CHAPTER 14: WHAT DID WE LEARN ABOUT AIRSPACE CAPACITY?

Why is it Important?

The analysis identified airspace overlaps or interaction between Washington public use airports.

The purpose of this section is to describe the approach to the airspace analysis utilized in LATS. This chapter also identifies potential constraints on the Washington State Aviation System as a result of airspace conflicts between airports that contribute to congestion.

Since airspace capacity analysis is primarily an FAA function as stated in Advisory Circular 150/5070-7 (507.b.2) and fixes for airspace conflicts are systematic in nature and handled by the FAA, the state has limited influence in this area. As a result, this section addresses airspace associated with Washington's public use airports in order to determine areas where interactions or overlaps in airspace occur. Additionally, this section examines whether such interactions or overlaps need to be addressed when analyzing future system improvements.

While a variety of mathematical techniques are available to measure the physical capacity of airport facilities to accommodate a set number of operations, passengers or air cargo tonnage, with airspace there are no such formulas. Airspace capacity is a function of "fixed" and "flexible" elements that interact in a constantly changing pattern. Fixed elements contributing to the airspace associated with individual airports include:

- Airport geographic location
- Airport runways and their orientation
- Level of approach precision by runway end
- Physical terrain and obstructions in the airport vicinity
- FAR Part 77 Surfaces

Flexible elements contributing to airspace capacity include:

- Weather, including wind direction, visibility, and ceiling
- Number and type of aircraft operating in the local airspace system
- Special airspace allocations and operating areas
- Air traffic management procedures applicable to each airport
- Air traffic management procedures as applied to the overall local system

Although airspace conflicts can exist without adversely impacting operations at any given airport, active air traffic management must be in place to permit this. Measurement of airspace capacity and air traffic modeling is very complex and beyond the scope or needs of this study. Consequently, this analysis will focus on those “fixed” elements of the Washington airport system.

What Does the Current System Look Like?

The airspace surrounding each airport is defined by the FAR Part 77 Surfaces. These surfaces delineate the geographic area surrounding an airport that is critical to safe aircraft movement and that must be preserved free and clear of obstructions and activities that might prove hazardous to aircraft operating into and out of the facility. The airport traffic pattern falls within each airport’s Horizontal and Conical Surface. Most importantly, the runway approach surfaces delineate the flight path of aircraft to each runway and are therefore critical to the determination of potential airspace conflicts between airports. The FAR Part 77 Surfaces for a typical single-runway airport are depicted in Figure 186 and described below.

Primary Surface

The primary surface is longitudinally centered on the runway, extending 200 feet beyond the threshold in each direction. The width of the Primary Surface is dependent upon the type of approach procedure available for the runway.

Approach Surface

The approach surface is an inclined slope or plane going outward and upward from the ends of the primary surfaces.

Horizontal Surface

The horizontal surface is a horizontal plane 150 feet above the established airport elevation. The shape of the plane is determined by striking arcs from the center of each end of the primary surface. The individual arcs are then connected by lines tangent to the arcs.

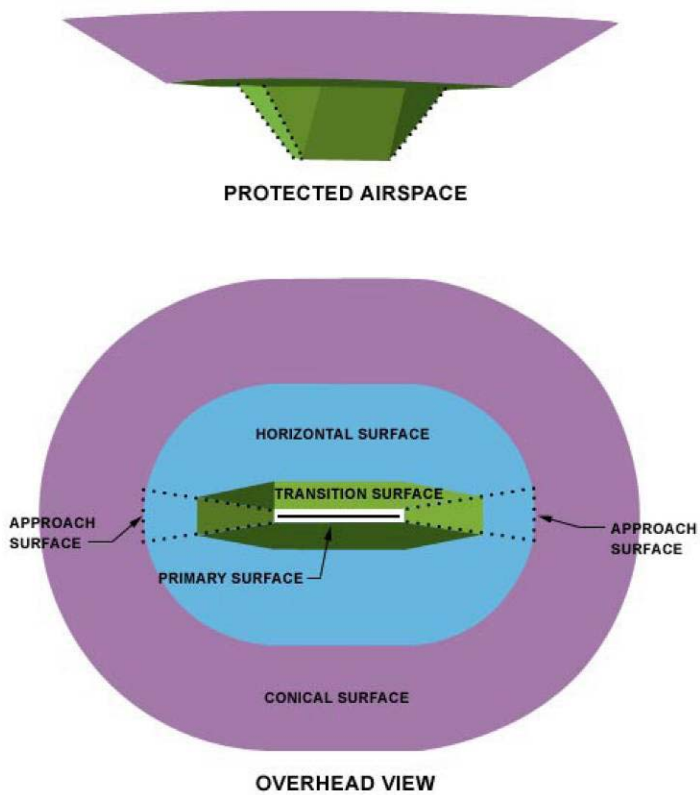
Transitional Surface

The transitional surface is an inclined plane with a slope of 7:1 extending upward and outward from the primary and approach surfaces, terminating at the point where they intersect with the horizontal surface or any other surface with more critical restrictions.

Conical Surface

The conical surface is an inclined plane at a slope of 20:1 extending upward and outward from the periphery of the horizontal surface for a distance of 4,000 feet.

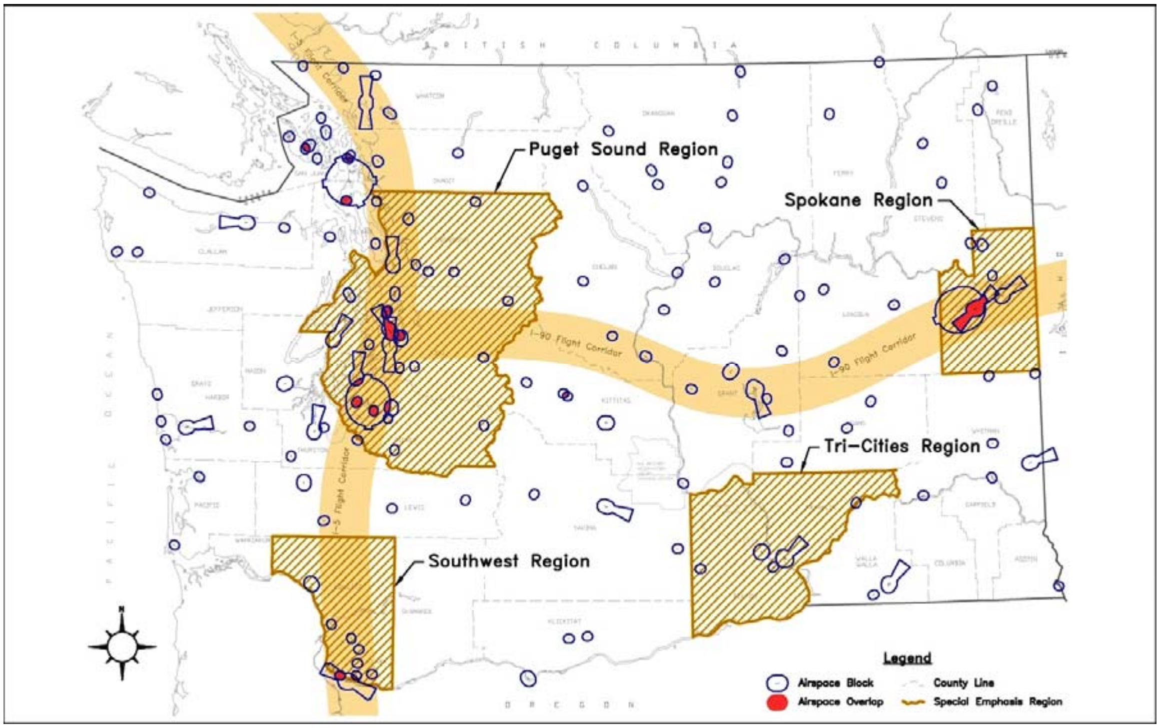
Figure 186: FAR Part 77 Surfaces[112]



The "airspace block" for each airport is composed of the combination of the surfaces mentioned above. In the State System, each block is depicted on a base map of airports within each Special Emphasis Area as defined during LATS Phase I. The overall statewide map of airport airspace allocations is shown below. For each of the Special Emphasis Areas – as well as other areas where airspace overlaps were identified – enlargements have been prepared at a scale sufficient to support meaningful interpretation and analysis. For reference only, estimated Flight Corridors have been included for Interstate 5 and Interstate 90.

[112] Washington State Department of Transportation, Aviation Division

Figure 187: Statewide Airspace Overview



Typically, pilots flying under Visual Flight Rules (VFR) tend to follow physical features on the ground. Since both Interstate 5 and Interstate 90 represent identifiable north/south and east/west features respectively, these are used as reference when traversing the state. For purposes of this discussion, the term *Flight Corridor* is used.

As noted above, the airspace analysis did not evaluate dynamic elements such as air traffic management procedures, arrival/departure routes, TERPS, or airport specific approach or missed approach or departure procedures. Whereas Part 77 Surfaces are fixed by the geographic location of the airport and runway orientation, air traffic management procedures are subject to manipulation and change from time to time. As a result, FAR Part 77 Imaginary Surfaces are used as a surrogate analytical tool under LATS Phase II.

What Was the Scope of Our Analysis?

During Phase I of the LATS study, an overview of existing airspace within the state was provided. Also included was a discussion of the application and implications that the conditions within the airspace have on the individual airports within the state. Under the Phase II analysis, a more detailed investigation of the airspace associated with the individual airports has been conducted. This investigation includes an airport-by-airport analysis of the reserved airspace associated with each of the system's airports as well as military and airports in other states and an identification of the overlaps or potential areas of conflict between airports.

The following data was used to prepare the analysis;

- Obstruction Identification Surfaces as defined in the Federal Aviation Regulations (FAR) Part 77 - Objects Affecting Navigable Airspace.
- Washington Aviation System airports identified during Phase I.
- Current available 5010 form records of active runways, runway location and orientation, level of approach precision by runway (visual, non-precision, precision) and/or runway FAR Part 77 classification.
- Current airport approach plate information.
- Current airport sectional charts and the information shown on them regarding airport location and runway orientation.
- Special Emphasis Region boundaries.

Methodology

The airspace analysis was performed using FAR Part 77 Surfaces to define an "airspace block" surrounding each airport. The "airspace block" identifies that area that is most critical to aircraft operations at the airport. The individual Part 77 Surfaces were aggregated into a single "airspace block" outline overlaid on each airport. The approach surfaces used to define each airport's "airspace block" are based on the actual orientation and level of precision for the approaches to each runway.

The airspace analysis was performed by overlaying each airport's "airspace block" on a base map and identifying overlaps between airports. No specific quantitative measure of one airport's impact on the Airport Service Volume (ASV) or operational capacity of another was generated. A rigorous quantitative model of the state's "airspace capacity" would require extensive analysis of a wide variety of factors including but not limited to airspace, the character of aviation activity, weather patterns, air traffic management at all levels (i.e. enroute control to local airport operations), as well as consideration of the national air traffic environment.

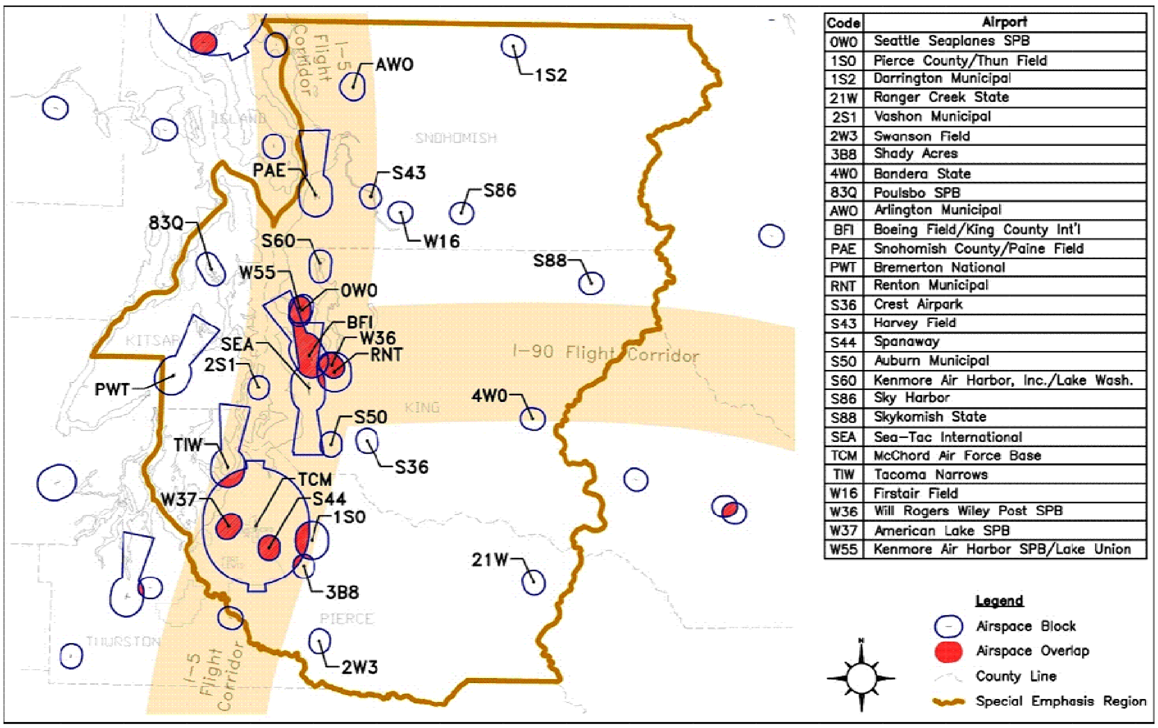
The airspace analysis under LATS Phase II provides a qualitative assessment of the state system from an airspace standpoint and identifies conflicts and problems that could serve to reduce system capacity as well as impact demand reallocation scenarios should air traffic control measures not allow for independent operations at the affected facilities.

Results

Puget Sound Special Emphasis Area Airspace

In the Puget Sound Region, 29 airports and seaplane bases were identified; including McChord Air Force Base. Of these, 12 show airspace overlaps. These overlaps occur in two groupings along the I-5 Flight Corridor between Seattle and Tacoma and are represented below.

Figure 188: Puget Sound Special Emphasis Region



The first group includes Seattle-Tacoma International Airport (SEA), Boeing Field/King County International Airport (BFI), Renton Municipal Airport (RNT) and Will Rogers Wiley Post SPB (W36), Seattle Seaplanes SPB (0W0), Kenmore Air Harbor SPB/Lake Union (W55), and Auburn Municipal Airport (S50).

The largest airspace overlap occurs between Seattle-Tacoma International and Boeing Field where BFI is directly under the northern approach to

SEA. The two airports do not share the same runway alignment and as such, do not share the same final approach. However, their proximity implies that flight path coordination between the two airports is required.

Slightly to the east, Will Rogers Wiley Post SPB is entirely contained within the footprint of Renton Municipal's airspace block. However, is should be noted that operations for both airports are controlled by the RNT airport traffic control tower. RNT and W36 also overlap with SEA and BFI.

North of Boeing Field, Seattle Seaplanes and Kenmore Air share the waters of Lake Union with slightly different published waterways. Due to the close proximity of these two seaplane bases, they almost entirely share the same airspace footprint. In addition, the outer approach to BFI overlaps this airspace combination.

The final overlap is between the southern approach to SeaTac and Auburn Municipal Airport. This is a minor overlay and does not appear to conflict with operations at either airport.

The second group includes McChord Air Force Base (TCM), Tacoma Narrows Airport (TIW), American Lake SPB (W37), Spanaway Airport (S44), Pierce County/Thun Field (1S0), and Shady Acres (3B8).

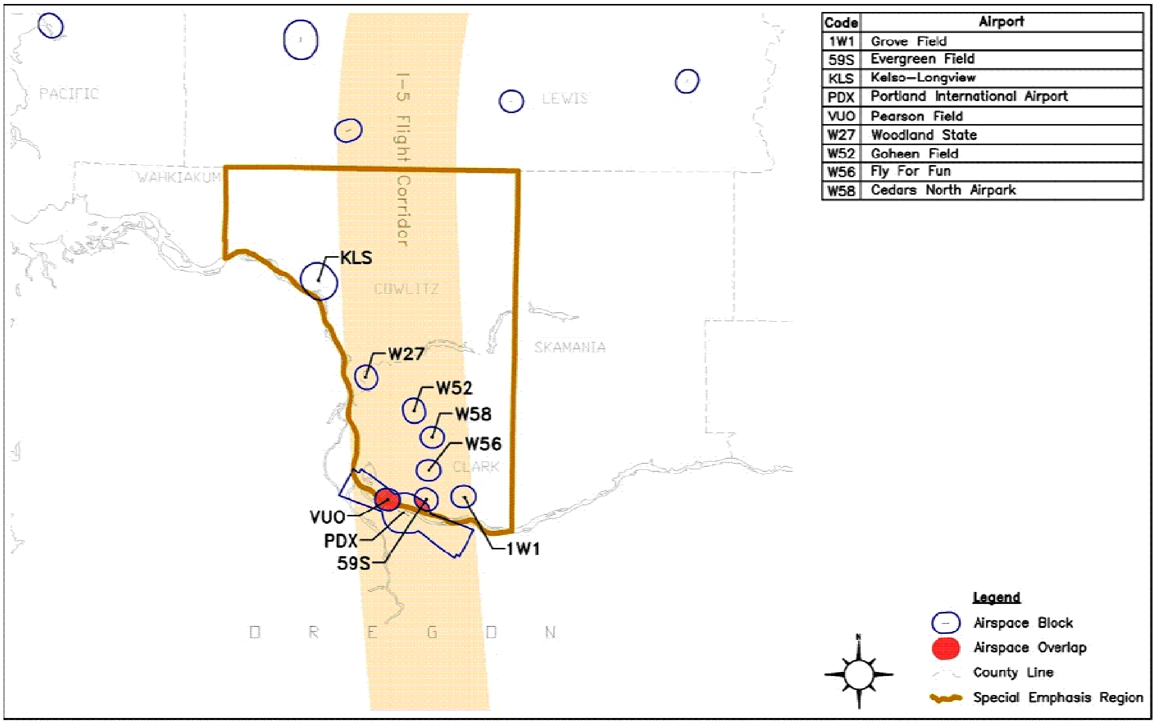
In this group, all airport airspace blocks overlay with that for McChord Air Force Base. The only airspace overlays that occur between civilian airports are that of Thun Field and Shady Acres.

It would appear that the biggest issue of overlap is with Spanaway Airport and McChord since Spanaway Airport is located just off of the southeastern side of the base.

Southwest Special Emphasis Area Airspace

In the Southwest Region, eight airports were identified for this study (Figure 189). In addition to those located in the State of Washington, Portland International Airport (PDX) was included because its airspace footprint reaches into Clark County. The airports in this region do not overlap one another; however, two do intersect the airspace of Portland International Airport.

Figure 189: Southwest Special Emphasis Region

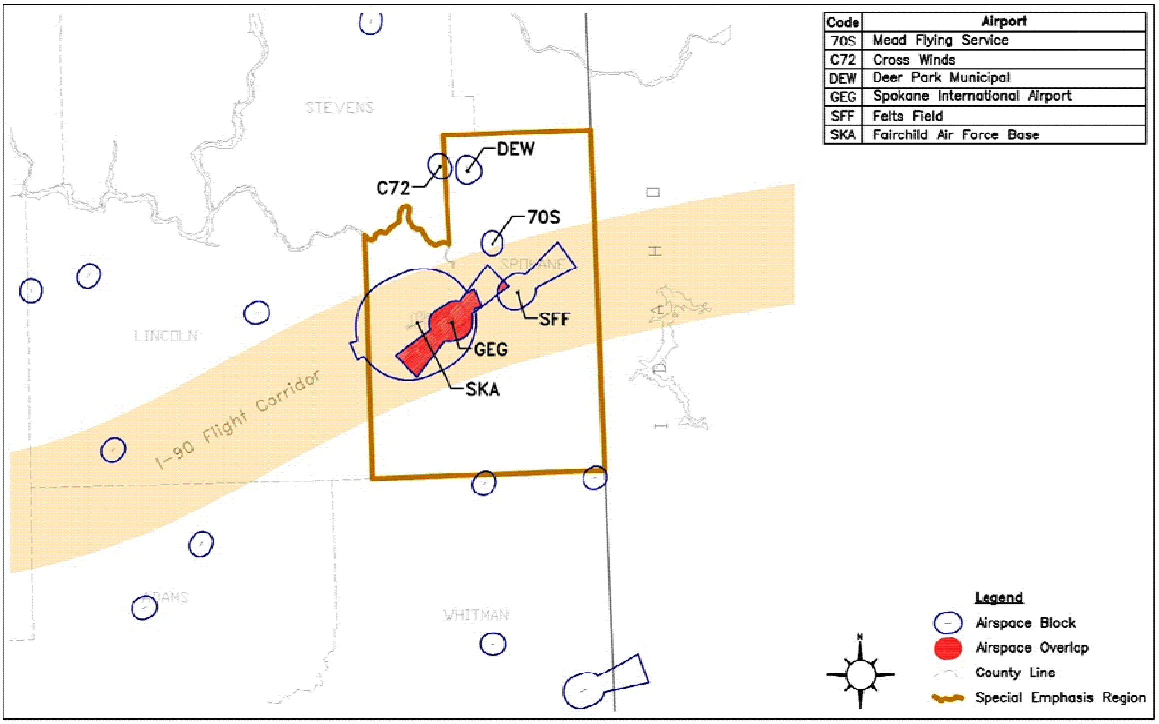


Pearson Field (VUO) lies entirely under the northwestern approach to Portland International Airport. As a result, Pearson Field is under significant influence and control from FAA airport traffic control located at Portland International Airport.

Spokane Special Emphasis Area Airspace

Out of a total of six airports analyzed, airspace within the Spokane Region (Figure 190) shows three airports with overlaps. The Fairchild Air Force Base (SKA) airspace block overlaps that of Spokane International Airport (GEG). The northeastern approaches to both airports intersect and as such, aircraft separation procedures are required.

Figure 190: Spokane Special Emphasis Region

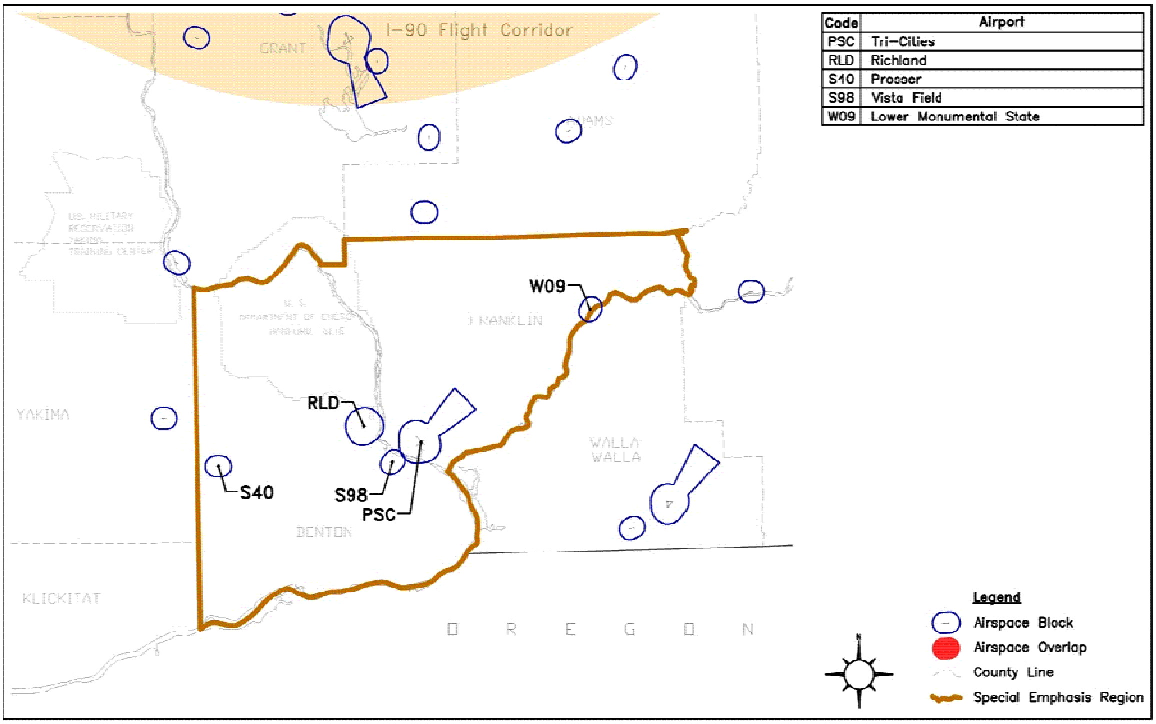


In addition, GEG's northeast approach overlaps a portion of Felt Field's (SFF) airspace block. However, the interaction at this point is not significant.

Tri-Cities Special Emphasis Area Airspace

There are five airports that were analyzed in the Tri-Cities Region (Figure 191). Although there is a slight overlap between the Tri-Cities Airport (PSC) and Vista Field (S98), this appears to not be of significance.

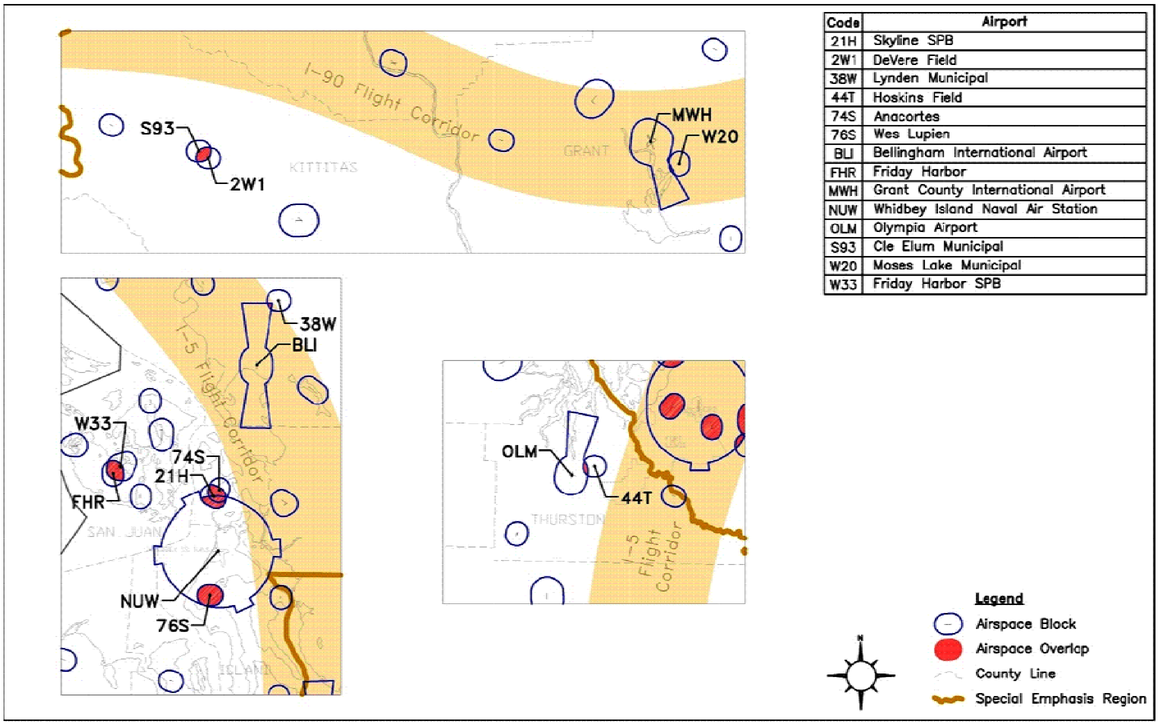
Figure 191: Tri-Cities Special Emphasis Region



Other Airspace Overlaps

In addition to the regions discussed above, the rest of the state was analyzed for other airports that might have overlapping airspace blocks. Figure 192 shows these areas.

Figure 192: Other Airspace Overlaps



Along the I-90 flight corridor, Cle Elum Municipal Airport (S93) and DeVere Field (2W1) both overlap almost half of the other's airspace block. Also, farther east along the corridor, the southern approach to Grant County International Airport (MWH) slightly overlaps Moses Lake Municipal Airport's airspace.

There are two areas in the Puget Sound, but not included within the Puget Sound Special Emphasis Region, that have airspace overlaps. The first is in the north sound. Friday Harbor (FHR) and Friday Harbor SPB (W33) have airspace blocks that overlap, the northern approach to Bellingham International Airport (BLI) slightly overlays Lynden Municipal (38W) airspace, and the airspace block for Whidbey Island Naval Air Station (NUW) overlays Wes Lupien Airport (76S) to the south, and Anacortes Airport (74S) and Skyline SPB (21H) to the north. Anacortes and Skyline's airspace blocks also overlay each other.

The second Puget Sound area is in the south sound. Olympia Airport (OLM) and Hoskins Field (44T) have airspace blocks that overlap.

Airspace Analysis – Statewide Perspective

From a statewide perspective, airspace encompasses more than the Part 77 surfaces associated with the individual airports, as described in the preceding. Outside these, aircraft are actively controlled by Federal Aviation Administration (FAA) Air Traffic Control personnel. Either in Terminal Radar Approach Control (TRACON) facilities or Air Route Traffic Control Centers (ARTCC), the FAA controls the flight of aircraft using any of the air routes described in the Phase I discussion of airspace. In determining the future of the state's aviation system it is important to understand whether this airspace system is capable of accommodating increases in traffic.

While no analytical studies have been undertaken to quantify the capacity of this airspace, evidence suggests that there is a finite limit to its ability to accommodate the levels of increase that are projected in this report. FAA is beginning a project to define how to measure this capacity but the results are unlikely to be completed in time to be used for this analysis. To attempt to add some perspective to this element, planners met with FAA personnel to discuss the state's airspace issues. The following observations were recorded. These must be considered when deciding on particular long-range aviation development strategies:

- The current airspace architecture could not accommodate a full build out scenario for all of the airports. In managing the airspace, FAA must not only separate aircraft from aircraft based on the technological requirements of the airplanes themselves, but also separate aircraft from airspace to account for the fact that the controllers operate in sectors of the airspace rather than within the total airspace environment.

- The exact capacity of the airspace is too big a concept for FAA to define. Many factors come into play such as structural elements (airspace designations, TRACON Control, etc.), technological elements (separations required between aircraft to account for wake turbulence, speed differentials, and the limitations of the approaches to individual airports) and human elements (the ability of a human being to actively manage airspace).

- Making changes to existing airspace control structure is extremely difficult. Multiple air traffic control groups control individual elements within the airspace and coordinated action will be required.

- The environmental impacts of changes to current flight routes are fairly severe and will require detailed environmental as well as technical analyses.

- The primary issue for future consideration when discussing airspace capacity are the flight corridors between airports. In the Northeastern U.S. and in California, it is felt that the airspace is reaching its capacity and steps have been taken to maximize the available resources. These steps have included increasing the number of TRACON facilities, examination of "independent flight tracks" between airports, and redesign of the control structure. This process has consumed considerable time and effort. Currently no plans are in place for similar efforts in the Northwestern United States.

- In addition to these general observations, specific comments related to the State of Washington include:

  1. For the majority of the state's airspace, capacity is not expected to be an issue for the next twenty years. Within the Special Emphasis Areas, particularly the Puget Sound and Southwest areas, the issue will arise within the planning period.

  2. In the Puget Sound Special Emphasis Area, the relationship between Paine Field and the other airports in the area is complicated by the fact that Paine Field is managed by a different TRACON than the other facilities. Additional activity at Paine is expected to slow down operations at other airports.

  3. There are currently airspace issues within the Puget Sound, Spokane and Southwest Special Emphasis Areas that are minimized through active management techniques. Some additional traffic will be manageable through changes in FAA management structure and policies.

Key Findings

Although airspace overlaps do occur between certain airports in the state, the impact of those overlaps on the operational capacity of the affected airports is more a function of the "flexible" elements of the capacity equation rather than on the fixed elements. For example, capacity constraints that may exist during periods of low visibility when airports are operating under instrument conditions may be non-existent during visual conditions. The variability of local weather conditions in the Pacific Northwest may mean that while one airport is experiencing reduced visibility and operating limitations another nearby airport is operating without constraints. The interaction of air traffic between the two airports is an on-going challenge for air traffic control staff.

- No significant airspace overlaps occur outside of the Special Emphasis Regions.
- The majority of overlaps occur within the Puget Sound Special Emphasis Region where population is the greatest.
- Airspace within Washington State is subject to overlap from airports outside of the state. More specifically, airports in Southwest Washington are affected by Portland International Airport.
- Seattle-Tacoma International Airport (SEA) and Boeing Field/King County International Airport (BFI) show the biggest airspace overlap in terms of potential operational conflict. As such, their proximity implies that flight path coordination between the two airports is required.
- Further study of airspace capacity and available technologies is needed to address future demand anticipated for the Central Puget Sound area. Such a study would fall under the purview of the FAA.