures and which set forth the rules governing maximum permissible noise levels.

Since the proposed action is a federal one, the FAA need only comply with NEPA. Actions taken by the federal government are not required to comply with state environmental procedures.

With respect to the noise provisions of Title 25, it has been stated above in the Noise Section of this Response to Public Comments that the regulation of aircraft noise by local governments is preempted by federal law. In this instance, the City of Seattle has exempted aircraft noise from the maximum permissible noise levels established by Title 25 of the Seattle Municipal Code.

C: Numerous commenters suggested that implementation of the Preferred Alternative would effect a lowering of property values in the communities over which airplanes do not currently fly.

R: Any diminution in property values is purely speculative.

SECTION 4F

C: Two commenters (PH 4; AEA 374, pp. 15-16) suggested that properties protected under Section 4(f) of the DOT and Section 106(b) of the National Historic Preservation Act be considered in the EA. Another (PHV, p. 37) focused particularly on park land, saying potential impacts needed to be assessed.

R: Significant noise impacts associated with implementation of the proposed action will remain the same as today because the proposed action will not increase the overall number of daily operations at the airport. "Protected properties" within the DNL 65 noise contour will experience no change in impacts. "Protected properties" located outside the DNL 65 noise contour are, by Federal definition, located in a noise environment which is compatible with airport operations.

ENDANGERED SPECIES

C: One commenter (PHV, p. 104) noted that there was no analysis of the potential impacts of the Preferred Alternative on peregrine falcons and bald eagles in downtown Seattle. Another (AEA 374, pp. 15-16) stated that no evaluation on any endangered or threatened species had been done.

R: Given the ambient noise in the Seattle downtown business district, the proposed changes to the existing arrival and departure tracks over that area will not create noise impacts greater than those presently experienced in that environment. Thus, there is not expected to be any noise impact on either of these species.

WATER QUALITY

C: One commenter (AEA 302) suggested that overflight pollution was detrimental to drinking water held in open reservoirs.

R: Any water quality impacts that might be attributable to aircraft overflying the Seattle metropolitan area would not change in the event the Preferred Alternative were adopted: The numbers of aircraft arriving and departing the Seattle area will not change as a result of the implementation of the Preferred Alternative and changes in procedures above 3,000 feet will not produce any perceptible changes in aircraft emissions.

C: Another commenter (AEA 374, pp. 15-16) stated that the EA did not address this impact category.

R: No obvious water quality impacts could be identified, therefore this subject was not included. To simply list the item followed by a statement of non-applicability would be meaningless.

OTHER ENVIRONMENTAL IMPACT CATEGORIES

C: At least one commenter (AEA 374, pp. 15-18) stated that the FAA had failed to take into account the potential environmental impacts of the Preferred Alternative on all the impact categories listed in its Order 1050.1D. In particular, it noted the potential for community disruption.

R: FAA is required to address those environmental subject areas which may be impacted by the proposed action. It is not necessary to simply list items followed by a statement of non-applicability. The commenters' reference to community disruption in FAA Order 1050.1D is taken out of context. The term "community disruption" refers to alteration of surface transportation patterns, division or disruption of established communities (caused by relocation of residents resulting from land acquisition), disruption of planned development or changes in employment. Implementation of the proposed action is not expected to result in any of the above. Therefore the social impacts category did not merit separate discussion in the Draft Environmental Assessment.

SECONDARY IMPACTS

C: One commenter (AEA 374, p. 23) stated that the proposed flight tracks would alter the flight tracks utilized by Boeing Field traffic. Also, a few commenters (PH 4; PH 1, p. 31; PH 32) requested an analysis of the potential impacts of the proposed action upon Boeing Field and seaplane operations at Lake Union.

R: While IFR traffic into and out of Boeing Field constitutes a significant amount of the overall Seattle terminal traffic, the flight tracks of aircraft bound for Boeing Field would not change as a result of the proposed plan. As is now the case, Boeing traffic would follow the same flight tracks at high altitudes, distant from either airport, as traffic bound for Sea-Tac. Boeing traffic would enter and exit terminal airspace at the same locations as Sea-Tac traffic, as it does now. And within ten to fifteen miles of Boeing Field, the Boeing traffic would utilize the same procedures that are currently being used for arriving and departing that airport.

Seaplane traffic departing from, and arriving at, Lake Union would not be affected by the proposed procedures. The procedures under consideration only affect turbojet and turboprop aircraft under air traffic control. The seaplane traffic based at Lake Union does not consist either of turbojet or turboprop aircraft. Further, that traffic normally does not come under air traffic control; it operates strictly under Visual Flight Rules at altitudes below those affected by the revised procedures being assessed herein.

C: Some commenters (PH 4; PH 1, p. 34; AEA 39; AEA 345; AEA 304; AEA 374, pp. 15-16) suggested that the environmental assessment include analysis of secondary impacts such as: 1) increases in surface traffic congestion resulting from airport peak periods, 2) decreases in air quality resulting from 1) above.

R: Implementation of the proposed action will not increase the number of overall daily operations at the airport. Accordingly, there is no need to evaluate potential impacts on surface traffic or air quality resulting from increases in surface traffic.

CUMULATIVE IMPACTS

C: At least two commenters (AEA 331, p. 7; PHV, p. 108) stated that the Draft Environmental Assessment was deficient in failing to evaluate the cumulative impacts of air traffic noise on ground traffic noise.

R: Since implementation of the proposed action will not increase the number of overall daily operations at Sea-Tac, there will be no cumulative impacts on surface traffic noise.

C: One commenter (AEA 374, p. 3) stated that the Draft Environmental Assessment failed to express cumulative noise exposure in terms either of a change in LDN or relative change in the cumulative contour area.

R: Implementation of the proposed action will not increase the number of overall daily operations at the airport. Therefore the DNL 65 and greater noise contours will not change.

C: Numerous commenters stated that the proposed action is part of a "series of interrelated actions" that should be evaluated together. Their most frequent claim was that the addition of a third runway to Sea-Tac (or conversion of an existing taxiway to a runway) or building a new airport should have been evaluated either because these are foreseeable actions owing to the "increased capacity" of the airport created by the proposed procedural changes or because those changes would expand the capacity of the airport to the same extent as a new runway. One commenter (PH 4, p. 2) suggested that the effects of: the results of mediation; noise reduction/management strategies; airline scheduling decisions; and Port of Seattle management decisions should have been evaluated together with the impacts of implementation of the proposed procedures.

R: These commenters are under the mistaken impression that the increase in capacity referred to in the Draft Environmental Assessment means an increase in the number of aircraft operating to and from Sea-Tac. That is not the case. The proposed procedures are designed, among other things, to expand the FAA's use of existing airspace to more efficiently meet the existing air traffic demand at Sea-Tac. The effect of the proposed procedures would be to increase the arrival rate of aircraft that are currently utilizing Sea-Tac, but not reaching the Airport as quickly as they could given the restrictions on the FAA's use of airspace under the current procedures. The proposed changes to arrival and departure procedures would simply accommodate the existing demand for landing and departing Sea-Tac more efficiently, thereby reducing delays. The proposed procedures do not enhance the ground capacity of Sea-Tac. There is no need to do so since there is existing ground capacity that is not fully used. This would be true even if the proposed procedures were put into effect.

There is no proposal before the FAA to expand Sea-Tac's ground facilities through the addition of a new runway or a taxiway conversion. Nor is there a proposal to build a new airport to serve the Puget Sound region. Without a proposal before the agency, the FAA could not assess with any specificity the cumulative environmental impacts of the construction of a new airport or a new runway with those of the Preferred Alternative. Divining the results of mediation, any changes in airline scheduling, and future decisions by the Port of Seattle regarding the management and operation of Sea-Tac would require the FAA to make a crystal-ball inquiry into these processes, which NEPA does not require of any agency. Only reasonably foreseeable actions need be addressed in an environmental assessment.

The FAA does expect, given the operational trend of the past three years and the population increase in the metropolitan area, that the volume of traffic at Sea-Tac will continue to increase. Any increase in the number of operations experienced at Sea-Tac will be the result of demand of the flying public, which the FAA does not control. The foreseeable increase in demand, to the extent that it would exacerbate the existing delay problem at Sea-Tac, was in fact an impetus for proposing a change to the existing procedures.

C: Several commenters (PH 18; PH 41; PH 1, p. 34; AEA 68; PHV p. 71; PHV p. 117; AEA 326, p. 4) asserted that increasing "overhead" capacity could create the need for more runways at Sea-Tac.

R: One of the purposes of the proposal is to assure the appropriate utilization of the runways presently in use at the airport. The difficulty, expense and long lead-time involved in construction of new runways is cited in the environmental assessment as one of the reasons for pursuing capacity enhancement which <u>does not</u> require construction of additional runways.

C: One commenter (AEA 371) suggested the need to study the cumulative impacts of the Preferred Alternative on military air traffic.

R: The FAA has for more than a decade routed virtually all military instrument traffic around the Seattle terminal airspace in order to keep this area available for civil traffic using the Sea-Tac Airport and the nearby satellite airports. None of the alternatives considered, including the Preferred Alternative and the "Do Nothing Alternative", would change this.

C: One commenter (AEA 374, pp. 21-22) asserted that the Preferred Alternative's failure to include a nighttime curfew for communities on the East Side of Lake Washington is a "connected action" which requires a cumulative impact analysis.

R: As noted in both the text of the Final Environmental Assessment and the Procedural Section of this Response to Public Comments, it is the FAA's intent to retain the provisions of Seattle TRACON Order 7200.1, Chapter 2, Section 6 paras. (c)(1) and (2), which describe the rerouting of eastbound departures through Elliott Bay during those late night hours when traffic is light enough to permit safe use. This procedure is presently being reviewed by the Mediation Committee - Seattle-Tacoma International Airport Noise Abatement.

C: One commenter (AEA 374, p. 21) suggested a need to evaluate the cumulative impacts of the recent revisions to the Seattle Terminal Control Area (TCA) and the noise impacts of the proposed procedures. This suggestion was premised on an assertion that as a result of the revised Seattle TCA, "certain general aviation aircraft [fly] at a lower altitude than previously permitted."

R: The meaning of this assertion is unclear since the revisions made to the Seattle TCA, which became effective on January 11, 1990, did not alter the requirements of Part 91 of the Federal Aviation Regulations regarding minimum altitude of flight.

To the extent that this commenter claims that noise impacts generated by "certain general aviation aircraft" flying below the floor of the new TCA are required to be evaluated together with the noise impacts of the Preferred Alternative, the FAA does not agree. The FAA has no reason to believe that aircraft abiding by the recent changes to the Seattle TCA will create any significant, or even measurable, noise impacts either separately or cumulatively with the proposed procedures. (Establishment and modification of TCAs are categorically excluded from the requirement to prepare an environmental assessment. See FAA Order 1050.1D, Appendix 3, Para. 4e.) There is no available data, nor any known means of collection of data, regarding "certain general aviation aircraft" that might fly beneath the revised lower limit of the TCA since these aircraft, by choosing to remain outside the TCA, would not be under air traffic control. Furthermore, the commenter provided neither specificity as to which "certain general aviation aircraft" might create the alleged cumulative noise impacts nor any data to confirm the assertion that these aircraft now fly lower than they would have but for the revised TCA.

SAFETY IMPACTS

C: Numerous commenters expressed concern for the safety of persons and property on the ground below the proposed flight tracks.

R: One of the goals of the proposed changes to the air traffic arrival and departure routes at Se-Tac is to utilize airspace in a more efficient manner. In doing so, specific areas where aircraft are now being concentrated have been identified as areas where improvement could be made by spreading aircraft out over airspace which is presently being under-utilized. The new procedures not only would improve the efficiency of air traffic control within the navigable airspace, but also would enhance safety by alleviating the congestion created by utilization of the current procedures. See the "Purpose and Need" Section of the Final Environmental Assessment text for a fuller discussion of this issue.

PROCEDURAL

C: One commenter (PH 1, p. 41;PH 4) noted that the Puget Sound Air Pollution Control Agency was not listed among those contacted.

R: The Puget Sound Air Pollution Control Agency was not contacted because implementation of the proposed action is not expected to create any perceptible change in air quality.

C: Two commenters (PH 4; AEA 371) claimed that the Draft EA failed to meet minimum standards for preparation of environmental assessments contained in the regulations of the Council on Environmental Quality (CEQ), specifically 40 C.F.R. Sections 1501 and 1508.

R: Since these commenters did not identify which provisions of Sections 1501 and 1508 they believe were violated, it is not possible to respond to these comments other than to say that the FAA believes that the Final Environmental Assessment does comply with the CEQ regulations and that whatever deficiencies there might have been in the Draft EA have been corrected.

C: One commenter (PH 4; PHV, pp. 46-47) remarked that the proposed action is similar to FAA actions proposed for Washington National Airport for which a DEIS was prepared in 1976. Two other commenters (AEA 331, p. 5; AEA 374, pp. 18-19) pointed to two judicial decisions that they felt set precedent for preparation of an EIS whenever permanent alterations in flight tracks are made.

R: In Virginians for Dulles v. Volpe, 541 F.2d 442 (4th Cir. 1976), the FAA was required to prepare an EIS to address the environmental impacts of its "acquiescence in the vastly expanded use" of Washington National and Dulles International Airports. The court made note of the fact that the FAA was the owner and operator of those airports. Its ruling did not encompass situations such as the present one where the proprietor is an entity other than the federal government.

Further, at the time that case was decided, the only remedy available to the court under NEPA was an order requiring preparation of an EIS. The CEQ regulations implementing NEPA, which require the preparation of an environmental assessment to determine whether an EIS is necessary, had not yet been issued.

The FAA does not agree with the commenters' interpretations of the two decisions cited for the proposition that changes that would permanently alter flight tracks are required to be analyzed in an EIS. In Runway 27 Coalition, Inc. v. Engen, 679 F. Supp. 95 (D. Mass. 1987), the court found that the FAA's new multiple runway configuration for arrivals on, and departures from, two runways at Logan Airport in Boston and changes to the headings given aircraft departing one of these runways were not categorically excluded from the requirement to do an **environmental assessment**. It did not require the preparation of an EIS.

In the second case cited by the commmenters, City of Irving v. Federal Aviation Administration, 539 F. Supp. 17 (N.D. Tex. 1981), the FAA had prepared an environmental assessment for a sixty-day test of a new departure procedure from the cross-wind runway at Dallas-Ft. Worth Regional Airport and made a finding of no significant impact. The court upheld this action. In so doing, the judge opined that if the new procedures were to be implemented on a permanent basis, an EIS would be necessary. This statement was made in dicta, unnecessary to the decision in that case. It does not control the decision whether to prepare an EIS that the FAA must make in considering changes to air traffic control procedures at Sea-Tac or elsewhere.

C: Several commenters (PH 1, p. 37; PH 4; PH 22; AEA 371; AEA 299) noted that they, or organizations representing their interests, were not contacted for input in preparing the Draft Environmental Assessment.

R: The decision whether to contact particular entities or governmental bodies when preparing an environmental assessment is within the discretion of the preparing agency.

C: One commenter (PH 14) questioned the propriety of using FAA Order 1050.1D because it was not published in the Federal Register and did not go through a public process.

R: There is nothing improper about the FAA's reliance on Order 1050.1D in implementing its NEPA responsibilities. The draft version of Order 1050.1C, the predecessor of Order 1050.1D, was published in the Federal Register on June 4, 1979 (44 Fed. Reg. 32094) for public review and comment. This was done in response to the publication by the Council on Environmental Quality (CEQ) of its regulations governing the federal agencies' implementation of NEPA, which became effective on July 30, 1979. Once comments were received, they were summarized and responded to at the time the final version of Order 1050.1C was published in the Federal Register, on January 10, 1980 (45 Fed. Reg. 2244).

A revision to Order 1050.1C, which produced the current Order 1050.1D, was published in the Federal Register on July 12, 1984 (49 Fed. Reg. 28501).

C: A few commenters (PH 17; PH 1, p. 43; AEA 371; AEA 41; AEA 326) asserted that the FAA's public involvement process, including its notice, location and timing of the public hearing and its method for making the Draft Environmental Assessment available was inadequate. At least two commenters (PH 17; AEA 299) requested an extension of the comment period. Others (AEA 300; AEA 345; AEA 331) suggested that one public hearing was insufficient and that the three-minute time limit on speakers at the public hearing was inadequate. One of these (AEA 300) stated that the public hearing officer had abruptly cut off the hearing and deprived at least forty people who wished to speak of the opportunity to do so.

R: The FAA does not agree with these comments. There are no specific requirements regarding the number of hearings to be held or the time limit on speakers at public hearings. Judging from the turnout at the public hearing and the number and substance of the comments received, additional public hearings and a more liberal time limit for public hearing speakers would not have provided any more meaningful input than that which was received. With respect to time that the public hearing ended, the FAA announced in its notice of the public hearing that the hearing was scheduled for 7-10 p.m. The hearing ended at 10 p.m., as scheduled. Those who did not get to speak were told that they could submit their comments in writing for consideration by the FAA. The FAA did not place any greater emphasis on verbal, as opposed to written, comments.

C: Commenter (PH 39; AEA 156) stated that her group did not get an individual copy of the Draft Environmental Assessment to review. Another (PHV, p. 101) said that (s)he did not receive the document in time to review it before the public hearing.

R: There are no particular requirements for distribution of (draft) environmental assessments or the timing of distribution vis-a-vis a public hearing. To a large extent, the procedures an agency follows are within its discretion. The CEQ's regulations only require that the FAA make an environmental assessment available to the public, not that every member of the public receive a copy of the document. The FAA provided a copy of the Draft Environmental Assessment to seventy-five public libraries in the Puget Sound area for interested members of the public to read; seventeen of these libraries received five copies of that document. In addition, a copy of the Draft Environmental Assessment was sent to each of fourteen area newspapers. Major air carriers, commuter and cargo airlines were sent one copy apiece. Ninety-eight members of the Seattle Users Forum were sent individual copies.

It was announced at the public hearing, which two of these commenters attended, that the public comment period would be extended for an additional week. Thus, these commenters were free to review the Draft EA and submit their comments to the FAA after the public hearing. The CEQ's regulations require only that if a public hearing is to be held, the draft environmental impact statement need be made available to the public only fifteen days in advance. The availability of the draft environmental assessment in this instance was published on December 26, 1989, twenty-nine days before the public hearing on January 24, 1990.

C: One commenter (PH 1, p. 39; AEA 156) claimed that the controversial nature of the proposed action necessitated the preparation of an environmental impact statement (EIS).

R: The CEQ's regulations interpret the term "significantly" as is it is used in NEPA to require an agency to consider the intensity of a proposed action. One of the factors to evaluate in determining intensity is "the degree to which the effects on the quality of the human environment are likely to be highly controversial." 40 C.F.R. Section 1508.27(b)(4). Neither the CEQ's nor the FAA's regulations require that an EIS be prepared whenever a proposal is controversial among some element of the public or likely to generate litigation, as is the case here. No commenters provided the FAA with information that would support the existence of the type of controversy which would require preparation of an EIS.

While the "controversial nature" of the proposed action does not require an EIS, the FAA recognized the public's interest in the proposed changes to procedures for aircraft arriving and departing Sea-Tac and therefore chose to prepare an environmental assessment of these changes, which are otherwise categorically excluded from the requirement for such a document, and opted to hold a public hearing to receive public comments on the proposal.

C: Two commenters (PHV, p. 97; AEA 83) recommended that an independent entity evaluate the environmental impacts of the proposal in an EIS so as to avoid bias they perceived on the part of the FAA toward the proposal.

R: These commenters did not point to any particular actions or statements of anyone within the FAA that evince a bias on the part of the agency in evaluating the environmental impacts of the proposed procedures. Naturally, an agency is a proponent of its preferred alternative. NEPA contemplates that an agency can evaluate the potential environmental consequences of its own proposed action with good-faith objectivity and make the appropriate finding regarding the significance of those impacts. Moreover, there is no precedent for delegating an agency's responsibility for complying with NEPA to an outside entity. In instances where a court has found an environmental document to be inadequate, it has directed the agency that prepared the document to remedy the defect.

C: One commenter (PHV, p. 114) noted that the extension of the public comment period was not publicized in enough time to permit additional commenters to render comments.

R: The FAA received a substantial number of comments in the week between the public hearing and the close of the comment period, as can be seen by examining the dates on comments appearing in Volume II of the Final Environmental Assessment. Comments were sent to the agency for at least three weeks after the close of the comment period.

EDITORIAL

C: Several commenters (PH 1, p. 42; PH 17; PH 19; AEA 162; AEA 326; AEA 374, p. 6) requested clearer graphics with greater detail. One commenter (PHV, p. 33) felt that it was necessary to know more precisely the location of the proposed flight tracks.

R: In response to comments, the Final Environmental Assessment contains clearer, more specific graphics. The flight tracks associated with each of the alternatives evaluated are depicted more precisely than those that appeared on the maps in the Draft Environmental Assessment. The commenters are referred to the portion of this document entitled Alternatives Considered.

C: Two commenters (AEA 331, p. 6; AEA 374, pp. 1-2, 19) claimed that the Draft Environmental Assessment was an efficiency, rather than an environmental, study.

R: Although the Final Environmental Assessment follows essentially the same format as that of the Draft Environmental Assessment, its text has been altered somewhat to explain in more colloquial, and less technical, terms the need for and the purpose of the proposal, as well as alternatives considered. Some of the technical information that appeared in the draft document has been moved to Appendix A for reference.

Because of the technical nature of the proposed changes to air traffic procedures, a substantial amount of text of the environmental assessment was devoted to the description of the purpose of, and need for, the proposed action, as well as the descriptions of the various alternatives. On the other hand, a relatively small amount of text was devoted to explaining the environmental consequences of the Preferred Alternative because of the lack of significant impacts anticipated.

C: One commenter (AEA 302) asked for an identification of the altitudes referred to in subparagraph 4 on page 60 of the Draft Environmental Assessment that are inefficient.

R: The statement was intended to compare relative performance levels. Any turbojet aircraft operates more efficiently as it climbs. Each altitude is more efficient than the one below it until it approaches its service ceiling, somewhere above 30,000 feet.

Appendix - A Demonstrations/Simulations

This section reports on 13 simulations of air traffic control procedures developed, run and analyzed by personnel of the Seattle TRACON and the Seattle ARTCC to compare various possible methods for routing traffic in the vicinity of the Seattle-Tacoma International Airport. The alternatives explored during these simulations included several which had been developed over the past decade but not imnplemented, as well as others developed by the team at the time of the simulations.

1. Simulation Methodology

The simulations were conducted over a period of approximately two weeks using the Seattle TRACON Enhanced Target Generator, a training simulator function of the ARTS IIIA system in use at major terminal air traffic facilities. This simulator creates artificial RADAR targets on a radar display exactly like those in use at the control facility. These targets are "flown" by simulator operators at another display nearby, and produce a realistic control environment in which varying routes, procedures and conditions can be entered by the operators.

The data from which the targets were built was obtained from the actual traffic during the late morning arrival "bank" of August 24, 1989, During this period, the Seattle Airport was able to accept 56 arrivals per hour and the actual aircraft, fleet mix, points of entry into the terminal airspace and times were used. Only flight numbers or call signs were changed for the benefit of the simulator operators.

The Enhanced Target Generator has certain inherent limitations which must be borne in mind while reviewing the following results:

a. High arrival speeds and lack of pilot-induced variables can skew arrival rates.

b. The target generator is limited to 64 aircraft tracks, which limits it to a run of approximately one hour of heavy traffic. Each simulation included some departures to demonstrate the feasibility of proposed routings, but the 64 track limitation precluded the simultaneous operation of heavy arrival and heavy departure demand. The study emphasis was placed on improving arrival capacity, and the assumption is that departures will initially use existing routes until reaching 3,000', then be routed between the arrival routes.

c. Conclusions regarding noise impact are not possible other than general observations regarding the location of the ground tracks. Altitudes flown and descent rates can be observed, but they are only computer generated approximations of median rates and do not represent the range of possibilities, given different aircraft and pilot-induced variables.

The possibilities ranged from a scenario using existing procedures and constraints to ones which permitted "clean slate" development of all routes above 3,000' above ground level with arrival flows entering the area over fixed points which are not runway or weather sensitive. In between these, the study group found alternatives which were possible though awkward; possible though inefficient and costly; impossible and dangerous; and several which were possible but unlikely to provide any benefit to the FAA or the community.

DEMONSTRATION #1

Airspace simulation was conducted on September 12, 1989, using the following conditions:

1. South Flow.

2. Existing Seattle arrival procedures, NAVAIDS, and noise abatement restrictions.

3. Good weather permitting Visual Bay Approaches and ready visual identification and separation of aircraft.

4. This scenario had an unrepresentative fleet mix, high in turbojets, but provided good refresher on procedures presently in place.

OBSERVATIONS:

a. Flow rates approximately equal to north flow (56-60) can be achieved but only with extensive use of visual separation.
Phenomena such as haze, scattered cloud, sun glare will effect the rate.

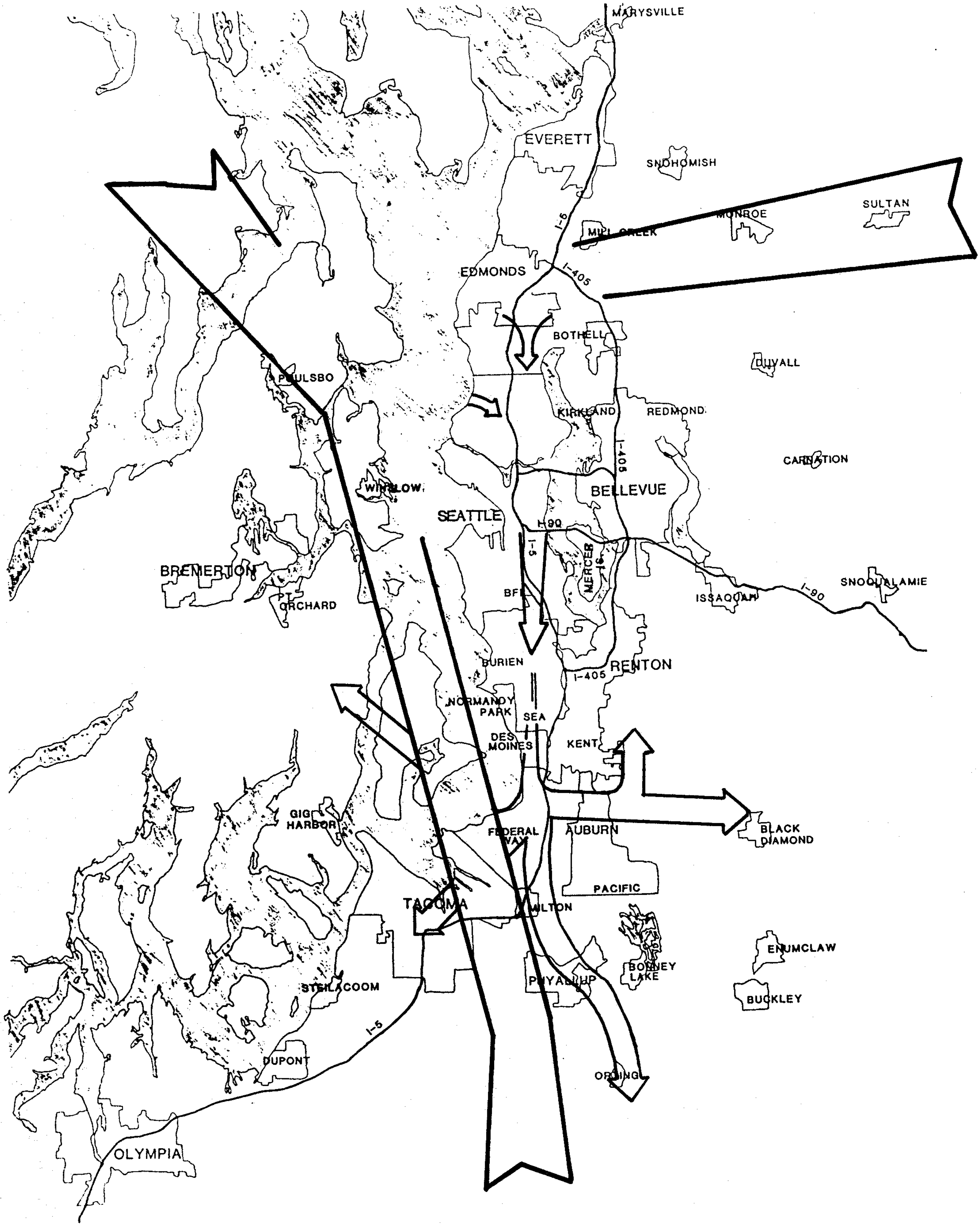
b. High flow rates cause a steady erosion of noise abatement procedures. In this simulation, Arrival East controller very quickly was forced to suspend use of Elliott Bay for his traffic and went straight-in from the Seattle 338/17.

c. Use of this arrival rate for more than 15 minutes will almost assure a stretching of the final; an estimated 60% of westside arrivals will miss Elliott Bay. While these procedures include all of the noise mitigation measures developed over the past twenty years, they do so at the expense of capacity. Any attempt to exceed 36-42 operations per hour can be successful only if one abandons noise mitigation in favor of system efficiency.

d. This configuration could probably not be mated with the static ARTCC arrival routes which are proposed to relieve the high altitude issues described on page 10 above. Instability and inefficiency problems with the enroute structure will continue.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #1

DEMONSTRATION #2

Airspace simulation was conducted on September 12, 1989, using the following conditions:

1. Existing Seattle arrival procedures, NAVAIDS, and noise abatement restrictions except as noted below:

a. All arriving turboprops and FAR 36 Stage III turbojets may be assigned routes east of Seattle Runway 16 Final approach course (east downwind), and will not be required to recross the runway 16 localizer.

b. East downwind turbojets will not descend below 8,000 until north of the Highway 520 Bridge and will intercept final at or above 5,000' and at 17 DME or more.

2. Good weather permitting Visual Bay Approaches and ready visual identification and separation of aircraft.

3. This problem had an unrepresentative fleet mix, high in turbojets.

OBSERVATIONS:

a. Arrival controllers commented on smoothness of operation, stated that integration of turboprops into flow would be easy.

b. This configuration could probably not be mated with the static ARTCC arrival routes which are proposed to relieve the high altitude issues described on page 10 above. Instability and inefficiency problems with the enroute structure will continue.

c. Possibility of demand imbalance adverse to west side arrival controller no greater than at present. Imbalance adverse to east side controller can be promptly reduced by shifting some aircraft to west side.

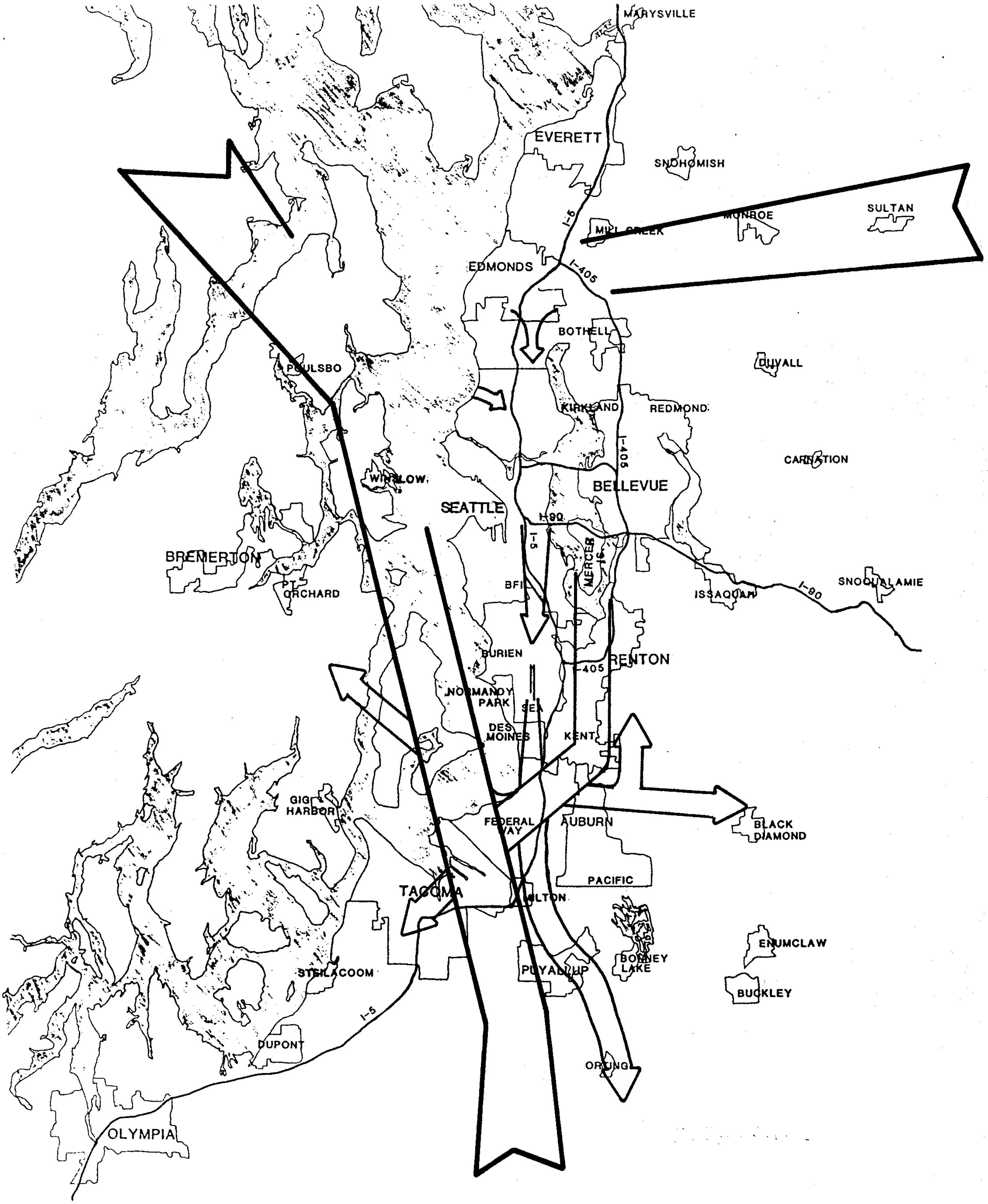
d. Some lost arrival opportunities will continue to occur due to the noise abatement requirement to turn on from the east outside the Seattle 338/17, but better positioning of turboprops and more orderly arrival flows will reduce this inefficiency.

e. This procedure will create turbojet arrival flight tracks along the east side of Lake Washington where none presently exist. Under all but the heaviest traffic load, these will be in a long low-thrust descent, and will involve only the quietest aircraft in the fleet. West side residents (Vashon, West Seattle, Magnolia, Queen Anne, Ballard) will experience significantly fewer overflights.

f. Some difficulties and inaccuracies will be experienced in sorting Stage II from Stage III aircraft from the flight plan data presented to the system. Sometimes different production numbers of the same aircraft fall on different sides of the Stage II/III divide.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #2

DEMONSTRATION #3

Airspace simulation was conducted on September 12, 1989, using the following conditions:

1. South Flow.

2. Use proposed "Price Alternative" design with the downwind legs approximately eight miles on either side of the airport.

3. Turbojet arrivals from the east and southeast must remain at or above 5,000 until turning final outside the SEA 338/17.

4. Weather 1,500 broken with 8 miles visibility, permitting sidesteps near the outer marker.

5. Metered arrival rate of approximately 52 per hour.

OBSERVATIONS

a. This problem was taken from actual traffic in a period when demand was greatest from the east, a situation which is likely to occur in at least one arrival bank each day. This configuration permits balancing of workload by having the flow from the southeast cross just south of the airport to merge with the arrival stream from Olympia. Metering should assure that no three arrival flows are heavily used simultaneously.

b. Smoothness of arrival flows was noted. "Long leg" arrivals from the southeast and southwest had ample time for descent, speed reductions in preparation for merge with "short legs".
This procedure will create turbojet arrival flight tracks along the east side of Lake Washington where none presently exist. Under all but the heaviest traffic load, these will be in a long low-thrust descent. In the South Flow simulations, arriving aircraft were over Renton at 10,000' and made an uninterrupted descent to the final approach course at 5,000' in the vicinity of the Evergreen Point Bridge. West side residents (Vashon, West Seattle, Magnolia, Queen Anne, Ballard) will experience significantly fewer overflights.

c. Proximity of the downwind legs to the airport permits easy adjustment of the location of the turn from downwind to base leg as demand increases and decreases.

d. High flow rates (52 per hour) were achieved, but only by the liberal use of sidesteps and some visual separation. Actual rates in the weather used for this simulation would probably be in the low 40's.

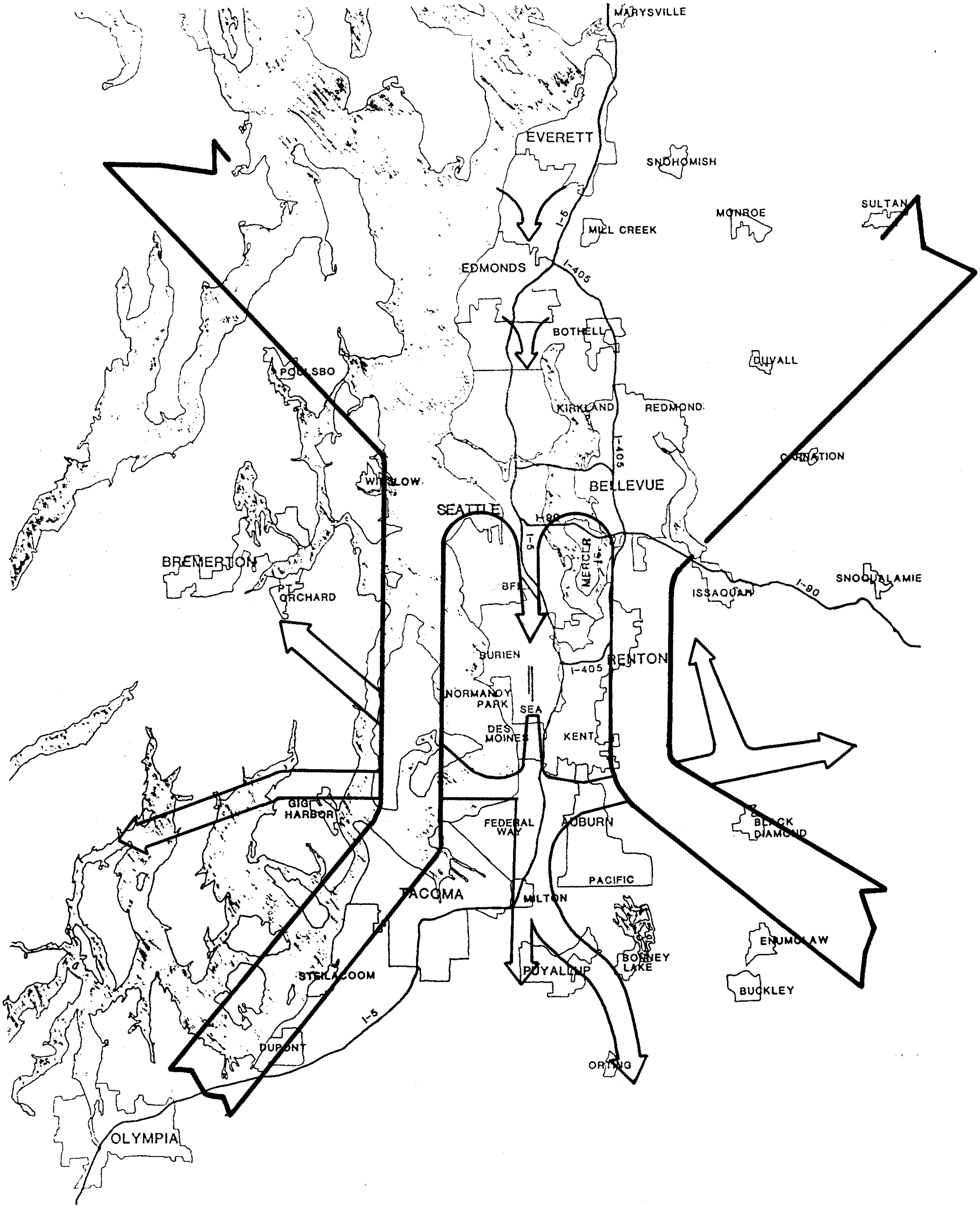
The inability of the simulator to replicate conditions with sufficient accuracy to predict exact arrival rates has already been noted, but in optimum weather this configuration should be limited only by the runway capacity, permitting 56 to 60 arrivals per hour.

e. These procedures are designed to mate with the enroute changes proposed by Seattle ARTCC to relieve the high altitude issues described on page 10, above.

f. Some lost arrival opportunities will continue to occur if controllers are required to turn aircraft onto the localizer from the east outside the Seattle 338/17. When this requirement was removed from the test, efficiency increased.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #3

DEMONSTRATION #4

Airspace simulation was conducted on September 13, 1989, using the following conditions:

1. South Flow.

2. Four arrival streams with eastside downwind outside the King County Metropolitan Area. Aircraft inbound along the Seattle 101 Radial turn northbound when passing HUMPP intersection (Seattle 101/25).

3. Meet existing Seattle turbojet arrival noise constraints.

4. Good weather permitting Visual Bay Approaches and ready visual identification and separation of aircraft.

5. Turbojets from southeast and northeast intercept final approach course at 5,000' or above and at 17DME miles or greater, without crossing runway 16 centerlines. Turbojets from the southwest and northwest will use existing Elliott Bay Procedures.

6. Metered flow of 52 per hour.

OBSERVATIONS

a. Because arrival streams are metered at the Terminal/ARTCC boundary, it would be likely that a group of closely spaced arrivals could be metered into the Southeast arrival gate; vectored on the wide downwind to the northeast corner of the terminal airspace, and there meet the next group of closely spaced metered arrivals. Use of this configuration would require that metering programs be modified to preclude this.

b. East Arrival controller may need to spread the downwind stream after passing abeam the airport to integrate it with the east arrival stream. Altitude restrictions are feasible, but specific ground track is probably not possible north of the Seattle 060 Radial in moderate to heavy traffic. This will cause some overflights in the northeast part of the Metropolitan area

c. This configuration makes it extremely difficult to depart Seattle to the east.

1) The arriving turbojet stream will be descending to 14,000' when handed-off by the ARTCC, necessitating restricting the departures to 13,000' or below until approximately 30 miles east (45 flying miles). While inefficient, this is probably achievable.

2) The turboprop/reciprocating arrival route underlies the turbojet stream at 10,000', which is the MEA/MVA in this area. It is

extremely difficult to get the departing commuter/light-twin type aircraft above this 10,000 traffic in order to go east at 11,000' or 12,000'.

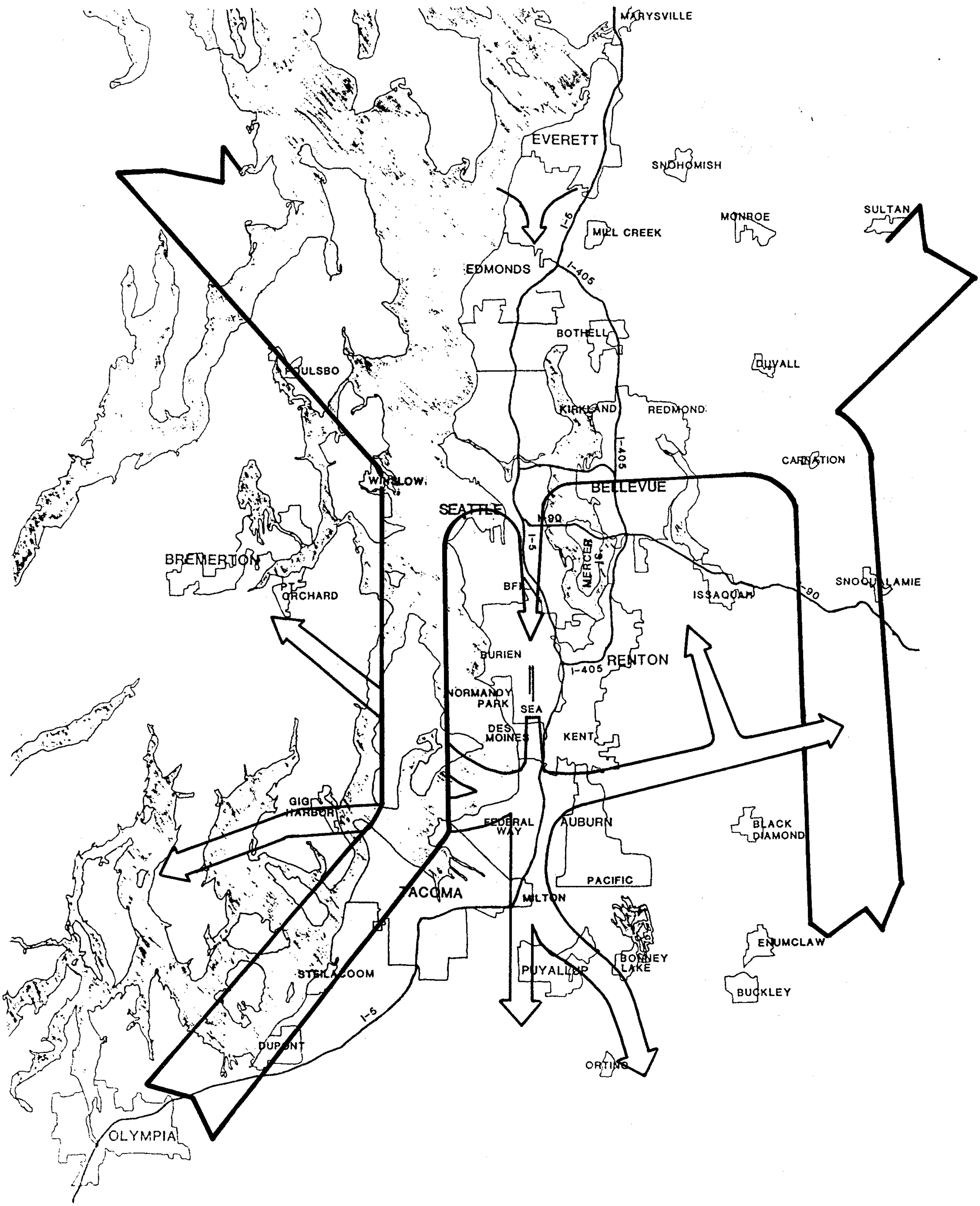
d. At these arrival rates, it will be impossible to carry the east arrival traffic across the localizer to join the Elliott Bay routing. Some lost arrival opportunities will continue to occur due to the noise abatement requirement to turn on from the east outside the Seattle 338/17, but the balanced and more orderly arrival flows may reduce this inefficiency.

e. These procedures could be mated with the enroute changes proposed by Seattle ARTCC to relieve the high altitude issues described on page 10, above.

f. Noise mitigation is emphasized in this plan. All tracks avoid those areas of the eastside which have traditionally had few turbojet overflights in the South Flow. They will now experience none. This will be done at the cost of making all arrivals from the east fly an arrival route which is from 10 to 30 miles longer than some of the other proposals. These miles will occur at a relatively low altitude and result in higher fuel consumption, air pollution, and will increase arrival noise exposure in the rural areas of Eastern King County. There are fuel consumption and air pollution penalties imposed on the departures under this plan, as spelled out in c.1), above.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #4

DEMONSTRATION #5

Airspace simulation was conducted on September 13, 1989, using the following conditions:

1. South Flow.

2. Four arrival stream configuration with no downwind leg east of the airport.

3. Arrival flow from the southeast on the 101 Radial remains at 10,000' or above until crossing over the Seattle VOR to join westside flow inbound from Olympia.

4. Visual Bay weather

5. Metered flow rate of 52 per hour.

OBSERVATIONS

a. These procedures could be mated with the enroute changes proposed by Seattle ARTCC to relieve the high altitude issues described on page 10, above.

b. Stream will have to be vectored south of the VOR to prevent two streams merging in the blind area near the RADAR antenna.

c. This configuration does not balance workload between two feeders. Extreme congestion is likely to occur over the Vashon area due to merging the two busiest arrival flows. Partial relief could be achieved by routing turboprops up the eastside, but complexity could be overwhelming.

1) west feeder would routinely handoff northeastbound turboprops to east feeder approx. five miles south of the VOR, at 10,000', to be merged with the northwestbound turboprops on the 101 radial.

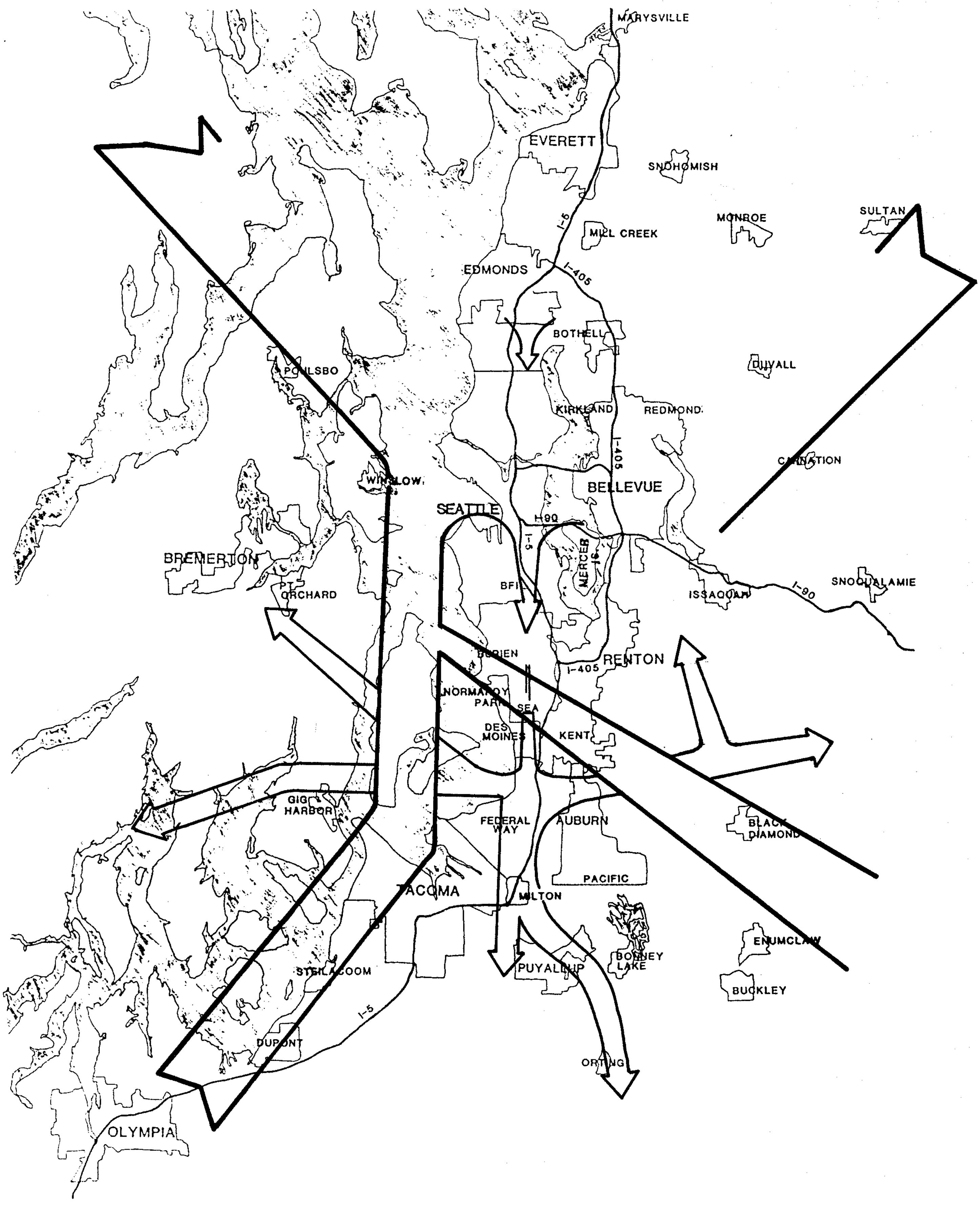
2) East feeder would routinely handoff westbound turbojets to west feeder approximately five miles south of the VOR at 11,000, to be merged with the northbound jets from Olympia.

d. West feeder airspace would be of approximately the same dimensions as at present. Additional workload introduced by bringing traffic from the southeast would probably render this completely unworkable at arrival rates in excess of 36 per hour.

e. Noise mitigation is good as long as demand stays below 36 arrivals per hour. Most turbojets will make minimum power descent and be routed away from areas which have traditionally been spared from overflights by arrival procedures.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #5

DEMONSTRATION #6

Airspace simulation was conducted on September 13, 1989, using the following conditions:

1. North Flow.

2. Arrival flow in the northeast quadrant turns south at the SEA 020/25 to join the inbound flow from the southeast in the vicinity of the SEA 101/25 in order to remain east of the King County Metropolitan Area. This is the north flow equivalent of Demonstration #4.

3. Turbojets on the east downwind remain at 14,000' until passing the departure stream near the SEA 069Radial. Turboprops pass under the departure stream at 10,000'.

4. Good weather permitting ready visual identification and separation of aircraft.

5. Metered flow of 52 per hour.

OBSERVATIONS.

a. Relatively large space available to Arrival East controller in the southeast quadrant makes sequencing of this relatively large volume of aircraft feasible, as is true presently. In the event of large numbers of aircraft inbound on the 101 radial simultaneously with aircraft on the 25-mile downwind, the controller can turn one flow to the southwest or south to parallel or even diverge from the other until making staggered base leg turns.

b. This configuration makes it extremely difficult to depart Seattle to the east.

1) The arriving turbojet stream will be descending to 14,000' when handed-off by the ARTCC, necessitating restricting the departures to 13,000' or below until approximately 30 miles east (45 flying miles). While inefficient, this is probably achievable.

2) The turboprop/reciprocating arrival route underlies the turbojet stream at 10,000', which is the MEA/MVA in this area. It is extremely difficult to get the departing commuter/light-twin type aircraft above this 10,000 traffic in order to go east at 11 or 12,000'.

3) The situation described in 2) above could be alleviated by bringing the turboprop arrival flow in on the 020 radial and placing them on a more conventional downwind approximately 8 miles east of the airport. (See Demonstration #10 for this modification.)

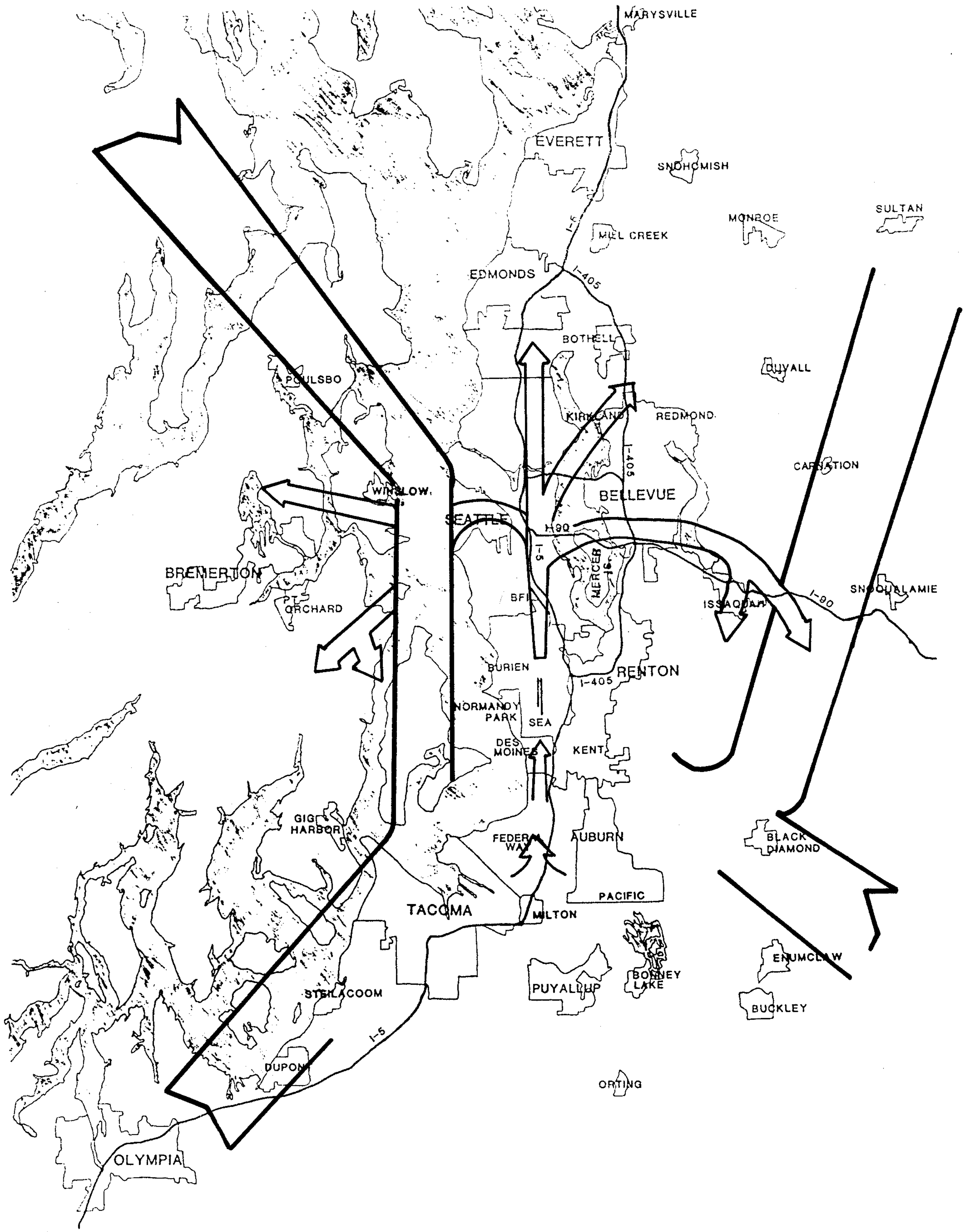
c. It was attempted to balance flows by taking the arrival flow in the northeast quadrant across the north edge of the terminal airspace toward LOFAL to join the west downwind flow. This flow conflicted with Elliott Bay departure flows.

d. These procedures could be mated with the enroute changes proposed by Seattle ARTCC to relieve the high altitude issues described on page 10, above.

e. Noise mitigation is emphasized in this plan. All tracks avoid those areas of the eastside which have traditionally had very few turbojet overflights. This will be done at the cost of making all arrivals from the northeast fly an arrival route which is from 10 to 20 miles longer than some of the other proposals. These miles will occur at a relatively low altitude and result in higher fuel consumption, air pollution, and will increase arrival noise exposure in the rural areas of Eastern King County. There are additional fuel consumption and air pollution penalties imposed on departures by this plan, as spelled out in b.1), above.

NORTH FLOW

RUNWAYS 34



DEMONSTRATION #6

DEMONSTRATION #7

Airspace simulation was conducted on September 15, 1989, using the following conditions:

1. North Flow.

2. Four arrival flow configuration, with the arrival flow in the northeast quadrant crossing VOR to join the westside arrival flow. (This is the north flow equivalent of Demonstration #5.

3. Good weather permitting ready visual identification and separation of aircraft, simultaneous operations on Runways 34L/R.

4. Metered flow of 52 per hour.

OBSERVATIONS:

a. Crossing at VOR causes loss of radar contact at critical time in sequencing. Flow should actually cross near Boeing Field.

b. Fairly smooth operation. At present, arrival "banking" at Sea-Tac comes in alternating areas. The bank used for this simulation is heavily weighted in the two east gates, in which case this configuration would permit some workload balancing on both sides of the Runway 34 final.

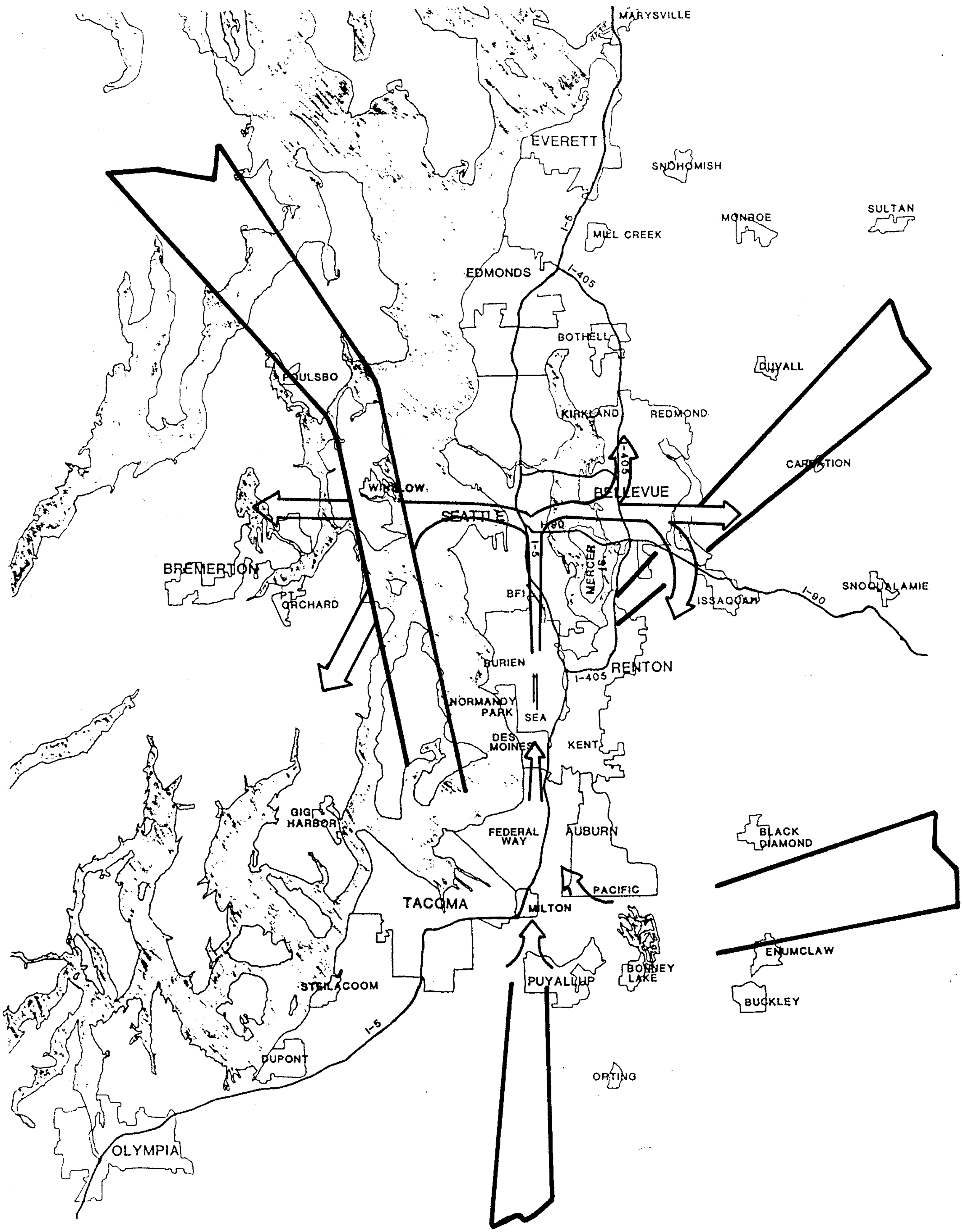
If this configuration were adopted, some entirely different design concept would probably be needed for the South Flow operation. Demonstration #5, the south equivalent of this one, failed at rates over 36/hour.

c. These procedures could be mated with the enroute changes proposed by Seattle ARTCC to relieve the high altitude issues described on page 10, above.

d. This arrangement will cause turbojet overflights in the Kirkland, Redmond, Bellevue areas. Any change in overflight or noise distribution in these areas should be made in pursuit of a more efficient alternative, such as Demonstration 3, above.

NORTH FLOW

RUNWAYS 34



DEMONSTRATION #7

DEMONSTRATION #8

Airspace simulation was conducted on September 15, 1989, using the following conditions:

1. North Flow.

2. Three arrival flow configuration in which arrival/departure gates on the east side of terminal airspace are runway sensitive, as at present. Simultaneous side-by-side arrival flows in the southeast quadrant from sectors 1 and 31.

3. Good weather permitting simultaneous operations on Runways 34L/R, with ready visual identification and separation of aircraft.

4. Metered rate of 52 arrivals per hour.

OBSERVATIONS

a. A large area is available to the southeast in which to "fan" arrivals or establish upwind or downwind legs to merge traffic with inbounds from south and northwest, in good weather.

b. Pilot nav parallel routes could probably be established.

c. Leaves entire northeast quadrant available for the use of the departure controller; enroute crossovers are minimal.

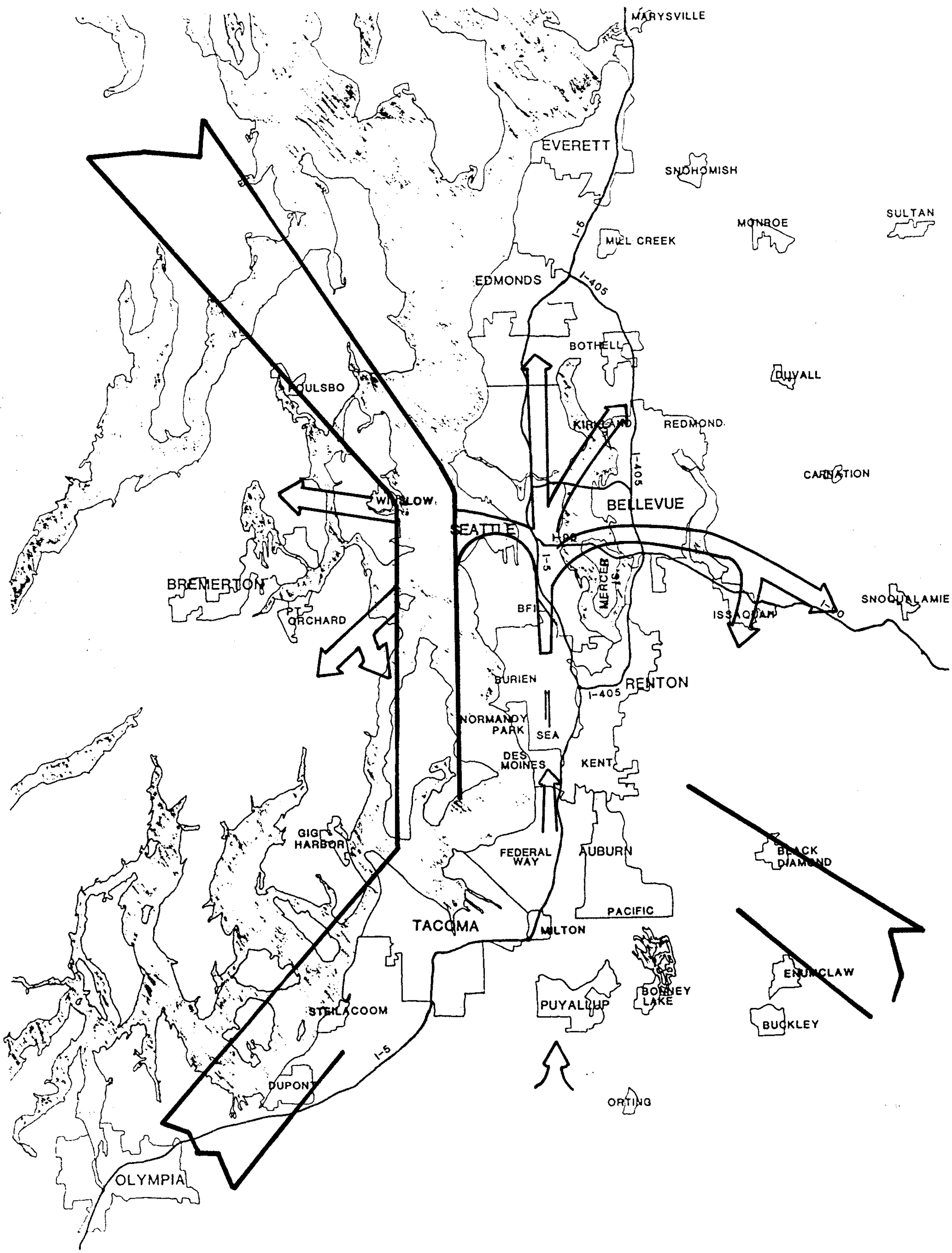
d. This option requires "flip/flop" in runway changes, resultant instability of sector boundaries, enroute structure.

e. Sector 1/31 boundary would be displaced southward to the vicinity of the 101 radial. The establishment of a corridor permitting Sector 31 (which is primarily northeast of Seattle) to present an arrival flow in the eastsoutheast area would preclude the use of metering and holding fixes in close proximity to terminal airspace, markedly reducing the effectiveness and accuracy of arrival metering.

f. This plan is noise neutral. It restricts nearly all aircraft to areas which are affected by aircraft overflights under present north flow procedures. The problems occur with attempts to apply this design concept to the south flow operation, as in Demonstration #9 below.

NORTH FLOW

RUNWAYS 34



DEMONSTRATION #8

DEMONSTRATION #9

Airspace simulation was conducted on September 15, 1989, using the following conditions:

1. South Flow.

2. Three arrival flow configuration in which arrival/departure gates on the east side of terminal airspace are runway sensitive, with simultaneous side-by-side arrival flows in the northeast quadrant from sectors 1 and 31.

3. Honor all existing Seattle turbojet noise constraints.

4. Good weather permitting the use of Visual Bay procedures, ready identification and separation of aircraft. Metered arrival rate of 52 per hour.

OBSERVATIONS

a. In periods of high demand, it may be necessary to deflect the sector 1 arrival stream toward the VOR, establishing an upwind-downwind situation in the Redmond Bellevue areas.

b. Pilot nav parallel routes could probably be established.

c. Sector 1/31 boundary would be displaced northward to the vicinity of the 030 radial. The establishment of a corridor permitting Sector 1 (which is primarily southeast of Seattle) to present an arrival flow in the northeast quadrant would preclude the use of metering and holding fixes in close proximity to terminal airspace, markedly reducing the effectiveness and accuracy of arrival metering.

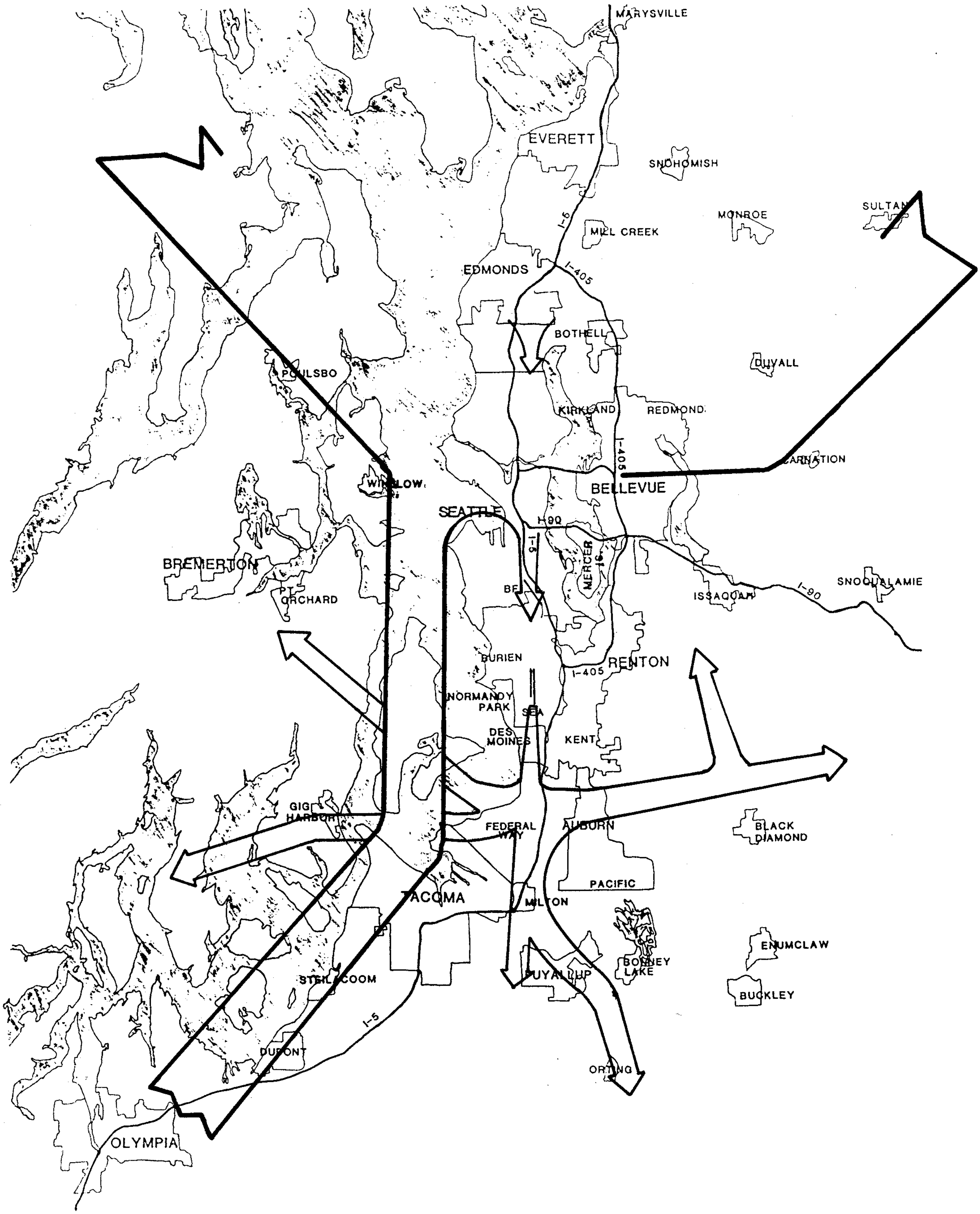
d. Leaves entire southeast quadrant available for the use of the departure controller.

e. This option requires "flip/flop" of arrival/departure gates in runway changes, resultant instability of sector boundaries, enroute structure. Enroute crossover problems east of Ephrata and Ellensburg, involving high altitude, high speed aircraft crossing at very shallow angles may not be acceptable. These would involve large numbers of arrivals from the direction of Denver, Dallas, Atlanta, crossing with departures to Minneapolis, Chicago, New York Complex.

f. This operation works only at arrival rates of 42 or less. Any attempt to increase above that number results in the same erosion of noise abatement as in the present Seattle South Flow configuration. Aircraft from the east have to be turned-on to the ILS from the east and aircraft from the west have to abandon the Elliott Bay procedure. See Demonstration #1.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #9

DEMONSTRATION #10

Airspace simulation was conducted on September 19, 1989, using the following conditions:

1. South Flow.

2. Four Arrival Streams with eastside downwind outside the King County Metropolitan Area. Aircraft inbound along the Seattle 101 Radial turn northbound when passing HUMPP intersection (Seattle 101/25), except that turboprop aircraft continue inbound on the 101 radial to join a downwind eight miles east of the airport.

3. Meet existing Seattle turbojet arrival noise constraints.

4. Good weather permitting Visual Bay Approaches and ready visual identification and separation of aircraft.

5. Turbojets from southeast and northeast intercept final approach course at 5,000' or above and at 17DME miles or greater, without crossing runway 16 centerlines.

6. Metered arrival rate of 52 per hour.

OBSERVATIONS

a. Because arrival streams are metered at the Terminal/ARTCC boundary, it would be likely that a group of closely spaced arrivals could be metered into the Southeast arrival gate; vectored on the wide downwind to the northeast corner of the terminal airspace, and there meet the next group of closely spaced metered arrivals. Use of this configuration would require that metering programs be modified to preclude this.

b. This configuration operated smoothly, and is capable of handling relatively high demand. The long, wide downwind and base legs create obvious inefficiencies from the perspective of the aircrews, causing as much as 25 extra flying miles in periods of low arrival demand.

c. It was found that if two eastside downwind legs are created for noise abatement, as in this simulation, the outer one could not be moved much closer than 25 miles if we are to have any area available for the departures to go north.

d. East Arrival controller may need to fan the downwind stream after passing abeam the airport to integrate it with the east arrival stream. Altitude restrictions are feasible, but specific ground track is probably not possible north of the Seattle 060 Radial.

e. Gate balancing from the east side to the west side is probably not possible for turbojets in this configuration.

f. An attempt to bring aircraft across the localizer for noise abatement or balancing resulted in excessive work for the east feeder as well as unacceptable congestion in the Edmonds-Kingston-Winslow area.

g. The arriving turbojet stream will be descending to 14,000' when handed-off by the ARTCC, necessitating restricting the departures to 13,000' or below until approximately 30 miles east (45 flying miles). This will cause increase noise exposure in the rural areas of Eastern King County, higher fuel consumption and air pollution, but it is operationally feasible.

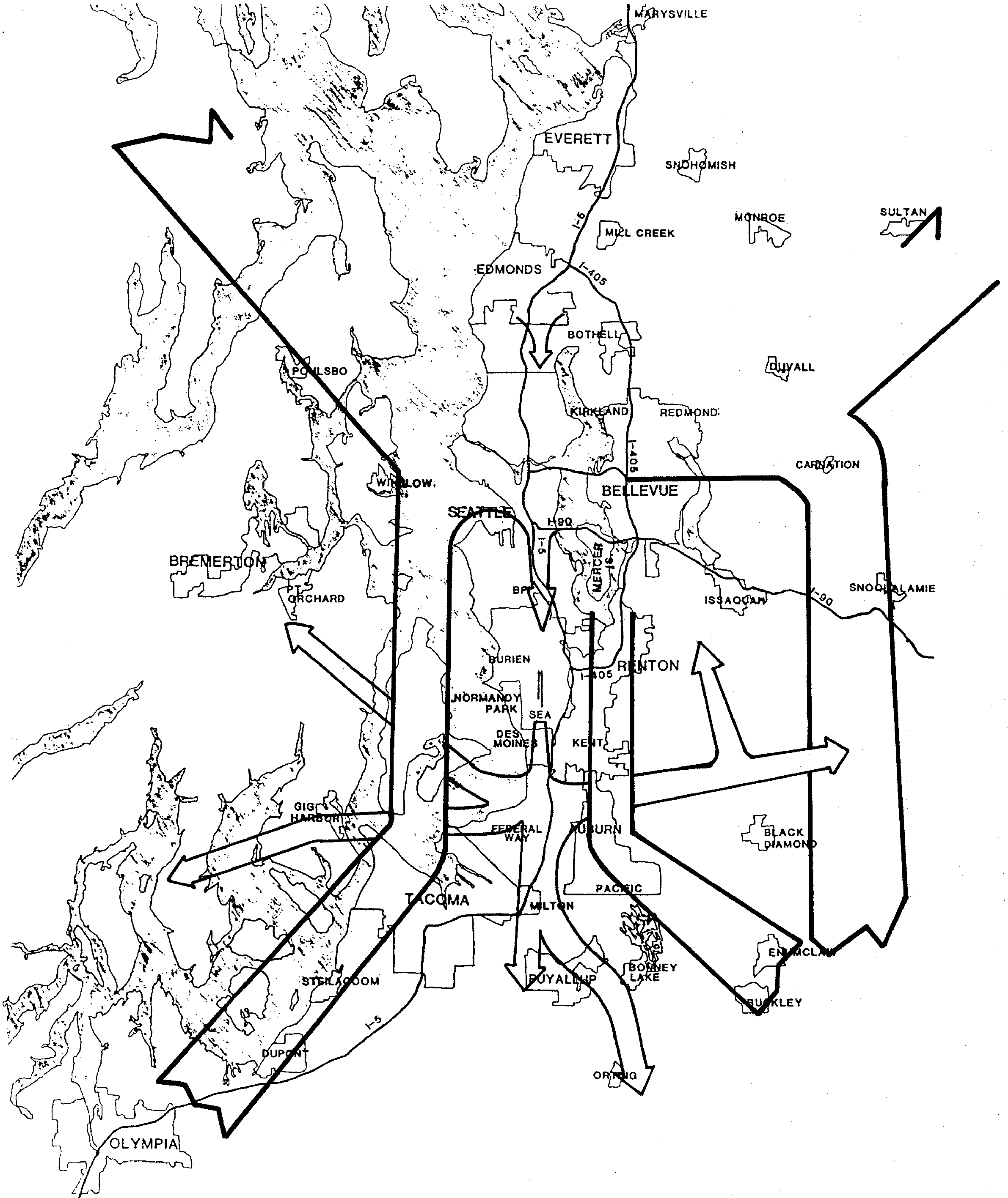
h. Some lost arrival opportunities will continue to occur due to the noise abatement requirement to turn on from the east outside the Seattle 338/17. Turboprops from the near downwind will fill some of these opportunities.

i. The workgroup agreed that of all the alternatives short of Alternative #3, this seems the most palatable from the point of view of the controller. This plan is however, grossly inefficient. It involves extended flight at low altitude near mountainous terrain for both arrivals and departures, with resultant high fuel consumption and increased air pollution.

While it maximizes noise abatement for those areas on the east side of Lake Washington which have not experienced south flow turbojet overflights, aircraft noise would be introduced into new areas in the vicinity of North Bend, Snoqualmie, and Carnation. Its efficiency and operational acceptability would be markedly enhanced if FAR 36 Stage III turbojets were added to the turboprops on the near eastside downwind leg.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #10

DEMONSTRATION #11

Airspace simulation was conducted on September 19, 1989, using the following conditions:

1. South Flow.

2. No changes to present terminal airspace boundaries or location of arrival or departure handoffs.

3. Place turboprops on eastside of 16 finals whenever possible, including inbound flows from Eastern Washington, Victoria/Bellingham/Vancouver, Portland via 158 radial.

4. Honor all existing noise abatement constraints.

5. Good weather permitting full use of simultaneous arrivals to runways 16L/R; ready visual identification and separation of aircraft.

OBSERVATIONS

a. High arrival rates are feasible, but only if eastside arrivals intercept the ILS from the east instead of crossing to the west side to enter through Elliott Bay. If Turbojets are required to use Elliott Bay from the east, rates over 36 will cause congestion north of Elliott Bay, rates over 42 cannot be achieved except in periods of unusually low turbojet concentration in the fleet mix.

b. Requirement to turn turbojets onto final from east outside the SEA 338/17 causes lost arrival opportunities, some of these will be filled from the west side, or with turboprops.

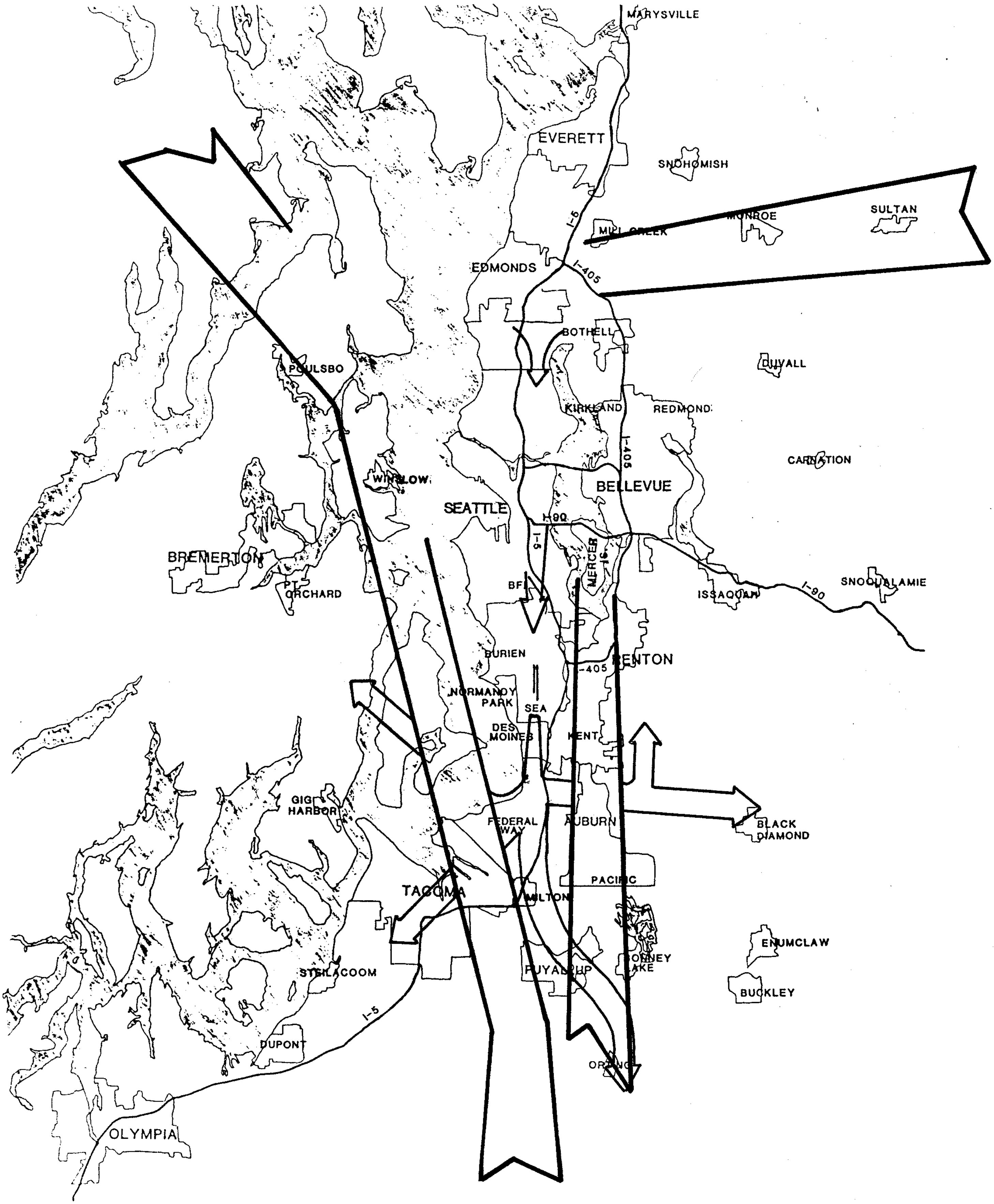
c. Noise mitigation is emphasized at the expense of system efficiency. All areas of the Eastside presently protected from turbojet overflight will continue to receive this benefit. There will be a small increase in turboprop activity.

d. In high rates, arrivals from the northeast may have to be brought toward Redmond and Bellevue to join turboprop downwind as is sometimes case at present.

d. This configuration could not be mated with the static ARTCC arrival routes which are proposed to relieve the high altitude issues described on page 10, above. Instability and inefficiency problems with the enroute structure will continue.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #11

DEMONSTRATION #12

Airspace simulation was conducted on September 19, 1989, using the following conditions:

1. South Flow.

2. No changes to present terminal airspace boundaries or location of arrival or departure handoffs.

3. Place turboprops and all FAR 36 Stage III complying jets on eastside of 16 finals whenever possible, including inbound flows from E. Washington, Victoria/Bellingham/Vancouver, Portland via 158 radial.

4. Honor all other existing noise abatement constraints.

5. Good weather permitting full use of simultaneous arrivals to runways 16L/R; ready visual identification and separation of aircraft.

OBSERVATIONS

a. High arrival rates are feasible, but only if eastside arrivals intercept the ILS from the east instead of crossing to the west side to enter through Elliott Bay. This configuration is preferred to the one in Demonstration 11 due to the greater ability to balance demand between the two downwinds.

b. This configuration seems to lend itself to a single feeder, two final arrangement. Feeder works the aircraft along the 158 radial, balances workload between the final controllers; assigns initial speeds, altitudes, merges some flows, assures aircrews have airport info.

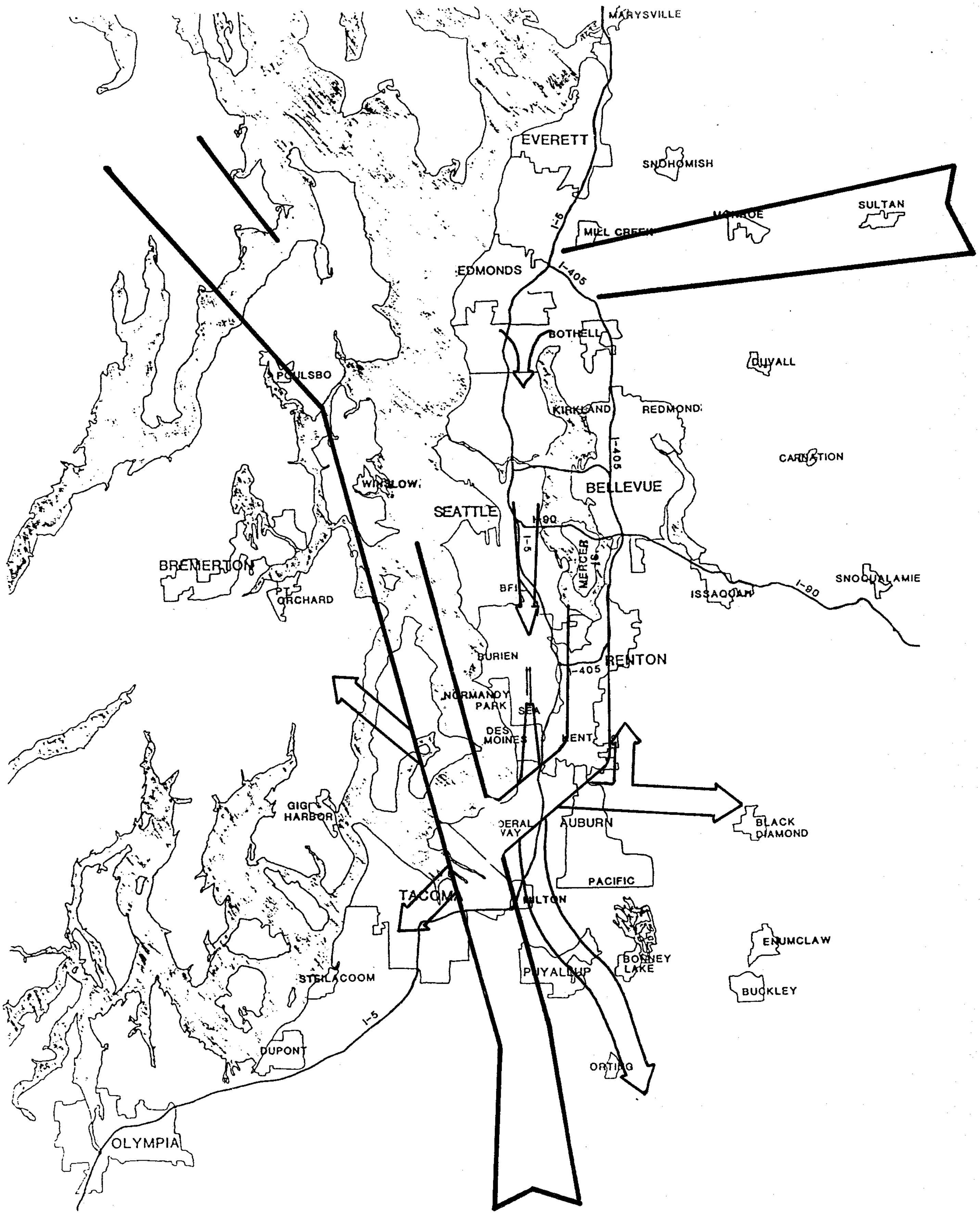
c. Requirement to turn turbojets onto final from east outside the SEA 338/17 causes lost arrival opportunities, some of these will be filled from the west side; some by turboprops.

d. There is ample space for departures.

e. This configuration could not be mated with the static ARTCC arrival routes which are proposed to relieve the high altitude issues described on page 10 above. Instability and inefficiency problems with the enroute structure will continue.

SOUTH FLOW

RUNWAYS 16



DEMONSTRATION #12

DEMONSTRATION #13

Airspace simulation was conducted on September 19, 1989, using the following conditions:

1. South Flow.

2. Assume Seattle ARTCC arrival routes are as proposed, with fixed arrival flows in four corners of the terminal airspace.

3. Alter Seattle TRACON internal airspace to divide arrival airspace along the 307 radial, East and West feeder controllers establish turbojet aircraft either side of the 307 radial, provide airspace for a final controller to place aircraft on a modified final approach course which passes through Elliott Bay.

4. Honor all other existing noise abatement constraints.

5. Good weather permitting full use of simultaneous arrivals to runways 16L/R; ready visual identification and separation of aircraft.

OBSERVATIONS

a. Four fixed arrival routes would require use of the "wide turbojet downwind" as demonstrated in 4 and 10 above with resulting limitations. This plan is grossly inefficient. It involves extended flight at low altitude near mountainous terrain for both arrivals and departures, with resultant high fuel consumption and increased air pollution.

While it maximizes noise abatement for those areas on the east side of Lake Washington which have not experienced south flow turbojet overflights, aircraft noise would be introduced into new areas in the vicinity of North Bend, Snoqualmie, and Carnation. This procedure would have severe adverse effect on all of Bainbridge Island, Poulsbo, and Silverdale. Aircraft would be paralleling the 307 radial outbound on both sides at approximately 5,000' in a high drag/high power configuration, awaiting the final sequence.

b. Eastside downwind from the southeast would have to fly approximately 70 miles prior to turning final for the airport. The potential for excessive demand and span of control for the East Feeder position is large.

c. West Feeder has severely constricted airspace due to Seattle Departures, McChord operations; would have difficulty achieving all initial tasks before passing control of aircraft to final controller.

d. Final controller would probably have to take arrivals from the northwest direct from Seattle ARTCC; would have no maneuvering room in which to sequence these aircraft.

e. Downwind aircraft would often require lost communication instructions while pointed toward the Olympic Range.

f. If the turbojet inbound on the 307 radial fails to establish visual contact with the turboprops inbound along the 338 radial as they enter Elliott Bay, a missed approach and re-sequence may be needed. The final controller would not have sufficient airspace to encompass this maneuver; aircraft would have to be handed back to feeder, with the possibility of pointouts to other operating positions.

APPENDIX B

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

September 1988

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.

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.

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.

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.

Appendix C - Glossary

This Glossary was compiled to promote a common understanding of the terms used in this document and were excerpted or paraphrased from those listings in The Airman's Information Manual (AIM) dated June 1, 1989.

ABEAM - An aircraft is "abeam" a fix, point, or object when the fix, point, or object is approximately 90 degrees to the right or left of the aircraft track. Abeam indicates a general position rather than a precise point.

ADDITIONAL SERVICES - Additional services are provided to the extent possible contingent only upon the controller's capability to fit them into the performance of higher priority duties and on the basis of limitations of the radar, volume of traffic, frequency congestion, and controller workload.

AIRCRAFT CLASSES - For the purposes of Wake Turbulence Separation Minima, ATC classifies aircraft as Heavy, Large, and Small as follows:

1. Heavy - Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.

2. Large - Aircraft of more than 12,500 pounds, maximum certificated takeoff weight, up to 300,000 pounds.

3. Small - Aircraft of 12,500 pounds or less maximum certificated takeoff weight. (Refer to AIM).

AIRMAN'S INFORMATION MANUAL/AIM - A primary FAA publication whose purpose is to instruct airmen about operating in the National Airspace System of the U.S.

AIR NAVIGATION FACILITY - Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and take-off of aircraft. (See Navigational Aid).

AIRPORT - An area on land or water that is used or intended to be used for the landing and takeoff or aircraft and includes its buildings and facilities, if any.

AIRPORT ELEVATION/FIELD ELEVATION - The highest point of an airport's usable runways measured in feet from mean sea level. (See Touchdown Zone Elevation).

AIRPORT SURVEILLANCE RADAR/ASR - Approach control radar used to detect and display an aircraft's position in the terminal area. ASR provides range and azimuth information but does not provide elevation data coverage of the ASR can extend up to 60 miles.

AIRPORT TRAFFIC AREA - Unless otherwise specifically designed in FAR Part 93, that airspace within a horizontal radius of 5 statute miles from the geographical center of any airport at which a control tower is operating, extending from the surface up to, but not including, an altitude of 3,000 feet above the elevation of an airport. Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area except for the purpose of landing at or taking off from an airport within that area. ATC authorizations may be given as individual approval of specific operations or may be contained in written agreements between airport users and the tower concerned.

AIR ROUTE TRAFFIC CONTROL CENTER/ARTCC - A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

AIRSPEED - The speed of an aircraft relative to its surrounding air mass. The unqualified term "airspeed" means one of the following:

1. Indicated Airspeed - The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term "airspeed>" (Refer to FAR PART 1).

2. True Airspeed - The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as "true airspeed" and not shortened to "airspeed."

AIR TRAFFIC - Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

AIR TRAFFIC CLEARANCE/ATC CLEARANCE - An authorization by air traffic control, for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace.

AIR TRAFFIC CONTROL/ATC - A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

AIR TRAFFIC CONTROL SPECIALIST/CONTROLLER - A person authorized to provide air traffic control service. (See Air Traffic Control, Flight Service Station).

ALPHANUMERIC DISPLAY/DATA BLOCK - Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display.

ALTITUDE - The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL). (See Flight Level).

1. MSL Altitude - Altitude expressed in feet measured from mean sea level.

2. AGL Altitude - Altitude expressed in feet measured above ground level.

3. Indicated Altitude - The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

ALTITUDE READOUT/AUTOMATIC ALTITUDE REPORT - An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability.

ALTITUDE RESTRICTION - An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

APPROACH CLEARANCE - Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required.

APPROACH CONTROL FACILITY - A terminal ATC facility that provides approach control service in a terminal area.

APPROACH CONTROL SERVICE - Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service. (Refer to AIM).

APPROACH GATE - An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the outer marker (or the fix used in lieu of the outer marker) on the side away from the airport for precision approaches and 1 mile from the final approach fix on the side away from the airport for nonprecision approaches. In either case when measured along the final approach course, the gate will be no closer than 5 miles from the landing threshold.

APPROACH SEQUENCE - The order in which aircraft are positioned while on approach or awaiting approach clearance. (See Landing Sequence).

APPROACH SPEED - The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

ARRIVAL TIME - The time an aircraft touches down on arrival.

AUTOMATED RADAR TERMINAL SYSTEMS/ARTS - The generic term for the ultimate in functional capability afforded by several automation systems. Each differs in functional capabilities and equipment. ARTS plus a suffix roman numeral denotes a specific system. A following letter indicates a major modification to that system. In general, an ARTS displays for the terminal controller aircraft identification, flight plan data, other flight associated information; e.g., altitude, speed, and aircraft position symbols in conjunction with his radar presentation. Normal radar co-exists with the alphanumeric display. In addition to enhancing visualization of the air traffic situation, ARTS facilitate intra/inter-facility transfer and coordination of flight information.

AUTOMATIC ALTITUDE REPORTING - That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC TERMINAL INFORMATION SERVICE/ATIS - The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., "Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa."

BEARING - The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees.

BELOW MINIMUMS - Weather conditions below the minimums prescribed by regulation for the particular action involved; e.g., landing minimums, takeoff minimums.

CEILING - The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," are not classified as "thin" or "partial".

CHARTED VISUAL FLIGHT PROCEDURE (CVFP) APPROACH - An approach wherein a radar-controlled aircraft on an IFR flight plan, operating in VFR conditions and having an ATC authorization, may proceed to the airport of intended landing via visual landmarks and altitudes depicted on a charted visual flight procedure.

CONFLICT ALERT - A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations recognized by the program parameters that require his immediate attention/action.

CONFLICT RESOLUTION - The resolution of potential conflictions between IFR aircraft and VFR aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied. Note: This separation procedure will not be provided utilizing fully digitized radar systems.

CONTACT -

1. Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).

2. A flight condition wherein the pilot ascertains the attitude of his aircraft and navigates by visual reference to the surface.

CONTACT APPROACH - An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument approach procedure and proceed to the destination airport by visual reference to the surface.

CONTROLLED AIRSPACE - Airspace designated as a control zone, airport radar service area, terminal control area, transition area, control area, continental control area, and positive control area within which some or all aircraft may be subject to air traffic control.

TYPES OF U.S. CONTROLLED AIRSPACE:

1. Control Zone - Controlled airspace which extends upward from the surface of the earth and terminates at the base of the continental control area. Control zones that do not underlie the continental control area have no upper limit. A control zone may include one or more airports and is normally a circular area with a radius of 5 statute miles and any

extensions necessary to include instrument approach and departure paths.

2. Airport Radar Service Area/ARSA - Regulatory airspace surrounding designated airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and VFR aircraft. The service provided in an ARSA is called ARSA service which includes: IFR/IFR - standard IFR separation; IFR/VFR - traffic advisories and conflict resolution; and VFR/VFR - traffic advisories and, as appropriate, safety alerts. The AIM contains an explanation of ARSA. The ARSA's are depicted on VFR aeronautical charts.

3. Terminal Control Area/TCA - Controlled airspace extending upward from the surface or higher to specified altitudes, within which all aircraft are subject to operating rules and pilot and equipment requirements specified in FAR Part 91. TCA's are depicted on Sectional, World Aeronautical, En Route Low Altitude, DOD FLIP, and TCA charts. (Refer to FAR Part 91, AIM).

4. Transition Area - Controlled airspace extending upward from 700 feet or more above the surface of the each when designated in conjunction with an airport for which an approved instrument approach procedure has been prescribed; or from 1,200 feet or more above the surface of the earth when designated in conjunction with airway route structures or segments. Unless otherwise specified, transition areas terminate at the base of the overlying controlled airspace. Transition areas are designed to contain IFR operations in controlled airspace during portions of the terminal operation and while transiting between the terminal and en route environment.

5. Control Area - Airspace designated as Colored Federal airways, VOR Federal airways, control areas associated with jet routes outside the continental control area (FAR 71.161), additional control areas (FAR 71.163), control area extensions (FAR 71.165), and area low routes. Control areas do not include the continental control area, but unless otherwise designated, they do include the airspace between a segment of main VOR Federal airway and its associated alternate segments with the vertical extent of the area corresponding to the vertical extent of the related segment of the main airway.

6. Continental Control Area - The airspace of the 48 contiguous States, the District of Columbia and Alaska, excluding the Alaska peninsula west of Long. 160 degrees 00' 00" "W" at and above 14,500 feet MSL, but does not include:

   A. The airspace less than 1,500 feet above the surface of the earth; or

B. Prohibited and restricted areas, other than the restricted areas listed in FAR Part 71.

7. Positive Control Area/PCA - Airspace designated in FAR, Part 71 within which there is positive control of aircraft. Flight in PCA is normally conducted under instrument flight rules. PCA is designated throughout most of the conterminous United States and its vertical extent is from 18,000 feet MSL to and including flight level 600. In Alaska PCA does not include the airspace less than 1,500 feet above the surface of the earth nor the airspace over the Alaska Peninsula west of longitude 160 degrees West.

CONTROLLED DEPARTURE TIME (CDT) PROGRAMS - These programs are the flow control process whereby aircraft are held on the ground at the departure airport when delays are projected to occur in either the en route system or the terminal of intended landing. The purpose of these programs is to reduce congestion in the air traffic system or to limit the duration of airborne holding in the arrival center or terminal area. A CDT is a specific departure slot shown on the flight plan as an expected departure clearance time (EDCT).

DEPARTURE CONTROL - A function of an approach control facility providing air traffic control service for departing IFR and, under certain conditions, VFR aircraft. (See Approach Control) (Refer to AIM).

DEPARTURE TIME - The time an aircraft becomes airborne.

DIRECT - Straight line flight between two navigational aids, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DISPLACED THRESHOLD - A threshold that is located at a point on the runway other than the designated beginning of the runway.

DISTANCE MEASURING EQUIPMENT/DME - Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

DME FIX - A geographical position determined by reference to a navigational aid which provides distance and azimuth information. It is defined by a specific distance in nautical miles and a radial, azimuth, or course (i.e., localizer) in degrees magnetic from that aid.

DME SEPARATION - Spacing of aircraft in terms of distances (nautical miles) determined by reference to distance measuring equipment (DME).

EN ROUTE AIR TRAFFIC CONTROL SERVICES - Air traffic control service provided aircraft on IFR flight plans, generally by centers, when these aircraft are operating between departure and destination terminal areas.

When equipment, capabilities, and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

EXPECTED DEPARTURE CLEARANCE TIME/EDCT - The runway release time assigned to an aircraft in a controlled departure time program and shown on the flight progress strip as an EDCT.

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 published MLS course, a straight line extension of a localizer, a final approach radial/bearing, or a runway centerline all without regard to distance.

FINAL APPROACH FIX/FAF - The fix from which the final approach (IFR) to an airport is executed and which identifies the beginning of the final approach segment. It is designated on Government charts by the Maltese Cross symbol for nonprecision approaches and the lightning bolt symbol for precision approaches.

FLIGHT INSPECTION/FLIGHT CHECK - Inflight investigation and evaluation of a navigational aid to determine whether it meets established tolerances.

FLIGHT LEVEL - A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hPa (1013.2 mb), and is separated from other such surfaces by specific pressure intervals.

FLOW CONTROL - Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given aerodrome (airport) so as to ensure the most effective utilization of the airspace.

GATE HOLD PROCEDURES - Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 15 minutes. The sequence for departure will be maintained in accordance with initial call-up unless modified by flow control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

GENERAL AVIATION - That portion of civil aviation which encompasses all facets of aviation except air carriers holding a certificate of public convenience and necessity from the Civil Aeronautics Board and large aircraft commercial operators.

GLIDESLOPE/GLIDEPATH - Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

1. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS/MSL, or

2. 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.

GLIDESLOPE/GLIDEPATH INTERCEPT ALTITUDE - The minimum altitude to intercept the glideslope/path on a precision approach. The intersection of the published intercept altitude with the glideslope/path, designated on Government charts by the lightning bolt symbol, is the precision FAF; however, when ATC directs a lower altitude, the resultant lower intercept position is then the FAF.

GO AROUND - Instructions for a pilot to abandon his approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., "Go around"

GROUND DELAY - The amount of delay attributed to ATC, encountered prior to departure, usually associated with a CDT program.

HANDOFF - An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HIGH SPEED TAXIWAY/EXIT/TURNOFF - A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

IFR AIRCRAFT/IFR FLIGHT - An aircraft conducting flight in accordance with instrument flight rules.

IFR CONDITIONS - Weather conditions below the minimum for flight under visual flight rules.

ILS CATEGORIES -

1. ILS Category I - An ILS approach procedure which provides for approach to a height above touchdown of not less than 200 feet and with runway visual range of not less than 1,800 feet.

2. ILS Category II - An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet.

3. ILS Category III -

   A. IIIA - An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 700 feet.

   B. IIIB - An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 150 feet.

   C. IIIC - An ILS approach procedure which provides for approach without a decision height minimum and without runway visual range minimum.

INITIAL APPROACH FIX/IAF - The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s).

INSTRUMENT APPROACH PROCEDURE/IAP/INSTRUMENT APPROACH - A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority.

1. U. S. civil standard instrument approach procedures are approved by the FAA as prescribed under FAR, Part 97 and are available for public use.

2. U. S. military standard instrument approach procedures are approved and published by the Department of Defense.

3. Special instrument approach procedures are approved by the FAA for individual operators but are not published in FAR, Part 97 for public use.

INSTRUMENT FLIGHT RULES/IFR - Rules governing the procedures for conducting instrument flight. Also a term used by pilots and controllers to indicate type of flight plan.

INSTRUMENT LANDING SYSTEM/ILS - A precision instrument approach system which normally consists of the following electronic components and visual aids:

1. Localizer.
2. Glideslope.
3. Outer Marker.
4. Middle Marker.
5. Approach Lights.

INSTRUMENT RUNWAY - A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved.

INTERSECTION -

1. A point defined by any combination of courses, radials, or bearings of two or more navigational aids.
2. Used to describe the point where two runways, a runway and a taxiway, or two taxiways cross or meet.

INTERSECTION - DEPARTURE/INTERSECTION TAKEOFF - A takeoff or proposed takeoff on a runway from an intersection.

JET ROUTE - A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as "J" routes with numbering to identify the designated route; e.g., J105.

LANDING MINIMUMS/IFR LANDING MINIMUMS - The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in FAR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

1. Straight-in landing minimums - A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or
2. Circling minimums - A statement of MDA and visibility required for the circle-to-land maneuver.

Descent below the established MDA or DH is not authorized during an approach unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and adequate visual reference to required visual cues is maintained.

LANDING SEQUENCE - The order in which aircraft are positioned for landing.

LATERAL SEPARATION - The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations. (See Separation).

LOCALIZER - The component of an ILS which provides course guidance to the runway.

LOCALIZER USABLE DISTANCE - The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received.

LOCAL TRAFFIC - Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.

LONGITUDINAL SEPARATION - The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles.

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE - Loss of the ability to communicate by radio. Aircraft are sometimes referred to as NORDO (No Radio). Standard pilot procedures are specified in FAR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach.

LOW APPROACH - An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway.

METERING - A method of time-regulating arrival traffic flow into a terminal area so as not to exceed a predetermined terminal acceptance rate.

METERING FIX - A fix along an established route from over which aircraft will be metered prior to entering terminal airspace. Normally, this fix should be established at a distance from the airport which will facilitate a profile descent 10,000 feet above airport elevation (AAE) or above.

MINIMUM CROSSING ALTITUDE/MCA - The lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum en route IFR altitude (MEA).

MINIMUM DESCENT ALTITUDE/MDA - The lowest altitude, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering in execution of a standard instrument approach procedure where no electronic glide slope is provided.

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE/MOCA - The lowest published altitude in effect between radio fixes on VOR airways, off-airway routes, or route segments which meets obstacle clearance requirements for the entire route segment and which assures acceptable navigational signal coverage only within 25 statute (22 nautical) miles of a VOR.

MINIMUM RECEPTION ALTITUDE/MRA - The lowest altitude at which an intersection can be determined.

MINIMUM SAFE ALTITUDE/MSA -

1. The minimum altitude specified in FAR Part 91 for various aircraft operations.

2. Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance for emergency use within a specified distance from the navigation facility upon which a procedure is predicated. These altitudes will be identified as Minimum Sector Altitudes or Emergency Safe Altitudes and are established as follows:

    A. Minimum Sector Altitudes - Altitudes depicted on approach charts which provide at least 1,000 feet of obstacle clearance within a 25-mile radius of the navigation facility upon which the procedure is predicated. Sectors depicted on approach charts must be at least 90 degrees in scope. These altitudes are for emergency use only and do not necessarily assure acceptable navigational signal coverage.

MINIMUM SAFE ALTITUDE WARNING/MSAW - A function of the ARTS III computer that aids the controller by alerting him when a tracked Mode C-equipped aircraft is below or is predicted by the computer to go below a predetermined minimum safe altitude. (Refer to AIM).

MINIMUMS/MINIMA - Weather condition requirements established for a particular operation or type of operation; e.g., IFR takeoff or landing, alternate airport for IFR flight plans, VFR flight, etc.

MINIMUM VECTORING ALTITUDE/MVA - The lowest MSL altitude at which an IFR aircraft will be vectored by a radar controller, except as otherwise authorized for radar approaches, departures, and missed approaches. The altitude meets IFR obstacle clearance criteria. It may be lower than the published MEA along an airway or J-route segment. It may be utilized for radar vectoring only upon the controller's determination that an adequate radar return is being received from the aircraft being controlled. Charts depicting minimum vectoring altitudes are normally available only to the controllers and not to pilots.

MISSED APPROACH -

1. A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing. The route of flight and altitude are shown on instrument approach procedure charts. A pilot executing a missed approach prior to the Missed Approach Point (MAP) must continue along the final approach to the MAP. The pilot may climb immediately to the altitude specified in the missed approach procedure.

2. A term used by the pilot to inform ATC that he is executing the missed approach.

3. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure.

MOVEMENT AREA - The runways, taxiways, and other areas of an airport/heliport which are utilized for taxiing/hover taxiing, air taxiing, takeoff, and landing of aircraft, exclusive of loading ramps and parking areas. At those airports/heliports with a tower, specific approval for entry onto the movement area must be obtained from ATC.

NAS STAGE A - The en route ATC system's radar, computers and computer programs, controller plan view displays (PVDs/Radar Scopes), input/output devices, and the related communications equipment which are integrated to form the heart of the automated IFR air traffic control system. This equipment performs Flight Data Processing (FDP) and Radar Data Processing (RDP). It interfaces with automated terminal systems and is used in the control of en route IFR aircraft.

NATIONAL AIRSPACE SYSTEM/NAS - The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NEGATIVE - "No," or "permission not granted," or "that is not correct."

NONDIRECTIONAL BEACON/RADIO BEACON/NDB - An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

NONPRECISION APPROACH PROCEDURE/NONPRECISION APPROACH - A standard instrument approach procedure in which no electronic glide slope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR - Precedes other terms and generally means without the use of radar, such as:

1. Nonradar Approach - Used to describe instrument approaches for which course guidance on final approach is not provided by ground-based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, and ILS/MSL approaches.

2. Nonradar Approach Control - An ATC facility providing approach control service without the use of radar.

3. Nonradar Arrival - An aircraft arriving at an airport without radar service or at an airport served by a radar facility and radar contact has not been established or has been terminated due to a lack of radar service to the airport.

4. Nonradar Route - A flight path or route over which the pilot is performing his own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route.

5. Nonradar Separation - The spacing of aircraft in accordance with established minima without the use of radar; e.g vertical, lateral, or longitudinal separation.

NOTICE TO AIRMEN/NOTAM - A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

OFFSET PARALLEL RUNWAYS - Staggered runways having centerlines which are parallel.

OUTER MARKER/OM - A marker beacon at or near the glide slope intercept altitude of an ILS approach. It is keyed to transmit two dashes per second on a 400 Hz tone, which is received aurally and visually by compatible airborne equipment. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway.

PARALLEL ILS/MLS APPROACHES - Approaches to parallel runways by IFR aircraft which, when established inbound toward the airport on the adjacent final approach courses, are radar-separated by at least 2 miles.

PARALLEL RUNWAYS - Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

PREFERENTIAL ROUTES - Preferential routes (PDR's, PAR;s, and PDAR's) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC's area and are referred to by the following names or acronyms:

1. Preferential Departure Route/PDR - A specific departure route from an airport or terminal area to an en route point where there is no further need for flow control. It may be included in a Standard Instrument Departure (SID) or a Preferred IFR Route.

2. Preferential Arrival Route/PAR - A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.

3. Preferential Departure and Arrival Route/PDAR - A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDAR's are not synonymous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose. (See Preferred IFR Routes, NAS Stage A).

PREFERRED IFR ROUTES - Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Airport/Facility Directory. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Airport/Facility Directory, pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes are correlated with SID's and STAR's and may be defined by airways, jet routes, direct routes between NAVAID's, Waypoints, NAVAID radials/DME, or any combinations thereof.

PROFILE DESCENT - An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glide slope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glide scope or other appropriate minimum altitude is intercepted.

QUOTA FLOW CONTROL/QFLOW - A flow control procedure by which the Central Flow Control Function (CFCF) restricts traffic to the ARTC Center area having an impacted airport, thereby avoiding sector/area saturation.

RADAR/RADIO DETECTION AND RANGING - A device which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

1. Primary Radar - A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.

2. Secondary Radar/Radar Beacon/ATCRBS - A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility.

RADAR ADVISORY - The provision of advice and information based on radar observations.

RADAR APPROACH - An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR).

RADAR APPROACH CONTROL FACILITY - A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility (see Approach Control Service). Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. A radar approach control facility may be operated by FAA, USAF, US Army, USN, USMC, or jointly by FAA and a military service. Specific facility nomenclatures are used for administrative purposes only and are related to the physical location of the facility and the operating service generally as follows:

Radar Approach Control/RAPCON (Air Force/FAA)

Terminal Radar Approach Control/TRACON (FAA)

RADAR CONTACT -

1. Used by ATC to inform an aircraft that it is identified on the radar display and radar flight following will be provided until radar identification is terminated. Radar service may also be provided within the limits of necessity and capability. When a pilot is informed of "radar contact," he automatically discontinues reporting over compulsory reporting points.

2. The term used to inform the controller that the aircraft is identified and approval is granted for the aircraft to enter the receiving controllers airspace.

RADAR ENVIRONMENT - An area in which radar service may be provided.

RADAR FLIGHT FOLLOWING - The observation of the progress of radar identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope.

RADAR IDENTIFICATION - The process of ascertaining that an observed radar target is the radar return from a particular aircraft.

RADAR IDENTIFIED AIRCRAFT - An aircraft, the position of which has been correlated with an observed target or symbol on the radar display.

RADAR SERVICE - A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft.

1. Radar Monitoring - The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS/MLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS/MSL no transgression zone.

2. Radar Navigational Guidance - Vectoring aircraft to provide course guidance.

3. Radar Separation - Radar spacing of aircraft in accordance with established minima.

RADAR SURVEILLANCE - The radar observation of a given geographical area for the purpose of performing some radar function.

RADAR TRAFFIC ADVISORIES - Advisories issued to alert pilots to known or observed radar traffic which may affect the intended route of flight of their aircraft.

RADIAL - A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

RECEIVING CONTROLLER/FACILITY - A controller/facility receiving control of an aircraft from another controller/facility.

RUNWAY - A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 01, Runway 25.

RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY - Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways.

SECTOR - A basic unit of airspace of which the lateral size and vertical limits are dictated by four factors.

1. Volume of traffic.
2. Communications and radar limitations.
3. Procedural complexity.
4. Terrain.

Each sector is controlled by a team of air traffic controllers using a specific frequency to communicate with aircraft.

SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE - An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

1. Initial Approach - The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.
2. Intermediate Approach - The segment between the intermediate fix or point and the final approach fix.
3. Final Approach - The segment between the final approach fix or point and the runway, airport, or missed approach point.

4. Missed Approach - The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude.

SEPARATION - In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

SEPARATION MINIMA - The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures.

SHORT RANGE CLEARANCE - A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

SHORT TAKEOFF AND LANDING AIRCRAFT/STOL AIRCRAFT - An aircraft which, 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.

SIDESTEP MANEUVER - A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted.

SIGMET/WS/SIGNIFICANT METEOROLOGICAL INFORMATION - A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles.

SIMULTANEOUS ILS/MLS APPROACHES - An approach system permitting simultaneous ILS/MLS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS/MLS, radar, communications, ATC procedures, and airborne equipment.

SPECIAL USE AIRSPACE - Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Types of special use airspace are:

1. Military Operations Area (MOA) - An MOA is an airspace assignment of defined vertical and lateral dimensions established outside positive control areas to separate/-segregate certain military activities from IFR traffic and to identify for VFR traffic where these activities are conducted.

2. Restricted Area - Airspace designated under FAR, Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Restricted areas are depicted on en route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown. and AIM).

3. Warning Area - Airspace which may contain hazards to nonparticipating aircraft in international airspace.

STANDARD INSTRUMENT DEPARTURE / SID - A preplanned instrument flight rule air traffic control departure procedure printed for pilot use in graphic and/or textual form. SID's provide transition from the terminal to the appropriate enroute structure.

STANDARD TERMINAL ARRIVAL ROUTE / STAR - A preplanned instrument flight rule air traffic control arrival procedure published for pilot use in graphic and/or textual form. STAR's provide transition from the en route structure to an outer fix or an instrument approach fix / arrival waypoint in the terminal area.

STRAIGHT-IN APPROACH--IFR - An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums.

STRAIGHT-IN APPROACH--VFR - Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern.

TARGET - The indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

TERMINAL RADAR SERVICE AREA/TRSA - Airspace surrounding designated airports where in ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. Service provided in a TRSA is called Stage III Service. The AIM contains an explanation of TRSA. TRSA's are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory.

THRESHOLD - The beginning of that portion of the runway usable for landing.

TOUCHDOWN -

1. The point at which an aircraft first makes contact with the landing surface.

2. Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

TOWER/AIRPORT TRAFFIC CONTROL TOWER/ATCT - A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the airport traffic area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar). (See Airport Traffic Area, Airport Traffic Control Service, Approach Control/Approach Control Facility, Approach Control Service, Movement Area, Tower En Route Control Service/Tower to Tower)

TOWER EN ROUTE CONTROL SERVICE/TOWER TO TOWER - The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

TRACK - The actual flight path of an aircraft over the surface of the earth.

TRAFFIC -

1. A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued (a) in response to a handoff or point out, (b) in anticipation of a handoff or point out, or (c) in conjunction with a request for control of an aircraft.

2. A term used by ATC to refer to one or more aircraft.

TRAFFIC ADVISORIES - Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

1. Visual observation.

2. Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or

3. Verbal reports from pilots or other facilities.

TRAFFIC PATTERN - The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

1. Upwind Leg - A flight path parallel to the landing runway in the direction of landing.

2. Crosswind Leg - A flight path at right angles to the landing runway off its upwind end.

3. Downwind Leg - A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.

4. Base Leg - A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

5. Final Approach - A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

TRANSFER OF CONTROL - That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

TRANSFERRING CONTROLLER/FACILITY - A controller/facility transferring control of an aircraft to another controller/facility.

TRANSPONDER - The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond. to AIM).

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.

UNCONTROLLED AIRSPACE - Uncontrolled airspace is that portion of the airspace that has not been designated as continental control area, control area, control zone, terminal control area, or transition area and within which ATC has neither the authority nor the responsibility for exercising control over air traffic.

VECTOR - A heading issued to an aircraft to provide navigational guidance by radar.

VERTICAL SEPARATION - Separation established by assignment of different altitudes or flight levels.

VFR AIRCRAFT/VFR FLIGHT - An aircraft conducting flight in accordance with visual flight rules.

VFR CONDITIONS - Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

1. An IFR aircraft requests a climb/descent in VFR conditions.

2. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

3. A pilot has requested a practice instrument approach and is not on an IFR flight plan.

All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in FAR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in TCAs/TRSAs as required by FAA Handbook 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

VIDEO MAP - An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAID's and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, minimum vectoring altitudes.

VISIBILITY - The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visibility is reported as statute miles, hundreds of feet or meters.

1. Flight Visibility - The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

2. Ground Visibility - Prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

VISUAL APPROACH - An approach wherein an aircraft on an IFR flight plan, operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization, may proceed to the airport of destination in VFR conditions.

VISUAL FLIGHT RULES/VFR - Rules that govern the procedures for conducting flight under visual conditions. The term "VFR" is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

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.

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.

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 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, cross 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.

VOR/VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION - A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots.

WAKE TURBULENCE - Phenomena resulting from the passage of an aircraft through the atmosphere. The term includes vortices, thrust stream turbulence, jet blast, jet wash, propeller wash, and rotor wash both on the ground and in the air.