APPENDIX J

Airspace and Navaids Documentation

- **Overview of National and State Programs Regarding Airspace/NAVAIDS Technologies in Alaska Draft Technical Memorandum**

ALASKA AVIATION SYSTEM PLAN

Overview of National and State Programs Regarding Airspace/NAVAIDs Technologies in Alaska

DRAFT TECHNICAL MEMORANDUM

September 8, 2008

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1 Executive Summary

1.1 Overview

Various existing and planned air navigation technologies and programs affect Alaska's airport system. This technical memorandum summarizes goals of the various technologies and programs, discusses how they relate to each other, and identifies their implementation schedule. It also discusses policy and implementation issues for the Federal Aviation Administration (FAA) and Alaska's Department of Transportation and Public Facilities (DOT&PF) and recommendations for further study.

The report was prepared for the following reasons:

1. FAA NAVAIDs and services are crucial to the aviation system in Alaska.
2. Rapid technological changes are underway.
3. Increased awareness and education is needed on activities of the FAA and other agencies.
4. Consolidation of information will aid decision making.

The report draws on information from three major, inter-related programs, along with discussions with key stakeholders.

1.1.1 FAA Flight Plan 2008-2012

The *FAA Flight Plan 2008-2012—Charting the Path for the Next Generation* (NextGen) is a national FAA document that outlines FAA's corporate strategy, summarizes what's been done recently, and details plans for the upcoming years. It is the overarching document for development of the airspace and navigation aids (NAVAID) system in the US.

1.1.2 Roadmap for Performance-Based Navigation

The *Roadmap for Performance-Based Navigation—Evolution for Area Navigation (RNAV) and Required Navigation Performance (RNP) Capabilities-2006-2025* is also a national FAA document. As one of the key initiatives in the FAA Flight Plan, the report outlines FAA's implementation strategy for performance-based navigation over three time periods between now and 2025. RNP represents significant changes to the navigation portion of the NextGen system mentioned previously.

1.1.3 Capstone Statewide Plan

The *Surveillance and Broadcast Services Capstone Statewide Plan, Version 7.1, 08 August 2007* is an FAA document co-signed by various Alaska aviation groups. Focusing on improving safety and access to Alaska's airports, it incorporates the primary elements of the two previously mentioned documents. However, this plan is specific to Alaska and its unique aviation environment. Originally Capstone was an FAA operational demonstration program that tested new technologies in different regions of the state. It involves equipment on the ground and in the aircraft. The new program described in the document above is now part of FAA's nationwide NextGen program, with a number of items unique to Alaska. The current program is perhaps better called the Alaska NextGen program, run by the Surveillance Broadcast Services Program, under the FAA Air Traffic Organization.

1.1.4 Meetings with FAA and Key Stakeholder Groups for Alaska Aviation

Consultant team members for the Alaska Aviation System Plan (AASP) attended meetings of various aviation groups in Alaska, and several meetings with FAA and DOT&PF staff. Key meetings occurred in February 2008 that provided information for this memorandum.

1.2 Airspace/NAVAID Technologies

The available airspace and the navigation aids (NAVAIDs) that support the airspace directly affect airport viability and usability. This memorandum discusses several new and existing technologies that will impact future programs in Alaska by offering safety enhancements.

1.2.1 Surveillance Technologies

Surveillance keeps track of aircraft position and altitude, which are important for air traffic control (ATC) and safety. Surveillance technologies discussed in this memorandum include RADAR and ADS-B. RADAR, the standard method of surveillance to date, is available in only 20 percent of Alaska's airspace, and over 90 percent of this radar coverage is at altitudes of 12,000 feet and above.

ADS-B (Automatic Dependent Surveillance - Broadcast) has been implemented in certain areas of Alaska as part of the Capstone Project. It is now being implemented nationwide as part of the NextGen ATC System. With ADS-B, the position information is more precise than with RADAR, and the information is updated quicker, which could allow reduced separation standards between aircraft in the future. With ADS-B, surveillance can more easily be provided over a greater area of Alaska, and to a lower altitude, greatly enhancing safety.

ADS-B requires equipment on-board each aircraft in order to relay that aircraft's position to the FAA and other aircraft with the proper equipment. The cost and means of equipping aircraft with this technology present challenges to implementing the overall NextGen ATC System, as well as attaining all the objectives of the Alaska NextGen program.

1.2.2 Navigation Technologies, IFR and VFR

Navigation in Alaska in the past has been primarily provided by various kinds of ground-based stations that transmit radio navigation signals. Because signal strength, terrain, and other issues limit their effectiveness, ground-based navigation systems are being phased out and replaced by satellite-based global positioning systems (GPS), which are generally less expensive, provide greater precision than ground-based systems, and are usually not constrained by line of sight. Navigation using GPS fits under a broad term called RNAV, as described previously. GPS navigation has now been enhanced by a system called the Wide Area Augmentation System (WAAS), which provides a more accurate GPS signal than the basic GPS signal. The original Capstone program and the current Alaska NextGen program have developed more efficient routes in Alaska using RNAV and improved approaches (commonly called instrument approaches) to it's airports. Additional instrument approaches are planned for many airports in Alaska. To have an approach at an airport often requires additional items such as enhanced airfield lighting, additional taxiways, and weather reporting equipment.

Aircraft also need special equipment in order to navigate using RNAV. More aircraft have this equipment than ADS-B equipment, but supplying the majority of the aviation fleet in Alaska with on-board RNAV equipment is also a major issue. A second issue is that planning of future instrument approaches needs be coordinated with airport improvement and aircraft equipage plans to ensure that when the approach is established, it can and will be used for its intended purpose.

1.2.3 Communication Technologies

Enhanced communications in Alaska has been one of the primary elements of Capstone and Alaska NextGen. This is being provided through a variety of new remote communication facilities to increase the area of Alaska with direct air-to-ground communication with the FAA. The combination of tracking aircraft through surveillance and communicating with aircraft (either by direct voice communication or data-links) to provide weather information, ATC instructions, and advisories greatly increases safety. Even though valuable advances have been made, Alaska is still very "communications poor"[1] due to huge areas without coverage and lack of general infrastructure.

A significant number of very small Alaskan aircraft are still not equipped with radios. Those same aircraft also do not have and cannot easily be equipped with ADS-B equipment. Except for areas of good RADAR coverage, these aircraft are invisible and cannot broadcast their location. Further study is needed to determine if this is a significant problem and how to improve safety for these aircraft if it is.

Communication coverage areas are also unclear. This information is evidently available from FAA computer programs that show coverage as a function of altitude. However we were not able to locate those programs during the course of the preparation of this paper.

This issue should also be studied further and the findings made available and understandable to those involved in planning the Alaska aviation system.

1.2.4 Weather Information

Accurate and timely weather information is critical for safe flight. The Alaska NextGen program has included installing additional weather reporting equipment to supplement improvements in surveillance, routes, approaches and communication. Progress has been made in Alaska to implement weather reporting stations to cover additional areas. However, Alaska still has very poor coverage compared to the rest of the country.[2]

An enhancement unique to Alaska is weather cameras. Over 80 operational weather cameras have been installed in the state, and an additional 139 sites are planned to be installed over the next seven years. The FAA weather camera system offers a valuable source of supplementary data that meets a couple of needs. The system adds information missing from the automated weather stations currently in use, which cannot detect weather until it is literally on top of the station. The system is also being used to fill gaps in locations, such as mountain passes, where no automated weather stations exist.

Flight service stations (FSS) convey weather to pilots for pre-flight planning and in-flight updates via radio. There are 14 FSS and three Automated FSS (with improved capabilities) in Alaska. The 14 standard FSS are all either seasonal or part time. Only the three AFSSs operate full-time, 24 hours per day.

1.2.5 Other Flight Safety Enhancements

Basic Capstone Aircraft Equipment

The basic Capstone equipment for aircraft includes the following:

- ADS-B Out equipment, which gives a signal that provides information on an aircraft's position, speed, altitude, identity, and other important data.
- ADS-B In equipment, which receives important information from ground stations as well as other aircraft with ADS-B Out.
- Multi-function display, which includes a moving map and also displays various ADS-B In information.
- RNAV GPS Navigation equipment.

The basic Capstone aircraft package provides a pilot with a moving map showing terrain information, the positions of other nearby ADS-B equipped aircraft, and various forms of weather information such as weather RADAR. The improvements to aviation safety experienced in southwest Alaska resulted from the integration of all the elements: situational awareness, weather data link, additional weather reporting stations, terrain, and air traffic awareness.

Traffic Information Service (Part of NextGen)
Capstone and the NextGen system call for a Traffic Information Service Broadcast (TIS-B), where an aircraft equipped with ADS-B In can see both other ADS-B equipped aircraft as well as non-ADS-B aircraft equipped with transponders. The Anchorage area is the only area in Alaska that currently provides TIS-B service.

Weather Information Service (Part of NextGen)
Flight Information Service - Broadcast (FIS-B) transmits graphical National Weather Service products, temporary flight restrictions (TFRs), and special use airspace information to ADS-B In receivers, providing pilots with improved situational awareness and safety. All original Capstone Ground Broadcast Transceivers (GBT) sites provide weather information, but only the Anchorage site provides full FIS-B service. FIS-B is expected soon from the Fairbanks site.

Aircraft Separation Standards
Better surveillance of aircraft coupled with better communication enables air traffic controllers to safely put more aircraft within a specified section of airspace. This is primarily an issue in the rest of the country. However this will also eventually be a benefit in Alaska because it will increase airspace capacity at urban airports such as Anchorage and Fairbanks, as well as airports with seasonal peaks of traffic.

1.3 Policy and Implementation Issues for FAA and DOT&PF

The transition from the current NAVAID system to the NextGen system will be a challenge. The type and timing of equipment required in aircraft needs to be determined. The FAA has agreed to continue installing NextGen equipment and associated Capstone enhancements in Alaska on an accelerated schedule as long as aircraft become equipped with Capstone (NextGen) equipment on a satisfactory schedule.

The cost to install NextGen equipment in aircraft is considerable. The Alaska Capstone Avionics Revolving Loan Fund can help purchase and equip Capstone electronics in the state's based aircraft. This is a State of Alaska program. It is expected to help stimulate equipage of commercial, but not general aviation aircraft.

The extent to which DOT&PF integrates aviation system planning with Capstone plans is another policy issue. An industry group has developed portions of a system plan to help decide where Capstone is most urgently needed and how it can be justified economically. While DOT&PF has been a part of this work, it may need to play a more integral role as decisions about the current phase of Capstone are refined.

1.4 Recommendations for Further Study/Actions

The following recommendations are offered for the Alaska Airspace System Plan:

- Create an information-exchange mechanism between FAA leaders and key team members of AASP.
- Coordinate airport improvements made by the DOT&PF or local airport owners with improvements being made to the airspace/NAVAID structure by the FAA and other agencies.
- Make Airspace/NAVAID information more accessible and easier to understand.
- Study additional ways to enhance safety and usability for both Capstone and non-Capstone-equipped VFR aircraft.

Specifics regarding these recommendations are contained in the main report.

2 Introduction

This paper is intended to provide an overview of the various existing and planned air navigation technologies and programs affecting Alaska's system of airports. Goals are outlined for the various programs, how they relate to each other, and their implementation schedule. Discussion is also included on policy and implementation issues for the Federal Aviation Administration (FAA) and Alaska's Department of Transportation and Public Facilities (DOT&PF) and recommendations for further study.

The available airspace and the navigation aids (NAVAIDs) that support the airspace directly affect the viability and usability of an airport. The benefits of contemplated airport improvements need to be understood regarding the ability of the airspace and NAVAID system to safely conduct aircraft in and out of the airport during various weather conditions or day/night operations. Correspondingly, the importance of improvements to the airspace and NAVAID structure near an airport need to be understood regarding the airport infrastructure's ability to accommodate the enhanced operations made possible by such improvements.

This paper has been prepared for the following reasons:

FAA NAVAIDs and services are crucial to the aviation system in Alaska.
A supportive relationship between airports and airspace/NAVAIDs is imperative anywhere, but especially in Alaska. "Over 95 percent of the state depends on aviation for its primary transportation."[3]

Rapid changes are underway.
New technologies such as GPS that affect aviation have matured and are beginning to rapidly change airspace/NAVAIDs, communications, and operating procedures. The pressure on the air traffic/airspace system worldwide has also generated bold new programs to address those challenges.

Increased awareness and education is needed on activities of the FAA and other agencies.
The FAA is made up of many different business units with different responsibilities. Their services are very broad and complex. People outside the FAA can encounter difficulty understanding how facets of the different FAA business units fit together. It can even be a challenge for those in the FAA. Other agencies such as the National Weather Service (NWS) also provide facilities that aviation depends on. Describing the FAA's role and responsibilities as they pertain to these programs, along with the role of other agencies, will help airport sponsors know what is available and where to go for assistance.

Consolidation of information will aid decision making.

Information on airspace/NAVAIDs is scattered among many sources. Some information is fairly accessible and some is not. The detailed and technical nature of the information makes summarizing a challenge. However, to prepare a proper system plan, a way is needed to combine and clearly summarize the information important to those charged with managing and improving a system of airports.

3 Overview of Major Programs

This paper draws on information from three major programs and discussions with key stakeholders as described below.

3.1 FAA Flight Plan 2008-2012

The *FAA Flight Plan 2008-2012—Charting the Path for the Next Generation* is a national FAA document. The report outlines FAA's corporate strategy, summarizes what's been done recently, and details plans for the upcoming years. The overall charge is to "reduce aviation congestion and manage the growth of the system, without compromising safety." The specific goals of the plan are to improve safety, increase capacity, provide international leadership, and achieve organizational excellence.

In order to accomplish these goals, the FAA has employed a program called NextGen (Next Generation Air Transportation System), which is designed to transform the national air transportation system from ground-based technologies to satellite-based technology. The NextGen program contains a blueprint for the aviation system of 2025 and a plan to get there. Two of the key initiatives of NextGen are Required Navigation Performance (RNP) and Automatic Dependant Surveillance System-Broadcast (ADS-B). These initiatives are described in this paper. A longer summary of the FAA Flight Plan is contained in the appendix. This summary also provides more explanation regarding NextGen initiatives. A copy of the FAA Flight Plan is available on the FAA website at www.faa.gov.

3.2 Roadmap for Performance-Based Navigation

The *Roadmap for Performance-Based Navigation—Evolution for Area Navigation (RNAV) and Required Navigation Performance (RNP) Capabilities-2006-2025* is also a national FAA document. Performance-Based Navigation (PBN) is the framework for defining navigation performance requirements that can be applied to an air traffic route, instrument procedure, or defined airspace. It is one of the elements contained in the FAA flight plan. The report outlines FAA's implementation strategy for performance-based navigation. It details FAA's transition plans over three time periods between now and 2025. RNAV and RNP navigation depend primarily on satellite (GPS) and internal aircraft systems as opposed to the ground-based systems that have been the primary NAVAID systems in the past. A longer summary for the Roadmap is contained in the appendix. The Roadmap is available on the FAA website at www.faa.gov.

3.3 Capstone Statewide Plan

The *Surveillance and Broadcast Services Capstone Statewide Plan, Version 7.1, 08 August 2007* is an FAA document co-signed by various Alaska Aviation groups. It only pertains to Alaska and incorporates the primary elements of the two previously mentioned documents. It is consistent with those documents, but goes into much greater detail regarding the plan to improve aviation infrastructure in Alaska. The Capstone program was initially implemented in Alaska in response to a 1995 study by the National Transportation Safety Board (NTSB) concerning aviation safety in Alaska. The initial implementation was limited to two specific regions: western and southeastern Alaska. The current Capstone Plan "outlines the plan for implementing proven Capstone Program technologies throughout Alaska to increase aviation safety and rural community access."[4] The new program is now part of FAA's nationwide NextGen program, with a number of items unique to Alaska. It is perhaps better referred to as the Alaska NextGen program.

The appendix contains a more detailed summary of the Capstone/ Alaska NextGen program. A copy of the document can be found at www.alaskaairmen.org.

3.4 Summary of Programs

The three previously listed programs all relate to each other. The FAA Flight Plan is the overarching document for development of the airspace and NAVAID system in the US. The RNP Roadmap is one of the key initiatives in the Flight Plan. The Capstone project was initiated in Alaska and for Alaska. Capstone was an FAA operational demonstration program that **tested new technologies in different regions of the state.** It was initiated **prior** to the FAA Flight Plan and the RNP Roadmap. Some of the key elements of the Flight Plan are **technologies successfully tested in Alaska** as part of Capstone.

Now that the FAA Flight Plan, NextGen, RNP Roadmap, and other standards have been adopted, the programs in Alaska need to be consistent with those programs. Much of the impetus behind the national programs has been to increase capacity, while maintaining and improving safety. The Capstone program has always been primarily about improving safety. The Surveillance and Broadcast Services Capstone Statewide Plan incorporates all the key elements of these national programs. It goes beyond them to address the unique challenges of aviation in Alaska with a primary goal of increasing safety.

3.5 Meetings with FAA and Key Stakeholder Groups for Alaska Aviation

Consultant team members for the AASP attended meetings of various aviation groups in Alaska, and several meetings with FAA and DOT&PF staff. A key group of meetings occurred during the week of February 11, 2008. Information gathered during those meetings also contributed to this memorandum.

4 Airspace/NAVAID Technologies

This section details more specific airspace and NAVAID technologies. It provides an overview of what currently exists and explains future plans and schedules for implementation. Issues pertaining to specific technologies are also examined.

4.1 Surveillance Technologies

Surveillance is essentially the means used to keep track of an aircraft's position and altitude. This is important for air traffic control (ATC) and safety. If the position of an aircraft is accurately tracked, the aircraft can be quickly located if search and rescue is required. It also allows a controller to advise aircraft of terrain hazards and nearby aircraft.

4.1.1 RADAR

The traditional method of aircraft surveillance has been RADAR. This technology scans a geographic area and determines aircraft position by reflected signals and transponder responses. Transponder returns are pulsed radio signals that equipment on the aircraft provide when scanned by RADAR. It allows aircraft to operate at reduced separations (i.e., from 30 nautical miles down to 3 nautical miles), but has limitations on areas of coverage. Radar service is available in only 20 percent of Alaska's airspace and over 90 percent of this radar coverage is at altitudes of 12,000 feet and above. Most of the airspace used for instrument flight rules (IFR) departure, enroute, and arrivals by commercial and general aviation operations is outside radar coverage, so non-radar ATC procedures are used, limiting system efficiency and capacity.

4.1.2 ADS-B

ADS-B (Automatic Dependent Surveillance - Broadcast) provides a new means for aircraft surveillance. ADS-B has been implemented in Alaska as part of the Capstone Project. It is now being implemented nationwide as part of the NextGen ATC System. In ADS-B, aircraft send position information to ATC sensors, which collect the information and display it on an air traffic controller's display screen. The ADS-B equipment on the aircraft sends information on location, speed, altitude, and aircraft identification and equipment. With ADS-B, the position information is more precise than with RADAR, and the information is updated much quicker. This is expected to allow reduced separation standards between aircraft in the future. ADS-B has two primary components: ADS-B OUT and ADS-B IN.

ADS-B OUT involves aircraft equipment that sends a signal to land-based ADS-B receivers regarding the aircraft's position, altitude, and other data. The information is derived via GPS. ATC can use this for more precise surveillance and control of air traffic.

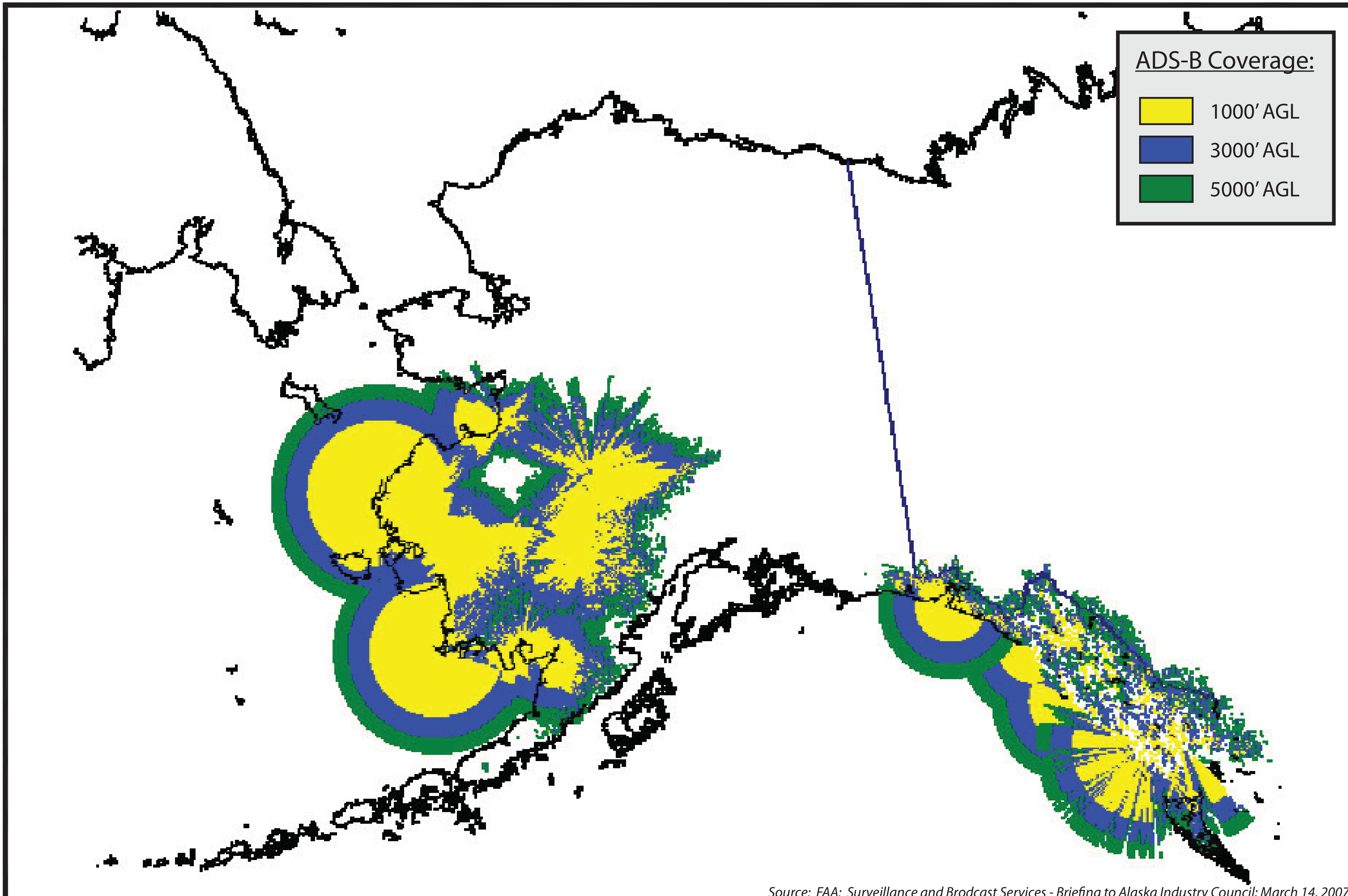
ADS-B IN equipment receives ADS-B and other data into the aircraft. This involves ADS-B transmissions from other aircraft in close proximity and uplinks air traffic data from ATC that provides information on all traffic in the vicinity. Both are derived from ADS-B and other sources such as RADAR. The ADS-B IN equipment can also provide weather information and other data. Since ADS-B provides the pilot with essentially instantaneous information on the relative position, speed, and altitude of nearby aircraft, a pilot could use the ADS-B IN display to obtain information as good as or better than that obtained with the naked eye. ADS-B IN has been a primary component of Capstone from the start of the program due to the increased safety provided by allowing pilots to be aware of other traffic in the vicinity (if that traffic also has ADS-B) and to have better weather information and displays in the cockpit.

Figure 1 shows ADS-B surveillance coverage provided by Segment 1 (the first two phases) of Capstone. Figure 2 shows the coverage to be provided during Segment 2 (Phase 3) of the Surveillance and Broadcast Services Capstone Statewide Plan. Figure 3 shows the combination of Segments 1 and 2. Figure 4 shows the location of ground-based transceivers (GBTs) that provide surveillance coverage. Figure 5 shows a graph with GBT coverage in relation to operations, accidents, and routes.

The FAA is implementing ADS-B coverage, as well as other components of the program in a phased approach. Low altitude enroute Service Volumes (SVs) have been established to manage the deployment of these systems. Service Volumes are distinct geographic areas within Alaska that reflect typical patterns of Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) commercial and general aviation operations. The SV concept was developed as part of the national contract for the Next Generation Air Traffic Control System. The boundaries of the Alaska SVs are shown in Figure 6. These low-altitude enroute SVs will have ceilings of 18,000ft MSL and floors of 1,000ft AGL. Due to limitations of ground station line-of-site, the 1,000ft AGL goal to cover VFR traffic may not be achievable in many areas.

The initial Capstone installations used "Universal Access Transceiver" (UAT) as the means for communication between the aircraft ADS-B equipment and the GBTs. UAT is used primarily by general aviation. The airlines and large corporate aircraft primarily use "1090 extended squitter" technology for sending out and receiving ADS-B transmissions. The original legacy Capstone Equipment will be upgraded with 1090 equipment, in addition to the UAT equipment. New equipment, which is being installed by FAA Surveillance and Broadcast Services (SBS), will have both 1090 and UAT equipment. It is not clear if all the Capstone equipment will receive 1090 transceivers or just the sites necessary to support the National NextGen contract.

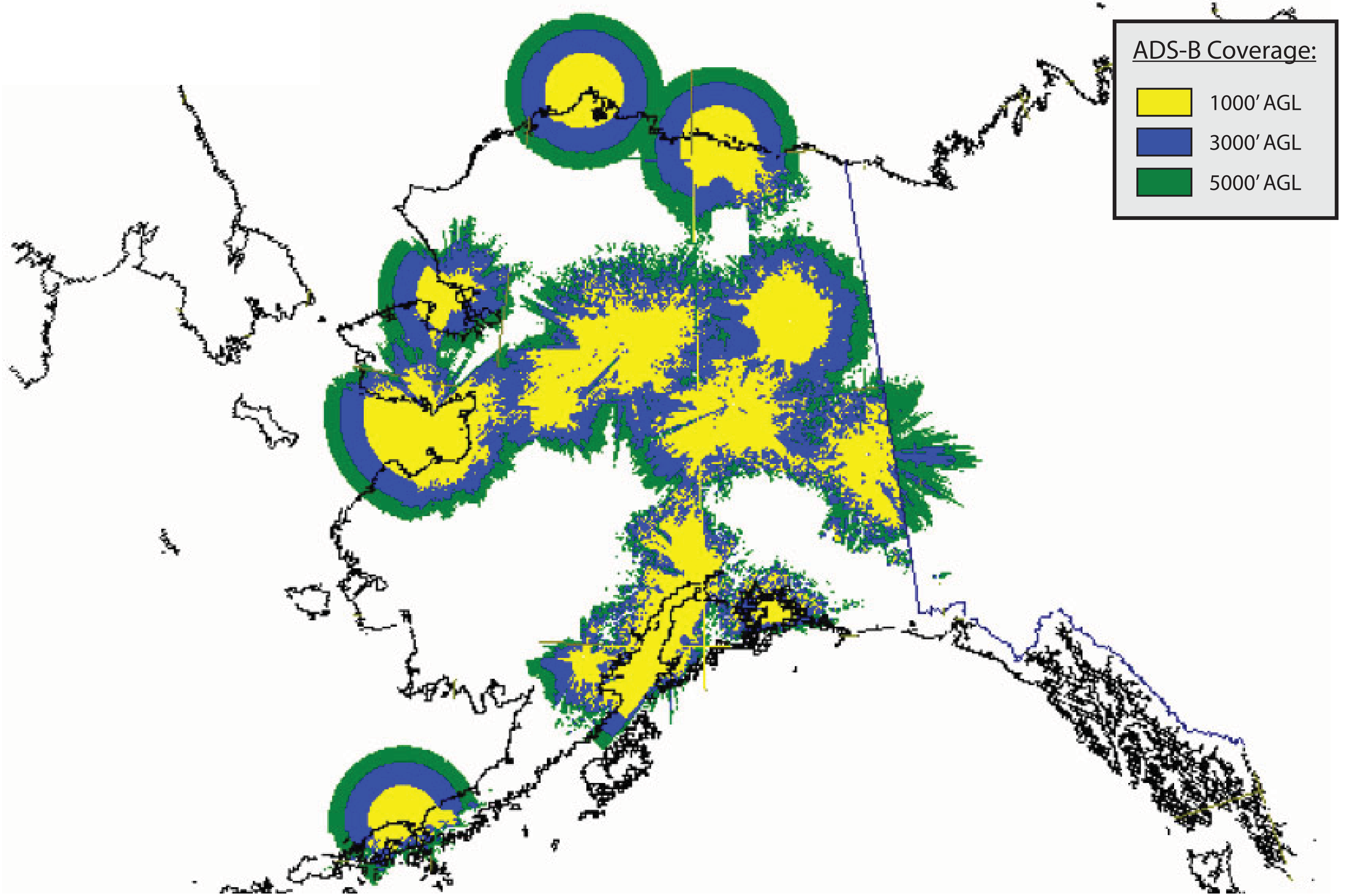
Some of the earlier Capstone briefings indicated a need for the installation of additional GBTs beyond the number ultimately chosen. The fewer number were selected based



ALASKA AVIATION SYSTEM PLAN

ADS-B COVERAGE
SEGMENT 1 (PHASE I & II)

FIGURE 1

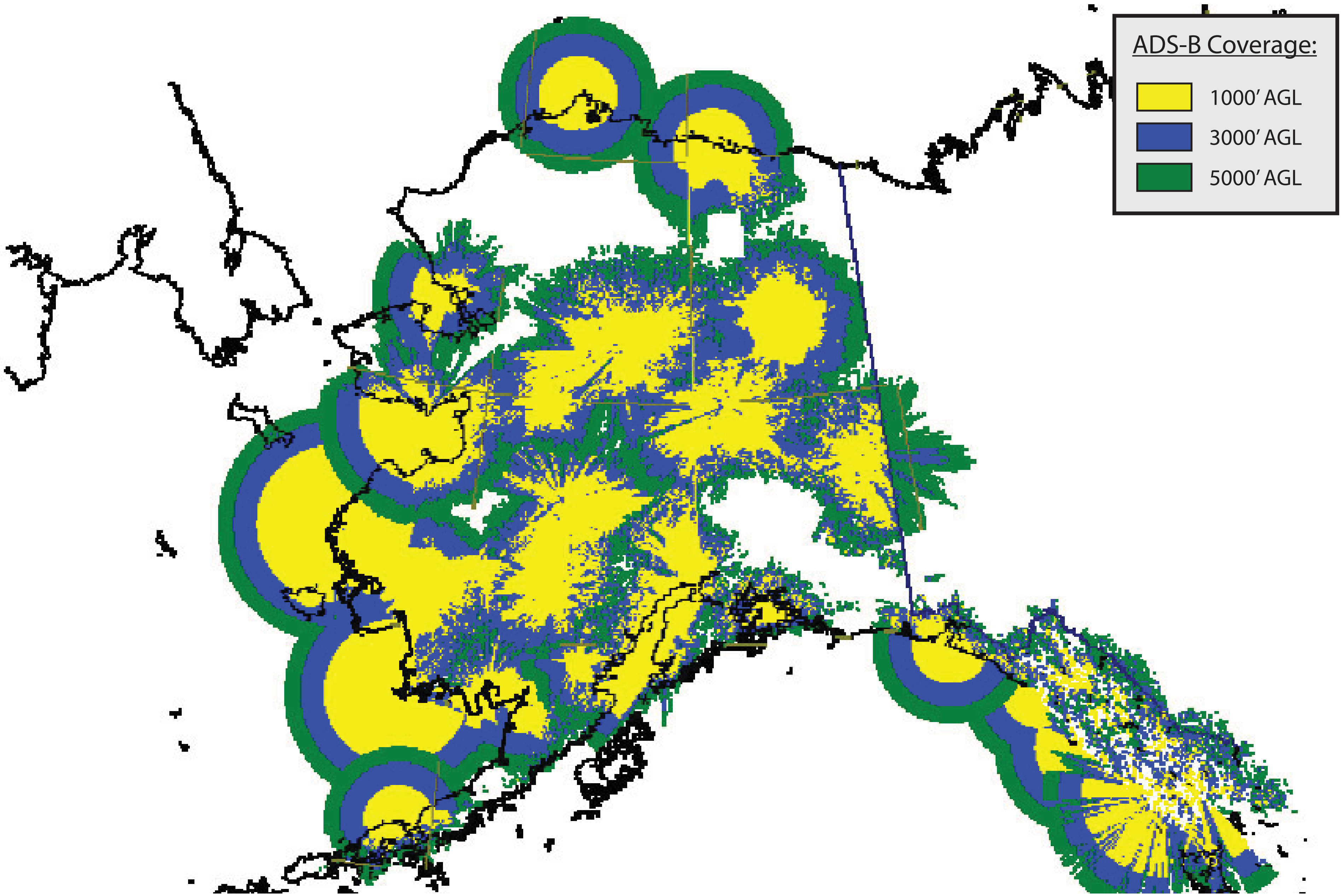


Source: FAA: Surveillance and Brodcast Services - Briefing to Alaska Industry Council; March 14, 2007

ALASKA AVIATION SYSTEM PLAN

ADS-B COVERAGE
SEGMENT 2 (PHASE III)

FIGURE 2

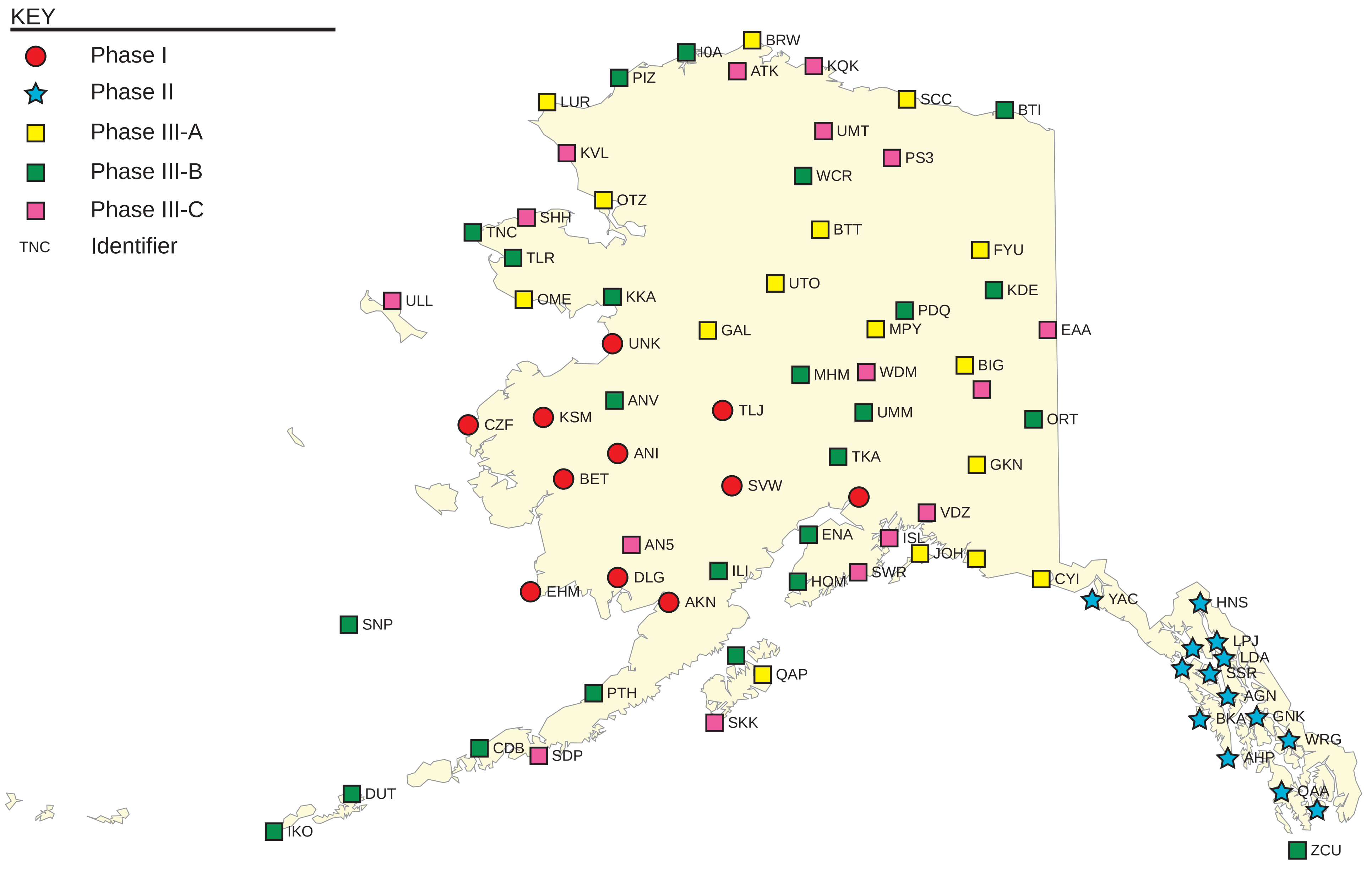


Source: FAA: Surveillance and Brodcast Services - Briefing to Alaska Industry Council; March 14, 2007

AASP ALASKA AVIATION SYSTEM PLAN

ADS-B COVERAGE
BOTH SEGMENTS 1 & 2

FIGURE 3

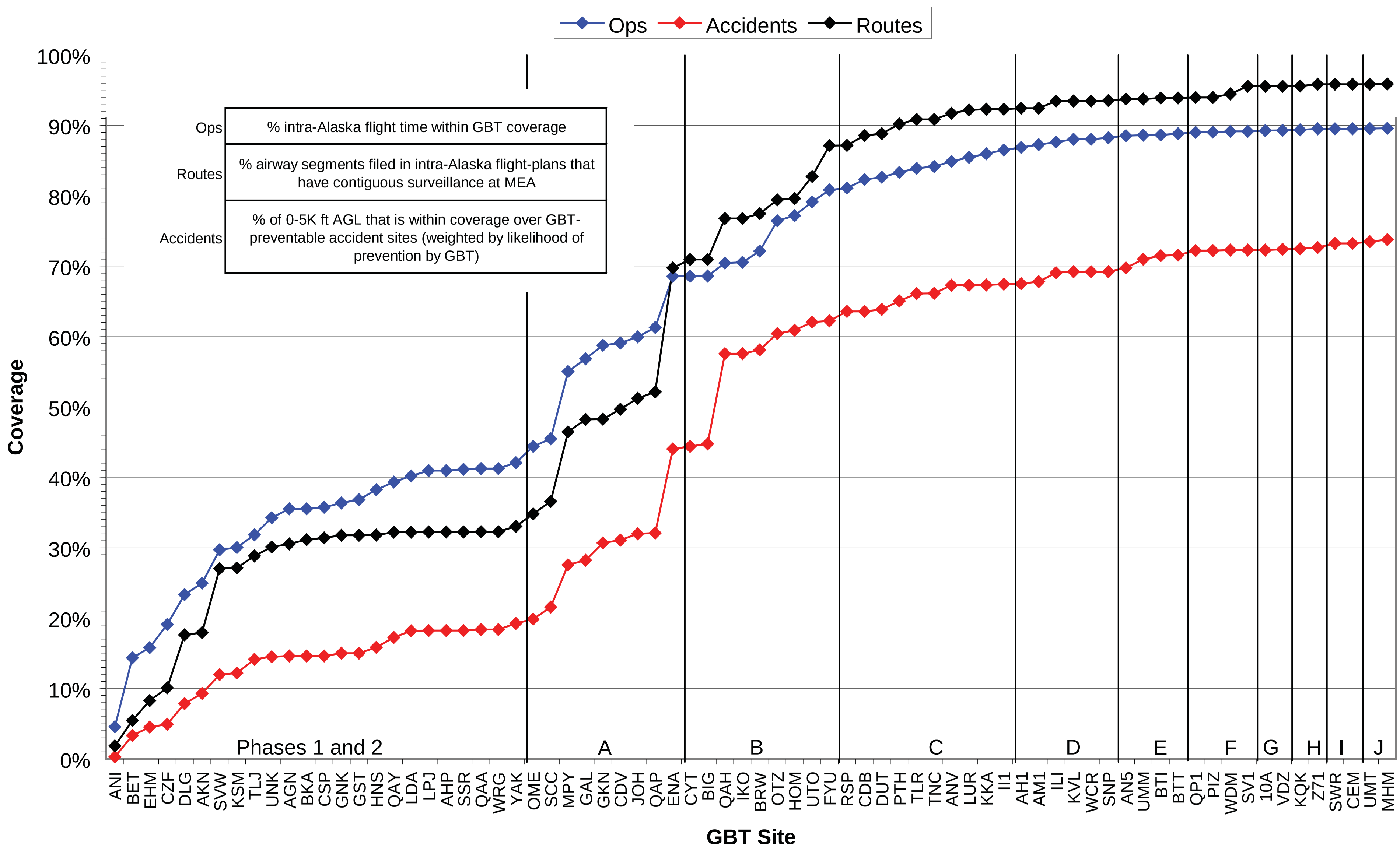


Source: FAA: Surveillance and Broadcast Services Capstone Statewide Plan, August 2007

AASP ALASKA AVIATION SYSTEM PLAN

PHASES OF GBT SITES

FIGURE 4

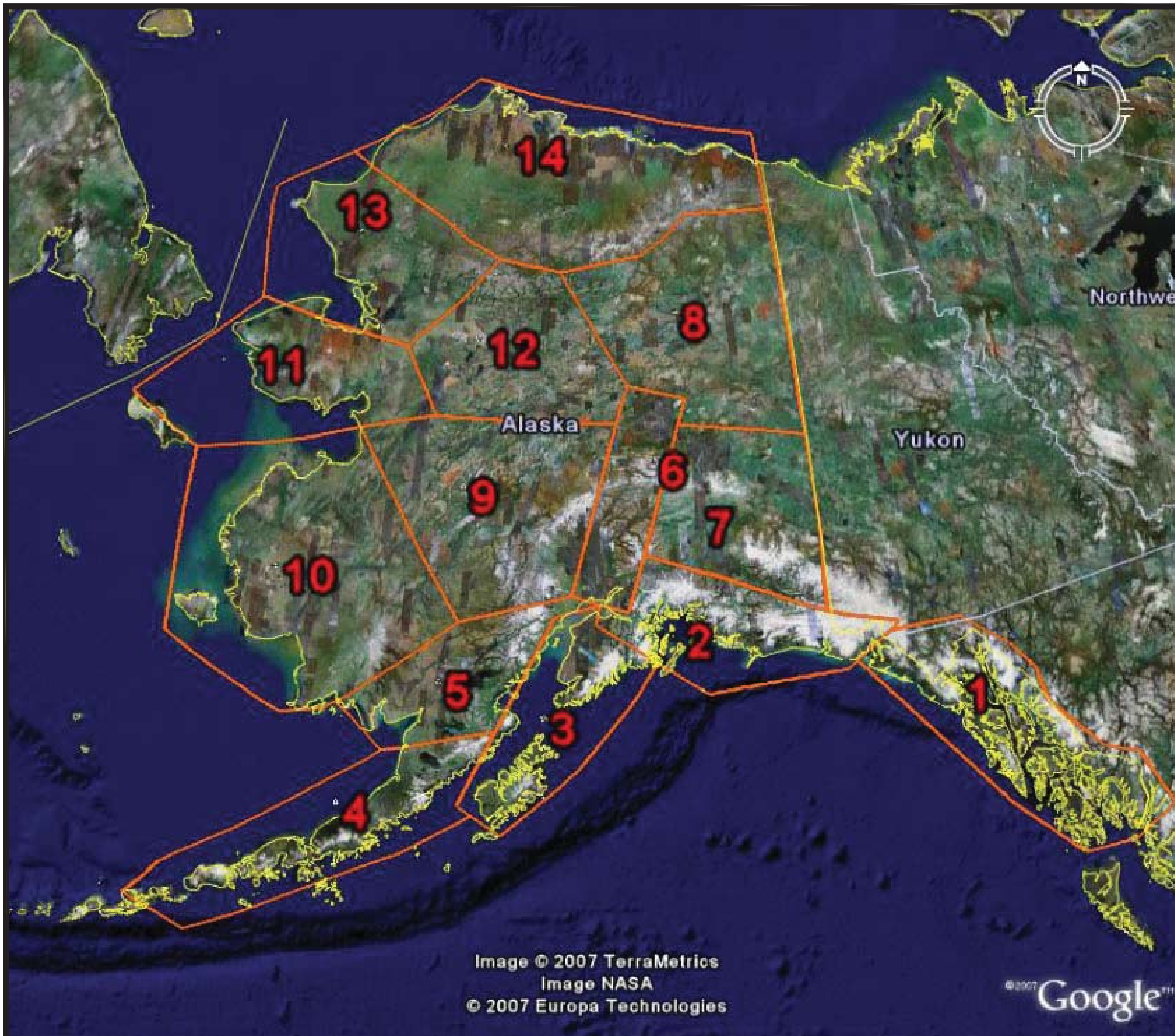


Source: The Mitre Corporation: "GBT Coverage Metrics"; August 28, 2006

ALASKA AVIATION SYSTEM PLAN

GBT COVERAGE METRICS

FIGURE 5



Source: FAA: Surveillance and Brodcast Services Capstone Statewide Plan, August 2007

SV	SV Name	SV	SV Name
1	Southeast Alaska	8	Upper Yukon River
2	Prince William Sound - Gulf of Alaska	9	McGrath - Upper Kuskokwim
3	Cook Inlet - Kodiak	10	Yukon - Kuskokwim Delta
4	AK Peninsula	11	Nome - Seward Peninsula
5	Lake Clark - Bristol Bay	12	Galena - Mid Yukon River - Koyukuk River
6	Anchorage - Fairbanks	13	Kotzebue - Northwest Alaska
7	AK Highway Copper River Isabel Pass	14	North Slope

AASP ALASKA AVIATION SYSTEM PLAN

LOW ALTITUDE ENROUTE SERVICE VOLUMES (SV)

FIGURE 6

upon budgets and cost/benefit analysis. Findings about future growth that come out of the Alaska Aviation System Plan (AASP) could help support the installation of additional GBTs and this should be monitored closely.

4.1.3 Multilateration

Multilateration is another relatively new means of providing surveillance. In multilateration, multiple sensors on the ground receive the signals from transponders on aircraft and use triangulation to calculate an aircraft's position. Use of multilateration across a large area of airspace is called Wide Area Multilateration. Multilateration does not require additional equipment on aircraft beyond that which most aircraft already have (transponders). Multilateration is especially useful in mountainous areas, as it can provide surveillance capabilities at much less cost than that same coverage using RADAR. Multilateration is a bridging technology until such time as ADS-B can be fully implemented. The FAA is currently implementing Wide Area Multilateration in the Juneau area. Other areas may get multilateration if the system at Juneau meets expectations.

4.2 Navigation Technologies, IFR and VFR

Navigation (aside from pilots using landmarks) in Alaska in the past has been primarily provided by various kinds of ground-based stations that transmit radio signals aircraft use to navigate. Various concerns regarding signal strength, terrain, and other issues place limitations on the kinds of routes that can be provided. In order to follow the NAVAID signals, at times aircraft have to take indirect routes, fly at high altitudes, or both. This creates many challenges.

4.2.1 Enroute Airways

Enroute airways are developed for use by aircraft flying under instrument flight rules (IFR). However, they are also depicted on visual flight rule (VFR) charts and are often used by VFR aircraft as a means of navigation.

Legacy Systems Used for Enroute Airways

Non-Directional Beacon (NDB) - An NDB transmits radio signals on a designated frequency. This information provides a tool for pilots to navigate within the National Airspace System (NAS). The signals follow the curvature of the earth so NDB signals can be received at much greater distances at lower altitudes than other systems. However, the NDB signal is affected by atmospheric conditions, mountainous terrain, coastal refraction and electrical storms, particularly at long range. In addition to providing navigational assistance to aircraft, NDBs also allow for non-precision approaches to airports. NDBs provide the capability to navigate to or from the NDB facility. They do not provide specific radials for a pilot to fly. Pilots need to use a compass along with the NDB signal if they want to fly on a specific radial. This is a complicated and imprecise process. Routes or approaches that are predicated on an NDB need to have large areas of protection from obstacles due to the low precision available when using an NDB to navigate. Alaska still has many airways that are predicated on NDBs. This is very different from the rest of the United States, where very few, if any, airways use NDBs to provide the navigation signal. Airways predicated on NDBs are called LF/MF airways (for low frequency/medium frequency). These airways are usually designated A, B, or G on a navigation chart (e.g., A5).

<u>Very High Frequency Omni-Directional Range (VOR)</u> – This is an enroute NAVAID which utilizes ground-based transmission facilities to provide navigational fix information to properly-equipped aircraft. A VOR transmits radio signals 360 degrees in azimuth on a designated frequency. This information has provided pilots a tool for point-to-point navigation within the National Airspace System (NAS). It is used for low altitude and high altitude airway vectoring through the airspace surrounding the airport, as well as transition navigation into or out of the enroute airspace structure. In addition to providing enroute navigational assistance to aircraft, VORs have also allowed for non-precision approaches to airports. A VOR allows a pilot to select a specific radial to fly on, and provides greater precision than an NDB. Airways predicated on VORs are called VOR airways and also called Victor Airways. These airways in the low altitude stratum (below 18,000 feet MSL) are designated with a V (e.g., V477). High altitude airways are designated with a J, and called Jet Routes.

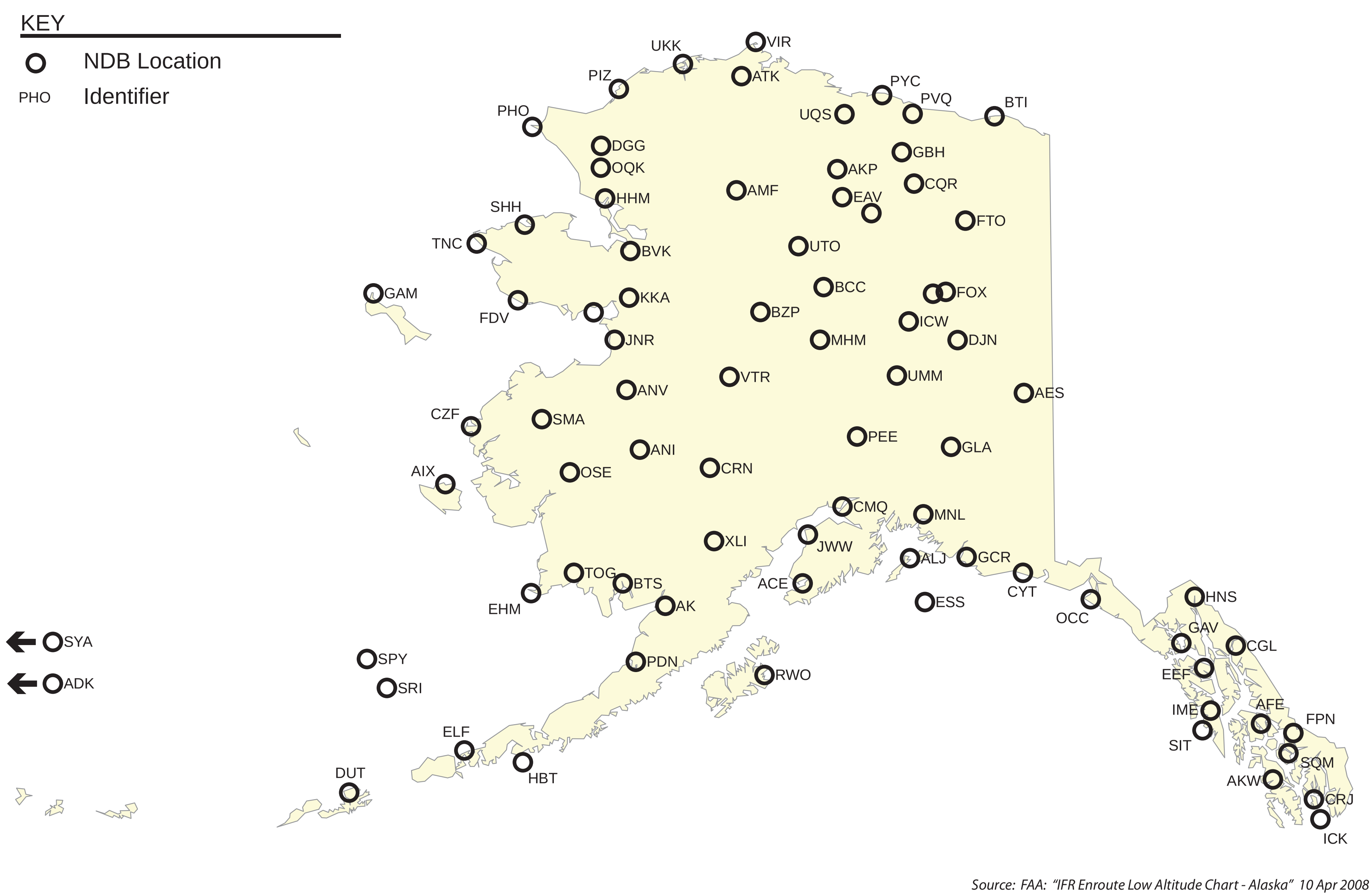
While VORs offer more precision than NDBs, both VORs and NDBs share a weakness in that the signal intensity diminishes as distance increases from the facility. VORs are also essentially limited by line of site. The normal range for low altitude VORs is 40 nautical miles. In some cases this distance can be increased slightly by conducting a satisfactory flight check.

NDB and VOR navigation systems are being phased out and replaced by satellite-based global positioning systems (GPS). The satellite systems, especially when augmented by the Wide Area Augmentation System (WAAS) and/or using RNP, provide greater precision than either NDBs or VORs. It is much less expensive to maintain the satellite system of navigation as opposed to land-based systems and the satellite system is not constrained by line of sight in the same manner as ground-based systems.

Figures 7 and 8 show where the existing NDBs and VORs are located in Alaska. Figures 9 and 10 depict which ones are being removed. Most of the legacy airways will be removed along with the removal of the legacy ground systems. This is recommended as part of Capstone phase 3 (2006-2009). The specific timeframe for divestment was not able to be determined as part of this study.

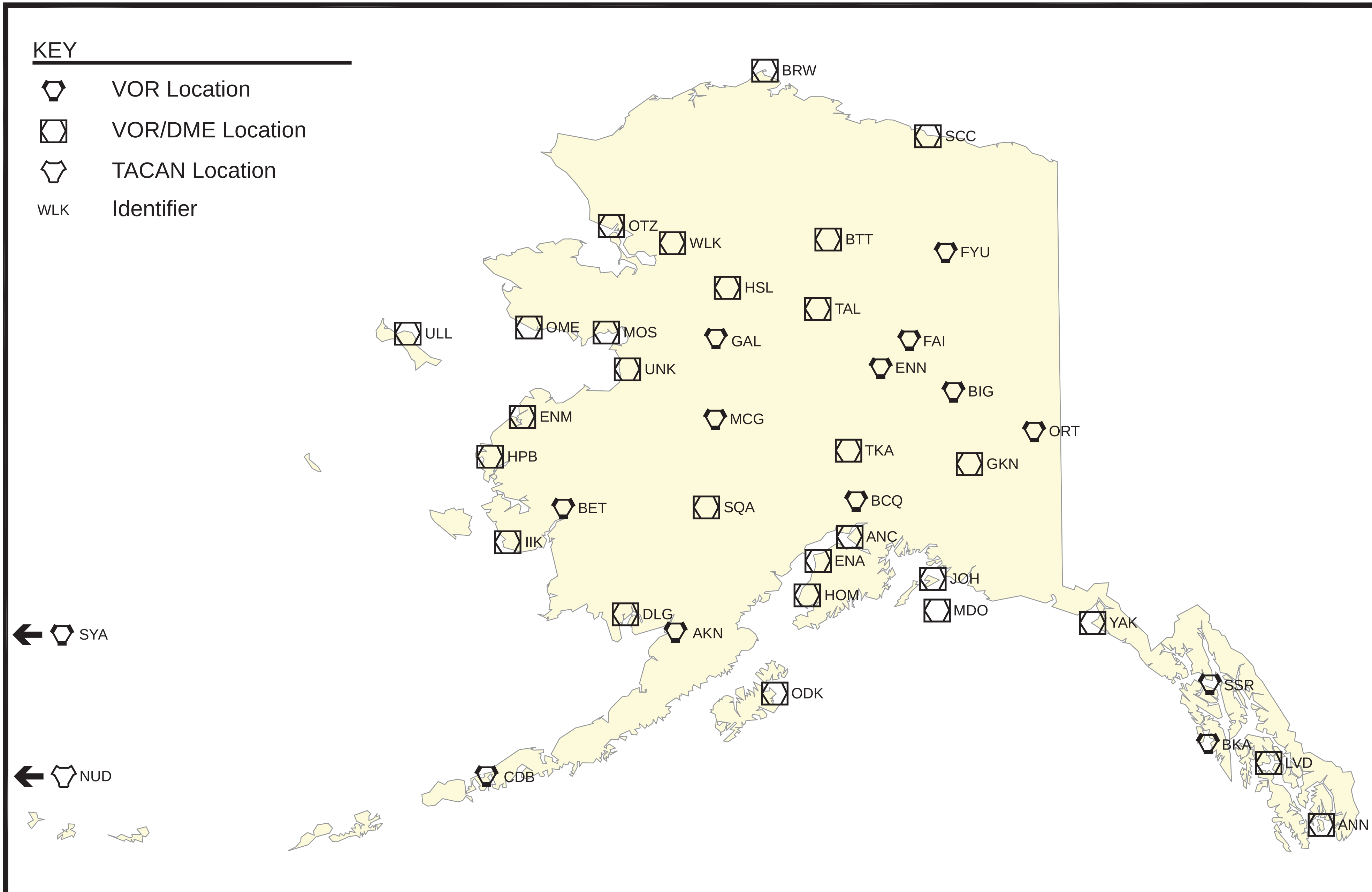
RNAV (GPS) Systems

Area Navigation (RNAV) is a general term for navigation systems that allow aircraft to fly



NDB LOCATIONS

FIGURE 7

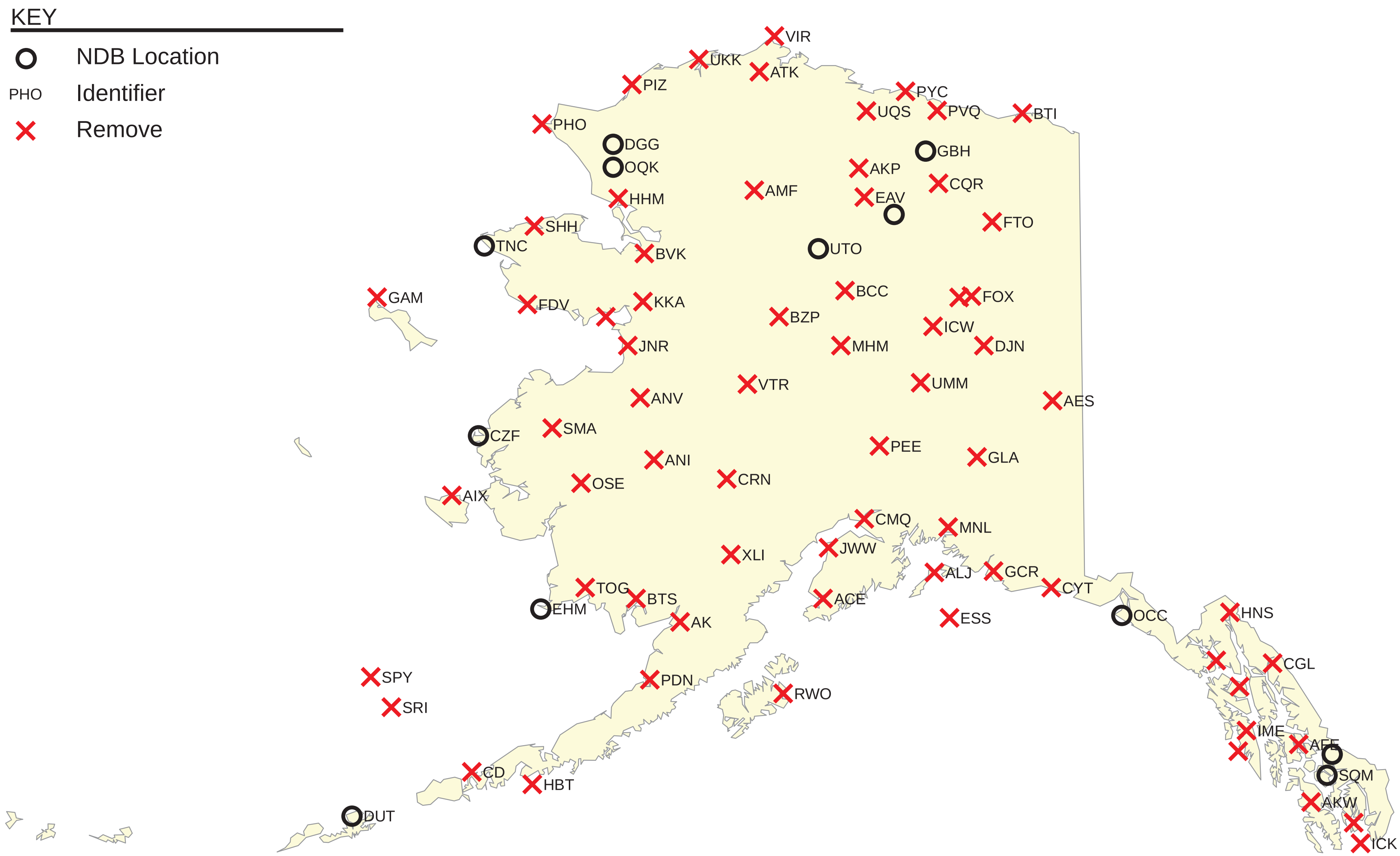


Source: FAA: *"IFR Enroute Low Altitude Chart - Alaska"* 10 Apr 2008

AASP ALASKA AVIATION SYSTEM PLAN

VOR LOCATIONS

FIGURE 8

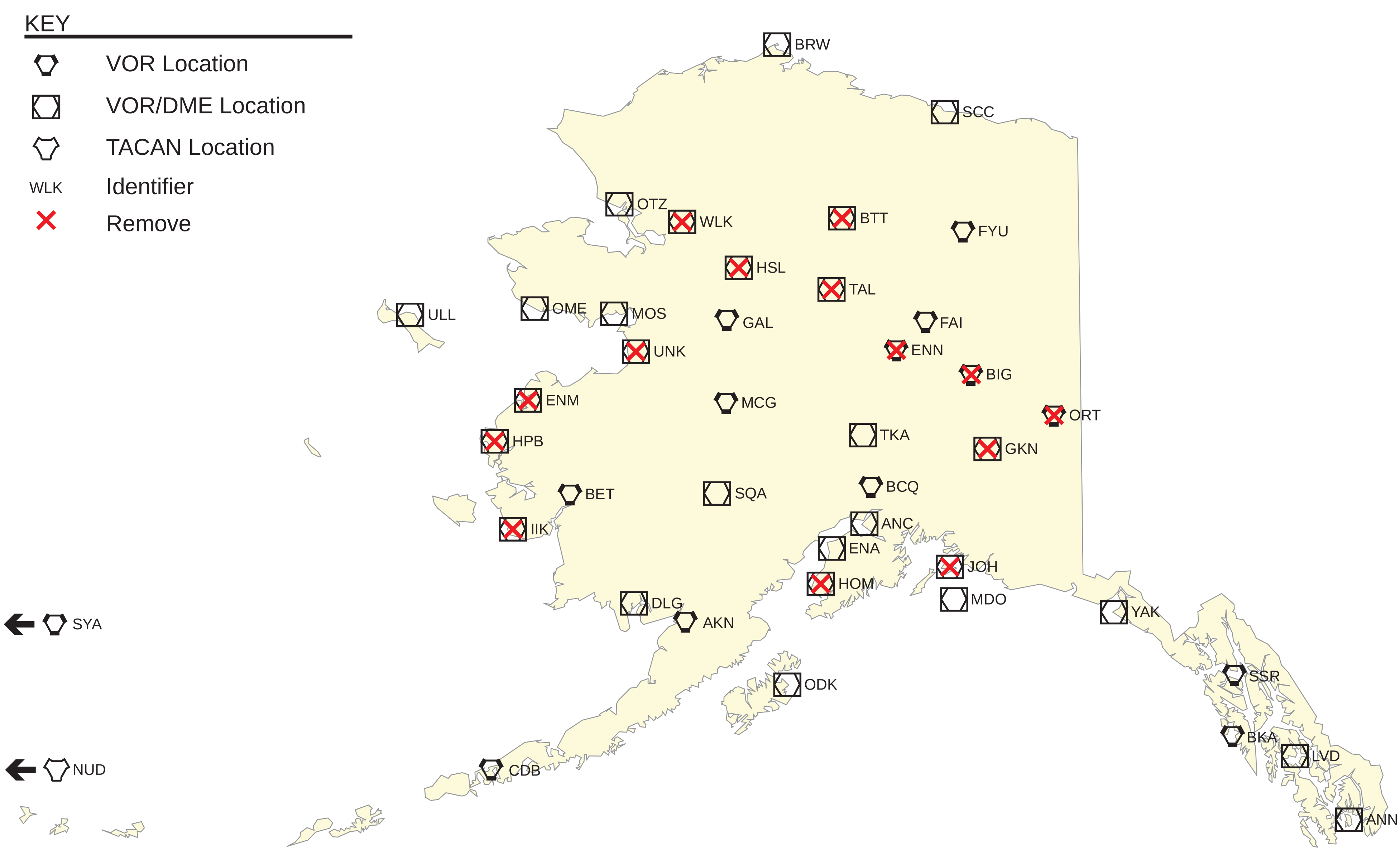


Source: FAA: "IFR Infrastructure Enhancements"

ALASKA AVIATION SYSTEM PLAN

NDB DIVESTMENT

FIGURE 9



Source: FAA: *"IFR Infrastructure Enhancements"*

ALASKA AVIATION SYSTEM PLAN

VOR DIVESTMENT

FIGURE 10

routes that are not dependant on going in direct paths between ground-based navigation aids. Early RNAV systems involved equipment on aircraft that used electronic means to allow aircraft to fly routes that were not necessarily direct between ground-based NAVAIDs. Other RNAV systems used inertial navigation systems. Most newer RNAV systems use GPS navigation which has now been enhanced by a system called the Wide Area Augmentation System (WAAS). This provides a more accurate GPS signal versus the basic GPS signal. Because it is not confined to ground-based navigational aids, RNAV has much greater flexibility when constructing routes. Also, since line of sight to a ground station does not apply to most RNAV equipment, lower minimum enroute altitudes (MEA) are possible on these routes. The only criterion is obstruction clearance. On the legacy airways, the MEA often needs to be much higher than what is required for obstruction clearance in order to make sure the aircraft is receiving an adequate signal for navigation. The higher altitudes can require aircraft to be so high in some cases that pressurization or oxygen is required. It can also put planes into icing conditions which they might otherwise not encounter.

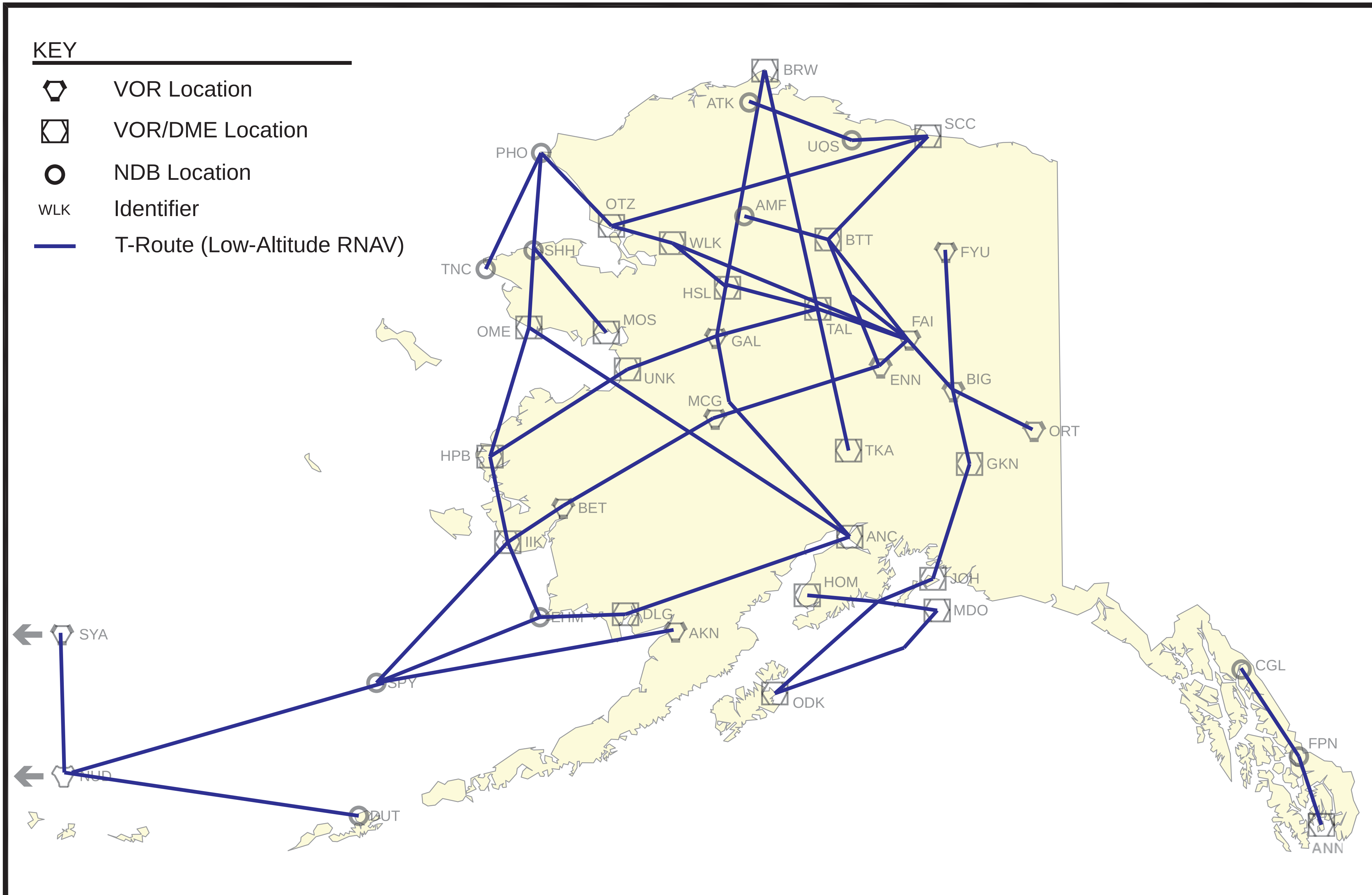
RNAV offers distinct advantages. Using a more direct route offers time and fuel savings. There is less dependence on Air Traffic Control communication for vectoring, altitude and speed assignments. Overall it offers a more efficient use of airspace.

Low altitude RNAV routes are designated with a T (e.g., T244). Many of the T routes are coincident with VOR airways. Other T routes are totally independent. Air traffic cannot currently issue a clearance for these RNAV routes due to needed upgrades to the air traffic control automation system and separation procedures using the new technologies. Existing low-altitude routes (T-Routes) are shown on Figure 11.

4.2.2 Instrument Approaches and Departures

There are 278 public airports in the State of Alaska, according to the most recent information on the DOT&PF website. This number does not include privately owned public use airports. Approximately 120 of these public airports (42 percent) have published instrument approach procedures. There are also military owned airports open to the public that have instrument approaches.

In Alaska, 44 percent of the approaches use ground based systems (ILS, VOR, NDB, etc.) and 56 percent use satellite systems (GPS, RNAV, etc).



Source: FAA: "IFR Enroute Low Altitude Chart - Alaska" 10 Apr 2008

ALASKA AVIATION SYSTEM PLAN

T-ROUTE LOCATIONS

FIGURE 11

The following tables give a summary of the percent of public airports that have ceiling and visibility minimums listed.

Ceiling Minimums Summary

Ceiling Mins (feet)	# of Airports	% of Total
<=200	2	1.7%
200	11	9.2%
300	11	9.2%
400	25	20.8%
500	26	21.7%
600	9	7.5%
700	6	5.0%
>=800	30	25.0%
Totals	120	100.0%

Visibility Minimums Summary

Visibility Mins (mile)	# of Airports	% of Total
<= 1/2	2	1.7%
1/2	9	7.5%
3/4	5	4.2%
1	79	65.8%
1 1/4	16	13.3%
>=1 1/2	9	7.5%
Totals	120	100.0%

According to the Capstone document, "new RNAV approach and departure procedures will continue to be developed for approximately 50 airports that the industry recommended for upgrade to IFR access. RNAV/RNP airways will also be charted to connect those and other IFR airports in an airport-to-airport GPS/WAAS based route structure. Communication facilities and additional Automated Weather Service Stations (AWSS), as required in support of the RNAV infrastructure, will also be fielded to expand the number of IFR airports in the state."[5] The schedule is contained in Capstone documents.

The issues with developing the approaches concern the need to get accurate survey data around the airport, to make sure the airport has the necessary runway length, lighting, and other services, and to make sure that the airport has the necessary weather and communication capabilities.

The FAA, State and other users should closely coordinate planning of instrument approaches with airport improvement plans and aircraft equipage plans to ensure that when the approach is established it can and will be used for its intended purpose. For example, some approaches need a visual glideslope system before use of the approach can be authorized at night. Other approaches may require obstruction lights to be added to certain obstructions near the airport. In some cases the approach cannot be authorized without the addition of a taxiway on the airport. In other cases an approach cannot be authorized if a weather reporting system is not in place. All of these kinds of items should be closely coordinated.

4.3 Communication Technologies

Communication is a very important part of aviation. Aircraft flying under IFR rules need to maintain communication with Air Traffic Control (ATC). Both IFR and VFR aircraft need to have communications in order to obtain up to date weather information. Communications is also desirable to keep track of aircraft on VFR flight plans. Most communication for weather and VFR flight plans is done with the Flight Service Station (FSS).

Enhancing communications in Alaska has been one of the primary elements of the Alaska NextGen program, along with greatly increasing surveillance for better air traffic control and flight following of VFR aircraft. Surveillance and communication really need to go together. As new airports receive routes to them, along with instrument approaches, it is important that communications are available to aircraft going to those airports. Additional communication facilities are called for in the Surveillance and Broadcast Services Capstone Statewide Plan. Obtaining information on the actual coverage provided by the communication facilities in Alaska has been difficult. The FAA evidently has programs to show (estimate) coverage of communications and surveillance, but it has been difficult to obtain that information within the scope of this paper. It is recommended that more research be conducted to document where the coverage is good and where there are gaps.

One challenge for communication that exists in Alaska more than anywhere else is that a significant number of very small aircraft are still not equipped with radios. These aircraft are not a problem during the worst weather conditions but can be a problem during good weather. They typically do not have the electrical systems and space in the cockpit for either radios or ADS-B equipment. Except for areas of good RADAR coverage, these aircraft are invisible and cannot broadcast their location. While this presents a challenge, the significance of this problem is not clear. Newer model handheld radios have stronger signals, greater range and better battery systems. It is unclear at this time if handheld radios are being used to a greater extent and whether or not the state or FAA should have a role in promoting their use. Additional discussion on this issue may be merited.

4.3.1 Communication with Air Traffic Control (ATC)

Communication with ATC is typically accomplished through remote communications air-ground (RCAG) sites or Radio Transmit Receive (RTR) sites. Information on the location and coverage areas for RCAG and RTR sites has not been readily available. RCAG and RTRs use the VHF frequency spectrum which is generally limited to line of sight. The information on coverage should be pursued further in subsequent studies. Figure 12 shows the information obtained on RCAG and RTR sites in Alaska.

4.3.2 Communication with Flight Service Stations (FSS)

Communication with FSS is normally accomplished through Remote Communication Outlets (RCOs). Figure 12 also shows the location of RCOs in Alaska. Coverage information for the RCOs was not able to be obtained. Future Plans for FSS in Alaska are outlined in the next section.

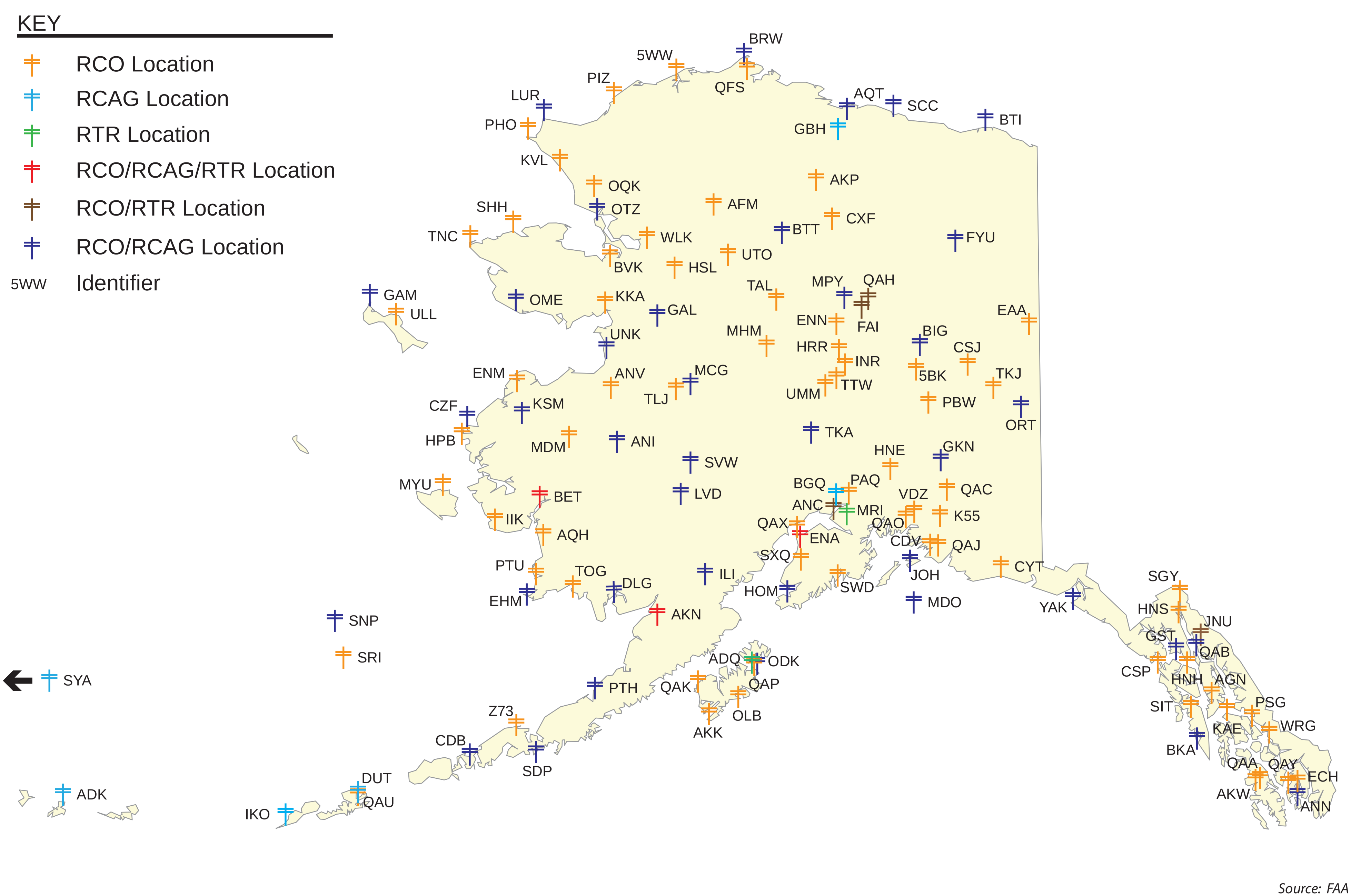
4.4 Weather Information

4.4.1 Recording Weather

Automated Weather Observing System (AWOS), Automated Surface Observing Systems (ASOS), and Automated Weather Sensor System (AWSS) are all systems that automatically record weather and put it in a format so that it can be transmitted to various dissemination sources. Most of these facilities are located at an airport. Many of the systems have a transmitter which continually transmits the weather via radio on a frequency that can be received by aircraft which are relatively close to the airport. The information is also transmitted to the FAA and National Weather Service (NWS) and disseminated from there by various means.

Weather is a very essential element of aviation. VFR aircraft are required to get all readily available weather information along their route of flight in order to determine that the flight can be safely conducted under VFR rules. IFR pilots also need to obtain weather information. Most aircraft operating under IFR cannot initiate an instrument approach to an airport unless current weather information is available.

In the early days of aviation all weather information was obtained by ground observers using various forms of weather equipment. Automated systems started showing up in the 1980s. These systems have been good for aviation in that they provide the ability to get up-to-date weather information at many locations without the need to pay for and staff all those locations with human observers. However, the automated stations are limited in that they only detect the weather immediately over and at the station. A significant



ALASKA AVIATION SYSTEM PLAN

ATC COMMUNICATIONS FACILITIES

FIGURE 12

change in the weather that is only half a mile away will not be detected, even though it will obviously affect aircraft using the associated airport. Good progress has been made in Alaska implementing additional weather reporting stations to provide additional coverage across the state. Many of these installations have been part of the original Capstone project. The sites currently installed in Alaska are shown in Figure 13.

Even though good progress has been made, some of the earlier Capstone reports called for additional installations that have not currently been budgeted. According to a source familiar with Alaska aviation, the state has less than half the number of weather stations for a comparable sized portion of the lower 48 states.[6] As the AASP moves forward, the requests for additional weather reporting systems should be identified in conjunction with other NAVAID, approaches, and airport improvement needs for Alaska's system of airports.

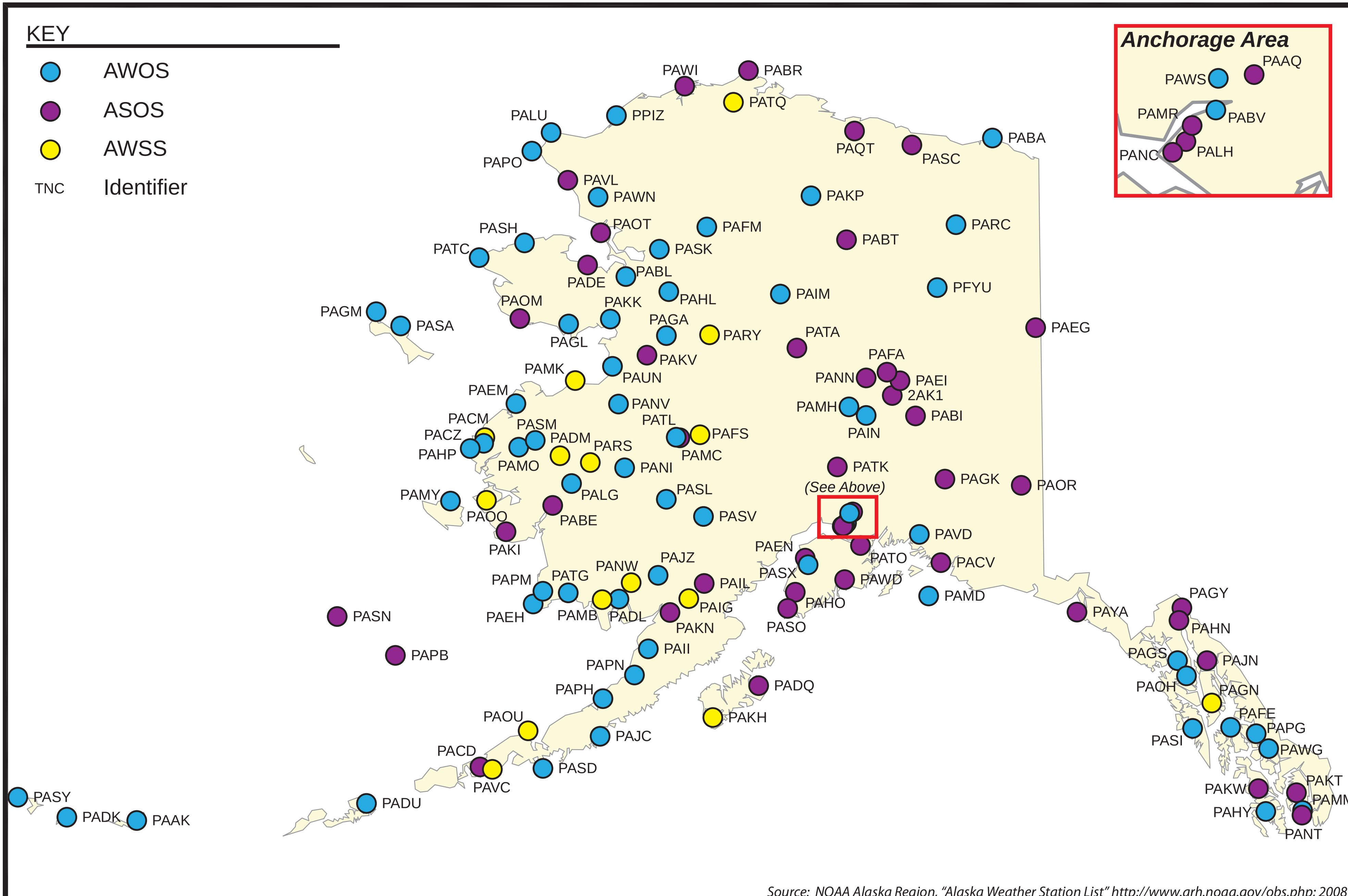
4.4.2 Weather Cameras

The use of weather cameras to assist aviation originated in Alaska. It has been a very successful program. Based upon anecdotal information, it seems to be unique to Alaska. A detailed check to verify this has not been conducted.

In late 2007, the FAA announced a decision to "invest approximately $102 million dollars over the next 26 years for the additional installation of and continued operation of aviation weather cameras in Alaska. An additional 139 weather camera sites are planned to be installed over the next seven years. Together with the 82 already operational sites, this will bring the network of weather cameras to a total of 221 sites by 2014".[7]

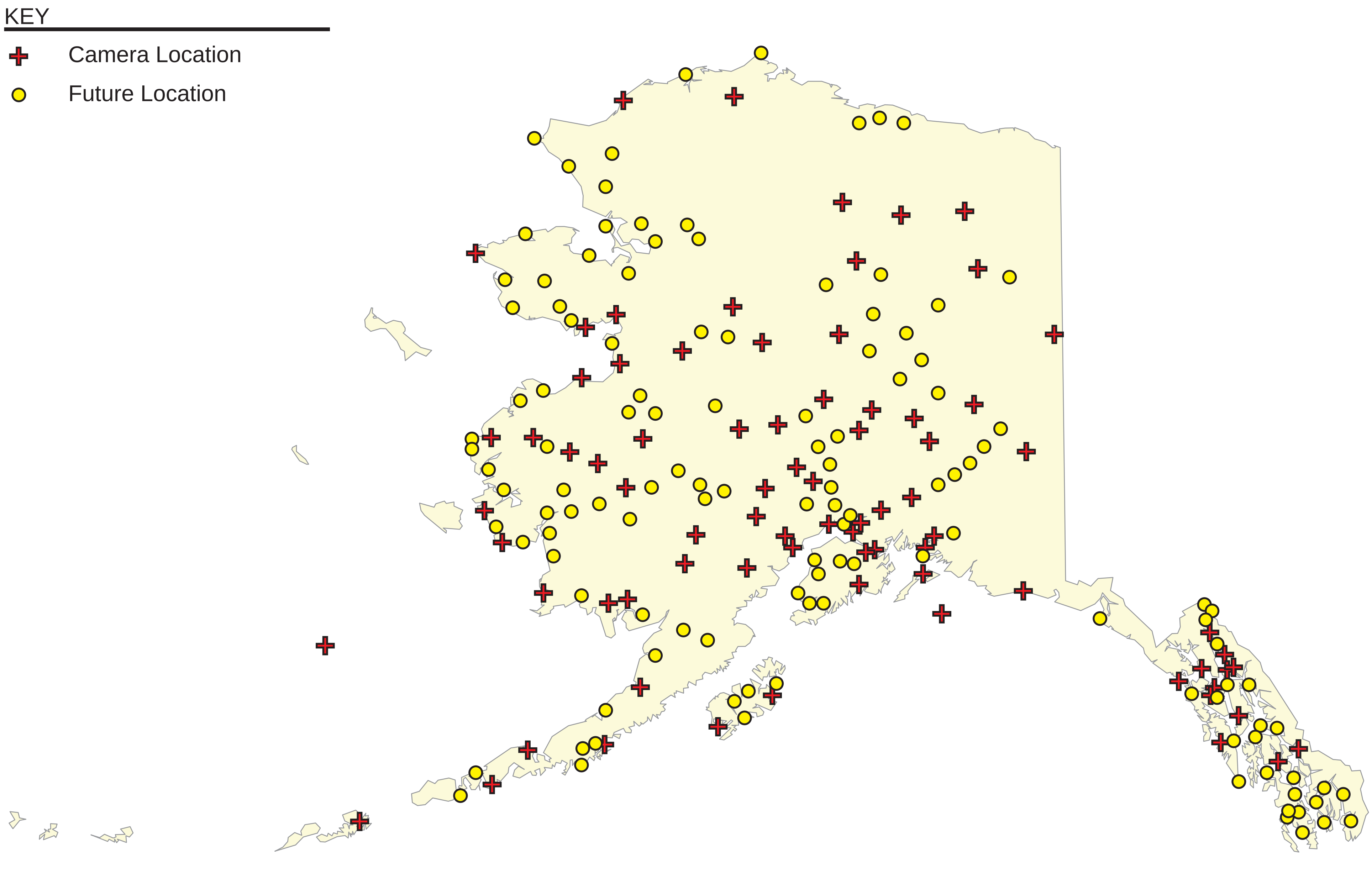
The reason weather cameras are important is that in mountainous areas or near bodies of water the weather can change rapidly within a few miles. As mentioned above, an automatic weather sensor can only tell the weather at its exact location. Weather cameras can look at an area, such as a mountain pass, and see the conditions. The weather cameras all feed into a central web site. Pilots can look at these sites just prior to departure and see how the weather looks. While in flight, a pilot can contact a dispatcher (for commercial operators) or a Flight Service Station (FSS). The dispatcher or FSS person can pull up the weather cameras for the areas of interest and tell the pilot what they see. Each weather camera shows an image of what it "sees" on a clear day along with the most current image. The images are generally updated every 10 minutes. As a supplementary weather product, these images may only be used to improve situational awareness. They cannot be used to meet regulatory purposes.

Figure 14 shows the location of current weather camera locations in Alaska, as well as the location of future sites. The information on the schedule for each of the future sites is available on the FAA Weather Cam Web Site at www.akweathercams.faa.gov.



ALASKA WEATHER STATIONS

FIGURE 13



Source: FAA: "Alaska Weather Cameras" http://akweathercams.faa.gov; 2008

ALASKA AVIATION SYSTEM PLAN

FAA WEATHER CAMERA LOCATIONS

FIGURE 14

4.4.3 Flight Service Stations

Flight Service Stations provide many important functions. Services break down into pre-flight and in-flight phases. They include weather briefings, filing and management of flight plans, Notices to Airmen (NOTAMs) and Pilot Reports. The FSS has personnel located at the station, at least part of the time, who can supplement the weather data provided by the automated equipment. There are 14 FSS in Alaska and 3 Automated FSS (with improved capabilities). Figure 15 shows the locations of the FSS and AFSS. There are not any plans to close these facilities.

4.5 Flight Safety Enhancements Not Covered Above

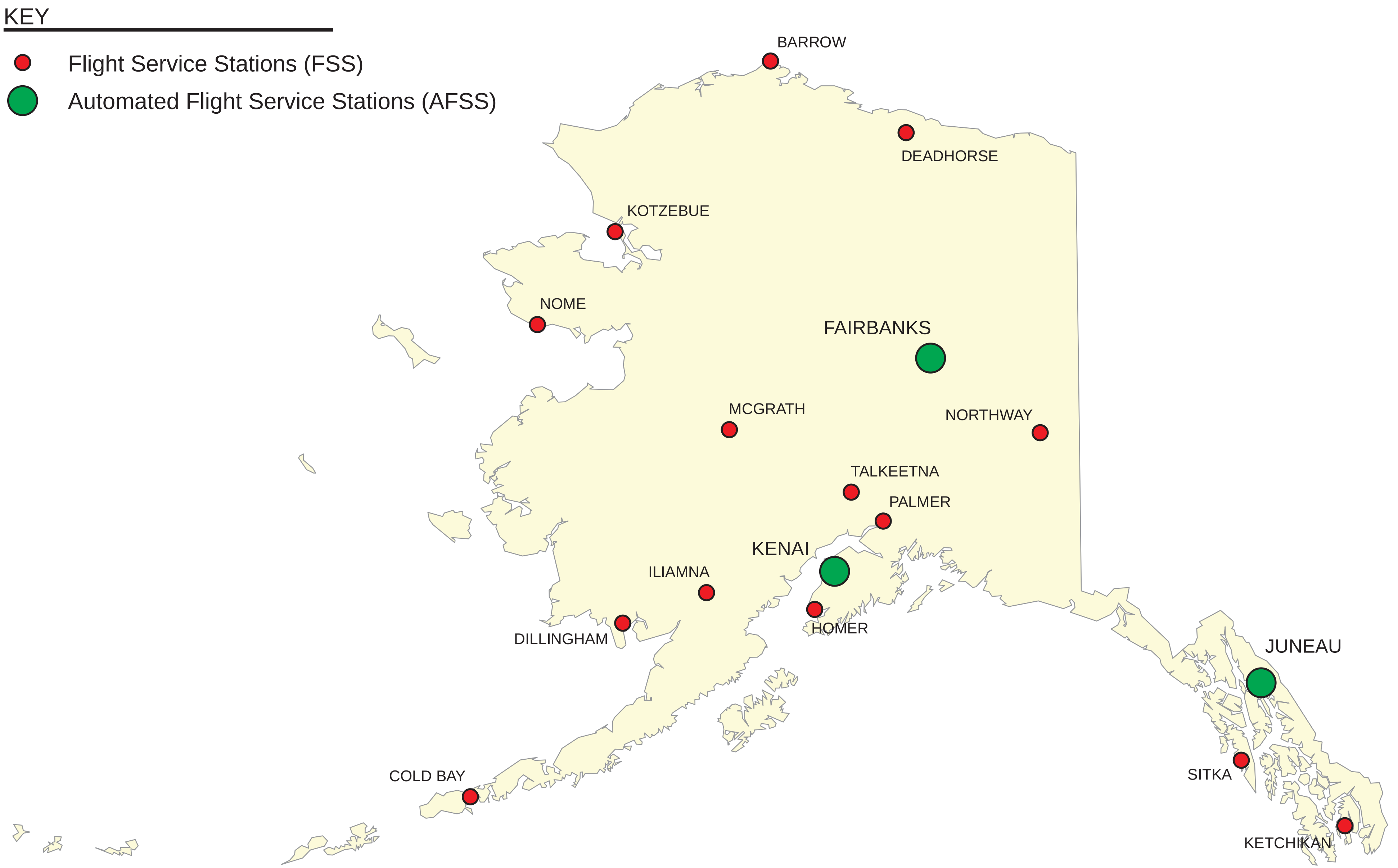
4.5.1 Traffic Information Service (Part of NextGen)

According to The *Surveillance and Broadcast Services Capstone Statewide Plan*, one of the benefits that can be provided by the NextGen system is Traffic Information Service Broadcast (TIS-B). The services provided by Capstone are labeled either "Essential" or "Critical." It is not clear from the documents which category TIS-B fits into. TIS-B traffic is Transponder traffic that is being read by Terminal Radar or a Multilateration system and then relayed to aircraft via the GBT / ADS-B data link. For an ADS-B aircraft "to see" the transponder traffic the aircraft must be in the radar coverage area and the ADS-B aircraft must be within the service volume of the GBT providing TIS-B service. What this essentially means is that where TIS-B service is provided, an aircraft equipped with "ADS-B In" can see both other ADS-B equipped aircraft as well as non-ADS-B aircraft which at least have a transponder. All IFR aircraft in the US and most VFR aircraft are equipped with transponders. In Alaska, however, there are a significant number of very small aircraft (1/3 of Alaska aircraft) that do not have transponders.

The Anchorage area is the only area in Alaska that currently provides TIS-B service. The plan calls for several other areas to receive TIS-B service if RADAR or multilateration is available.

4.5.2 Weather Information Service (Part of Capstone)

Flight Information Service - Broadcast (FIS-B) transmits graphical National Weather Service products, Temporary Flight Restrictions (TFRs) and special use airspace information to "ADS-B In" receivers. RADAR and Satellite maps can be displayed right on the aircraft's multi-function display. This provides the pilot with great situational awareness and greatly increases safety. FIS-B is considered an essential service. All of the original Capstone ADS-B sites provide FIS-B service. TIS-B in Alaska today has very limited products. There are no satellite maps and the NextRad radar is only available from seven sites in the entire state. From a review of Appendix-B in the Capstone document, it appears all future service volumes will have FIS-B. It is not clear if all GBTs will provide this data. It may be appropriate to identify additional products that might be added to TIS-B and call for the research to develop them.



Source: FAA Alaskan Region. <http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/fs/alaskan/> 2008.

AASP ALASKA AVIATION SYSTEM PLAN

ALASKA FLIGHT SERVICE STATIONS

FIGURE 15

4.6 Aircraft Separation Standards

One major benefit of the NextGen system is that the provision of better surveillance of aircraft coupled with better communication provides air traffic controllers with the ability to safely put more aircraft within a specified section of airspace. This greatly increases airspace capacity. Capacity is not much of an issue in Alaska, except at airports such as Anchorage and possibly Fairbanks. The new system will ultimately help those airports. It also can help airports with seasonal peaks of traffic as long as the operating procedures for those airports can be developed.

5 Issues and Recommendations

5.1 Policy and Implementation Issues for FAA and DOT&PF

On a nationwide basis the biggest policy and implementation issue is how to transition from the current NAVAID system to the NextGen system. The main issue is determining exactly what equipment will be required in aircraft and when it will be required. The cost to install NextGen equipment in aircraft is considerable. A recent estimate provided at the ATC 2008 World Conference in Amsterdam in March of 2008 was $22 to $31 billion to equip aircraft in or flying to the US. A Notice of Proposed Rulemaking (NPRM) was issued by the FAA regarding this subject on October 5, 2007. The comment period closed in March 2008. The FAA received substantial objections to this proposed rule and the status of the rule appears to be uncertain at this time. The uncertain status means that the equipment requirements are not defined. Manufacturers are waiting for the NPRM before developing the next generation of equipage, which is expected to lower the cost to aircraft owners.[8] This is holding back Alaskan efforts to stimulate equipage, as current equipment is too expensive, and there is no guarantee that the equipment purchased today will satisfy the final rule. Meanwhile, a contract has been executed on a national basis for installation of the ground based portion of the equipment that will be required for the national NextGen program.

In Alaska, agreement has already been reached with the FAA that they will continue to install NextGen equipment and associated Alaska NextGen enhancements on an accelerated schedule as long as Alaska aircraft become equipped with Capstone (NextGen) equipment on a satisfactory schedule. An important milestone was reached when Governor Palin signed Senate Bill 249 which creates the Alaska Capstone Avionics Revolving Loan Fund, a low-interest loan program to help purchase and equip Capstone electronics in Alaska based aircraft. This will primarily benefit commercial operators. The aviation community is still working on how to equip general aviation. It is extremely important that a successful solution for funding general aviation be found. If not, the continued development of Alaska NextGen will be in jeopardy. This will continue to be a policy and implementation issue for both FAA and DOT&PF.

The extent to which DOT&PF integrates aviation system planning with Alaska NextGen plans is another policy issue. The industry group that has worked with the FAA to develop and implement Capstone and the subsequent Alaska NextGen program has essentially conducted portions of their own system plan as a means for helping decide where equipment and procedures are most urgently needed and how it can be justified from a cost/benefit standpoint. While DOT&PF has been a part of this work, it does not appear that DOT&PF has been a significant driver in the planning. Now that an Alaska Aviation System Plan is being conducted, it seems that DOT&PF should play a more integral role as decisions about the current phase of Alaska NextGen continue to be refined.

5.2 Recommendations for Further Study/Actions

The following recommendations are offered for the Alaska Aviation System Plan:

- Create an information-exchange mechanism between FAA leaders and key team members of AASP.
- Coordinate airport improvements made by the DOT&PF or local airport owners with the improvements being made by the FAA and other agencies to the airspace/NAVAID structure.
- Make airspace/NAVAID information more accessible and easy to understand.
- Study additional ways to enhance safety and usability for both Capstone and non-Capstone-equipped VFR aircraft.

5.2.1 Information Exchange

The FAA has a very comprehensive program of NAVAID, Communication, Safety and Airspace updates for the State of Alaska. Much of this was initiated as part of the Capstone project. A great deal of data has been collected by the FAA and analyzed to justify the initial (now completed) and future phases of Capstone, which is now a coordinated subset of the implementation of the NextGen Air Transportation System. From reviewing the various documents produced as Capstone moved forward, it is apparent that some desired elements of Capstone and the follow-on programs are not being implemented at this time due to budget constraints and lack of information to justify certain elements from a cost benefit standpoint. For example, the number of airports to be provided with instrument approaches, routes to those airports, and weather reporting equipment at those airports has been reduced from earlier recommendations. A number of those elements may be justified but the data needed is currently not available. Much of the data is the type often gathered as part of a system plan update. It is recommended that the managers of the Alaska Aviation System Plan meet with the managers of the key programs for improving airspace/NAVAIDs in Alaska to review the information most urgently needed and determine how much of it should be included in system plan studies. The proper coordination process to exchange and share data needs to be determined. This dialogue should be ongoing.

5.2.2 Coordination

The FAA, State and other users should closely coordinate planning of instrument approaches with airport improvement plans and aircraft equipage plans to ensure that when the approach is established it can and will be used for its intended purpose. For example, some approaches need a visual glideslope system before use of the approach can be authorized at night. Other approaches may require obstruction lights to be added to certain obstructions near the airport. In some cases the approach cannot be authorized without the addition of a taxiway on the airport. In other cases an approach cannot be authorized unless a weather reporting system is in place. All of these kinds of items should be closely coordinated. To accomplish this coordination it will be necessary to identify the stakeholders, their roles, and the current coordination structures.

As the AASP moves forward, the needs for additional weather reporting systems should be identified in conjunction with other NAVAID, approaches, and airport improvement needs for Alaska's system of airports.

5.2.3 Improved Accessibility and Understandability of Airspace/NAVAID Components

Adding airspace/NAVAIDs data to a GIS database that covers all of Alaska may be the best way to accomplish this. A review of the documents used to produce and develop Capstone and NextGen programs for Alaska indicates there has been good coordination with certain parts of the DOT&PF. It is not clear what kind of coordination has occurred with the aviation planning staff in each region of the DOT&PF.

Going forward, it seems essential that the DOT&PF aviation planners and the preparers of the AASP have a thorough understanding of how the airspace/NAVAIDs improvements initiated by Capstone and now being implemented by NextGen programs will improve accessibility and safety for each airport in Alaska. A very good way to do this might be to produce GIS coverage maps of various components. These could include existing and planned elements of surveillance, weather reporting, communication, instrument approaches, airway routes, and other safety enhancements. This data could then be compared to socio-economic data and airport infrastructure data to help prioritize improvements to the airport and aviation infrastructure. This data should also be very helpful to the FAA in order to justify and plan future enhancements.

Some of the data for GIS appears to be readily available. This includes ground-based transceiver (GBT) sites, surveillance coverage, weather stations, weather cameras, existing and planned instrument approaches, and radio communication outlets (RCO). Some of the data is not readily accessible from public sources. This includes communication coverage and which services (essential or critical) are included in the different geographic service volume areas.

It is recommended that additional studies be conducted to determine the feasibility of adding airspace/NAVAIDs data to a GIS database that covers all of Alaska and that additional work be done to collect key airspace/NAVAIDs information that has not been readily available.

5.2.4 Safety Studies

One of the discussion items that came up several times during meetings with stakeholders is that Capstone and successor programs is providing great improvements for IFR aircraft and it is making it possible for more VFR flights to be conducted under IFR rules. Capstone is also providing great safety improvements in Alaska for VFR aircraft that are equipped with Capstone equipment. However, due to icing and other conditions in the State certain Capstone equipped VFR aircraft will never transition to the IFR realm. Other VFR aircraft will never install Capstone equipment due to cost and also due to the capability of some aircraft to be able to accept the Capstone equipment. Further studies are recommended to analyze available literature concerning additional safety and navigation enhancements potentially viable for VFR aircraft compatible with Capstone and additional equipment such as synthetic vision. The viability of these systems might lead to the need to gather certain obstacle or other information on airports as data is gathered for the AASP update.

Further, it is recommended to study the viability of establishing "VFR only" GPS routes. These routes could potentially be used by VFR aircraft equipped with handheld GPS receivers. These receivers are now available at a relatively low cost and have WAAS and moving map capability with terrain and obstacle alerts. The units also have internal battery capability for four hours, plus. If development of these routes proves feasible it may lead to the need to gather certain obstacle or other information as the AASP progresses.

Appendix A: Summaries of Previous Reports

A.1 FAA Flight Plan 2008-2012

The Federal Aviation Administration (FAA) developed a strategic plan called *FAA Flight Plan 2008-2012: Charting the Path for the Next Generation.* The report outlines FAA's corporate strategy, summarizes recent actions, and details plans for upcoming years. The goals of the plan are to increase safety, increase capacity, provide international leadership, and organizational excellence. A copy of the FAA Flight Plan is available on the FAA website at www.faa.gov.

In order to accomplish these goals, the FAA has employed a program called NextGen (Next Generation Air Transportation System), which is designed to transform the national air transportation system from ground-based technologies to satellite-based technology. Two of the key initiatives of NextGen are Required Navigation Performance (RNP) and Automatic Dependant Surveillance System-Broadcast (ADS-B).

A.1.1 RNP

In simple terms, RNP provides a new type of on-board air navigation system for aircraft. The system primarily uses the Global Positioning System (GPS) for deriving the navigation signal, though it can also take advantage of other systems. RNP allows for more flexible air navigation routes in all phases of flight, and more precision in the en-route phase, than can be provided by land-based navigation systems. It also offers curved routes that cannot be supplied by land-based systems. This key initiative will provide more airspace capacity through tighter and more precise routings through the airspace. RNP also provides much safer approaches in areas of dangerous terrain. Alaska Airlines was a pioneer in use of RNP and used it to develop better approaches into Juneau and other Alaska airports.

A.1.2 ADS-B

ADS-B provides a new means for aircraft surveillance, which is one of the primary means ATC uses to separate and sequence aircraft. The current method of aircraft surveillance has been RADAR, which scans a geographic area and determines aircraft position by reflected signals and transponder responses. These are pulsed radio signals that equipment on the aircraft provide when scanned by RADAR. In ADS-B, aircraft send position information to ATC sensors, which collect the information and display it on an air traffic controller's display screen. The ADS-B equipment on the aircraft sends information on location, speed, altitude, and aircraft identification and equipment. With ADS-B, the position information is much more precise than with RADAR, and the information is updated much quicker. This is expected to allow reduced separation standards between aircraft in the future. Another benefit which is especially important in

Alaska is much quicker and more accurate search and rescue capabilities. ADS-B has two primary components: ADS-B IN and ADS-B OUT.

A.1.3 Other NextGen Initiatives

While RNP and ADS-B are the primary building block components for NextGen, the plan includes many other initiatives. Among those are the following:

- Required Communication Performance (RCP) involving improved ATC /aircraft communication using systems such as data links
- Required Surveillance Performance (RSP)
- Required Total System Performance (RTSP)
- Automated 4-D trajectory systems
- Improved dissemination of weather information to aircraft crews
- Improved dissemination of aircraft traffic information to crews
- Research into wake turbulence monitoring

By providing precise navigation and surveillance capabilities, NextGen is expected to make much more efficient use of airspace. This will be accomplished by precise routings and reduced separation standards. Some of these improvements can be completed in the near term, while others will take more time. These kinds of improvements can help airports that are in dense airspace areas, and/or are affected by airspace capacity issues. For airports with closely spaced parallel runways, more advanced and future technologies than currently envisioned by NextGen are required.

A.2 Roadmap for Performance Based Navigation

The FAA also developed the *Roadmap for Performance Based Navigation-Evolution for Area Navigation (RNAV) and Required Navigation Performance (RNP) Capabilities-2006-2025*. The report outlines FAA's implementation strategy for performance-based navigation and details FAA's transition plans in three time periods:

- Near-term
- Mid-term
- Far-term

A.2.1 Near-term Period: 2011-2015

The focus during this period is on wide-scale Area Navigation (RNAV) implementation and the introduction of RNP for en route, terminal, and approach procedures. FAA seeks to get operators on-board and understand the value of investments in current and new aircraft acquisitions, FAA investments in satellite-based navigation and conventional navigation infrastructure.

GPS technology allows lower minimum enroute altitudes (MEA), improving safety by allowing maximum use of available airspace and the ability to avoid icing and turbulence at higher altitudes. This has already been successfully implemented in Alaska.

A.2.2 Mid-term Period: 2011-2015

During this period, operations will change to predominantly RNP. This is expected to improve flight efficiency and airport access. The mid-term strategy will focus on expansive use of RNAV to improve flight operations.

A.2.3 Far-term Period: 2016-2025

This term concentrates on performance-based operation through integrated RNP, Required Communications Performance, and Required Surveillance Performance Focus will be on optimizing airspace, automation enhancements, and modernization of communications, navigation, and surveillance infrastructures.

A.3 Capstone Statewide Plan

The Capstone Program was implemented in Alaska in response to a 1995 study by the National Transportation Board, concerning aviation safety in Alaska. The Capstone Program took new technology and installed both the ground based equipment and airborne equipment in a certain portion of the state and in a limited number of aircraft, as a trial program to see if this new equipment and the necessary procedures could actually be implemented. This led to increased aviation safety in the State of Alaska.

Aviation is vital to Alaska's transportation system. It is the primary mode of transportation for over 95 percent of the state; however Alaska also has the highest aviation accident rate in the US. The purpose of the Capstone Program is to increase safety and improve access to rural communities in Alaska. To accomplish this, the plan includes:

- Installing new safety equipment (avionics) in aircraft
- Improving navigation, communication, surveillance and weather reporting facilities
- Upgrading airport facilities to allow better access

Capstone Phase I consisted of installing and using ADS-B technology in western Alaska. Phase II, which began in March of 2003, expanded the program into Southeast Alaska. Phase III will include the entire state. Implementation of Phases I and II resulted in a "47% reduction in the aviation accident rate of Capstone avionics equipped aircraft compared to non-equipped aircraft in southwest Alaska."[9]

A.3.1 Strategy for Expanding Capstone throughout Alaska

The document called *Surveillance and Broadcast Services Capstone Statewide Plan, Version 7.1, 08 August 2007* outlines the implementation plan for the Capstone Program

Technologies. The plan is divided into three sections: (1) Ground Infrastructure Deployment Plan, (2) Avionics Equipage Plan, and (3) Implementation Plan.

Ground Infrastructure Deployment Plan

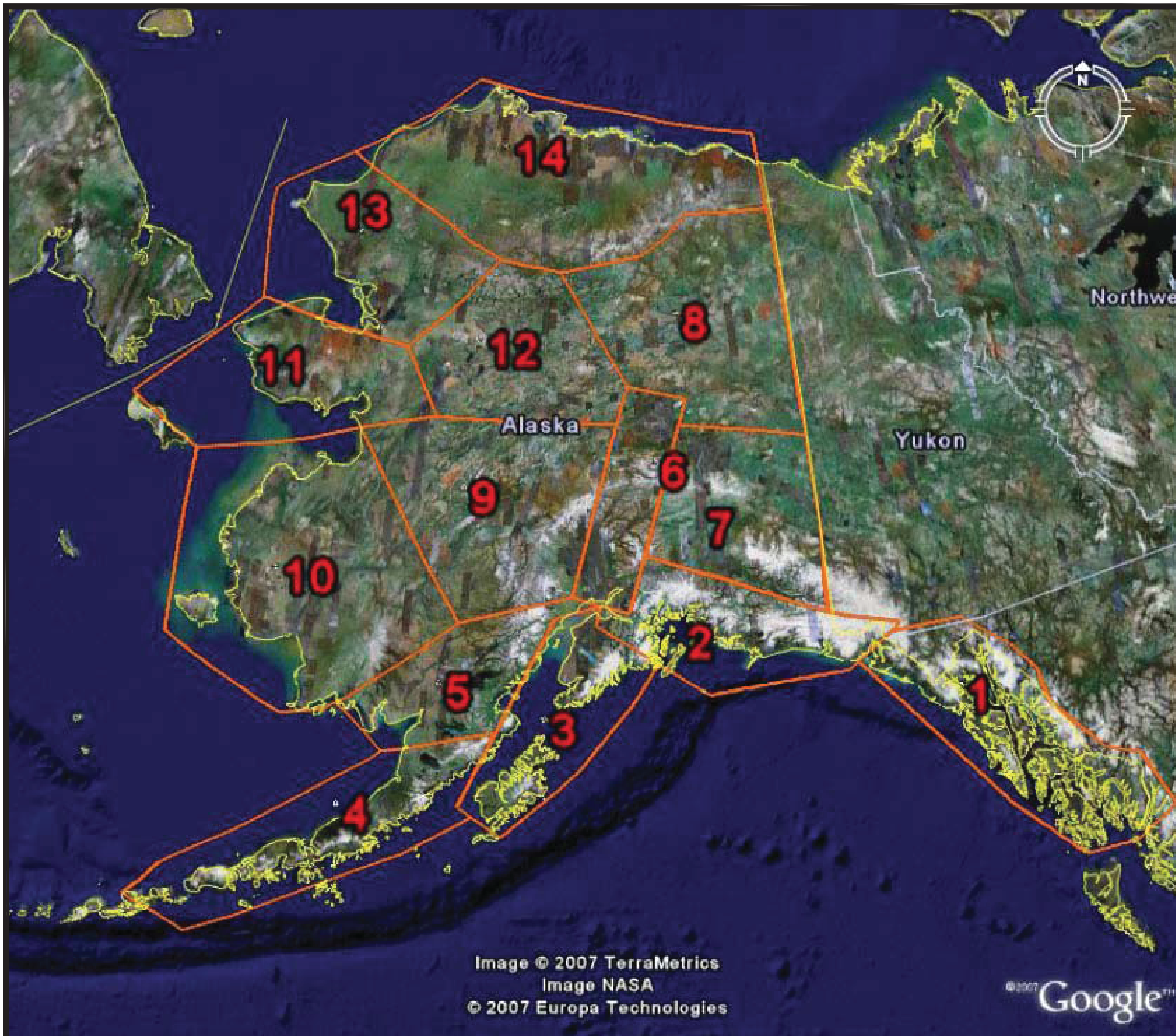
One of the main components of the Capstone Plan is the installation of airport access improvements, including communication and weather reporting systems and navigation improvements (RNAV routes and procedures). The FAA has agreed to this and will accelerate this installation from 10 years to 5 years if aircraft owners equip their aircraft with the proper avionics to use it. This is consistent with the NextGen transformation plan.

Low altitude enroute Service Volumes (SVs) have been established to manage the deployment of these systems. The boundaries of these SVs are shown in Figure A1. These low-altitude enroute SVs will have ceilings of 18,000ft MSL and floors of 1,000ft AGL. Due to limitations of ground station line-of-site, the 1,000ft AGL goal to cover VFR traffic may not be achievable in many areas.

> "The ground infrastructure includes remote located ADS-B ground stations with capability for outputs to ATC (Flight Service, Tower, Terminal, Enroute) and company flight monitoring, and inputs from surveillance sources (e.g., radar) and weather/flight information for broadcast services to the aircraft. Other ground infrastructure includes automated weather stations, remote VHF voice communications, and development of GPS/WAAS based RNAV routes, approach, and departure procedures."[10]

Equipment services within each SV may include:

- Automatic Dependent Surveillance-Broadcast (ADS-B)
  - Air Traffic Control (ATC) Surveillance
  - Operator Flight Monitoring Services (OFMS)
  - Search and Rescue Data Collection (SAR)
- Automatic Dependent Surveillance-Rebroadcast (ADS-R)
- Flight Information Services Broadcast (FIS-B)
- Traffic Information Services Broadcast (TIS-B)



Source: FAA: Surveillance and Brodcast Services Capstone Statewide Plan, August 2007

SV	SV Name	SV	SV Name
1	Southeast Alaska	8	Upper Yukon River
2	Prince William Sound - Gulf of Alaska	9	McGrath - Upper Kuskokwim
3	Cook Inlet - Kodiak	10	Yukon - Kuskokwim Delta
4	AK Peninsula	11	Nome - Seward Peninsula
5	Lake Clark - Bristol Bay	12	Galena - Mid Yukon River - Koyukuk River
6	Anchorage - Fairbanks	13	Kotzebue - Northwest Alaska
7	AK Highway Copper River Isabel Pass	14	North Slope

AASP ALASKA AVIATION SYSTEM PLAN

LOW ALTITUDE ENROUTE SERVICE VOLUMES (SV)

FIGURE A1

Not all SVs are capable of providing all of the above listed services due to physical and communications constraints, therefore, not all of these services will be included in the airspace of each service volume.

The FAA's initial summer 2007 SV deployment included SV 6 (Anchorage-Fairbanks), SV 11 (Nome-Seward Peninsula), and SV 13 (Kotzebue-NW Alaska), to complement the already installed sites in southwest and southeast Alaska.

To summarize, some of the SVs are being developed with some services. Development of additional SVs, and installation of additional services in the SVs which have already been implemented will require additional analysis and justification from a cost/benefit standpoint.

Airports and RNAV Route Structure

Figure A2 shows the Alaska low altitude enroute SVs with aircraft flight path data included. Airport access infrastructure improvements within these SVs may include:

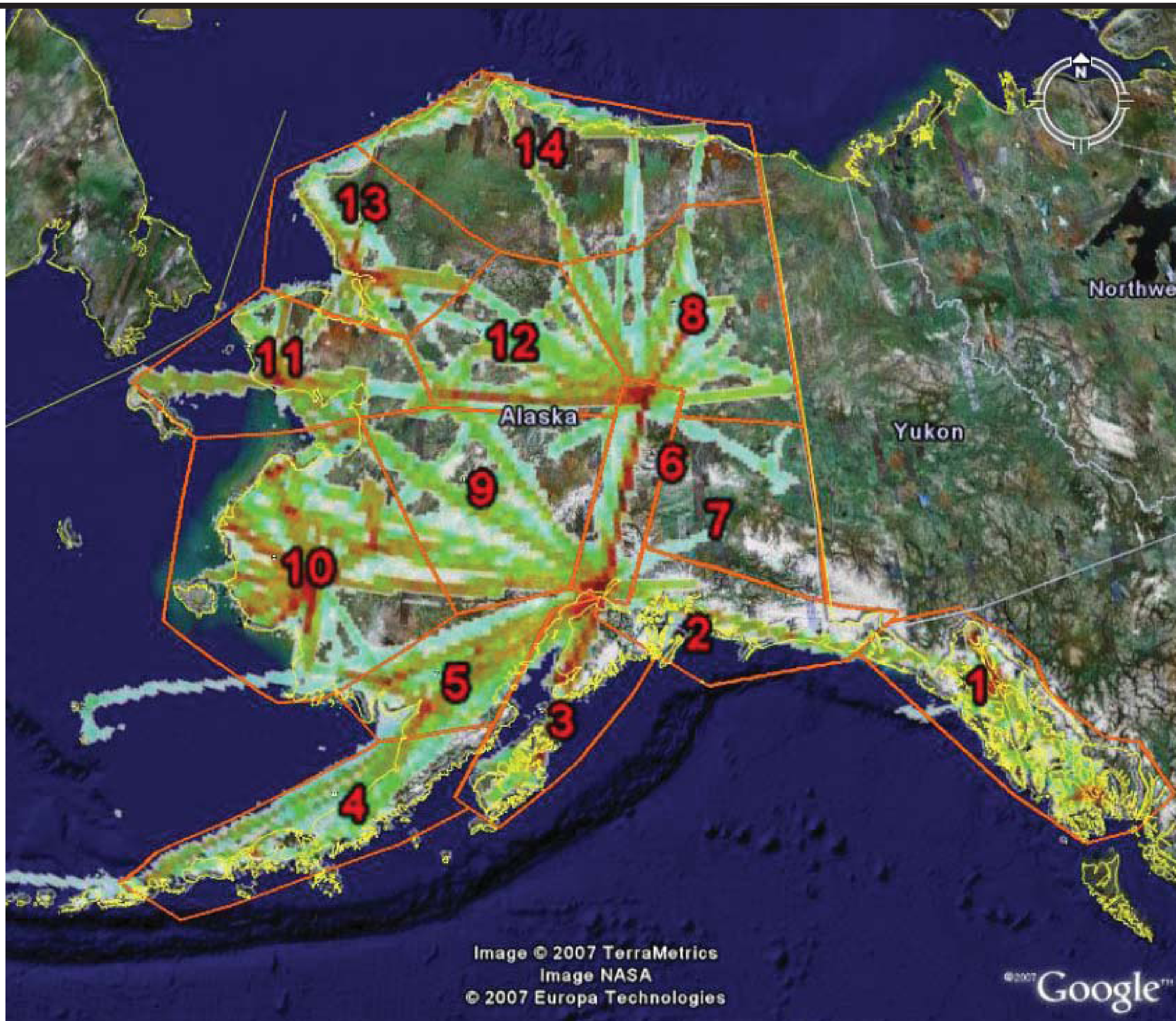
- Airport RNAV Approach/Departure Procedures
- VFR/IFR RNAV Route/Airway Improvements
- Automated Weather Systems (AWOS/AWSS)
- Air to Ground Communications Improvements

There are 25 airports that have been identified for improvements to IFR capability. Additional airports have also been identified, but more analysis needs to be done to justify the expenditure of funding for these airports. New RNAV routes have been developed to reach these airports, and lower minimum altitudes have been developed for some existing routes, but the use of these routes cannot be approved until additional procedures are developed and training accomplished.

Avionics Equipage Plan

In order for the State's ground infrastructure deployment plan to provide intended benefits, aircraft operating in the state must have the proper equipment. The cost of these new technologies is high and it will take a long time to order and install the equipment in all of the aircraft. An assistance program is necessary for operators and to achieve the benefits. The proposed aircraft Safety Equipage Assistance Program (SEAP) funding would assist Alaska-based aircraft operators to install the proper equipment necessary to improve the system.

> "The first step focuses on the initial equipage of commercial, public safety, and high utilization general aviation aircraft to maximize reliable and safe statewide transportation access, with remaining aircraft equipped over the later years."[11]



Source: FAA: Surveillance and Brodcast Services Capstone Statewide Plan, August 2007

ALASKA AVIATION SYSTEM PLAN

LOW ALTITUDE ENROUTE SERVICE VOLUMES (SV) WITH FLIGHT PATH DATA

FIGURE A2

The new avionics equipment necessary to make this program successful are:

- ADS-B
- GPS/WAAS
- MFD-(moving map multi-function display of terrain, traffic and weather)

When used in conjunction with the planned ground based infrastructure, this program is projected to achieve a 30 percent reduction in aircraft accidents across the state. A more detailed discussion of the avionics equipage plan can be found in the *Capstone Plan*.

There is lots of detailed discussion in the Capstone Plan about funding, which is no longer current, based upon activities in the state legislature, and the selection of a national NextGen contractor. Governor Palin signed Senate Bill 249, which creates the Alaska Capstone Avionics Revolving Loan Fund, a low-interest loan program to help purchase and equip Capstone electronics in Alaska based aircraft. The Division of Investments in the Alaska Department of Commerce, Community, and Economic Development will administer the program. Terms of the loan program include no more than 10 years, interest rate not less than 4 percent, up to 80 percent of the purchase price, and collateralization for the loans. The loan program is scheduled to begin July 1, 2008.[12]

Implementation Plan

A coordinated installation of surveillance broadcast services, airport access upgrades, and aircraft avionics equipage is important for successful implementation. Installing the ground infrastructure concurrent with avionics equipage is essential in order to achieve the necessary safety and access benefits.

Figure A3 summarizes the deployment schedule for ground infrastructure deployment and avionics equipage. "The goal for Service Volumes in Alaska is to encompass 90 percent of the flight hours flown and 90 percent of the geographic areas of the historical accidents sites. Correspondingly, the goal for avionics equipage is 90 percent of the annual flight hours, and to help bring safety in Alaska up to near CONUS (continental United States) standards."[13]

Program goals and progress will be reviewed annually by the Agreement Implementation Committee (AIC). Adjustments to the goals may be required. Both FAA and AIC "are committed to the success of this program and agree to make reasonable good faith efforts in seeing this program of early transition to NextGen in Alaska a reality."[14]

"The major measures of success from this plan are an increase in aviation safety and access by air travel across the state of Alaska. Along with reduction of accident rates, a number of secondary benefits should be examined including the change in on-time-arrival, fuel savings, reduction of insurance costs, and improved search and rescue operations."[15]

Deployment Time Period	Ground Infrastructure Deployment SV (enroute-low altitude)	Safety Avionics Equipage
Baseline Status in July 2007	• 24 ADS-B sites in the Southwest and Southeast regions of Alaska.	• Approximately 190 commercial aircraft equipped with ADS-B avionics in the Western Region. • Approximately 185 commercial aircraft equipped with ADS-B avionics and WAAS avionics in the Southeast Region. • Total of 375 aircraft equipped • SEAP being defined.

FY 07 – FY 09	6 – Anchorage-Fairbanks
	11 – Nome-Seward Peninsula
	13 – Kotzebue-NW AK
	1 – Southeast AK
	Additional complete Capstone Phase 1 & 2
	
	Actions:
	• Immediately begin deployment of 3 SVs
	  o Anchorage-Fairbanks (SV-6)
	  o Nome-Seward Peninsula (SV-11)
	  o Kotzebue-NW AK (SV-13)
	• Complete the SVs initiated in Capstone I and II.
	• Establish clear avionics standards (including UAT or 1090ES) and publish NPRM by end FY 07.
	• Continue work on first 13 airports including at least site surveys.
	
	Status:
	End of FY 09: SVs 6, 11, 13, 1 operational
		• End of FY 08: 525 equipped or committed
		• End of FY 09: 1,325 equipped or committed
		
		Actions:
		• Implement SEAP, beginning after JRC decision.
		• FY 08 additional:
		  o 150 installed
		  o 300 user agreements
		• FY 09 additional:
		  o 800 installed
		  o 350 user agreements
		
		Status:
		• Outreach program defined by September 07.
		• Outreach program secures funding for first year funding needs of SEAP in FY 08.
		• End of FY 08: 525 equipped or committed to equip (with user agreements)
		• End of FY 09: 1,325 equipped or committed to equip.

Source: FAA: Table 1 - Capstone Statewide Plan, August 2007.

The following are the primary and secondary measures that will be used quantify the implementation impact of the plan.
Primary measurements:

- Increase in aviation safety
    - reduction of accidents
    - reduction in aviation fatalities
    - reduced insurance costs based on safety equipage
- Increase in access
    - reduction of IFR cancellations
    - decrease in MedEvac response times
    - community socio-economic growth based on improved aviation transportation infrastructure

Secondary measurements:

- Aircraft equipped with approved avionics package
- SV's installed and operational
- Number of airports upgraded from VFR to IFR
- Additional weather reporting stations
- Additional RCO's and/or RCAG's
- Fuel savings and on-time-arrival schedule due to improved infrastructure.
- Reduction in SAR costs

It will be difficult to obtain information regarding existing aircraft operations as this data is not recorded.

> "The Alaska aviation system is dynamic with changes in given areas driven by outside influences, such as military mission changes, natural disasters, and changes in economic conditions. As these and other factors change, specific areas of the plan will be re-evaluated and revised appropriately. Representatives from a statewide working group (AIC members, FAA, Alaska operators, other interested Alaska and national entities) will monitor conditions, and along with other entities as appropriate, periodically review this plan, recommend changes which will be considered for adoption by the AIC."[16]

Appendix B: Comments on Draft Technical Memo

Comments by Tom George, Regional Representative, Aircraft Owners and Pilots Association on draft "Overview of National and State Programs Regarding Airspace/NAVAIDs Technologies in Alaska," July 8, 2008

General comments:
The report needs to be revised to recognize the difference between the Capstone Program, and today's SBS Program. Capstone was an FAA operational demonstration program which tested new technologies (ADS-B and WAAS routes and approaches) in different regions of the state. The current program is perhaps better called the Alaska NextGen program, run by the Surveillance Broadcast Services Program, under the FAA Air Traffic Organization. This is a fully operational program, which is quite different from the Capstone Program, under a different organizational structure. Both the old Capstone and new SBS Program have in common that they are working closely with industry.

Another point worth documenting in this memo is that the FAA in this instance has been willing to define specific objectives for the Alaska NextGen program that map to, but go well beyond the FAA NextGen program for the nation. So far the national program has been defined largely as an ADS-B out program, focused on the surveillance benefits from a GPS based tracking system. The Alaska program is broader in that it is taking a systems approach with the goal of improving aviation safety and access for Alaska. This includes not only using the new ADS-B technology for FAA surveillance, but using the bandwidth of the ADS-B UAT data link to supply weather to the cockpit, adding additional space-based instrument approaches (WAAS/GPS), additional weather reporting stations to make those approaches usable, space-based navigation routes (T and Q Routes), and additional communications outlets to allow pilots to talk to FAA enroute. This difference in scope between the Alaska NextGen and overall national FAA NextGen plan recognizes that there are needs for Alaskan infrastructure upgrades due to our lack of roads and high reliance of aviation as a component of the basic transportation system of the state.

1.2.2 Navigation Technologies
Needs a section on WAAS GPS, to explain that the WAAS augmentation to GPS is allowing routes and RNAV approaches which may now be created independent of the very expensive ground navigation systems currently in use (VOR, NDB and ILS). The reduced cost to purchase, install and maintain ground based navaids at each airport is a tremendous advancement that is expected to increase access and safety, however there still are costs for airport surveys (to determine that airspace is free of terrain or obstacles for the approaches), airport improvements required where lower minimum approaches are needed and there are line-of site limitations between the aircraft and geo-stationary satellite which provides the GPS correction signal.

1.2.3 Communications Technologies

This section seems to make a big deal out of “very small” aircraft with no radios. There certainly are some aircraft in Alaska that do not have communication radios, typically used for hunting or other back-country access where aircraft weight is a performance factor. Radios are not required to fly in this airspace. The latest FAA GA Survey should be a source to quantify how many aircraft this represents. The issue is raised several times in this document as a major problem, which I don’t believe it is. When low-cost, light weight ADS-B equipment is developed, these aircraft owners will decide if they see enough benefits to equip. This is a minor issue in comparison to the broader challenges of moving forward into the Alaska NextGen architecture.

Also in this section it is not clear if we are talking just about RCO’s (VHF radio communications equipment) or ADS-B, which also offers the ability to communicate weather. This section needs clarification.

The point that needs to be made is that communications is a component of the system. Alaska is still very “communications poor” due the huge areas, and lack of general infrastructure. Com is part of the infrastructure that needs improvement.

Coverage of RCO's and RCAG's is available from programs that the FAA has, that show coverage as a function of altitude.

1.2.4 Weather Information

Weather information is critical (as opposed to good weather). In spite of the additional weather reporting sites that the FAA has added in Alaska under the Capstone Program, we still have very poor coverage in comparison to the rest of the country. "progress has been made to cover as much of the state as possible" is not an accurate statement. Capstone added additional coverage in select areas where weather would support new instrument approaches. The current SBS statewide plan has targeted some additional airports, again to support new WAAS approaches, still far short of any kind of complete coverage.

The FAA weather camera system offers a valuable source of supplementary data that meet a couple needs. They add information missing from the automated weather stations currently in use, that can't detect weather until it is literally on top of the station. Cameras offer a visual information source that allows pilots, flight service briefers and weather forecasters to see they type and extend of the weather during daylight hours. They are also being used to fill gaps in locations, such as mountain passes, where no automated weather stations exist. These stations primarily help pilots who fly under visual flight rules make flight planning and operational flight decisions, and weather forecasters who forecast mountain pass weather conditions.

FSS doesn't supplement the weather data, they convey it to pilots for pre-flight planning and inflight updates via radio. The 14 standard FSS are all either seasonal or part time. Only the three AFSS's operate full time, 24 hours/day. FAA is planning to modernize the data system used by the Alaska FSS stations, which are still operated by FAA personnel. FSS in the lower 48 states is contracted to a private sector company.

1.2.5 Other Flight Safety Enhancements
This section is weak. The improvements to aviation safety experienced in southwest Alaska resulted from the integration of all the elements: situational awareness, weather data link, additional weather reporting stations, terrain and air traffic awareness, etc. Explanations of TIS and FIS are also incomplete, or not accurate (no satellite weather maps are displayed in the aircraft at present). All the Ground Based Transceivers (referred to as Capstone ADS-B sites) broadcast weather. Today, only the Anchorage site supports FIS-B, although the FAA is promising it in Fairbanks soon.

The aircraft separation standards discussion is also misleading. Nationally, increasing capacity of certain airspace is an issue, which ADS-B is expected to address. Separation standards are needed in order for the FAA to provide operational services with the new technology, but I don't believe any have been developed for other than enroute operations, nor is that a priority in Alaska, to the best of my knowledge. The priority is to be able to offer service (a) where it is needed and (b) in areas that have never had the radar coverage, due to the high cost of installing and operating a radar.

1.3 Policy Implementation....
The "Alaska Capstone" loan fund is a State of Alaska program, and should be recognized as such. It is expected to help stimulate equipage of commercial, but not general aviation aircraft.

Recommendations
"Studying and creating information exchange" needs to be strengthened to more specific actions:
Integrate State of Alaska more completely into the FAA/Industry aviation infrastructure planning for the Alaska NextGen system. (See additional comments in 5.2.2)
Lead state agency efforts to stimulate equipage with avionics needed to utilize the Alaska NextGen system. (This includes not only possible loan/grant program for commercial and private aircraft, but also to equip state-operated aircraft, and encourage other entities to equip.)
Advocate with the FAA to continue to implementation of Alaska NextGen infrastructure. (See additional comments in 5.1)
Participate in education of Alaska pilots regarding the benefits of the Alaska NextGen system, to encourage equipage and use of the new infrastructure.

4.1.3 Multilateration
I believe the Juneau Wide Area Multi-lateration is a "demonstration" program.

4.2 Navigation
Since such a large proportion of aviation operations in Alaska are conducted under Visual Flight Rules, it is appropriate to mention that pilotage is the primary method of navigation, which is limited to suitable weather conditions and daylight operation. To fly at night and in poor weather conditions, instrument airways and approaches have been developed, initially using ground based transmitters. The "various concerns" have to include a very sparse network of navigation aids in an area 1/5th the size of the lower 48 states. These factors all create a situation of limited access to locations in Alaska. GPS and WAAS are revolutionizing how these airways and approaches may be designed, which may have a profound effect on air navigation.

RNAV GPS
This section (or somewhere in the document) needs an explanation of WAAS, and what it does to make ground based transmitters all but obsolete. Needs to include a map showing the WAAS infrastructure in Alaska, and perhaps WAAS coverage.

4.2.2 Instrument Approaches
DOT's website does not accurately account for all the public use airports in the state. A better source of public use airports is the FAA 5010 database, which I think lists about twice the number reported here. Most military airports in the state are not open to the public, although their instrument approaches are usable by civil aircraft for training. Need to elaborate on this.

4.3 Communications Technology
para 2 The FAA does have programs to show (estimate) coverage of com and surveillance. There is also a flight-check process which verifies coverage, which should be explained. We also need to know if the FAA is performing verification of the coverage for stations it is installing today.

para 3 Again, the notion that a lot of aircraft are not equipped with radios. This needs to be nailed down, as it is probably not a big issue.

4.3.1 Info on the RCAG sites should be readily available from FAA ATO.

4.4.1 Recording weather
statement, "Good progress has been made in Alaska implementing weather reporting stations to cover as much of the state as possible." This is nonsense. We still have less than half the number of weather stations for a comparable sized portion of the lower 48 states.

Let's do the homework, or ask NWS, but get some real figures on coverage and not make blanket statements which imply an adequacy of coverage.

There is also need to add some discussion of the limitations of automated weather stations, that don't show timely changes in the weather, etc. For example, the ceiling sensor is a one-degree beam directly over the station. Cloud banks aren't detected at all until they physically arrive over the station, long after they may have been influencing aircraft attempting to fly to the station. Similarly, visibility (reported up to 10 miles) is measured by a beam of light about 1 meter long, again right at the station. Fog banks, smoke, or other atmospheric phenomena again aren't detected until they reach that beam of light. Conversely, emissions from vehicles on the ground may cause a station to report IFR conditions, under an otherwise blue sky day. This is one of the benefits of weather cameras, is to make up for some of these limitations on the current generation of automated weather reporting equipment.

4.4.3 Flight Service Stations
This section could use some additional detail on what Flight Service does, and the services they provide. Services break down into pre-flight and inflight phases. They include weather briefings, filing and management of flight plans, Notices to Airmen (NOTAMs) and Pilot Reports.

para 2, mentions intent to keep "approximately" the current number of FSS in Alaska. What is the reference for this? All info from FAA so far on this topic has stated very clearly that NO FSS are planned to be closed in Alaska. If there is talk of changing the mix, that needs to be referenced carefully.

4.5.1 Traffic Information Service
para 1, last sentence. "significant number of very small aircraft that do not have transponders." The figures I am aware of are that about 1/3 of aircraft in Alaska don't have transponders.

para 2, The only areas that are candidates for this service are those with terminal radar services, which today are Fairbanks and Anchorage. The Juneau wide area multilateration may provide a source of TIS-B, if the demonstration project is successful. As the document is worded, it implies that other areas might obtain this service, which I don't believe is true. Need to determine what FAA intends to do, and convey that information.

4.5.2 Weather Information Service

TIS-B today has very limited products, which should be spelled out. There are no satellite maps, and the NextRad radar is only available from seven sites in the entire state. A map of that coverage should be included, in part to show how limited that coverage is. It would also be appropriate to identify additional products that might be added to TIS-B, and call for the research to develop them.

4.6 Aircraft Separation Standards
This section is where the difference between the national NextGen system and the Alaska program need to be spelled out. The national goal is to improve capacity. In Alaska the issue is improved safety and access. The report indicates that airspace capacity is an issue for Fairbanks and Anchorage. I am not aware that that is the case. If so, a source should be provided.

5.1 Policy and Implementation
This is a good start on a discussion of the relationship between the national and Alaska programs. It needs to be expanded to get at one of the current problems--The NPRM being in limbo means that the equipment requirements are not defined. Manufactures are waiting for the NPRM before developing the next generation of equipage, that is expected to lower the cost to aircraft owners. (Statements made at Oshkosh confirm this, and could be referenced.) This is holding back Alaskan efforts to stimulate equipage, as current equipment is too expensive, and there is no guarantee that the equipment purchased today will satisfy the final rule. This is a huge issue, and needs to be understood by all parties as it may cause DOT and the Alaskan industry groups to revise their approach with the FAA to continue the roll-out of Alaska NextGen infrastructure.

5.2.2 Coordination
It is noble to say that coordination needs to be improved. To seriously consider doing that, some analysis is required to identify the stake holders, their roles, and the current coordination structures so we know who what, if anything, needs to be changed. This is a serious need, which should be articulated in greater detail. This recommendation should be expanded to explain what is needed and call for the further evaluation required.

5.2.3 Improved Accessibility
para 1 Hints at the problem of coordinating between the Alaska NextGen planning and implementation with different elements of DOT. Coordination needs to be improved (i.e. more DOT staff time devoted to it) and the structure of the department, spread across three regional offices, makes this coordination more challenging.

GIS data. There is a great need to get the aviation infrastructure in general (not just Capstone) into a GIS for use by many users. Before than can be done several issues need to be addressed, such as who the stakeholders are, what data is important to capture, what formats will be used, and who will "own" the data after initial collection, to ensure that different data layers are updated as they change, to keep the overall data system reasonably current going into the future.

5.2.4 Safety Studies

para 1 Wording in the first sentence is awkward. I assume the intent is to see more VFR flight migrate to IFR, for increased safety. This reads that we are going to fly VFR under IFR rules.

para 2 Where is the interest in VFR GPS routes? This needs to be expanded upon, including identifying who is interested in establishing these routes.

Endnotes

[1] Comment by Tom George, Regional Representative, Aircraft Owners and Pilots Association (see Appendix).
[2] Comment by Tom George, Regional Representative, Aircraft Owners and Pilots Association (see Appendix).
[3] *Surveillance and Broadcast Services Capstone Statewide Plan, Version 7.1, 08 August 2007*, p. III.
[4] Ibid, p.I.
[5] Ibid, p. 16.
[6] Comment by Tom George, Regional Representative, Aircraft Owners and Pilots Association (see Appendix).
[7] FAA web site (http://akweathercams.faa.gov/wxcamannouncements.php).
[8] Comment by Tom George, Regional Representative, Aircraft Owners and Pilots Association (see Appendix).
[9] Ibid, p.III.
[10] Ibid, p. 5.
[11] Ibid, p. 4.
[12] Alaska Dept. of Transportation web site (http://www.dot.state.ak.us/stwdav/Capstone.shtml)
[13] *Surveillance and Broadcast Services Capstone Statewide Plan, Version 7.1*, *08 August 2007*, p. 25.
[14] Ibid, p. 25.
[15] Ibid, p. 28.
[16] Ibid, p. 28.