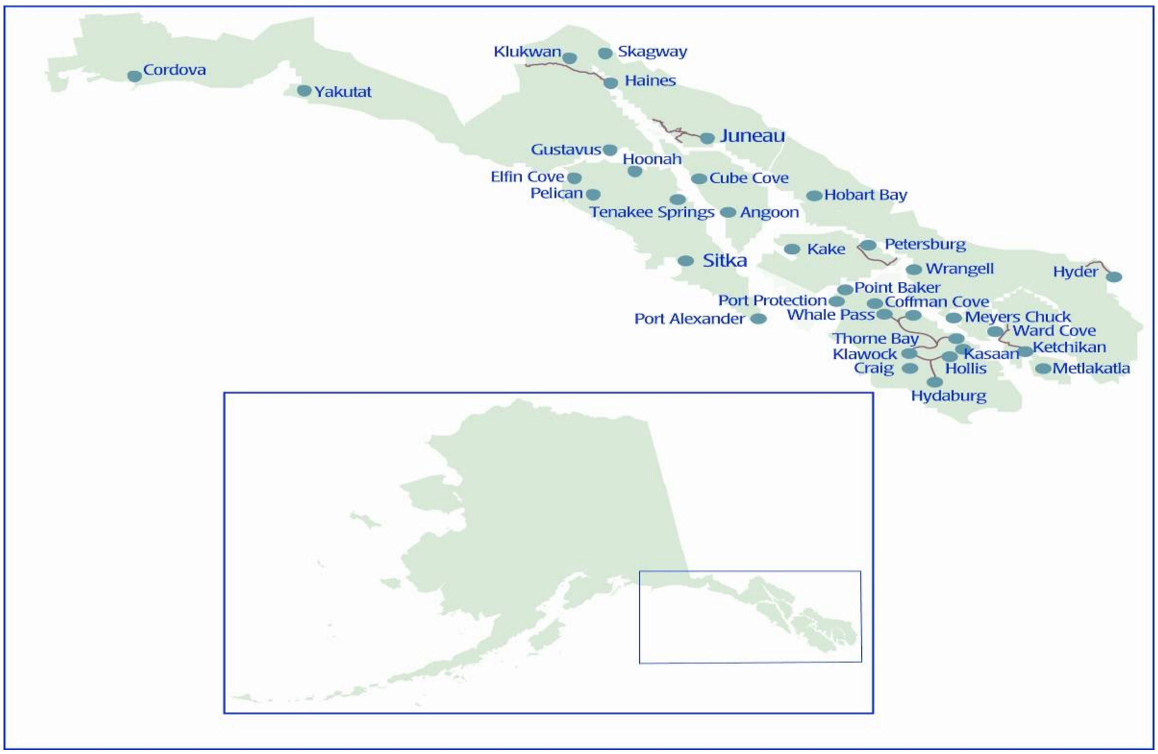
Capstone Phase II Implementation and Impact Assessment Summary Report, 2005

September 2006



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Highlights of Capstone Phase II, 2005

During 2005 the Capstone program made some progress toward implementation of capabilities designed to improve commercial aviation in Southeast Alaska. Two thousand and five was the first year that some aircraft in the fleet were fully equipped and that there were sufficient GBTs in service to begin to realize the benefits of Capstone and ADS-B technology.

Some of the 2005 Capstone highlights for Southeast Alaska follow:

- The Ground Based Transceiver (GBT) network expanded in 2005 with ten GBTs on the developmental network and only four sites still to be brought on line. The continuing process of developing and certifying ground infrastructure components appears to be a factor in the delay of the full implementation of the Capstone Phase II program.
- A total of 47 aircraft installations were completed in 2005 bringing the total aircraft equipped to 109. The 2005 avionics installations included 17 Chelton, 27 Garmin and 3 aircraft that were converted from Chelton to Garmin. At the end of 2005, 56% of the aircraft commercial fleet was equipped and 62% of those expected to be equipped had been modified. Four non-commercial aircraft have been equipped owned by Civil Air Patrol and University of Alaska.
- Chelton's implementation of the UAT interface and the processing on broadcast services information within the Chelton avionics is remains substantially behind schedule. The result is few of Capstone's air-ground capabilities and none of the air-air, and ground-air broadcast services capabilities are available to Chelton equipped aircraft. Cockpit traffic display, operator flight monitoring, FAA radar like services, and cockpit weather display are not yet available. The aircraft already equipped with the Chelton EFIS/PFD/MFD subsystem are not able to display ADS-B traffic or FIS-B weather, and not able to exchange information over the UAT data link. As an interim measure, Capstone began installing the Garmin UAT subsystems, configured for transmit-only, in these Chelton equipped aircraft without interconnecting them with the Chelton avionics, resulting in the Chelton aircraft being "seen" by other fully configured Capstone equipped aircraft and the FAA ground system, even though they can't receive or interpret the data link themselves.
- The Supplemental Type Certificate (STC) for helicopters was developed and the first aircraft was being modified for testing at the end of the year.
- There were two accidents during 2005 involving Capstone partially-equipped aircraft. Neither accident would have been mitigated by Capstone as one was mechanical and the other was due to landing in soft sand on a beach.

Capstone Phase II Implementation and Impact Assessment Summary Report, 2005[1]

Introduction

Capstone is a joint initiative by the FAA Alaska Region and the aviation industry to improve aviation safety and efficiency in Alaska by using new technologies. FAA started Phase I of the Capstone program during 2000 in the watershed of the Yukon and Kuskokwim rivers of southwest Alaska – the Y-K Delta. In March 2003, the FAA began Phase II in Southeast Alaska. This report summarizes Phase II's progress in 2005.

Background

Capstone Phase II is installing a suite of IFR-capable avionics in commercial aircraft in southeast Alaska, building ground infrastructure for aircraft surveillance and up-link of weather and flight information, installing automated weather observation systems and remote ATC voice communication sites, and increasing the number of airports served by instrument approaches. Capstone is also making changes in air space requirements to reduce minimum enroute altitudes on some airways so that suitably equipped aircraft can provide greater air transportation access to cities and villages in Southeast Alaska during poor weather conditions. The FAA expects these improvements will reduce the number of mid-air collisions, controlled-flight-into-terrain (CFIT) accidents, and weather-related accidents while lowering weather-related restrictions that affect routine and emergency air transport and improving operational control and pilot decision making.

The program focuses on passenger and cargo operations under Parts 133 and 135 of Federal Aviation Regulations (FAR; 14 CFR, Chapter 1). Part-135 operators fly fixed-wing and helicopter air taxi, commuter, and sightseeing (flightseeing) operations. Part-133 operators also use helicopters for various non-passenger activities such as helicopter logging. Aircraft owned by these carriers are eligible to receive Capstone Phase II avionics. Float planes, flying under Visual Flight Rules (VFR) in the summer season, account for a large share of FAR Part-135 operations in Southeast Alaska and will also be receiving this equipment.

Description of the Capstone Phase II Area

Capstone Phase II covers an area of Alaska south of latitude 61 degrees north and east of longitude 146 degrees west. As shown in Figure 1, this area includes Alaska's panhandle and extends westward from the north end of the panhandle along the Gulf of Alaska to Cordova near the eastern edge of Prince William Sound. The area is relatively isolated. Only a few villages are connected by roads, and only Haines and Skagway have a road that connects to the Alcan Highway providing access to cities in Canada, or to the Lower 48. Most residents travel by air or water. The 45 communities in the area have more than 75,000 residents with almost half living in the regional hub of Juneau, which is also the state capital. Of the 44 other communities, 29 have fewer than 500 residents. Figure 1 also shows the general levels of flight activity serving the 25 communities that have more than one flight per week by scheduled commercial operators.

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[1] The contents of this material reflect the views of the authors. Neither the Federal Aviation Administration nor the Department of Transportation, makes any warranty or guarantee, or promise, expressed or implied, concerning the content or accuracy of the views expressed herein.

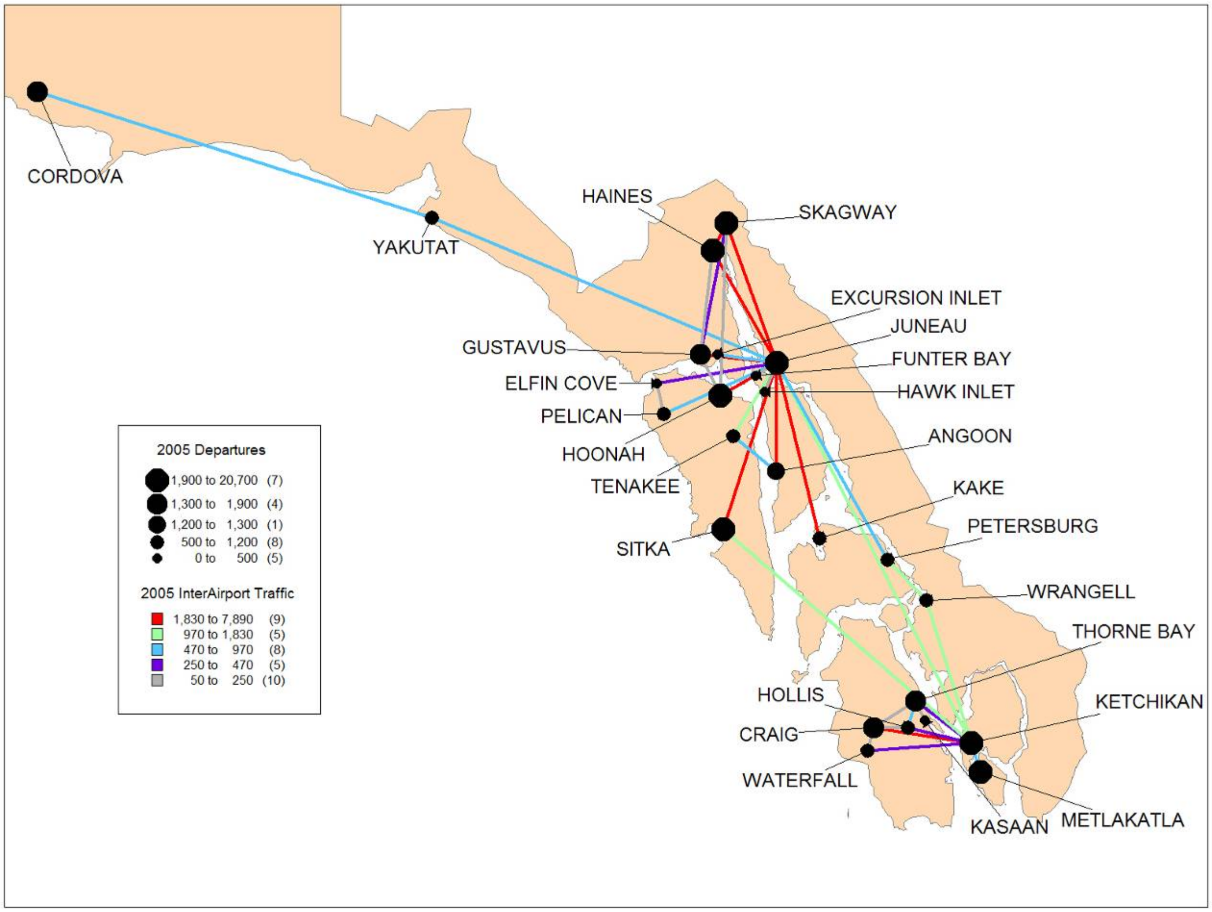

Figure 1. Southeast Alaska Major Communities

Aviation Access Prior to Capstone

Southeast Alaska has 89 airport facilities—24 airports, 9 heliports, and 56 seaplane bases. (See Appendix 8.5 for a listing of these airport facilities.) These numbers are greater than those presented in the Baseline Report due to a later analysis of the flight patterns in Southeast Alaska which indicated other facilities should be included. Figure 2 summarizes the scheduled and unscheduled departures for all of Alaska in 2005 by Part-135 aircraft that are required to report their operations. Operators with no scheduled flights or operating as on-call charters only are not required to file flight data with the Bureau of Transportation Statistics and are not included in the figure. This figure indicates that 16% of flights are either completely within the Capstone area or are flying from/to other points in Alaska to/from the Capstone Phase II area. Of the approximately 10% of Alaska flights that fly completely within the Capstone Phase II region, 79% of these depart from the seven top airports.

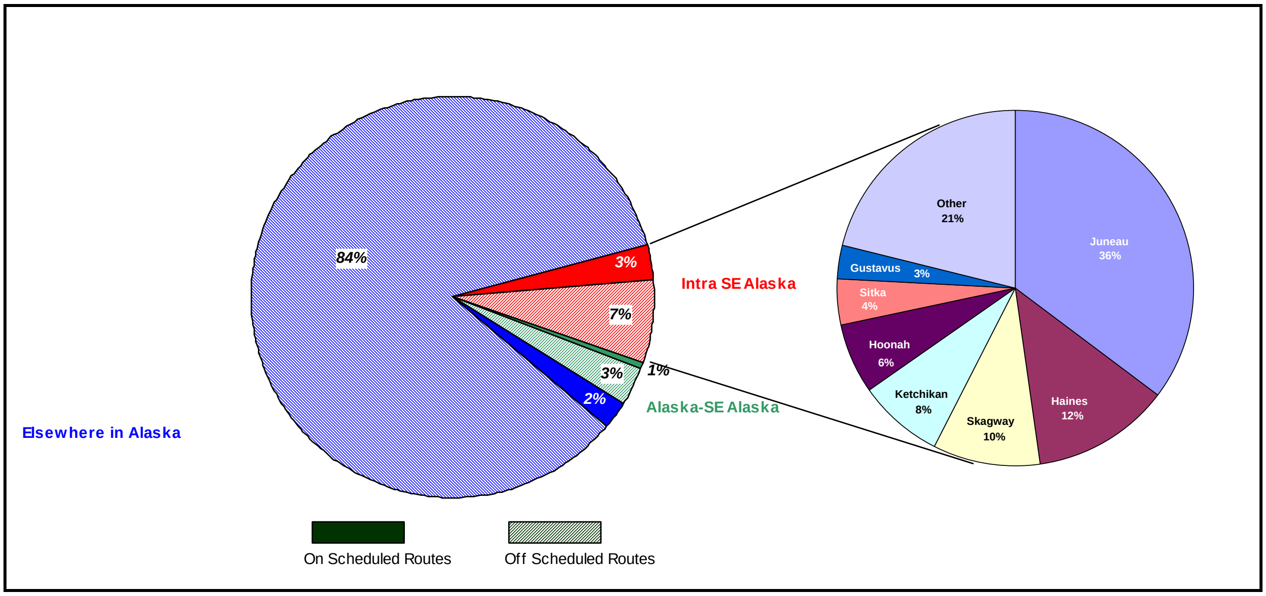

Figure 2. Scheduled and Unscheduled Alaska Flights To or From Capstone Phase II Airports

Weather, terrain, and communications are primary limitations on aviation access in Southeast Alaska. Weather hazards include several conditions that create poor visibility and low ceilings. The area is a marine environment with extremely variable weather and frequent storm systems with low ceilings and fog. Many destinations in the area do not have weather reporting facilities. Operators depend on area forecasts and pilot reports to make Go/NoGo decisions. Some flight routes have long distances between weather stations; for example, the route from Yakutat to Sitka is 201 nautical miles between weather stations. The terrain is extremely mountainous, which often causes low enroute ceilings due to fog and clouds trapped in the area's numerous valleys. These low ceilings reduce opportunities for VFR flight. The high terrain-limited Minimum Enroute Altitude (MEA) on pre-Capstone IFR airways limited IFR flights that might be affected by icing. The mountains and the valley and inlet locations of most airports restrict aircraft-to-ground and line-of-sight communications abilities.

Accidents Prior to Capstone

There were 179[2] accidents, 41 of them fatal, within the Phase II area reported by the National Transportation Safety Board from 1990 through 2002. The Capstone Phase II Baseline Report divided these into the categories and sub-categories described in Table 1. The result of this categorization of these accidents is presented in Figure 3. There is a transition period during 2003 through 2005 that is after the baseline but before Capstone implementation has reached a point where any significant benefit could be realized. This is described in the Aviation Safety section of this report.

For all of the accident charts in this section, the inner pie shows all accidents divided into major categories, the outer pie extensions show more detail within the major categories. For example, difficulties with off-airport landing sites may occur, such as soft spots on packed sand or unseen logs during water landings. Float planes flying in the summer are indicated by the extension labeled as 'Site' outside the wedge labeled 'Landing'.

[2] Revised data after Capstone Phase II operating areas were validated. The previous accident total of 231 in the UAA-ISER Phase II Baseline Report was modified after the specific operating areas were defined and the accident locations were identified.

Table 1. Accident Causal Categories

Basic Cause Categories

1. **Mechanical:** Engine failure, inoperable control surfaces, failed landing gear or floats, propeller or shaft failure.
2. **Navigation:** Controlled Flight into Terrain (CFIT) while en route is often associated with reduced visibility and small navigational errors. Some CFIT accidents are due to pilots being off-course.
3. **Traffic:** Usually mid-air collisions. Also includes ground or water accidents from last-moment avoidance of other aircraft and from jet blast on airport surface.
4. **Flight Information**: Usually accidents that result from inadequate weather information and are often caused by icing and sometimes poor visibility but rarely convective weather. (Surface winds contributing to take-off or landing accidents have been included under take-off or landing rather than here.)
5. **Fuel:** Accidents caused by fuel mismanagement.
6. **Flight Prep:** Accidents caused by a variety of poor flight preparation measures, including failure to insure that cargo is tied down and within the aircraft's weight and balance limits and failure to check whether fuel has been contaminated by water.
7. **Takeoff:** Accidents during take-off, including pilots' failure to maintain control in wind, improper airspeed, waterway debris, hazards at remote lakes, rivers without markings or moorings, poor runway conditions and obstacles at off-runway sites.
8. **Landing:** Accidents during landing, including pilots' failure to maintain control in wind, improper airspeed, waterway debris, hazards at remote lakes, rivers without markings or moorings, poor runway conditions and obstacles at off-runway sites.
9. **Other:** Includes colliding with watercraft or ground vehicles, hitting birds and pilots under the influence of alcohol or drugs.
10. **Unknown:** Missing aircraft, cause not determined.

Cause Sub-Categories

Runway: Accidents on take-off or landing related to runway or waterway conditions such as potholes, submerged obstacles the runway
Site: unusual hazards of water or off-runway sites
Water taxi: collisions with objects (not a/c) while taxiing on the ocean, rivers or lakes
Maneuvering: Typically, stalling the aircraft while maneuvering

Capstone Relevant Sub-Categories or Categories

Weather: Accidents where the availability of weather information was a factor.
CFIT: Controlled Flight into Terrain (or Water) accidents
TCF: Terrain Clearance Floor violation - CFIT that occurs on approach or departure.
Map: Accidents where the pilot did not know aircraft's location
Midair: Midair Collisions between aircraft.
Runway Collisions: between aircraft on the ground or water.
Fuel: Accidents caused by fule mismanagment.

NOTE:

This analysis is from UAA-ISER's Phase II Baseline Report and reflects the applicability of Phase I avionics plus TCF violations and runway collisions. It is updated here only to reflect fuel management enhancements available with the Chelton avionics. Chelton also includes other capabilities such as glide-range guidance that might help with emergency landings and Highway In The Sky (HITS) guidance which may help with complex navigtion. Re-analysis of the historical accidents in light of additional capabilities will be performed in the coming year.

Half of the 41 fatal accidents are from causes specifically targeted by Capstone Phase II and were due to causes that Capstone avionics, training, and data are intended to address. The largest share of fatal accidents is identified as Controlled Flight Into Terrain (CFIT) accidents, operating either in cruise flight or on approach or departure.

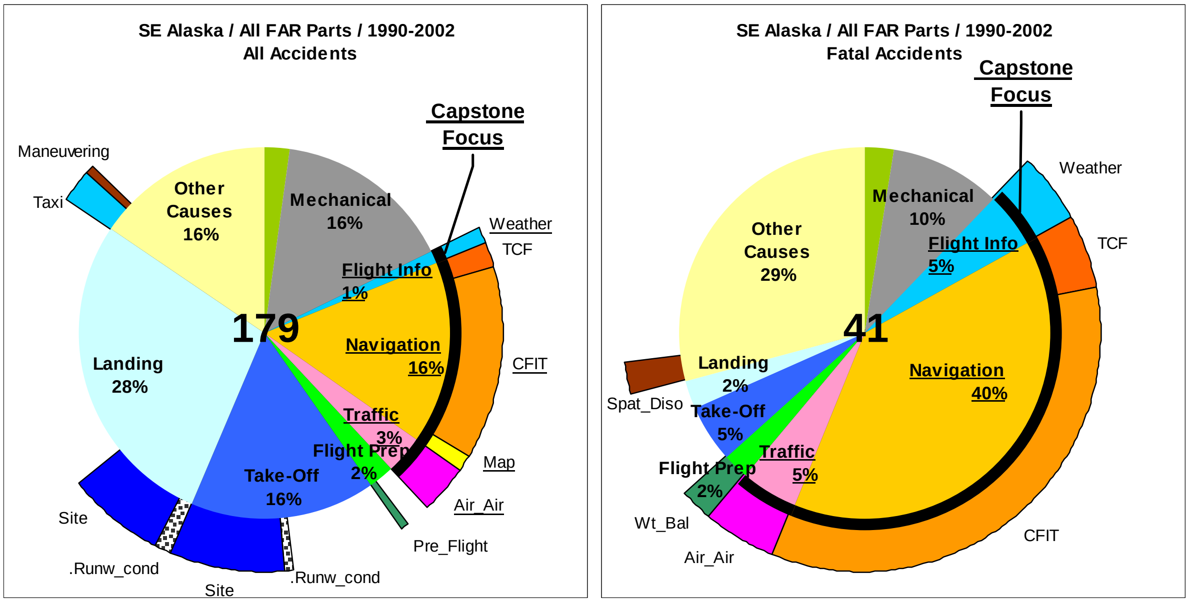

Figure 3. Accidents in SE Alaska, by Category, 1990-2002

The Capstone Phase II Program

Capstone seeks near-term safety and efficiency gains in aviation by accelerating implementation and use of modern technology. The capabilities of Capstone Phase II target four specific safety problems in Southeast Alaska:

- CFIT accidents (within the navigation category)
- Accidents associated with aircraft traffic – especially mid-air collisions
- Inadequate flight information – especially weather information
- Inadequate infrastructure to support IFR operations.

Program Overview

Capstone implements new technologies enabling pilots to cope with terrain, traffic conflict and weather hazards. These technologies also allow dispatchers/operators better means to monitor their aircraft and give air traffic controllers expanded surveillance coverage to provide Air Traffic Control (ATC) services.

The first objective in support of expanded IFR operations is to allow the use of GPS/WAAS technology for the enroute portion of flights on routes in Alaska outside the operational service volume of ground based navigation aids. This promotes safety by creating and promoting a usable IFR environment that allows an IFR option for pilots that have had to fly predominantly in the visual flight rules (VFR) environment that exists today. Capstone is establishing new departure and approach procedures, initially at Juneau, Haines, Hoonah and Gustavus airports and will expand to other parts of Southeast Alaska. This allows safer airport-to-airport access. These procedures will be developed as "specials" and achieve the lowest possible minimums for RNAV/GPS non-precision approaches by applying waivers with special training and equipment requirements.

Capstone is also providing additional flight and traffic information services in Southeast Alaska to improve overall safety. This initiative promotes better situational awareness of weather and other traffic by expanding the Automatic Dependent Surveillance-Broadcast (ADS-B) ground infrastructure to Southeast Alaska and adding data link avionics. This provides a data link for ADS-B and Flight Information Services-Broadcast (FIS-B). The objective is to use multiple means to alert pilots of possible traffic conflicts and weather hazards. Adding a universal access transceiver (UAT) to the avionics will enable display of other ADS-B aircraft (cockpit display of traffic information or CDTI). Installing an ADS-B ground system will provide track information to controllers and Automated Flight Service Station (AFSS) specialists. The UAT data link will also be used to relay weather information to the cockpit. Multilateration and Traffic Information Services – Broadcast (TIS-B) are being evaluated for possible inclusion in the future to enhance the surveillance picture in the cockpit.

Systems and Capabilities

Figure 4 depicts Phase II capabilities. Avionics systems are being installed to enable instrument approaches/departures and GPS/WAAS navigation on lower-altitude airways. This also requires the publishing of new navigation charts and instrument departure and approach procedures for use by pilots and controllers. New communications transceiver sites support this by preventing gaps when MEAs are lowered below the line-of-sight of existing communication sites. Finally, new weather observation facilities are included at airports to meet the requirements of commercial IFR operations.

There are now two airborne configurations available to the operators: a primary flight display (PFD)/primary navigation display (PND) pair developed by Chelton and a Garmin MFD similar to the Phase I avionics. Garmin was a late addition to the Phase II program in response to operator requests for a less complex and more compact installation. Section 3 provides additional details on the deviation from the original plan of having Chelton be the sole provider of avionics for the Phase II program. The operators can now select the configuration that best suits their operations and aircraft. Both are coupled with WAAS-GPS receivers capable of increased accuracy and integrity to enable Capstone area navigation (RNAV) capabilities. Automated Weather Sensor System (AWSS), Remote Communications Air-Ground (RCAGs) facilities and Remote Communications Outlets (RCOs) complement and support these airborne components. Phase II also includes traffic situation awareness displays in the Juneau Air Traffic Control Tower (ATCT) and Juneau Aeronautical Flight Service Station (AFSS), connection into existing air traffic automation and display facilities at Anchorage ARTCC (Air Route Traffic Control Center) through interconnecting telecommunications via the Alaska NAS Inter-Facility Communications System (ANICS), and ground broadcast transceiver (GBT) sites which communicate with the aircraft avionics.

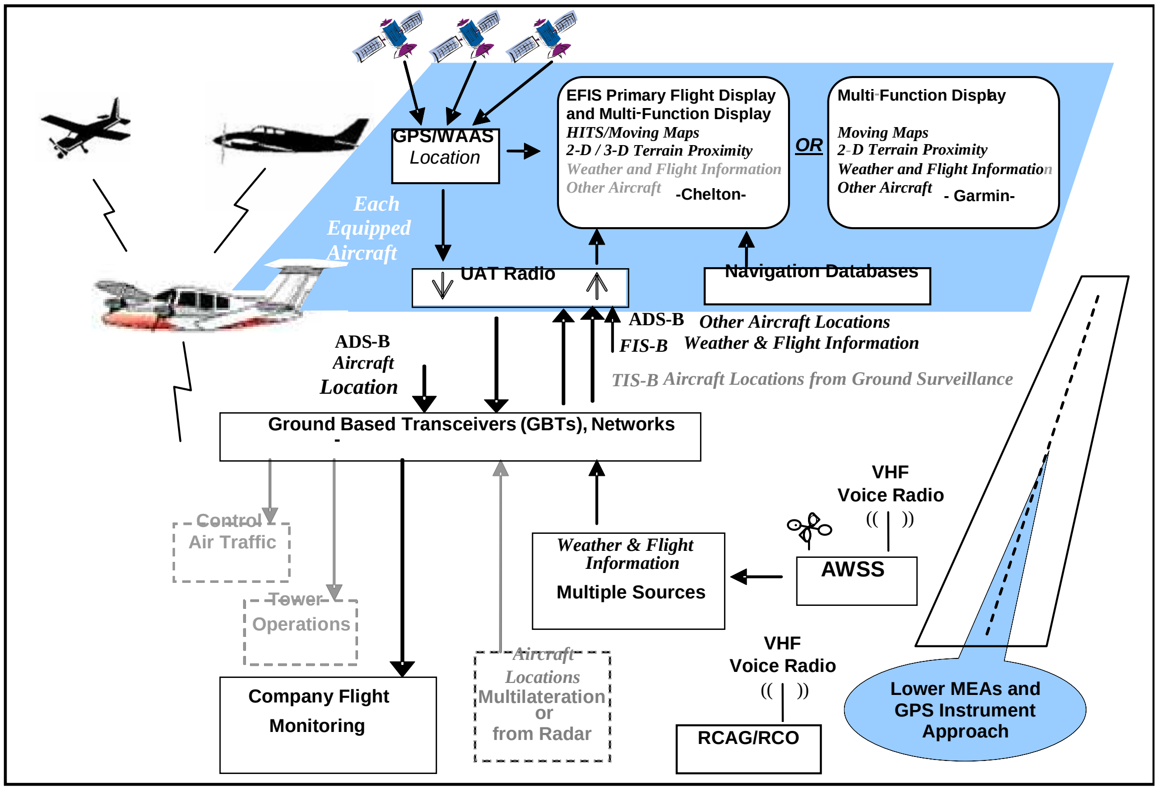

Figure 4. Capstone Phase II Systems and Capabilities
Capabilities Not Operational in 2005 Are Gray

Capstone Phase II plans to integrate these new and existing systems and equipment to complement RNAV services and provide a lower altitude, usable IFR infrastructure. Together, these systems and equipment should enhance operations and safety in the Southeast Alaska airspace system.

Ground System

The ground system will expand the Capstone Phase I data link infrastructure into Southeast Alaska. It consists of the ATC automation within Anchorage ARTCC and new remote GBT sites. It will expand ATC surveillance for radar-like-services and provide weather information to the cockpit and tracking data to enable flight following for commercial operators and FAA AFSS specialists. Communication sites and weather reporting sites are discussed in following sections. A multilateration surveillance system may be installed later in Juneau, supplementing ADS-B in the terminal area for aircraft that have transponders but not ADS-B. Surveillance of these non-Capstone aircraft could then be provided to controllers, and with TIS-B, could also be provided to Capstone-equipped pilots. Surface surveillance (including vehicles) was evaluated in Juneau and may be included in future programs.

Aircraft Systems

Installation of government-provided avionics began in 2003 for planned equipage of up to 200 commercially operated aircraft (estimated 150 fixed-wing and 50 rotor-wing) in and around Southeast Alaska. The intent of the Phase II avionics is to increase pilot situational awareness and increase navigational performance during IFR and VFR operations. Chelton Flight Systems (formerly Sierra Flight systems) was selected to provide its EFIS-2000 Primary Flight Display (PFD) and its Navigation Display (Figure 5), and supporting avionics. Garmin-AT Corporation was selected to provide their MX20 Multifunction Display (Figure 6) with supporting avionics, which is often the choice of helicopter operators to better meet their special operational requirements at lower workloads. Both avionics sets include GPS-WAAS receivers. Garmin has also been selected to provide a stand-alone UAT ADS-B system which will be used with both types of avionics. The Capstone program will oversee integration of these systems with the ground system and provide avionics units to individual aircraft operators. Installation of these avionics is covered under a multiple make, model, and series FAA Supplemental Type Certificate (STC).

Figure 5. Chelton EFIS-2000 Primary Flight Display and Navigation Display

Figure 6. Garmin MX-20 Multi-Function Display

Capstone Phase II Progress

The Phase II Capstone Program has accomplished some important milestones since beginning in 2002. New MEA routes and RNAV Approach and Departure procedures have been certified for a number of airports. Aircraft equipment installations are progressing. Communications, AWSS and GBT ground infrastructure installations are continuing.

However, by spring 2006 some of the most important of the planned capabilities of the program have not been realized; completion of these continues to be delayed. The following points are important to understanding these delays and the current status of the program.

1. In April 2002 contracts for Phase II avionics were let to Chelton for an EFIS/PFD/MFD subsystem and to Avidyne for a UAT subsystem. The contract with Avidyne was terminated by the FAA and a subsequent contract for the UAT subsystem was then made with Garmin AT (who had built the avionics for Phase I). This need for a second contract resulted in a 21 month delay in the original plans for the delivery of the airborne UAT subsystem.

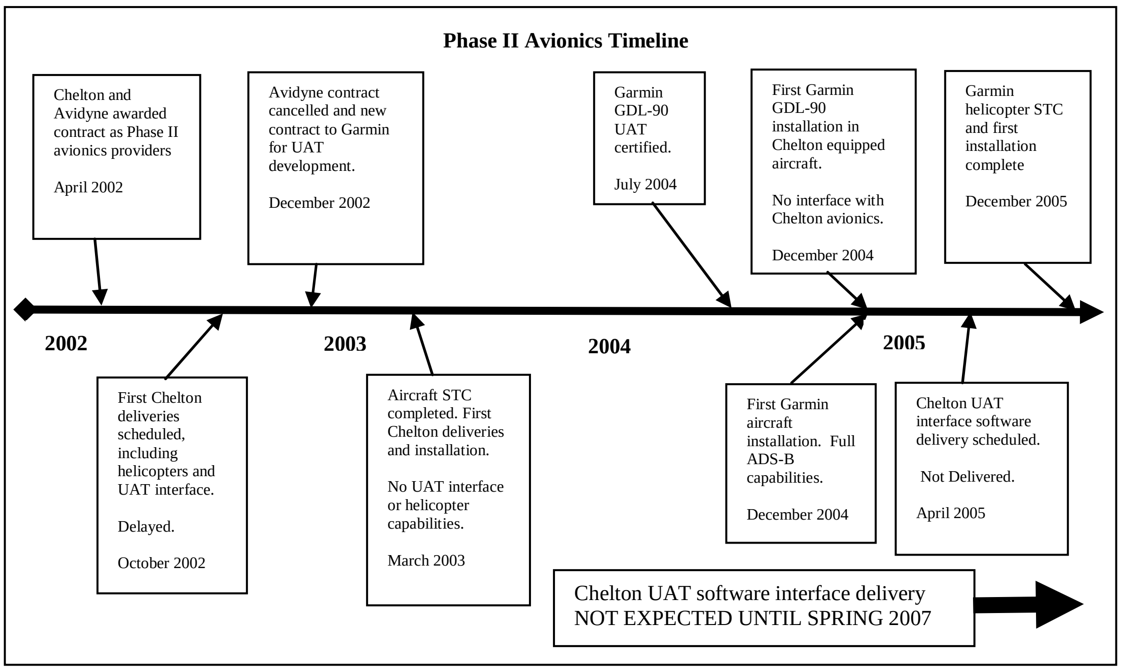

Figure 7 Avionics Development Timeline

2. Capstone's original plan was to offer the operators options on 4 levels of equipage: 1) standalone ADS-B system only, 2) standalone ADS-B system and a navigation display, 3) standalone ADS-B system, a navigation display, and a primary flight display, and 4) standalone ADS-B system and a navigation display, a primary flight display, and a secondary GPS/WAAS navigator. Chelton did not initially offer a navigation display system without the PFD, this became available in 2003, but no operators have ordered that configuration. After numerous delays and technical difficulties with Chelton avionics, and after the desire by helicopter and VFR operators for a less complex system, Capstone let another contract with Garmin AT to provide an avionics alternative that would more closely resemble Capstone Phase I and provide a less complex system. The numerous delays and technical difficulties with the Chelton avionics as well as the need for a second contract to provide an alternative to Chelton avionics, has resulted in significant delays in the delivery of avionics for SE. By the end of 2004, under pressure from the Capstone office Chelton implemented a complete

hardware change in AHRS and GPS sensors as well as numerous EFIS software, installation manual, and flight manual supplement changes.

3. Capstone's plan was to use the new MOPS-compliant UAT data link that was defined post-Phase 1 to provide ADS-B and related broadcast services. This meant that new GBTs and airborne UATs needed to be specified, developed, and procured. Standards development progressed as predicted; however, it took longer then expected to produce new certified UAT avionics and to specify and deliver new GBTs. This delayed GBT certification by approximately 2 years.

4. Chelton's implementation of the UAT interface and the processing on broadcast services information within the Chelton avionics was contracted for completion in 2002 and has not yet been delivered. The result is few of Capstone's air-ground capabilities and none of the air-air, and ground-air broadcast services capabilities are in place for Chelton equipped aircraft. Cockpit traffic display, operator flight monitoring, FAA radar like services, and cockpit weather display are not yet available. The aircraft equipped with the Chelton EFIS/PFD/MFD subsystem are not able to receive information from the UAT data link and so are not able to display ADS-B traffic or FIS-B weather. As an interim measure, Capstone has installed Garmin UAT subsystems configured for transmit-only in these Chelton equipped aircraft, without interconnecting them with the Chelton avionics. These aircraft can be "seen" by other fully configured Capstone equipped aircraft and the FAA ground system, but they can't receive or interpret the data link themselves.

Progress continued during 2005 in the Capstone Phase II Program. Developing infrastructure for such a complex aviation system is a multi-year task. Progress has been slower than anticipated on certification of the GBTs, weather stations and other elements. Aircraft modification is now progressing at a reasonable pace with 62% of the scheduled aircraft modifications either fully (Garmin) or partially (Chelton) completed. The following subsections present progress of the various program elements attained by 2005.

Ground Based Transceivers

New GBT sites[3] have been chosen to provide surveillance coverage (Figure 8) at, around, and between the key airports with new GPS approaches. Capstone is also choosing other sites to create and expand a low altitude RNAV route structure in Southeast Alaska. Initially, 14 sites have been identified. Surveillance data will be linked back to the MicroEARTS automation system at Anchorage ARTCC. The data will be used for ATC and distributed to other users including air carrier operations centers (AOCs) and local operators, via the ETMS system, and Aviation Flight Service Station (AFSS) for flight following. FIS-B (and eventually, TIS-B) will also be available via the Capstone Communications Control Server (CCCS) via the GBTs. FIS-B weather and other NAS data will be uplinked in Southeast Alaska as it is the Bethel, YK Delta area.

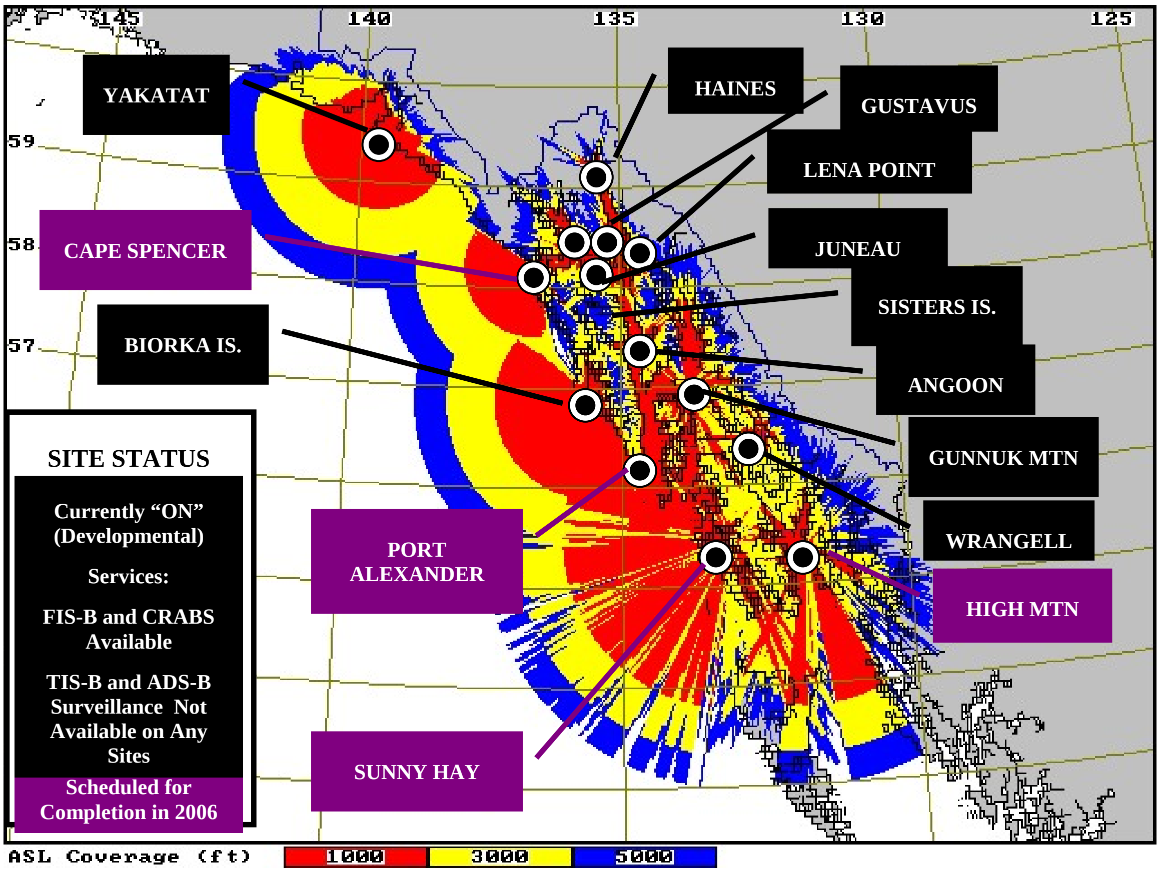

Figure 8. Surveillance Coverage Planned with New GBTs

Construction was completed on ten GBTs in 2005 and the remaining four GBTs are anticipated for completion in 2006. The ten completed GBTs are now on the developmental network providing FIS-B and CRABs data for flight monitoring. ADS-B ATC surveillance is not yet available on any of the GBTs at the end of 2005. Previously shown Figure 8 identifies the locations and serviceability at the end of 2005. Certification was anticipated in 2004 but the testing and the certification was still ongoing at the end of 2005. Final testing and certification necessary for these GBTs to be on the operational network was expected to be complete by summer 2005, but is not complete to date. The full benefits of the Capstone

[3] Surveillance sites for the Cordova area were not available at the time of this report and are not shown in Figure 8.

program cannot be realized until this certification is complete and the units are brought online on the operational network.

Voice Communications

Communications enhancements include new RCAGs to fill ATC communication gaps, enable new RNAV operations, and lower many minimum enroute altitudes. Initial communications improvements to support Capstone Phase II are shown in Figure 9 and will include a new RCAG facility at the south end of Stephens Passage for direct pilot-controller voice contact and at Mt. Robert Barron for improvements along Lynn Canal and over Icy Bay. Flight Service support will also be improved with the installation of an RCO radio in the same vicinity. Further communications improvements are expected as needs are documented.[4]

The RCAG sites at Gunnuk Mountain and Robert Baron were serviceable during after certification in 2004. Construction continues on the final scheduled RCAG site at Cape Spencer, not completed by the end of 2005.

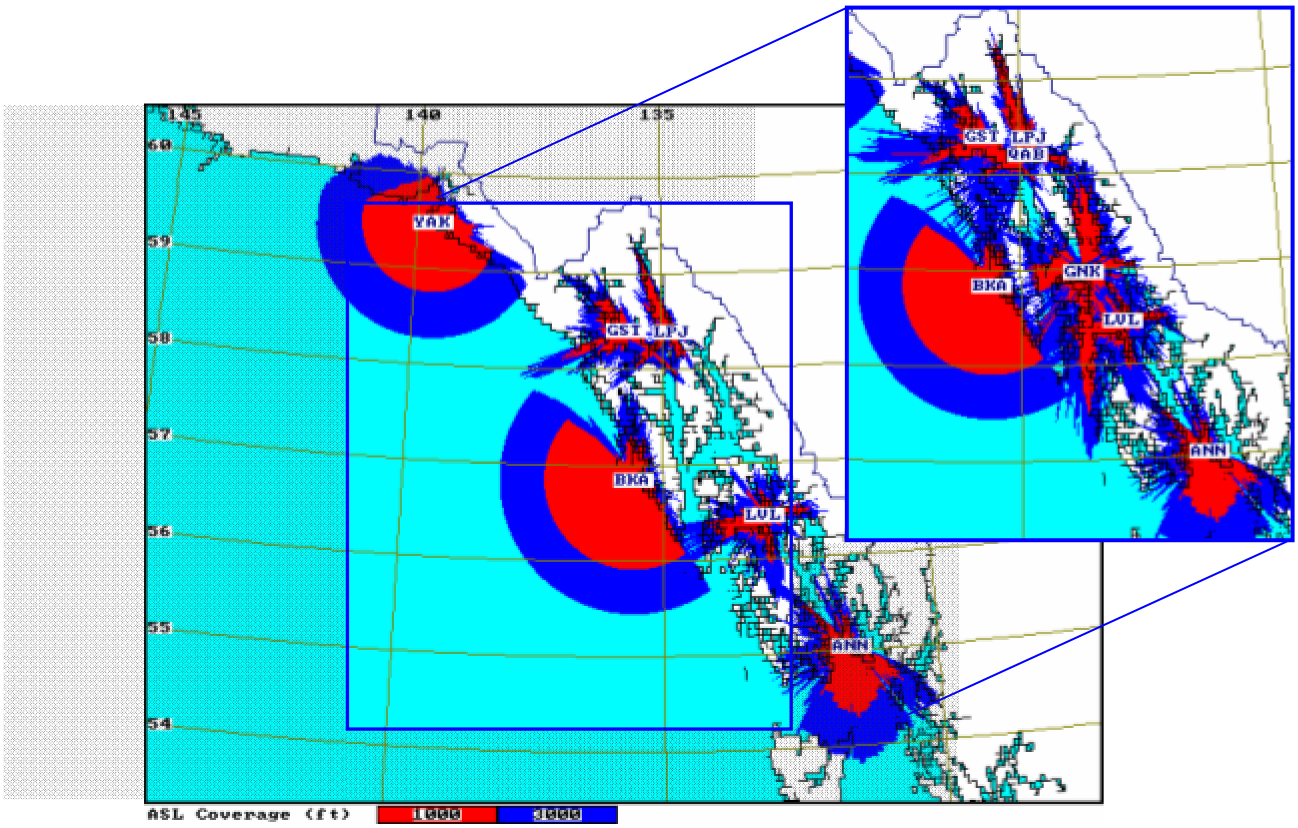

Figure 9. Voice Communications Coverage Before Capstone, with Inset showing Coverage Improvement by Capstone Phase II

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[4] Current and future voice communications coverage in the Cordova area was not available at the time of this report and is not shown in Figure 9.

Automated Weather Observation Stations

Commercial air carriers need weather observations for destination airports before performing an instrument approach. Observations are also useful inputs to the overall weather picture because additional sites improve the accuracy and detail of weather forecasts in the region. New Automated Weather Sensor System (AWSS) sites will be installed and report weather conditions including temperature, dew point, wind, altimeter setting, visibility, sky condition, and precipitation. The weather reports from these sites will be available by phone, over radio on aviation frequencies and, once connected to the national weather collection system, can be extracted from other weather data at AFSS, other NAS systems, and over the internet or via FIS-B. Hoonah was added in 2005.

Hoonah currently has an operating AWSS that has been added by the Phase II program. Southeast Alaska now has 19 stations. Figure 10 depicts the current operational stations.

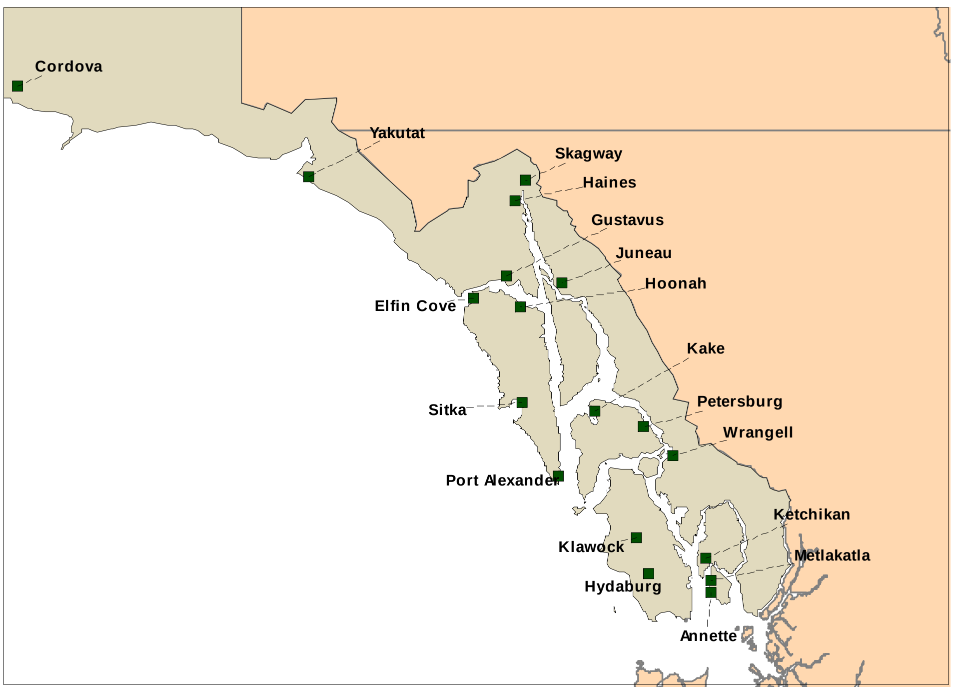


Figure 10. Southeast Alaska Weather Reporting Facilities

Other Infrastructure Changes Supporting Capstone Phase II

Situational awareness displays are planned for the Juneau air traffic control tower and the AFSS. Surveillance data derived from the ground system will be used to feed new "BRITE"-like displays in the Juneau ATCT cab. The AFSS will also receive a flight following or flight plan monitoring capability. When suitable for integration with ADS-B, a multilateration installation is planned for Juneau to increase the number of "participating aircraft" for surveillance in the area and provide another data feed for TIS-B. Multilateration will identify/locate targets in the terminal area and on the ground at Juneau airport. The new tower displays have not been installed as of the end of 2005. They are planned for installation after ADS-B surveillance becomes available.

Airspace

To provide RNAV services, Capstone is developing an end-to-end (airport-to-airport) RNAV airspace structure. The Capstone enroute initiative is providing RNAV/GPS MEAs that are significantly lower than the conventional MEAs that exist in Southeast Alaska. The MEAs in Southeast Alaska are often limited by line-of-sight issues with navaids and/or communications sites that are blocked by terrain. Using satellite navigation allows for lower MEAs, but not lower than the Minimum Obstruction Clearance Altitude (MOCA). Minimum Enroute Altitudes have been developed and approved for over 1,500 miles of airspace in Southeast Alaska. Satellite navigation allows RNAV/GPS routes to be established in areas that optimize flight efficiency not based on the location of ground based navaids. The initial approach/departure procedure changes are in effect between Juneau and the airports of Hoonah, Gustavus, and Haines. Based on user/operator input and acceptance, this will expand to other city-pairs. In 2004, the FAA certified 19 new RNAV Approach/Departure Procedures at Angoon, Juneau, Kake, Ketchican, Klawock, Petersburg, Sitka and Wrangell. They also certified four special four RNAV routes, known as R2010, R2015, R2020 and R2025.

In 2005, no new RNAV Approach/Departure Procedures were certified in the Phase II area but 18 other procedures were certified across Alaska.

Aircraft Systems

A total of 47 aircraft installations were completed in 2005 bringing the total Capstone Phase II aircraft equipped to 109. The 2005 installations included 17 Chelton, 27 Garmin and 3 aircraft that were converted from Chelton to Garmin. It should be noted that ERA Aviation is self-equipping with Chelton and has completed 12 installations. ERA is not included in the equipage or operational sections of this report as they do not operate intra-Southeast Alaska, a criterion of the analysis in this report.

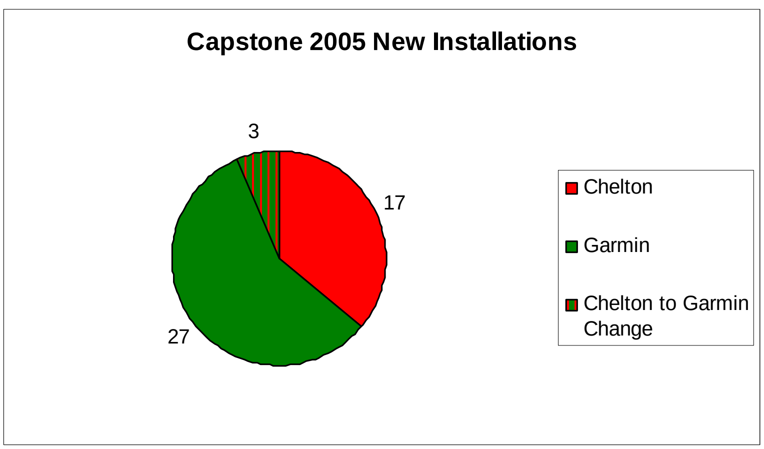


Figure 11. Aircraft Equipped with Capstone Phase II Avionics in 2005

The Chelton installations are only partially complete. All Chelton equipment is installed with the exception of connectivity with the Universal Access Transceiver (UAT). Chelton has not completed the necessary interface between their system and the UAT. Phase II Chelton operators will see essentially three levels of service. Level I provided the basic features of the Chelton avionics, such as "Highway-In-The-Sky" guidance, terrain and warning system (TAWS B or C) and navigation information, modified periodically for safety or performance enhancements. Level II, with the GDL-90/UAT installed in a stand-alone mode, is providing a down-link of data from the aircraft. This downlink can be received and used by Garmin aircraft for situational awareness and by the ground system for flight following (and eventually for Air Traffic Control). Level III offers a full system capability and adds a direct interface between the

Chelton avionics and the UAT; it will provide the pilot with uplink information (FIS-B weather and other information, and potentially, air traffic data from ground surveillance systems). This new interface will also provide the pilot/operator with air traffic information from other aircraft for display on the Chelton avionics. It is now expected that modifications to Level III will be started by mid-summer 2007.

Figure 12 shows the progress of the installations. Only 4 of the 109 equipped aircraft, belonging to the University of Alaska Anchorage (1 Chelton) and Civil Air Patrol (3 Garmin), were non-commercial. The rest were Part 135. Of the 109 equipped aircraft, 8 are IFR capable. There are 97 Class 0 (single engine, piston), 7 Class 1 (twin engine piston) while 5 are Class 4 turbine powered aircraft. The Supplemental Type Certificate for helicopter installations was completed in 2005 and the first helicopter (Class 3) was being modified and tested at the end of the year. It is anticipated that 28 helicopters will be modified. The majority of aircraft equipage for Capstone Phase II takes place during the winter months as it is the “off” tourist season.

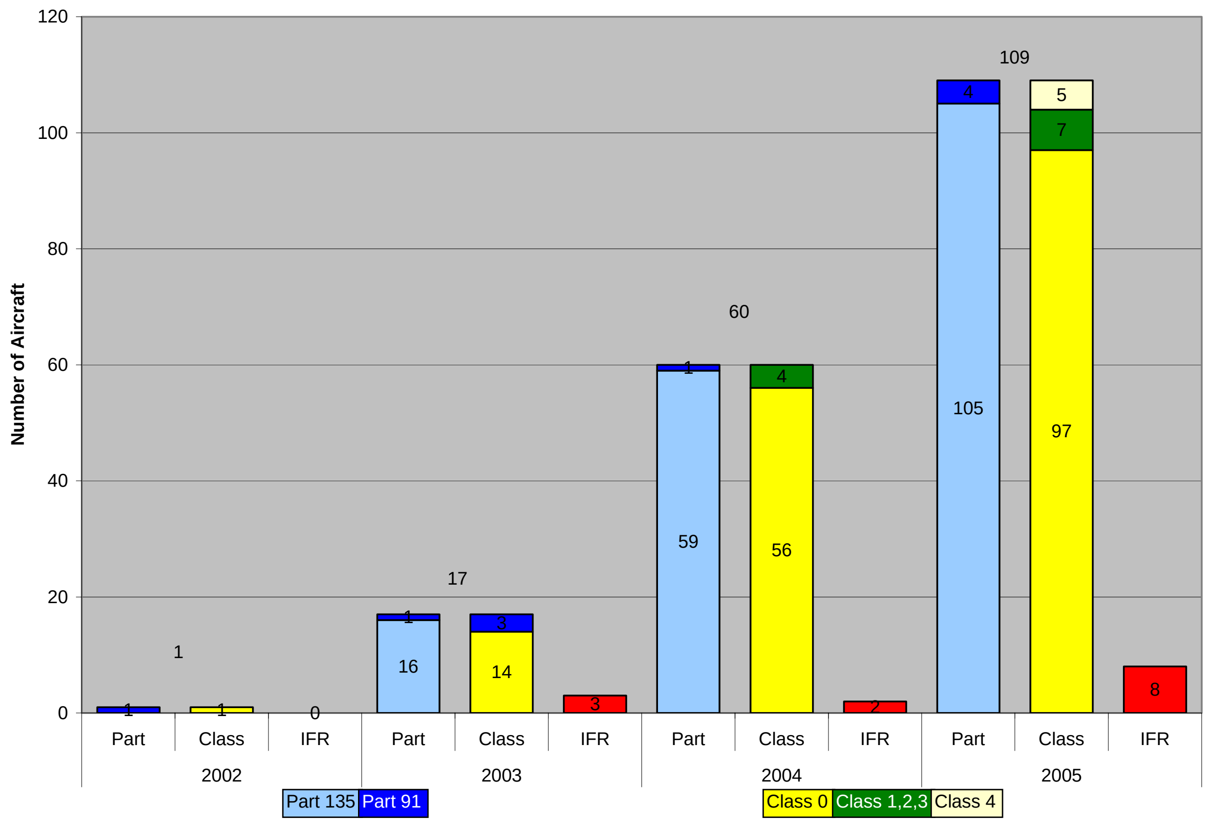


Figure 12. Cumulative Partially or Fully Equipped Aircraft Through 2005

The Southeast Alaska commercial fleet currently comprises 188 aircraft. Of those, it is expected that 164 will be equipped with Phase II avionics by the Capstone Program. Therefore, at the end of 2005, 56% of the aircraft commercial fleet was equipped and 62% of those expected to be equipped had been modified. Two aircraft that were previously equipped have been removed from the fleet due to accidents. Figure 13 shows the fleet distribution at the end of 2005.

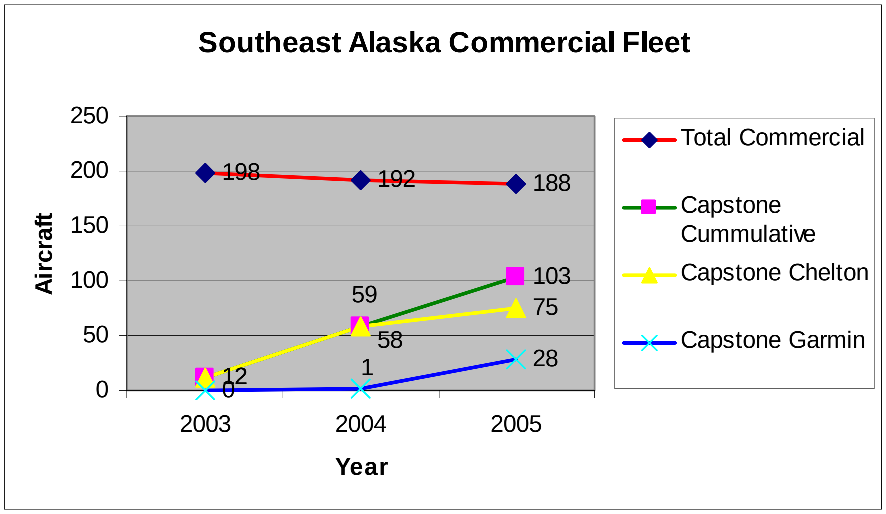
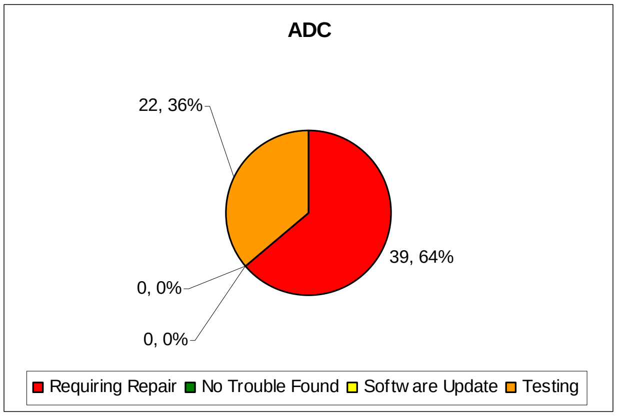


Figure 13. Commercial Operating Fleet Through 2005

Equipment Reliability

Reliability programs are not required by the FAA for small Part-135 operators. The only quantitative data available on the reliability of Capstone avionics is from the manufacturer concerning components that have been returned for repair.

Chelton had 233 units returned to the manufacturer during 2005. Slow turnaround times were noted in the last year's report for the Chelton avionics and a review of this year's data indicates a significant improvement in 2005. Air Data Computers and Integrated Display Units are key elements of the Chelton system and had the highest removal rates of the components for reasons other than updating and are shown in Figure 14. During 2005, 39 ADCs had been removed for specific failures and another 22 were sent back to undergo evaluation. This does not include problems found with the altitude sensor in the ADC requiring all ADCs to be returned for modification. Twenty-six IDUs required repair and 8 were sent for testing.



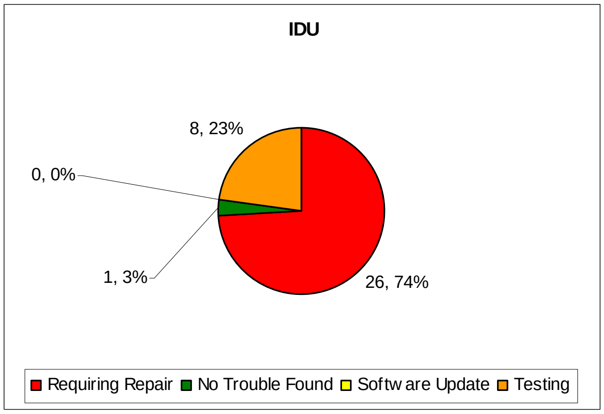
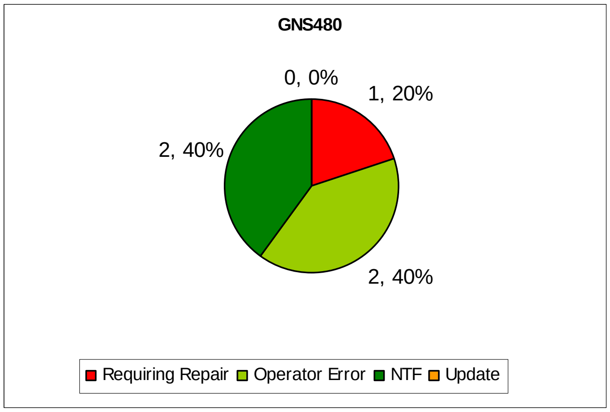


Figure 14. Chelton Air Data Computer and Integrated Display Unit Repair Data - 2005

Garmin system components generated very few returns to the manufacturer. A total of 13 units were returned and of those only 3 required repair, 5 were sent in due to operator error and the remaining were for software updates. The GNX 480 and MX 20 each had one unit requiring repair.



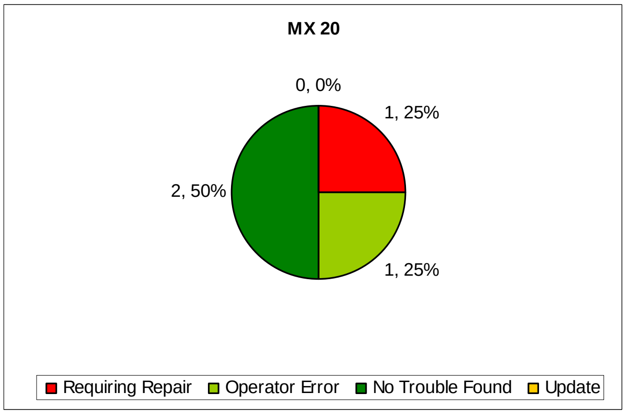


Figure 15. Garmin Repair Data - 2005

Limited reliability and lack of adequate test equipment create an economic impact on the operator. Aircraft that are not operating for maintenance or parts reasons do not generate revenue and significantly impact customer satisfaction. An operator or pilot might consider not documenting malfunctions or failures if they know the aircraft may be grounded for any period of time. This would increase the safety risk of pilots flying with an aircraft that does not meet its airworthiness requirements.

Management and Dispatch

Interviews with the management in the Phase II area, notably Juneau and Ketchikan, point to definite improvements in Safety Programs as well as the safety culture and posture of organizations. Most stated during interviews that this is due to a combination of the overall improvement through the synergistic interface of Capstone, the Medallion Foundation, Alaska Weather Cams, and other recent FAA and industry sponsored programs in Alaska.

> *"New equipment provides an improved confidence level, a greater passenger comfort level, and better situational awareness."*

One of the key disappointments to management is the current inability of both air and ground equipment to better "paint" traffic. This comes as a direct result of the incomplete integration of the Chelton equipment into the system and the perceived lack of operational GBT coverage in much of the Phase II area during 2005.

> *"The ability to see other traffic in the cockpit – when that capability comes – will be a major improvement and the most valuable to us."*

Economic impacts, for the most part, are intuited by management at this point and not measured. However, 50% noted improvements, 7% noted deterioration, and 43% noted no change in economic impact. On the plus side was the availability of more direct routing and the ability to determine flight level winds. When taken advantage of, both can lead to fuel saving. However, the operators do not have historical economic databases with which to compare with post-Capstone results.

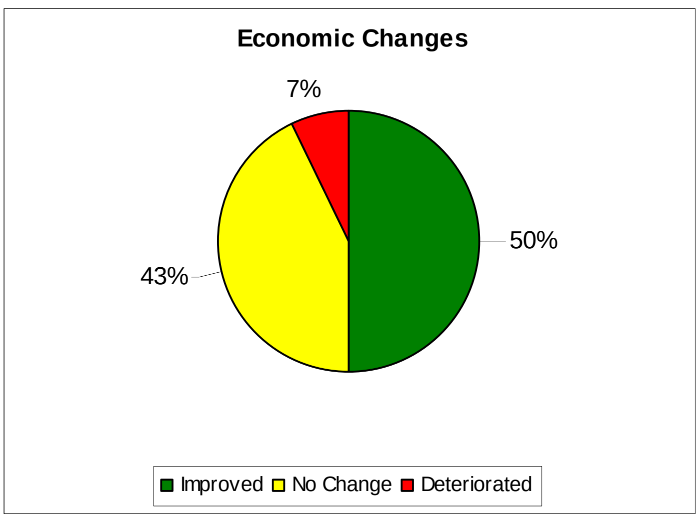


Figure 16. Airline Management's Opinion on Economic Impact

The training required to prepare newly hired pilots and to keep all pilots current in Capstone equipment operations was noted by some as having a negative impact upon the economics of their operation. This, however, is said to more than offset the improvement in safety. Though, not yet a factor, the economic impact of maintaining the equipment in the future is of concern.

The Capstone II area is spread over the wide area of Southeast Alaska. When asked about the communications between themselves and the FAA Capstone Program, eighty-four percent rated communications between the two as good or excellent. This is a marked improvement which many noted is due to the efforts of the full time technical representative assigned to Juneau. Prior to having a representative, operators rated communications lower. Of continuing concern is the lack of visibility of

Alaska Capstone Program Office representatives and a perceived lack of availability of this staff to assist with the resolution of questions.

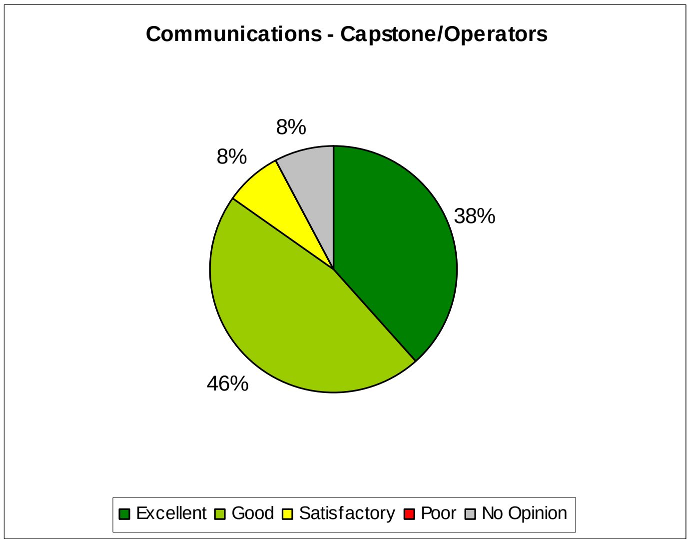


Figure 17. Airline Management's Opinion on Communications With FAA

Operators report near universal agreement that the Capstone systems offer the potential for a long term and significant improvement in Safety for flight in the Southeast. They express disappointment that the ability to display traffic, both in the cockpit and on ground systems, has not matured at a faster rate.

Dispatch and flight following surveys were notable for a lack of information due to the Dispatchers having a lack of training and knowledge of what capabilities are available to them . The Juneau area had some GBT coverage and a mixture of Chelton and Garmin aircraft. Without resolution to the Chelton integration issues, only the Garmin and those Chelton aircraft with a UAT could be displayed on the available flight following systems. Ketchikan had the same mixed fleet problems and also lacked any significant GBT coverage. This resulted in very few flight monitoring comments.

When discussing potential uses of the flight monitoring capability and the information that is considered important to the flight followers, several emphasized that they were conducting primarily only short duration VFR operations and the survey items such as alternate airport selection, rerouting, and fuel/load planning were at the bottom of their priority list. With some of the operators having only a single or very few pilots, all of the dispatch/flight following concerns fall upon the self-dispatching pilot and the value of the organizational flight monitoring capability is diminished.

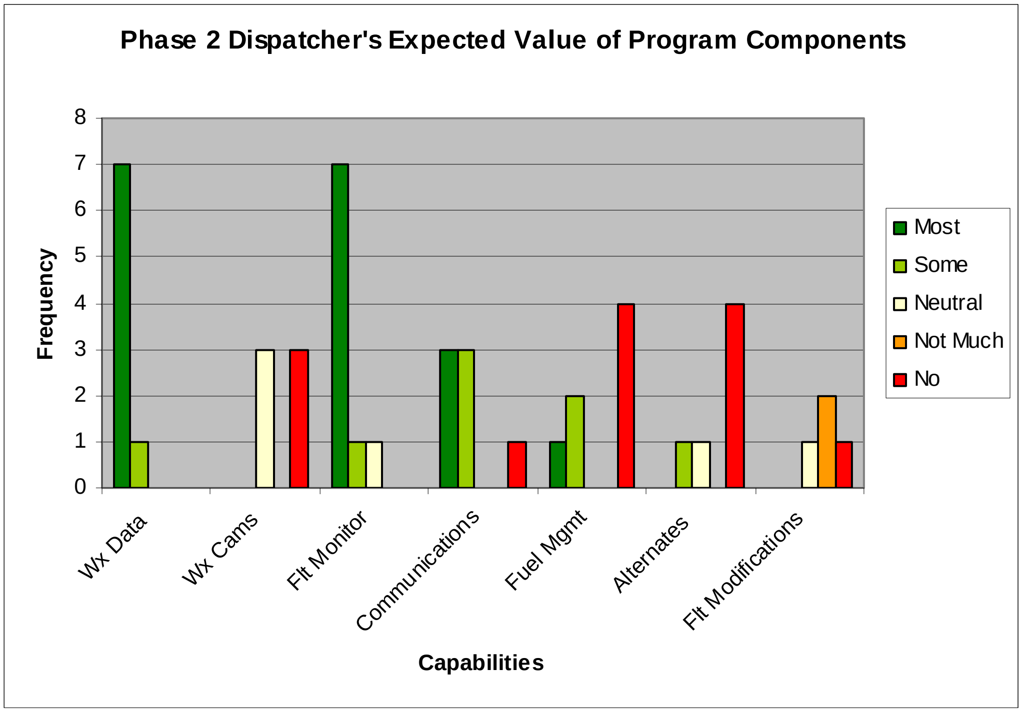


Figure 18. Dispatcher's Value of Information

Phase II Operator Training

The University of Alaska Anchorage (UAA) provides initial Capstone training for pilots using a "train-the-trainer" approach. UAA has an agreement with the FAA Capstone office to provide initial training to the air carriers' trainers on the operation and use of the Capstone system. UAA's training program provides each operator with an 8400.10 (Air Carrier Inspector Handbook) compliant training program. The training program outlines ground training, flight training and checking, and recordkeeping. Beginning in spring of 2003, UAA provided initial training for each of the operators. UAA timed the training to coincide as closely as possible to the delivery of a carrier's first Capstone-equipped aircraft. The typical operator had two people receiving 16 hours of classroom training with the avionics training device.

In 2004 UAA also entered into an agreement with the FAA to train key maintenance personnel on the Chelton Phase II system. The training focuses on field maintenance with an emphasis on troubleshooting, removing and replacing inoperative components, and updating software. Four maintenance technicians attended the one Chelton maintenance training class that was conducted in 2005. No Garmin maintenance training had been conducted by year end 2005.

Nine pilot training classes were held during 2005. Six of those classes were for Garmin initial training and one was for Chelton initial training. Twenty-two Garmin and four Chelton pilots attended these classes. Four pilots attended classes on special routes and airports. UAA had trained 67 company pilot trainers by the end of 2005. Figure 19 depicts cumulative training UAA has accomplished by the end of 2005.

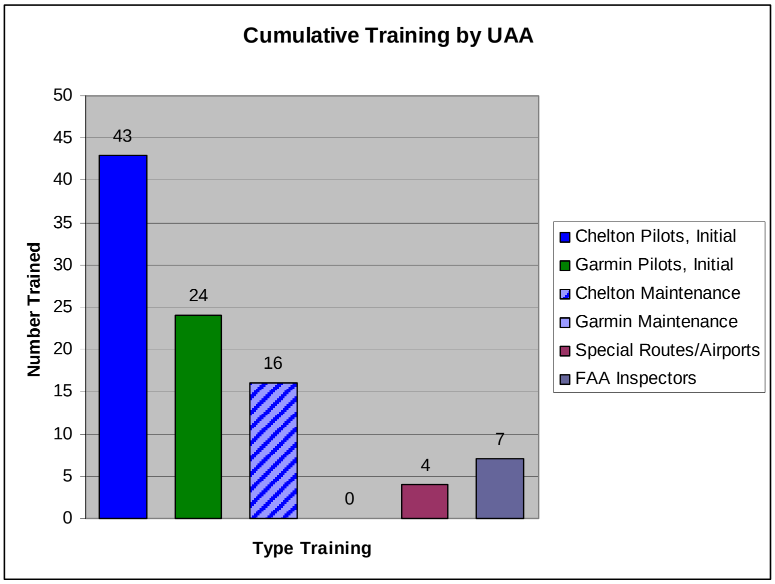


Figure 19. Cumulative Training Accomplished by UAA

A survey of the pilots who have attended the UAA Capstone II training indicates that the quality of the training received is more than adequate as shown in Figure 21. Fifty percent or the respondents felt that it was excellent, 37 percent thought it was good and none felt that it was less than adequate or poor. The pilots' opinion of the quality of the recurrent training was lower with only 25 percent feeling that it was excellent, 60 percent good and no one felt it was less than adequate or poor. Thirty-five percent did not respond to the recurrent question in the survey since most of the Garmin pilots had not gone through recurrent training yet. The pilots overwhelmingly (80%) indicated that they would not make changes to the training programs. Though small in number, simulators were mentioned or an integral part of the most common recommended change. Simulators are available but during the preparation for the summer season when many new pilots are brought in, the number of simulators is insufficient.

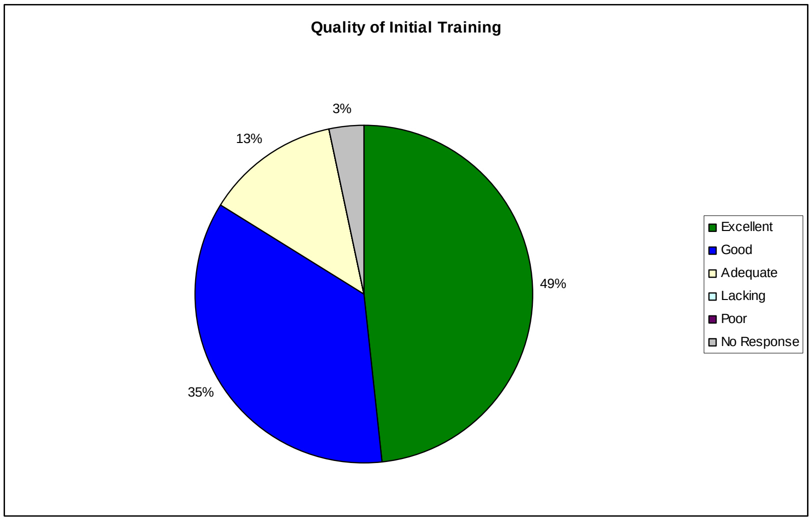
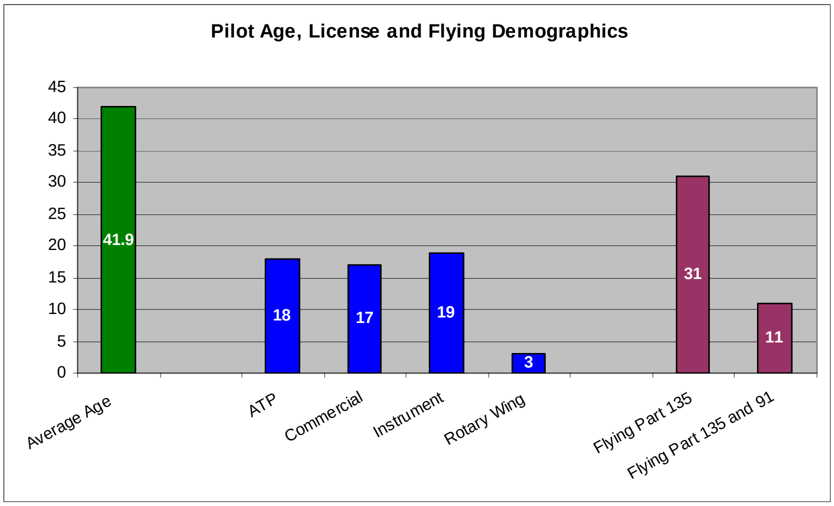


Figure 20. Quality of Capstone Training - Pilot Ratings

Pilot Surveys

Pilots operating Capstone-equipped aircraft were surveyed in winter of 2005/2006. Many of the pilots that operate in Southeast Alaska leave the area during the winter months when the tourist season ends. In the future, a portion of the interviews will be conducted prior to the end of season to capture a wider range of pilot age, experience and opinions. Thirty-one pilots were interviewed. Thirteen of these pilots currently operate Chelton equipped aircraft, 9 pilots operate Garmin equipped aircraft and 9 pilots that have experience operating both systems. The following graphs in Figure 21 provide the demographics of the survey group.



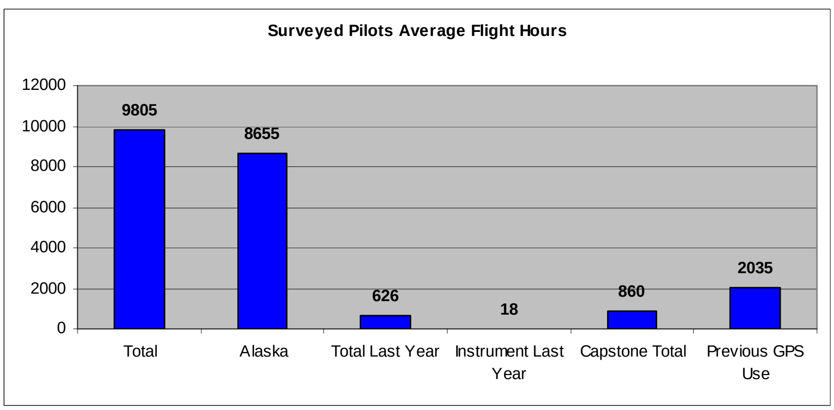


Figure 21. Surveyed Pilots Demographics

The surveys asked pilots how often they use the capabilities of Capstone Phase II avionics and ground systems, how easy that capability is to use (relative to other avionics they are familiar with), and how useful they find the capability to be. Pilot responses are summarized in the array of pie charts in Figure 22. The responses indicate the initial capabilities of the Capstone Phase II program are relevant to pilots' perceived needs, that pilots use the capabilities to varying degrees, and that the usability and usefulness of Capstone are regarded favorably. The pilots were not surveyed for responses to the Traffic function during the survey this year since Chelton does not currently have that capability and the Garmin users were only able to see the Chelton aircraft for part of the year. Traffic will be included in next year's analysis.. A key issue with all Chelton users is the lack of a traffic display.

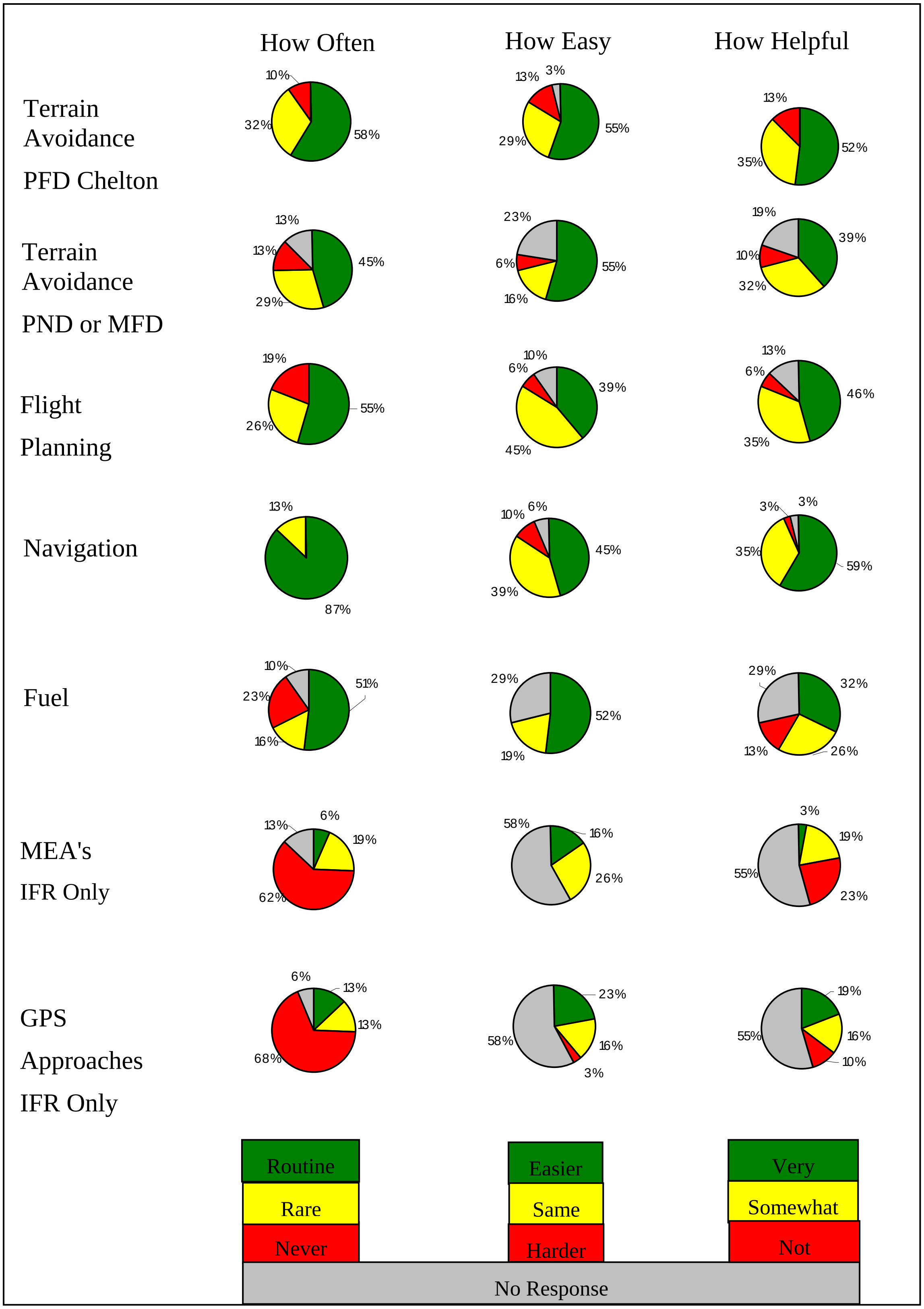


Figure 22. Frequency of Use, Ease of Use, and Usefulness of Capstone Capabilities

With the ground infrastructure incomplete, the Chelton equipment only partially installed and 2005 being the first year of operating experience for the Garmin pilots, the responses for some functions are not likely to be indicative of a fully operational system.

The navigation element of the Capstone system by all 3 pilot groups rated as the most often used. One-hundred percent of the Garmin pilots stated that they used the navigation function regularly while 89% of those pilots operating both systems and 77% of the Chelton pilots used it regularly. None of the pilots in any of the groups stated that they never used the system. Ninety-two percent of all pilots rated the system as easier or the same as other navigation systems. Although the navigation elements show a high degree of use, they also result in issues from the pilots:

> *"Need a more detailed map, including Canada"*
>
> *"PND – terrain features grainy – could use improvement"*

Terrain avoidance, on the PFD or PND, was highly rated by the pilots for use, usefulness and usability by all 3 groups. The Chelton users seemed to prefer the PND (54%) over the PFD (46%). Terrain avoidance was rated as easy to use almost equally by all groups. Nearly half Chelton and Garmin users rated terrain avoidance as very helpful whereas the "both" user group rated the PFD (45%) and the PND (22%) as very helpful. While terrain avoidance rated high in all areas, it also elicited numerous comments relative to the accuracy and format of displayed information.

> *Chelton comment: "It changes range when near terrain and overlays red and yellow making the nearest terrain harder to see and therefore more dangerous."*
>
> *Garmin comment: "The lack of detail on the MX20 is sorely lacking; many islands, shorelines, etc. are inaccurate, missing, or displaced (sometimes a half mile or more)."*

The flight planning function was equally rated by pilots of all 3 groups with 56% stating that they regularly use the system. Fifty-six percent of the Chelton users found flight planning to be very helpful while only 33% of the Garmin users and 45% of the users of both systems rated it very helpful.

Chelton pilots and pilots of "both" types use fuel planning with 77% and 56%, respectively, routinely using the system with 62% of the Chelton pilots considering it very helpful. The Garmin system does not provide as sophisticated a system for fuel planning and use and therefore it was rated very low with only 11% regularly using the system and none rating it as very helpful.

Both MEA and GPS approach use were universally rated low by all pilots in all groups. One hundred percent of the Garmin pilots stated they never or rarely use GPS approaches and 89% rarely or never use MEAs (the remaining 11% did not respond to the question). Chelton faired little better with only 23% routinely using GPS approaches and 8% using MEAs routinely. Only 11% of the pilots experienced with both systems selected routine use of GPS approaches and MEA.

The Highway in the Sky (HITS) is a feature that is only on the Chelton system. Sixty-two percent of the pilots routinely use HITS, 77% stated that it was easy to use and 52% stated that it was useful. Some pilots see HITS as unnecessary in the "VFR" flying environment of Southeast Alaska. For those flying "IFR" in VMC it has been described as "great". Similarly, some pilots stated that they turned the HITS off when flying VFR, regardless of type of flight plan, as it is too distracting.

Several responded to the survey question concerning any "situation in which you can directly attribute your use of the Capstone equipment to the prevention of an accident or incident." This is one example:

> *"Yes, snow storms closed in behind and in front of me & the training & my knowledge of the Capstone prevented an incident. The skyways, flight plans, min alt, and many other features allowed me to conclude the flight safely."*

Pilot Survey - Capstone Program Benefits

Figure 23 indicates how pilots responded to questions concerning several areas of potential Capstone benefit. The responses noted must be tempered by several facts relative to operations in Southeast Alaska.

- Only a limited number of the twenty-six 135 Capstone operators use IFR certified aircraft
- The lead operation for most operators is day VFR, tourist, flight-seeing
- Chelton, used exclusively by 15 of the 26 operators and in part by 2 of the operators, has not integrated traffic or weather information into its cockpit display.
- GBT density and certifications in the area are at an early stage of development and the mountainous terrain limits reception in many areas.

Seventy-six percent of the pilots found No Benefit or did not respond concerning safer operations at remote airports having new instrument approach procedures. Over 80% of the pilots either found that the availability of new IFR approaches did not result in fewer cancellations or simply did not respond. Their VFR operating environment and VFR certified aircraft make the use of IFR, GPS approaches unnecessary and, except in emergency situations, they fly VFR.

When weather deteriorates, 55% rate Capstone as a Major benefit, and 23% rate it as a Significant Benefit when flying in minimum VFR conditions. The responses indicating a potentially less safe operation are mostly concerned with the "comfort factor" gained through the new equipment:

> *"A less experienced pilot might exceed his or her limits in hopes of getting the flight accomplished"*

Over 85% of the Chelton pilots see either No Benefit or did not respond concerning near mid-air collision avoidance benefits from the Capstone program. This is a direct result of the Chelton system's inability to display traffic in the cockpit at this time. The Garmin pilot's responses rated near mid-air benefits highly with 66% seeing at least Some Benefit. A number of pilots stated that this benefit could not be fully achieved until all aircraft had the traffic capability in the cockpit. Taxi and traffic information responses are again tied to traffic information in the cockpit. Without the display, it is either of no use (74%) or not considered for a response (17%).

Weather information is not getting into the cockpit, as 94% of the responses indicate no value or no response to questions concerning useful weather information. This benefit should improve as additional GBTs are certified and FIS-B data is more readily available. SVFR improvements have not been appreciably noted. Over 60% either rated this as No Benefit or did not respond. Controllers are not currently using Capstone information for aircraft location information, so information sharing between the pilot and the controller has resulted in no noticeable improvement for SVFR.

The ability to reroute and divert flights is rated positively by 58%. As GBTs come on line and organizations make more use their flight following capabilities, reroute and divert capability becomes easier.

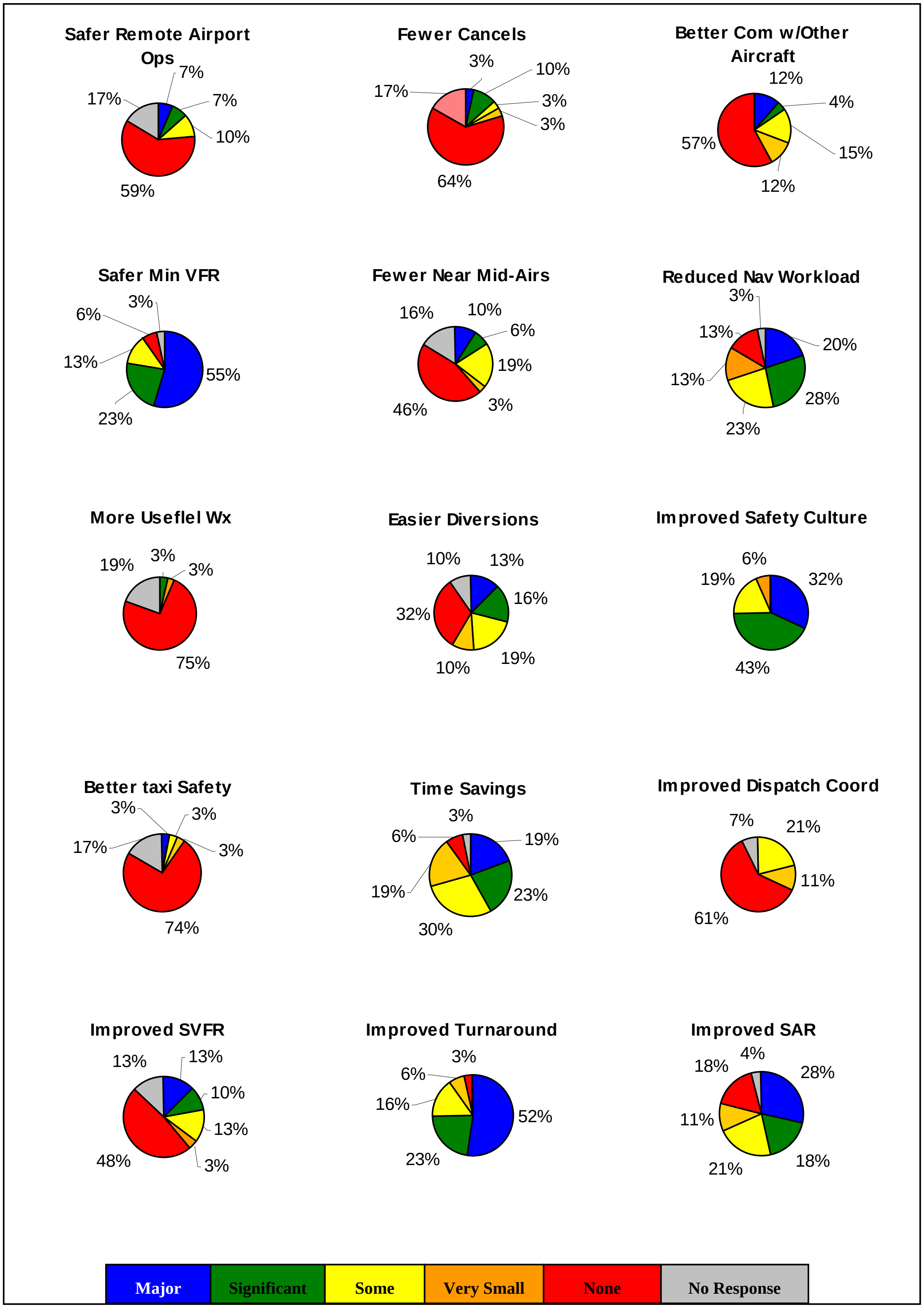


Figure 23. Pilot's View of Capstone Program Benefits

Pilots nearly unanimously rated time savings as a benefit from more direct flight routes: 20% Major Benefit, 23% Significant Benefit, 30% Some Benefit, and 19% Very Small Benefit. The key detractor to direct flight in the Southeast is the terrain, with numerous narrow, mountain lined passages. Terrain Awareness is one of the two highest rated benefits of Capstone. Fifty-two percent rated the area as a Major Benefit, while 23% rated it as Significant. For the 3% that rated it as no benefit, system accuracy may be the key reason:

> *"Accuracy of the graphics programs may cause problems (e.g. Baranof eastern shoreline is off by up to 200 yards)"*

Surprisingly, many view the Search and Rescue capability as a Capstone benefit: 28% Major, 18% Significant and 21% Some. Garmin pilots perceive it as even a greater benefit with 56% rating it as Major, 11% Significant and 22% Some. Most see it as a potential benefit, rather than a current benefit. Without a current, radar-like service, it is still difficult to determine where an aircraft may have "gone off a screen".

Pilots have not yet seen any benefit in plane-to-plane communications derived from traffic displays – as noted Chelton does not yet have traffic in the cockpit and only 8% of the Chelton pilots considered it as Some Benefit. Thirty-three percent of the Garmin pilots rated this benefit as Major or Some. Over all the pilot groups, fifty-seven percent noted No Benefit, and another 12 percent reported only a Very Small Benefit.

The navigation workload has been reduced for all but 16% of the responding pilots: 20% Major Benefit, 28% Significant Benefit, 23% Some Benefit, and 13% a Very Small Benefit. This reduced navigation load allows for more attention to primary flying tasks.

Collaboration with dispatch concerning mission continuation is rated fairly low, with 61% seeing No Benefit and 7% not responding. No one reported this as a Major Benefit. Two primary reasons for this are:

- The flight following systems in the Southeast are in their infancy and the companies' policies have not evolved yet to facilitate coordination between pilots and flight followers for these situations.
- Many of the companies are small operations with low pilot manning only and no Dispatch/flight following function for them to coordinate with.

The bottom line for benefits is in the area of improved safety culture. Pilots unanimously believe that Capstone is a benefit: 32% Major, 43% Significant, 19% Some and 6% Very Small. There were no surveys that indicated "No benefit" or who failed to rate this element. One comment helps sum this area up:

> *"The passengers feel safer."*

Operators' Safety Posture and Other Safety Programs

Most of the Phase II operators are small companies certified under Part-135 and their required quality assurance programs and records keeping are more limited than Part-121 operators. Using surveys provides some indication of improvements in the general safety structure of the operators, as shown in Figure 24. Sixty-two percent of the respondents indicated they have revised their Operations or Policy Manual and had conducted a safety audit or review. Forty-six percent have set or revised safety goals, implemented an accident/incident reporting program and have developed a new safety program or appointed a Safety Officer. Only 23% had written a new employee safety letter.

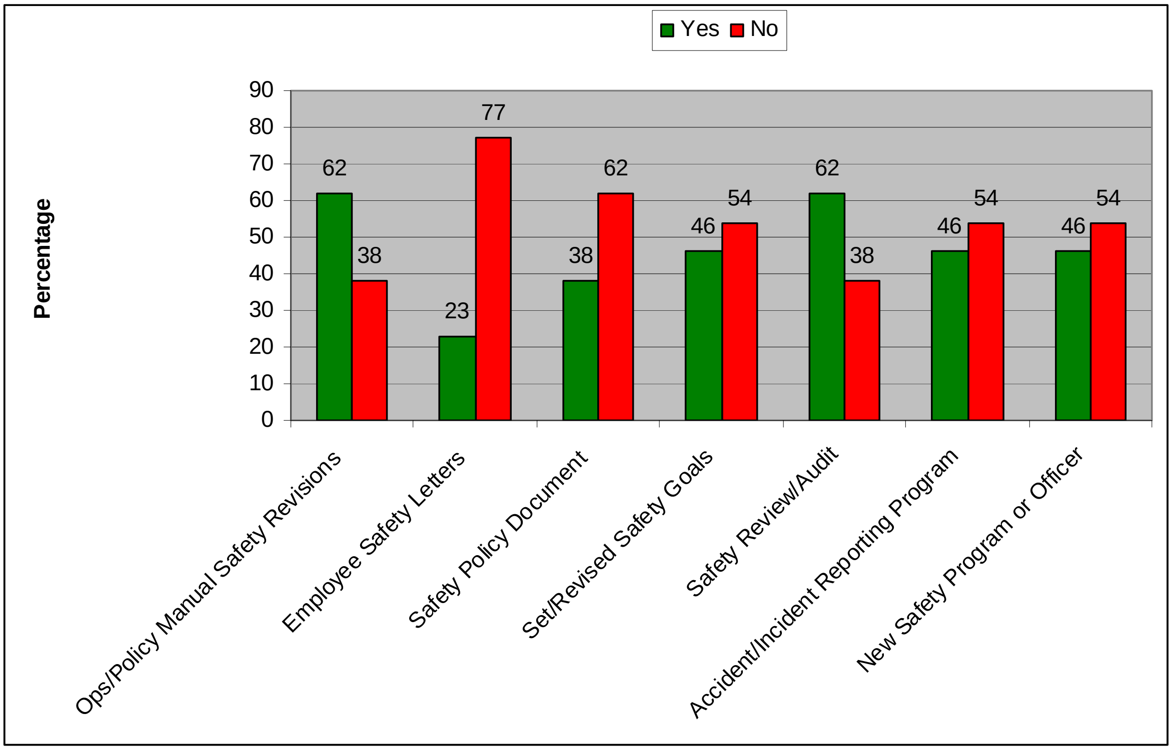
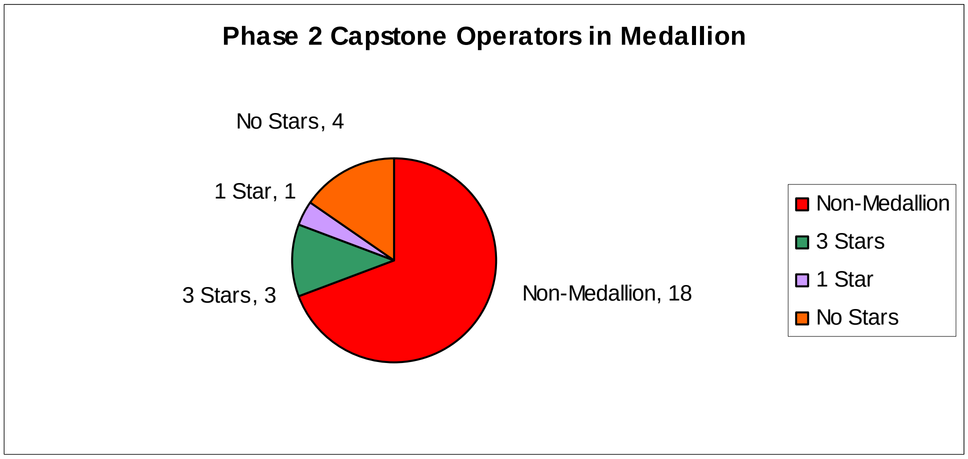


Figure 24. Changes to Safety Posture or Awareness

The Medallion Foundation, created in 2001, is one of the more important flight safety programs in Alaska. Although program membership is voluntary, the prestige that comes with earning a Medallion Shield has proven to be a powerful incentive for many Alaska carriers to join. To earn the shield, air carriers must complete the entire program and satisfy the five program goals (Stars) designed to increase safety awareness and improve safety practices. At the end of 2005, the Medallion Program has enrolled only eight of the 26 Southeast operators and only four of those operators have achieved even one of the five Stars necessary to obtain a Shield. Operators with at least one Star were responsible for 39% of Part-135 operations and Non-Medallion members and those members who have yet to earn a single Star conducted 61% of the operations in Southeast Alaska.

Figure 25 shows the number of operators that have earned Medallion Stars for meeting some of the program goals and the percentage of flight operations by number of Stars and non-Medallion operators.



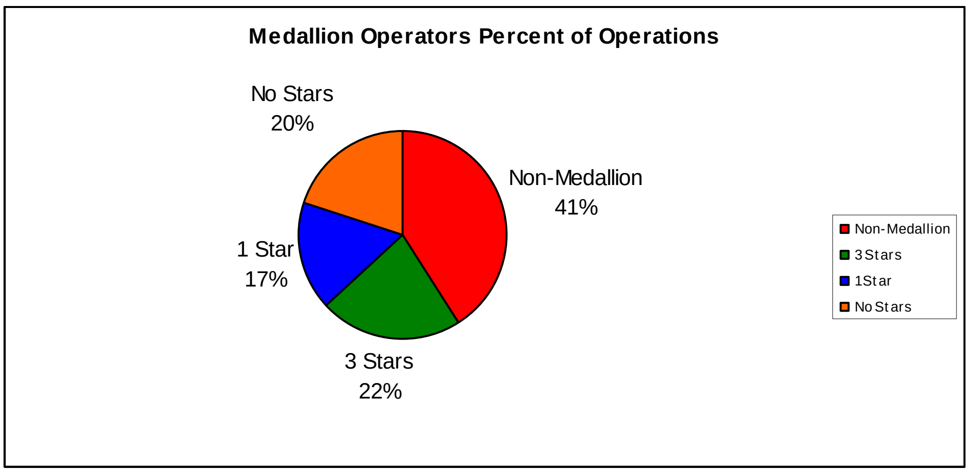


Figure 25. Impact of Medallion Program

Aviation Safety

This section characterizes numbers and rates of accidents in SE Alaska. First, it classifies accidents in 2005 and in the 2002-2005 Capstone period and compares types of accidents between Capstone-equipped and non-equipped aircraft. Second, it compares overall accident rates between commercial aircraft in SE Alaska and other parts of Alaska. It also compares overall accident rates between aircraft prior to equipage and after equipage. The final analysis compares accident counts between operator and operation types before and during the Capstone period.

Transition Period

There is a transition period from calendar year (CY) 2003 through CY 2005 that is after the designated project baseline but before implementation has reached a point where any significant benefit could be realized. During this period, only a limited number of aircraft were modified (and these only partially completed) and the supporting ground infrastructure was not yet available. Some benefit could be expected due to improved GPS-WAAS and avionics capabilities, new route structures and additional training received by pilots, but there is insufficient data at this point to provide any meaning analysis.

As reflected in Table 2, there is a reduction in the annual rate of accidents in each overall statistical category. It should be noted that numerous factors can have an effect on reducing or increasing annual accident rates such as weather conditions, other safety initiatives, or a general emphasis on safety by pilots and companies. A number of factors can contribute to the accident reductions in the Phase II area and it is too early to determine Capstone's contribution to accident reductions in Southeast Alaska. From 2003 through 2005, there were an additional 30 accidents within SE Alaska. Figure 26 shows the categorization of these accidents.

Table 2. Baseline Period 1990-2002 and Phase II Period 2003-2005

Summary Period	1990-2002	2003-2005
Total Accidents	179	30
Average Per Year	13.8	10.0
Total Fatal Accidents	41	6
Average Per Year	3.2	2.0
Total Accidents FAR Part 135/121	69	14
Average Per Year	5.3	4.7
Total Accidents FAR Part 91/133	110	15
Average Per Year	8.5	5.0
Total Fatal Accidents FAR Part 135/121	20	1
Average Per Year	1.5	0.3
Total Fatal Accidents FAR Part 91/133	19	5
Average Per Year	1.5	1.7

Capstone avionics, training and information are efforts to help pilots avoid CFIT accidents, collisions between aircraft, and some accidents where flight information is a factor. From 1990 through 2002 during the baseline period and from 2003-2005 during the Phase II transition period in Southeast Alaska about 19 percent, or 40 of the total 209 accidents, are from causes specifically targeted by Capstone Phase II. These might have been prevented if the Capstone program had been in place. These causes are highlighted in the figure with a dark band. Also highlighted are fuel management (categorized as 'Fuel') accidents which the new avionics may help in preventing. Even though equipage of Capstone avionics is still in progress and full capabilities are not available, early indications appear promising when comparing the baseline period of 1990-2002 and the initial Phase II period of 2003-2005.

Categories of the 47 ***fatal*** accidents in Southeast Alaska during the same periods are shown in Figures 26 and 27. These figures indicate that Capstone could potentially have prevented a much larger fraction of the accidents that were fatal than the non-fatal ones. Nearly half of 47 fatal accidents are from causes specifically targeted by Capstone Phase II and were due to causes that Capstone avionics, training, and data are intended to address. The largest share of fatal accidents is identified as Controlled Flight Into Terrain (CFIT) accidents, operating either in cruise flight or on approach or departure.

The primary causes of the overall accidents and the primary causes of fatal accidents had very different percentages. Many accidents which occurred during takeoff, landing, or have a primary cause identified as mechanical, did not have associated fatalities. For example, between 1990 and 2005 there were 55 accidents categorized as 'Landing' with only 1 having fatalities. By contrast there were 29 accidents categorized as 'Navigation' (sub-categorized as CFIT or TCF) with 17 accidents having fatalities and there were 6 Mid-Air collisions with 2 suffering fatalities. It is the goal of the Capstone Phase II to address these serious accidents.

Overall accident reduction is cautiously expected in the Phase II area once the avionics equipage and ground infrastructure reach targeted levels. Based on the summary report of the Capstone Phase I area[5] reflecting a 50% reduction in accidents from 2000-2005, it is hoped to see accident reductions in the Phase II area while recognizing differences in the nature of flight operations and other environment factors between the two regions.

[5] The Safety Impact of Capstone Phase 1. Summary Report through 2003
May 2004 University of Alaska Anchorage, MITRE Corp. Center for Advance Aviation System Development

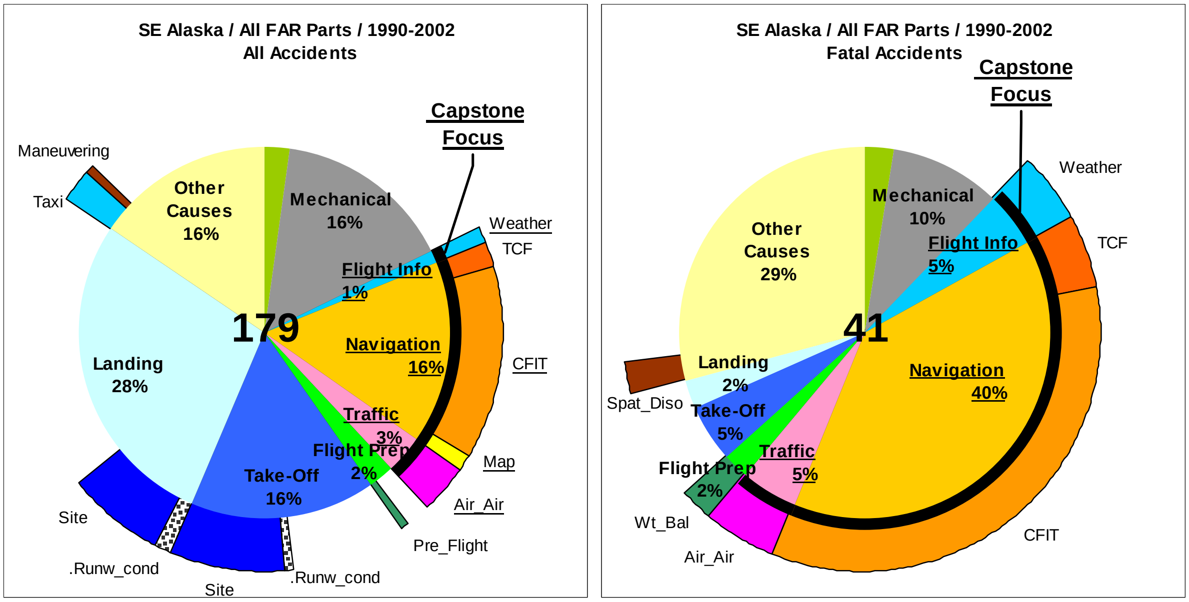


Figure 26. Accidents in SE Alaska, by Category, 1990-2002

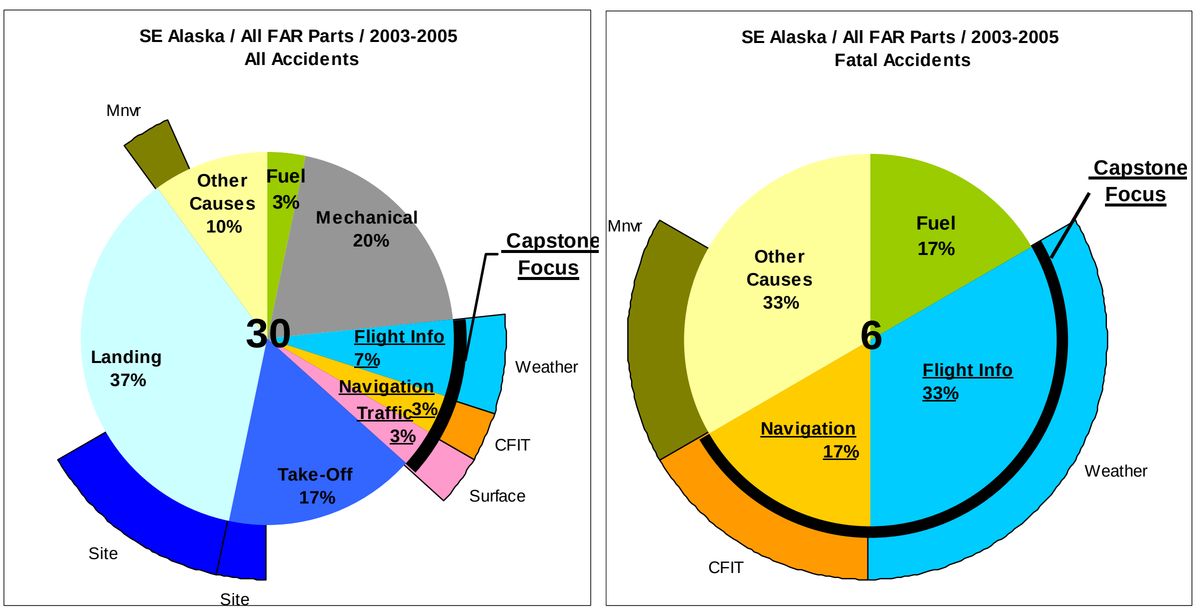


Figure 27. Accidents in the SE Alaska, by Category, 2003-2005

Accidents in 2005

The left side of Figure 28 shows the accident categories of SE Alaska Part-135 aircraft involved in accidents in 2005. The right side of the figure shows all Part-135 accidents in SE Alaska since Capstone implementation began there.

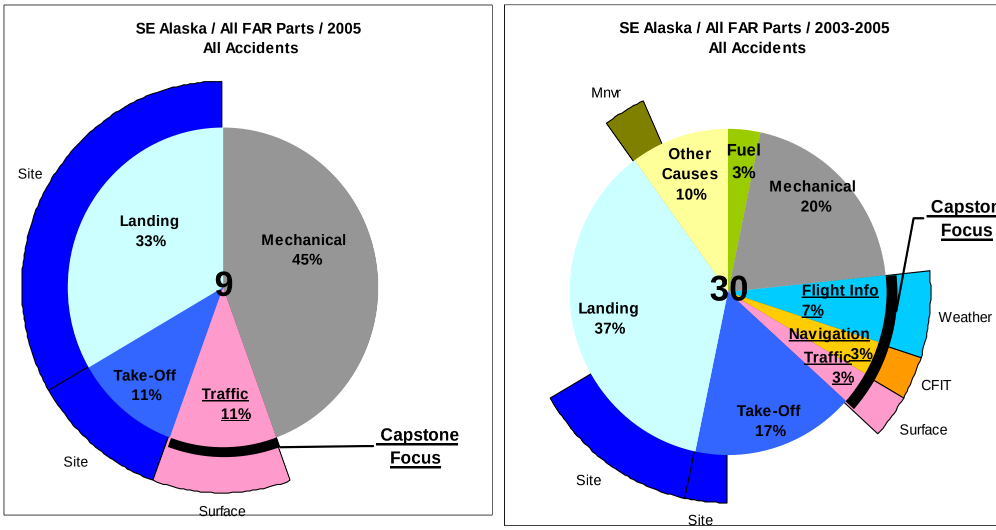


Figure 28 Categories of Accidents in 2005 and Since Capstone Implementation in SE Alaska

Figure 29 shows accident categories for Capstone non-equipped and equipped aircraft since 2003. The breakdown of accidents by major category is essentially similar and within the levels of variation one should expect for this number of occurrences. Details of the Capstone equipped accidents can be found in Section 8.1, Appendix A.

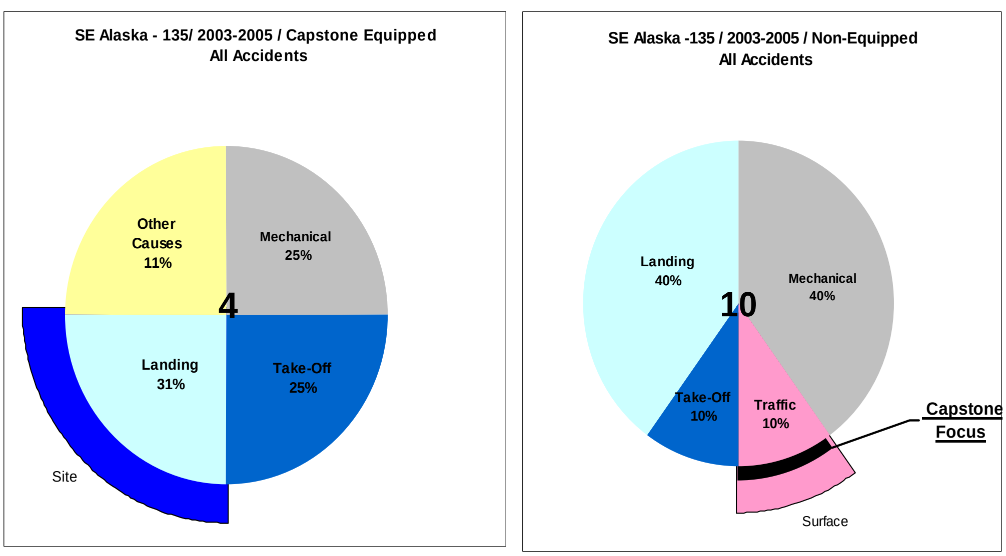


Figure 29 Categories of Accidents by Non-Equipped and Capstone-Equipped Aircraft 2002-2005

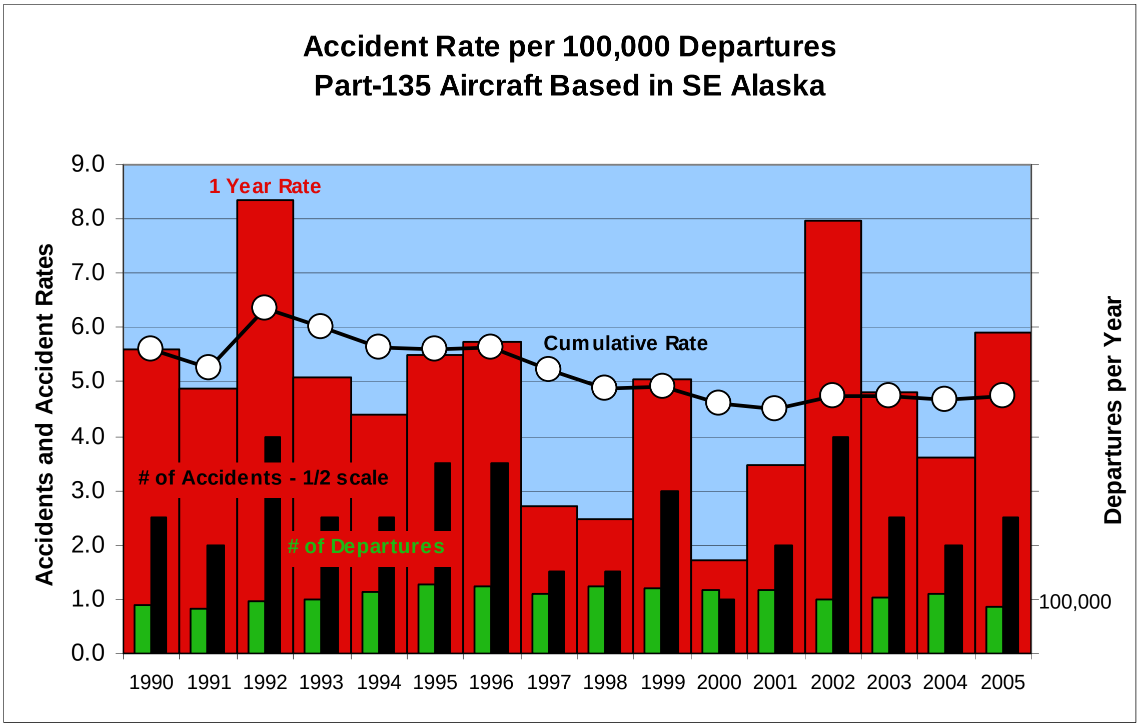
There are two types of Capstone equipage in SE Alaska. One set of equipment is similar to that in Phase 1 where the cockpit has a terrain database, surveillance of similarly equipped aircraft, and weather information provided by ground based transceivers. The second set of Capstone equipment provides only terrain warning and in some cases transmits the aircraft position that aircraft with the first set of equipment can receive and process. It should be noted that all four accidents of equipped aircraft happened to aircraft with the second set of Capstone equipment.

Comparison of SE Alaska Accident Rates to Other Parts of Alaska

The count of accidents in Alaska is determined from NTSB accident reports. However, to estimate an accident rate, one needs to estimate either the number of flight hours or the number of departures or operations that are conducted each year in Alaska. This latter piece of information is not as straight forward to obtain as it is in the Lower 48. To be consistent with the reporting of accident rates in Phase 1 of the Capstone program, the accident rate will be in terms of accidents per 100,000 departures. The current and historical operations data and the methods by which we estimate historical operations counts are described in Section 8.2, Appendix B of the full report.

Figure 30 shows departure count, accident count and accidents per 100,000 departures for Part-135 and Part-121 aircraft in SE Alaska and for all other flights in Alaska. The scales for accident rates (the wide red bars) is the same in both the upper and lower sections of the figure, indicating that over time the accident rate within SE Alaska is comparable to the rate for other parts of Alaska. From year to year, the accident rate in SE Alaska is also much more variable than in the remainder of Alaska.

The continuous curve (black line with white dots) on each chart represents the cumulative total rate of accidents per departure from 1990 through 2005. After the first few years, the cumulative accident rates for the other parts of Alaska have been relatively stable with a slight downturn in the last few years. In SE Alaska the accident rate was generally trending downward until 2002, after which it has become relatively stable. These later years are those in which Capstone equipped aircraft have begun populating SE Alaska.



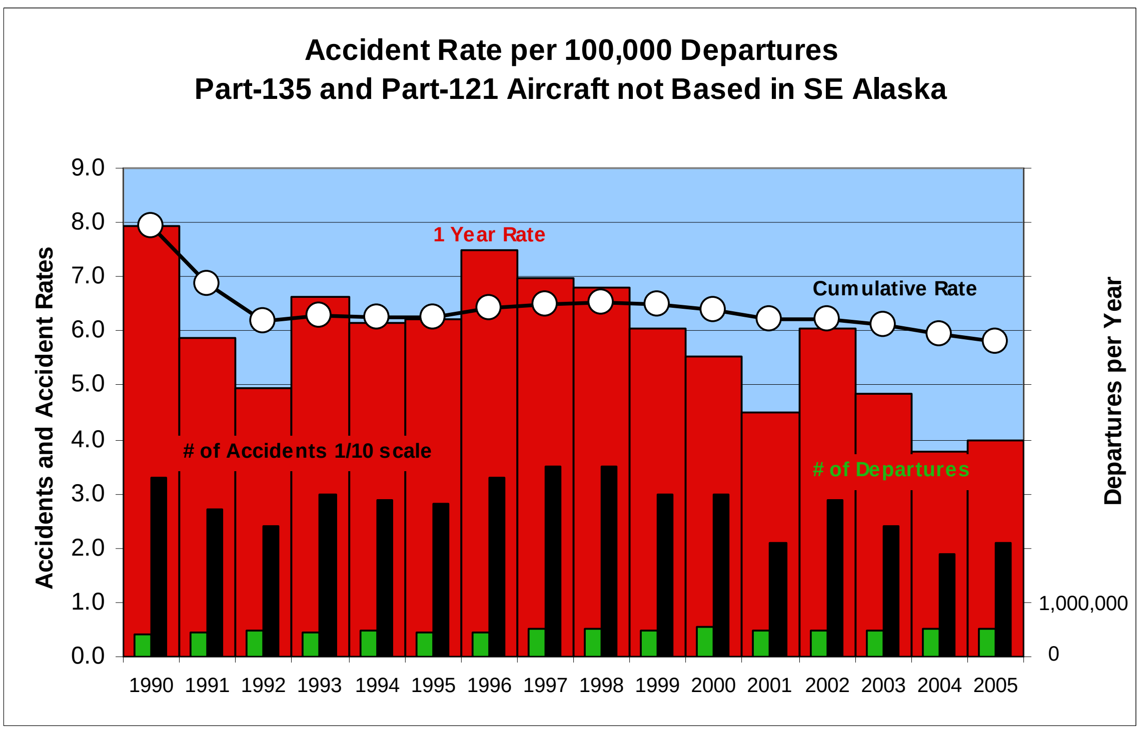


Figure 30. Accident Rates for SE Alaska Part-135 Aircraft and Those Based Elsewhere in Alaska

Comparison of Accident Rates Before, During, and After Equipage/Start of Services

The relative stability of Part-135 accident rates in SE Alaska since 1993 extends through the end of 2005 with an accident rate of approximately 4.8 accidents per 100,000 departures. A time magnified view from 1999 through December 2005 (using daily data) is shown in Figure 31. The black line represents the cumulative accident rate for all Part-135 and Part-121 accidents for aircraft based in SE Alaska. The red line represents the cumulative accident rate for all unequipped aircraft while the blue line represents the cumulative accident rate of the Capstone-equipped aircraft. For the equipped aircraft fleet there were essentially no operations prior to 2003. The first Capstone-equipped aircraft accident in SE Alaska was on September 20, 2004. This was followed with another equipped accident of September 28, 2004 which caused an accident rate for equipped aircraft about double that of the general population. The other two equipped accidents also happened about a week apart in April 2005 causing the accident rate to soar.

The blue curve is obviously more erratic because the accidents are averaged over fewer operations than the red and black lines. The only observation about the equipped accident rate is that the shape and height of the curve are accentuated by the few number of Capstone-equipped operations in the year 2005 and that it is very quickly approaching the overall accident rate in SE Alaska as the percentage of operations of Part-135 aircraft that are equipped has exceeded 70% by the end of 2005.

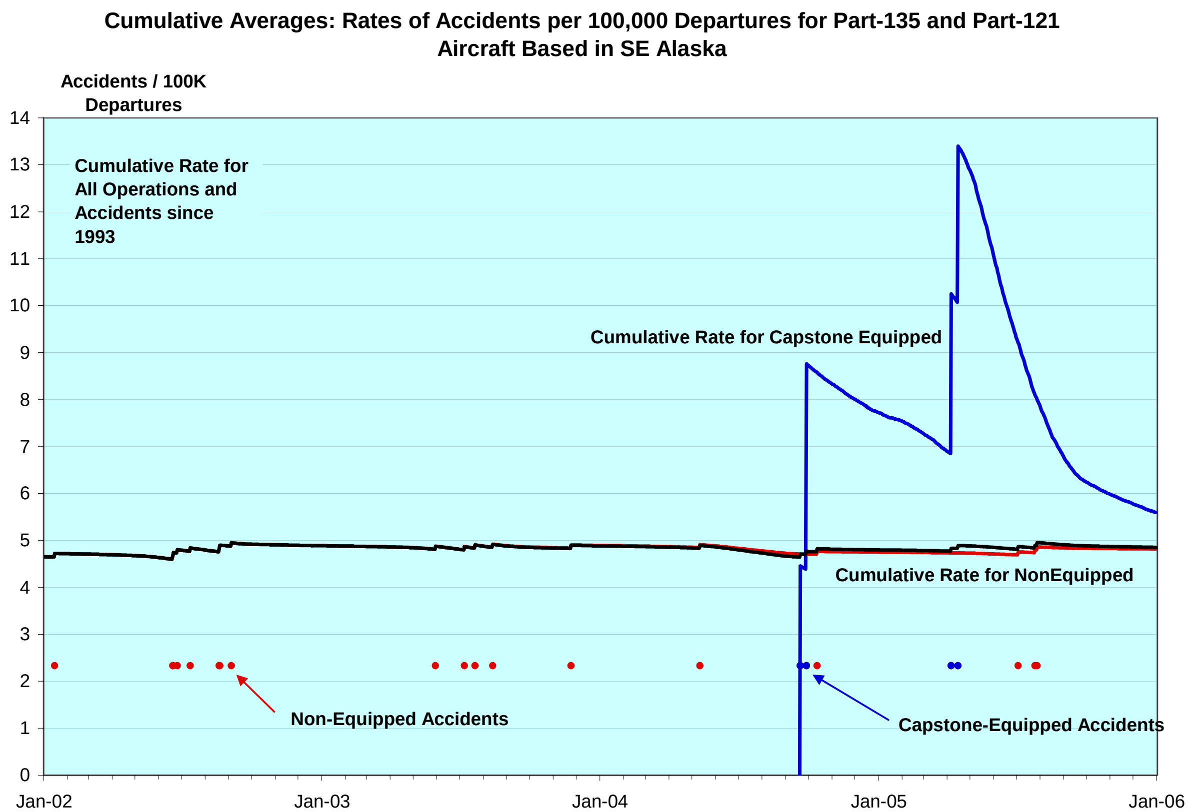


Figure 31. Relative Accident Rates for SE Alaska Commercial Aircraft
<u>With</u> and <u>Without</u> Capstone Avionics

Comparison of Accident Rates Between Operator and Operations Types

Public aviation transport in SE Alaska relies on three major carrier types: Part-121 Air Transport operations which fly larger more capable aircraft with multiple crew members and have comparatively few accidents; Part-135 Commuter operators whose operations include at least some scheduled service; and, Part-135 Charters who are not scheduled. Reporting requirements (and hence, available operations data) are very different between the two Part-135 types.

Accident percentages for scheduled commuters and unscheduled charters are comparable. Figure 32 shows the variation of the percentage of accidents by charters and commuters over time. In any given year in SE Alaska there are only between 2 and 8 accidents by Part-135 operators. Thus, of the 81 Part-135 accidents over the time period between 1990 and 2005, 37 have happened to charter operators and 44 have happened to commuter operators.

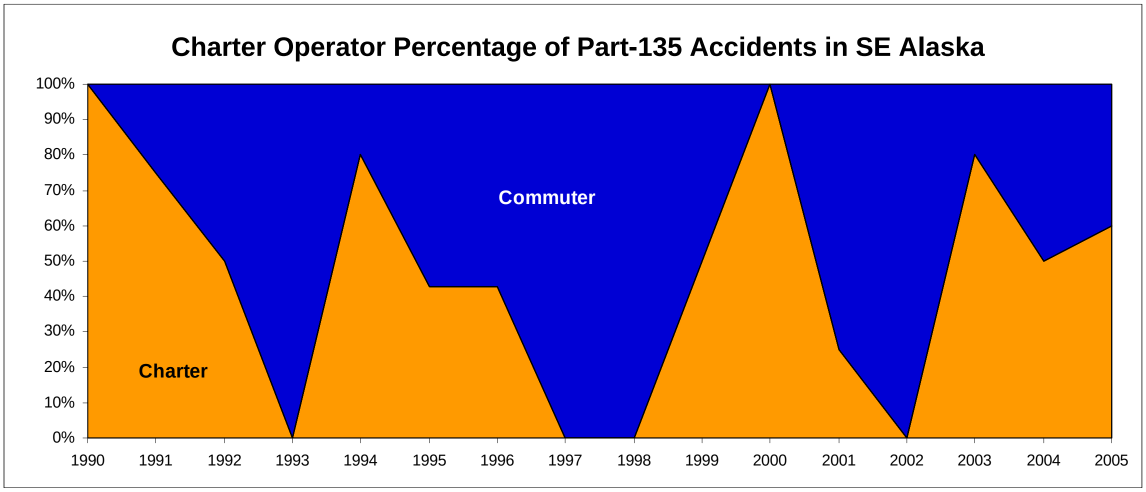


Figure 32 Relative Percent of Accidents for Scheduled/Unscheduled Operators in SE Alaska

Both types of Part-135 operators use non-revenue flights to ferry or position aircraft and to test or train. In addition, commuter operators often fly unscheduled as well as scheduled flights. Figures 33 and 34 show the breakdown of historical and Capstone-era accidents for these operations types.

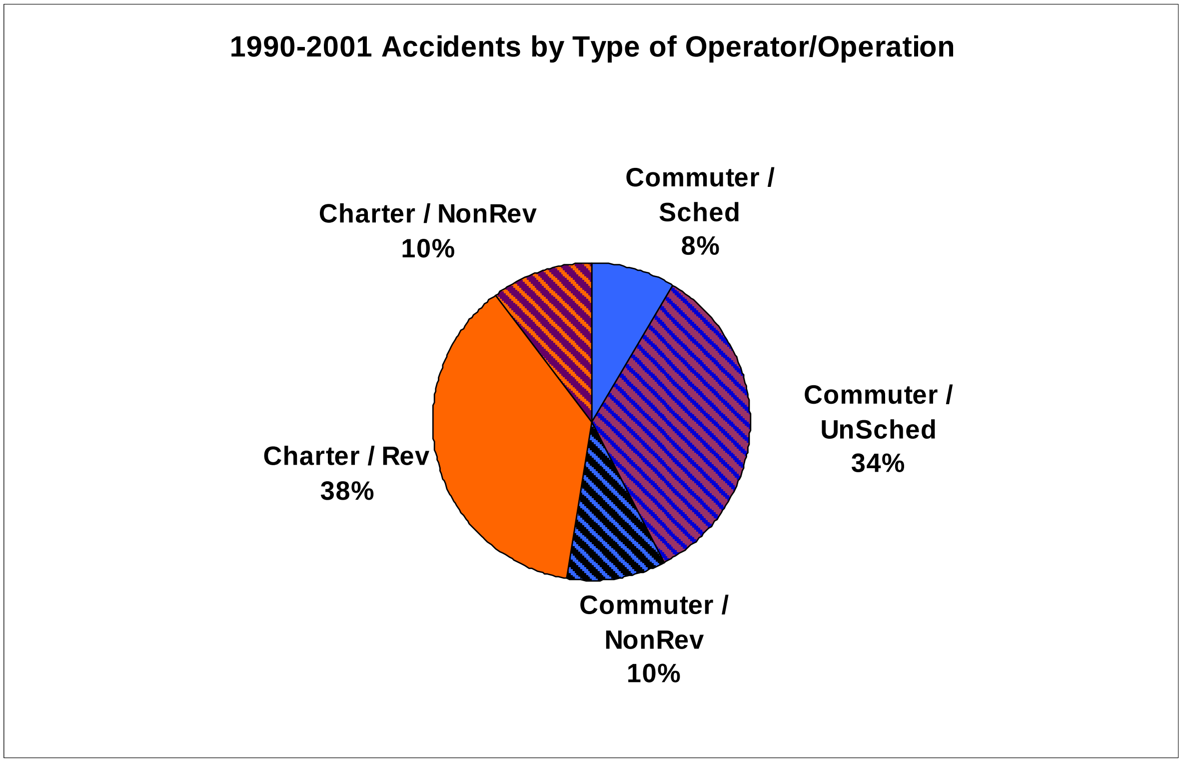


Figure 33. Historical Proportions of Accidents by Operator/Operations Types in SE Alaska

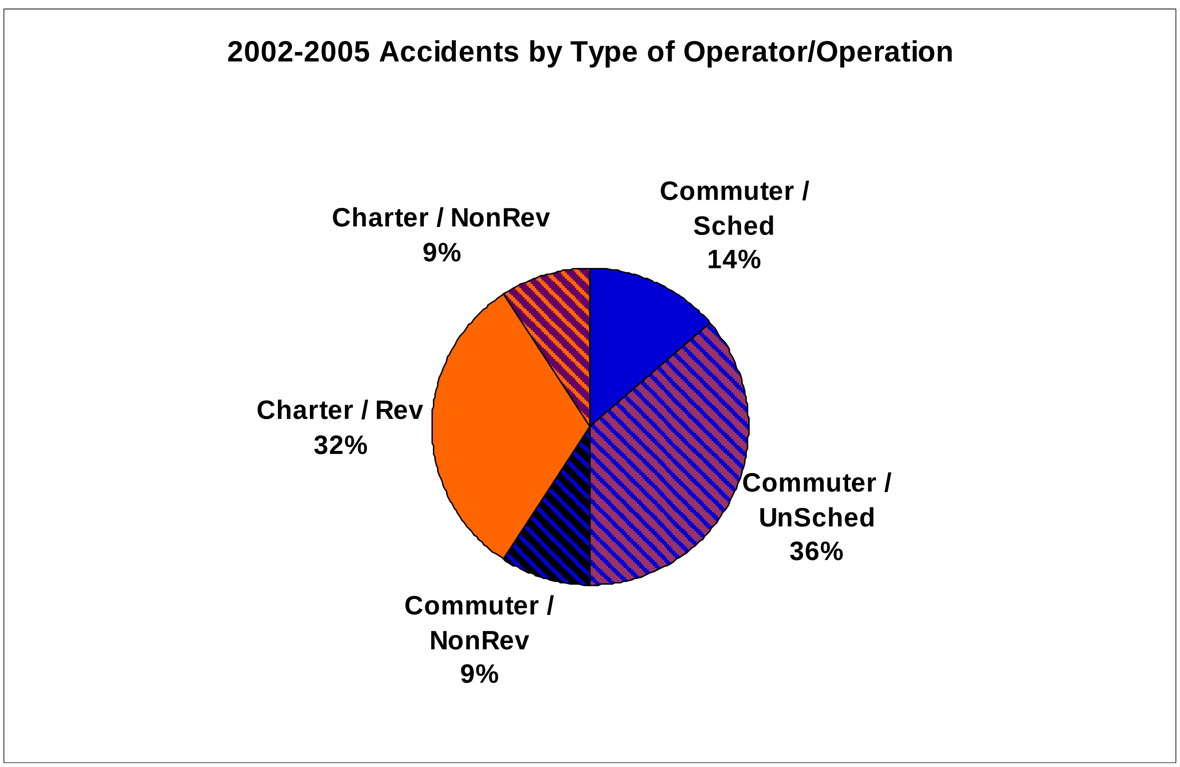


Figure 34. Proportions of Accidents by Operator/Operations Type Since Capstone Implementation in SE Alaska

Conclusions

During 2005, the Capstone Phase II program progressed with sufficient GBTs operating on the developmental network to provide services to the first fully equipped Garmin aircraft. Helicopters will be added in 2006 as the STC is now complete and installations were beginning at the end of 2005. Garmin UATs were added to the Chelton equipped aircraft to allow the fully equipped Garmin aircraft the benefit of “seeing” all equipped aircraft traffic. Chelton software for interfacing with the UATs was not completed in 2005 and this prevents the program from achieving the full benefits of the Capstone avionics. As discussed in the report, there are a number of challenges facing the program and 2006 will be an important year in determining Capstone Phase II success.