Federal Aviation Administration
Alaskan Region

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Capstone Avionics Installation Program

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ALASKAN REGION
Capstone
Investment in Safety

Table of Contents

List of Tables

Chapter 1

Avionics Installation Analysis, Capabilities,

Capacities, Strategies and Planning[1]

1. Overall analysis of the avionics installation.

There are two types of avionics installation facilities in Anchorage Fairbanks and Bethel: operator-owned and independent. Some operator-owned facilities have sufficient capacity to install the Capstone avionics not only in their own aircraft, but also in aircraft owned by other operators (and are willing to do so). This information is based on numerous discussions with avionics installers, with considerable refinement of their estimates over time with more consistency. However, because there have been no installations do date of the exact system, there was considerable uncertainty and a significant spread of estimated installation hours.

Together, all the installation facilities surveyed have a total capacity to install over 200 aircraft from January 1 to June 1, 1999, if all avionics are certified and delivered on time, if almost all Bethel operators without their own installation facilities use Anchorage shops, and there are no unusual circumstances diverting avionics installation resources from Capstone. There is no need to bring in additional installation resources. If delays prevent installations during the winter, capacity will be substantially reduced.

Most installers have excess capacity during the winter, but not during the spring or summer. For this reason, the installations must occur mainly prior to mid-April, and avionics must be delivered on a schedule permitting this. Avionics installation capacity figures by month are as follows:

Month	Total Installation Capacity, both operator-owned and independent (aircraft/month)
December	42
January	42
February	42
March	32
April	22
May	16
June and later	16

Table 1. Installation Capacity by Month

From this table it is apparent that a delay in either certification or delivery of the avionics will have a major impact on the number of aircraft that can be installed with the current capacity of the avionics installation

[1] This document was prepared under contract by: Small Aircraft Transportation Systems (SATS). Snap shots of capabilities and capacities are based on conditions existing from June through October 1999. Specific portions of the SATS report were intended for the exclusive use of the Capstone office to help manage installation costs, and are not found in this release. Three SATS reports were compiled into one document for ease of publication.

shops. If the winter capacity window is lost, then either installations will be delayed for several months (until after the summer flying season) or much more difficult and expensive methods of providing the needed installation capacity will have to be found.

2. Operator-Owned Avionics Installation Facilities

Some likely Capstone operator-participants have operator-owned avionics installation facilities.

a. ERA Aviation expects to equip eight of its aircraft, all Twin Otters, with the Capstone avionics. It has the capacity to install not only its own aircraft, but also other aircraft, and would like to do so. It can complete a total of between 44 and 66 aircraft over the January through May, 2000 time period, depending on whether there are other ERA maintenance jobs that must take precedence, and whether overtime would be paid. This is a good time for installations on other company's aircraft because there is excess capacity in the ERA maintenance facility at this time. ERA can complete two to three aircraft per week, depending on whether overtime is applied and other jobs are delayed. At two aircraft per week for 22 weeks, 44 can be completed; at 3 per week, 66 can be completed. To establish an assured capacity number, we are using a total of 44 installations.

b. If there was a need to install more and FAA was willing to pay overtime, the rate of equipage could be increased. This is a consistent rate, even during the summer, because field mechanics do the light work, and maintenance work in ERA's main facility is not very seasonal. ERA has excellent facilities located at Anchorage International Airport. It is a Part 145 repair station and Part 121 operator, with all the required training, drug testing etc.

   44 aircraft total (minimum).

c. Hageland Aviation Services expects to install 16 of its aircraft, but no aircraft owned by others. It will accomplish these installations at Bethel or St. Mary's, in its hangar facilities.

   16 aircraft total.

d. PenAir expects to equip six of its aircraft, 3 Piper Cherokees, and 1 Navajo Chieftan and 2 CE-208s. PenAir has an in-house, but independent, avionics facility (BCon) which can install all of PenAir's aircraft at its Anchorage facility. See BCon, below, for additional capacity.

   6 aircraft total.

e. Grant Aviation expects to install 21 of its aircraft. It will do all of its own aircraft, but not any aircraft owned by others, in part because of liability concerns. It can install 1/week, and intends to do "piecemeal" installations at night, returning the aircraft to service the next day (at least for part of the installation), and thus keeping the airplanes flying. It will accomplish these installations at its Emmonak maintenance facilities by rotating airplanes from Bethel to there.

   21 aircraft total.

f. Larry's Flying Service expects to install 6 airplanes, and will do all of its own installations at its repair station in Fairbanks.

   6 aircraft total.

g. Ptarmigan Air expects to install 2 airplanes, and will do its installations through a contractor who is its Director of Maintenance.

   2 aircraft total

3. Independent Facilities

a. Aviation Electronics Inc. From January through May, 2000, their excess capacity (over what their normal customers will absorb) is as follows: January through March, they can accommodate 2 aircraft per week; during the months of April and May, they can do 1 aircraft per week.

33 aircraft total.

b. Aviation Specialists of Alaska. From January through May 2000, their excess capacity (over what their normal customers will absorb) is as follows: from January through April 15, they can do 2 aircraft installations per week; then from April 15 to May 1, they can do one per week. None can be installed after May 1.

28 aircraft total.

c. Northern Lights Avionics. From January through May, their excess capacity (over what their normal customers will absorb) is as follows: in January and February they can do 2 to 3 installations per week; in March they can do 1 to 2 per week; and in April they can do 1 per week. None can be installed in May.

29 aircraft total.

d. Joe Prescott. There is one independent avionics installer in Bethel (who is an employee of Hageland Aviation, and also works independently). He believes he can do a total of 10 aircraft of other operators, as in independent contractor (in addition to doing Hageland's aircraft) over the five-month period. He would work out of the operator's hangar, or could lease space from one of the mechanics at the airport.

10 aircraft total.

e. BCon Inc. BCon is a FAA Repair Station within PenAir, and does all of PenAir's avionics repair and maintenance. BCon has a capacity of 1 installation per week, using 1.5 – 2 persons on working on an aircraft. In addition to PenAir's fleet of 6 listed above, BCon believes it can install an additional 30 aircraft over the five month installation period. It is willing to perform installations in Bethel if the 50% higher expenses involved are reimbursed.

30 aircraft total.

4. Owner's Proposed Approach and Schedule

See **Table 2** for listings of likely participating operators, their aircraft by type, and their expected avionics installer. All owners plan on installations from January 1 to June 1, 2000. Note: there may be additional operators, installers and aircraft participating in the program that have not been identified at this time.

5. Permanent or temporary avionics installation and maintenance staffing increases anticipated due to the Capstone Program.

a. Installation

1. No permanent of temporary avionics installation and maintenance staffing increases are necessary in Anchorage. However, it may be necessary to create some additional capacity in Bethel, which will generally (but not always) involved paying an hourly premium of about 50% of Anchorage rates.

2. The major issue to some Bethel operators is the cost of down time for the Capstone avionics installations. Operators with their own maintenance facilities do not appear to have a major problem with the down time, even if the facilities are in Anchorage. In addition, some Bethel operators without their own installation facilities don't mind going to an independent shop in Anchorage because it is their normal maintenance base, or they have other things to do in Anchorage and their airplanes are relatively fast, or can fly IFR, etc. There is sufficient avionics installation and maintenance capacity in Anchorage to handle all Capstone installations on the planned schedule if they are performed in Anchorage on the schedule planned, and no need to increase installation or maintenance staffing from outside Alaska to accommodate Capstone installations.

3. It is not clear if the very limited avionics installation and maintenance capacity currently in Bethel will be sufficient to handle the installations of aircraft of operators which will not participate in Capstone if they have to fly to Anchorage for their installation. In Winter, when the installations will be performed, days are short and slow VFR aircraft (e.g., C-172s, and helicopters) require significant down time to go to ANC, including likely delays returning to Bethel due to bad weather. For these aircraft, it is likely that Bethel installations will be required by some operators as a condition of participation.

4. Bethel operators with such aircraft strongly prefer that the independent avionics installers come to Bethel to perform the installation because of the time their airplane would be out of revenue service if it is taken to Anchorage for the installation (including weather delays). During the low season, estimated revenue loss to the operators per day their aircraft are out of service is 3 hours of lost profits, net of the variable costs saved, this amounts to $660 per day in the low season. In the high season, from April to October, this amounts to $1,320 per day lost profits because of the larger number of hours, 6, typically flown in a day. (These figures are based on an average CE-207 hourly charge of $260, less $40 for variable costs not incurred, resulting in lost profits per hour out of service of $220). These operators currently choose to do all their maintenance in Bethel, with the work done in the evenings and off-hours, to avoid this loss of revenue. They pay the Anchorage shop personnel's transportation and lodging expenses, plus a premium on the labor hours, amounting to a cost increase of about 50%. Similarly, for the Anchorage shops to set up operations in Bethel to perform Capstone installations, they have estimated an increase in their costs of about 50% (transportation, lodging, hangar rental, etc.), which would be recovered by an increase in their hourly labor charge of 50% (from $60 – $90 per hour). There is one installer located in Bethel (Joe Prescott) who charges the prevailing Anchorage rate, without this premium, because he already lives in Bethel and will not incur the additional transportation and lodging expenses, and does not need financial encouragement to winter in Bethel.

5. The operators are concerned with total down time of their airplane, not merely total man-hours working on the plane. It appears that an installer can put 1.5 to 2 technicians on an airplane of the size of a CE-207 at one time. The installers have estimated a range of 3-7 working (week) days for the installation, with an average of 5 days. This does not include intervening weekend days, and does not include any delays waiting for unexpected replacement parts, etc. It also does not include ferry time and time waiting for adequate weather conditions to make the trip back to Bethel.

6. It currently appears that despite this down time cost to the operators enough Bethel operators are willing to take their airplanes to Anchorage, where there is sufficient existing installation capacity, in order to be part of the program, and, therefore, it will not be necessary to cause the creation of additional capacity in Bethel. However, this could change as operators look more closely at their lost revenue because of downtime situation. If more than 10 aircraft need Bethel installations, it will be necessary to attract installers to Bethel, which might require allowing higher maximum reimbursement levels for installations done there (or might not, depending on the complexity of the installations of that particular operator).

b. Maintenance

There is significant operator concern about Capstone system avionics malfunctions, based on the lack of service history of the system, if such malfunctions could cause their aircraft to be inoperative. This is especially a problem where operators will be removing avionics such as GPSs, comm radios, ADFs and DMEs. They want assurance that malfunctions of the Capstone equipment can be addressed immediately at Bethel, without having to seek maintenance services in Anchorage or from Anchorage shops, or UPSAT personnel, traveling to Bethel, as well a MEL relief.

6. Recommendations for industry improvements

Including any additional personnel, avionics installation training, new processes or procedures, or new facilities to accomplish the Capstone Program in accordance with the schedule included in the Capstone Program Plan.

a. Capstone should not need to take action to provide avionics installation personnel from outside Alaska, or even from outside the Anchorage, Bethel and neighboring area pools (e.g., Emmonak), who are employees or contractors of Bethel operators, to provide capacity for Capstone installations.

b. Capstone will not have to provide any special training of installation personnel to install the avionics, beyond clear installation instructions, other than that involved with any special testing equipment, such as for pressure encoder or the UAT transmitter.

c. No new certification processes or procedures will be required.

d. Initially, it does not appear that any new installation facilities or personnel are needed in either Anchorage or Bethel to accomplish the installations because 10 installations can be handled with no additional effort or cost over Anchorage rates. However, if enough Bethel-based operators do not take their aircraft to Anchorage because of the feared long downtime of VFR aircraft, this can be handled in two ways. One avionics technician can do 10 aircraft there during the 5 month installation period. In the alternative, Anchorage shops can send personnel to Bethel. This has been done in the past in order to fix a series of squawks or perform a new radio installation (anything not requiring bench testing). The value of the air transportation and lodging paid by the operator, plus a $10 surcharge on the Anchorage hourly labor rate, amounts to a 50% increase in the hourly cost, which is the same amount quoted by the Anchorage shops as a labor cost per hour increase (from $60/hour in Anchorage to $90/hour in Bethel). As discussed above the cost of sending avionics technicians to Bethel for an installation is far less than the cost to the operators of their aircraft down time. It appears that if installations must be conducted in Bethel, the facilities of operators will be sufficient to accommodate them. In addition, there is some hangar space for lease that could be used to install aircraft for operators who do not have their own hangar.

e. Test equipment for the encoding altimeters and the UATs, and personnel qualified to perform the testing, will probably be needed both in Anchorage and at Bethel, for all aircraft maintained there. Some means of verifying the operation of the UAT at the installation facility is necessary, otherwise the aircraft could be flown back to bethel before it was discovered that transmissions were not being made. If the cause was a faulty wire to the UAT, this coule require the removal of the aircraft interior to fix the problem. In addition, even after the “infant mortality” stage, a subsequent failure back in Bethel could require a trip to Anchorage for this testing (if it was a problem that could not be fixed by a box replacement), or a technician would have to go to Bethel. With up to 150 aircraft with encoding altimeters and UATs, and testing required every two years on the encoders, there will be 1.5 aircraft per week that will need maintenance testing for this alone. FAA must determine if the same standards for encoder accuracy, relating to test periods (every 24 months) and equipment are sufficient for the ADS-B functions included in Capstone, so that conventional test equipment may be used. If not, new test equipment must be procured.

Note: SafeFlight 21 may have similar testing requirements, and it may be possible to reduce test unit acquisition costs by cooperating with their testing contractor or supplier.

f. The program schedule is achievable with current resources, but only if installations begin on time in January and avionics are delivered on schedule to take advantage of the excess installation capacity during the winter. See Table 1 for capacity by month estimates.

7. Capstone Operator Candidates, Aircraft and Installers

Proposed number and type of operator and aircraft and installers within the Capstone area on September 17, 1999 are presented in **Table 2**.

Revised: November 4, 1999

Organization Owner/Contact	**No. A/C**	**Type: Number: VFR/IFR**	**Installer**	**Comments** * Responded to Fax Back or otherwise have info.
Hageland Aviation Services EPUA Ron Tweto, Joe Prescott, Avionics	15 VFR 4 IFR	CE-172: 1 CE-207 or 207A: 14 CE-208B: 3 IFR F-406: 1 IFR	Undetermined. Independent shop	*
Grant Aviation ENHA. Mark Hechel, Jack Allen, Dir. Maint. Bet. Don Christenson, Dir. Maint. ANC	5 VFR 5 IFR	CE-207: 5 PA-31: 5 Navajo IFR	Grant/ Johnson Avionics	*
Yute Air Services YAAA Will Johnson, Mike O'Brien	9 VFR	CE-106:1 CE-207:7 PA 32 300:1	AEI, ASA	*
ERA Aviation ERAA. Dennis Martin	8 IFR	DHC-6: 8: IFR	Self	
Arctic Circle Air Service ACSA Frank Neitz	5 VFR 3 IFR	CE-206; 1 CE-207A: 4 CE-208: 1 IFR SC-7 (Skyvan): 2 IFR	AEI	*
Village Aviation HYQA Bruce Larsen	7 VFR	CE-172: 2 CE-206: 1 CE-207: 4	NLA, AEI	*
Larry's Flying Service FWRA Walt Chapman	8 VFR Incl. rotation	CE-172: 2 CE-206: 1 CE-207A: 2 PA-32-300: 2 BN2A-21	Self, in Fairbanks, full repair station	*
Arctic Transportation Services UATA. Mike Brown, Brian Andrus, Dir. Maint.	4 VFR 2 IFR	CE-207: 4 Casa 212: 2: IFR	ERA for Casa, NLA for VFRs	*
Peninsula Airways (PenAir) PNSA Orin Seibert, Dick Harding	3 VFR 3 IFR	CE-208: 2: IFR PA-32-301: 3 PA-31-350: 1: IFR	BCon	*

Organization Owner/Contact	**No. A/C**	**Type: Number: VFR/IFR**	**Installer**	**Comments** * Responded to Fax Back or otherwise have info.
Yukon Helicopters YUKC Cindy Andrecheck	5 VFR incl. the B-206	CE-172 CE-185 CE-207: 2 B-206 BE-58TC UH1-B	NLA, AEI if in Bethel. Prescott OK. Fast airplanes OK in ANC if 3 days down.	*
Craig Air VDQC Craig Emery	5 VFR Maybe +Twin Bonanz	CE-172 CE-182 CE-207: 3	NLA	*
Ptarmigan Air YGZC Steve Williams	4 VFR	DHC-2: 2 PA-18: 2	Tailwind Aviation	*
Alaska Central Express YADA Mike Murphy	2 VFR	CE-207A: 2		
Cub Drivers D20C Deal Hilde	1 VFR	CE-185: 1		*
Kusko Aviation KUSA Fuzzy	3 VFR	CE-207:1 PA-32-300: 2		
Hangar One Air H1YC. Harry Faulkner	1 VFR	CE-206		*Not sure if he wants to participate.*
Kuspuk School District K1SM	1 VFR	CE-172		
Neitz Aviation NZYC. Frank Neitz	1 VFR	CE-185	NLA	*
Tanana Air Service BTHA. Fred Ciarlo	1 VFR Aniak	PA-32-260	Galena Avionics in FRB	*
Richard Townsend R9TC. Richard Townsend	1 VFR	DHC-2		
Vanderpool V5PC. Robert W and Gail Vanderpool	1 VFR	CE-185		
Walters W9GC. George Walters	1 VFR	CE-185: 2	NLA	*
Alaska State Troopers Steve Elwell 243-1596 Doug Norris 248-1410	1 VFR	CE-207: 1	ASI	
Frontier Flying Service Bob or John Hajdukovich 474-0014				
Total VFR Total IFR Total VFR and IFR	84 VFR 25 IFR 109			

Organization Owner/Contact	No. A/C	Type: Number: VFR/IFR	Installer	Comments * Responded to Fax Back or otherwise have info.
Total Confirmed; Master List	91			

Table 2 Participating Company, Aircraft and Installers

Notes:

1. All aircraft are VFR unless designated IFR.
2. Selection criteria: Aircraft expected to spend at least 50% of flight hours in Bethel/Capstone area over the year, or be on a regular rotation into Bethel for maintenance replacements.
3. Additional details will be gathered for Report E-1.

Chapter 2

Strategic Planning for Capstone Avionics Installations

1. Strategic Approach.

The recommended strategic approach is contained in this document. Manner and timing of installation selected by each operator-participant.

a. General:

1. The "manner and timing" of the installations is specified by stating the preferred installer and scheduled installation week (specified by the month and day of the Monday of that week, e.g., "1/17") for each participating aircraft.

2. The planning for installations, and the actual installation schedule, are governed by five factors, which will vary by week.

3. The number of avionics ship sets delivered by UPSAT.

4. The capacity of the installers to make Capstone installations during that week.

5. The dates selected by operators to minimize their costs, including scheduling downtime for the avionics installation during a scheduled major maintenance activity.

6. The priority system selected to accommodate operator installation preferences that exceed available installation capacity or avionics deliveries in that week.

7. A contingency system to account for unplanned changes in: avionics delivery schedules, actual installation capacity, or operator aircraft availability.

b. Avionics Delivery and Installation Approval Schedule

Avionics Delivery Schedule. UPSAT is obligated under its contract with FAA to deliver 133 ship sets under the following schedule:

1. 20 ship sets on 1/10/00,

2. 35 ship sets on each of the following dates: 2/9/00, 3/10/00, 4/8/00, 5/9/00.

3. On this schedule, capacity for 20 installations will be lost during the first half of January. However, there is still sufficient capacity to complete all installations by June 1 if 20 more are delivered on 2/1/00 and the balance are delivered on 2/15/00.

4. Expected avionics installation approval dates are as follows:

- GX50/60: TSO is completed; STC expected 11/22/99; PMA expected 12/6/99.

- MX20: TSO 12/21, STC expected 12/21/99, PMA expected 12/24/99.

- UAT: STC expected 12/21/99, PMA expected 12/24/99.

2. Capacity of installers.

There have been changes in installation capacity during the report generation period.

a. Hageland's avionics person has left the company. Hageland will therefore be using one of the independent avionics installation shops for their 16 installations.

b. Hageland's avionics person also was going to perform 10 installations in Bethel as an independent installer, and this capacity is also lost.

c. ERA has less capacity than previously estimated because of higher demand for existing customers. ERA can perform 1.5 installations per week, rather than the previously estimated 2 per week, for a loss of 11 installations.

d. Grant will install 10, rather then the previously estimated 21, for a loss of 11.

e. Larry's Flying Service is able to install not only its eight aircraft, but also another three per week, in Bethel, for a total of 60 additional installations.

The net result of this is:

a. Total installation capacity (Anchorage, Fairbanks, Bethel, etc.) is 238 ship aircraft.

b. Bethel installation capacity is 60 to 90 aircraft, but at a probable installation cost increase of 10 – 50%.

3. Operators Preferences: Selected Installer, Scheduled Maintenance, Installation Dates

Of the approximately 120 aircraft currently indicated by operators to be installed, approximately 30 will be installed by the operator itself, and the other 90 aircraft will be installed by operators who are installing avionics for other operators and by independent avionics shops. When avionics deliveries are insufficient to meet installation operator demand and shop capacity, available avionics should be provided to operator/installers and independent installers in a manner to maximize overall (over 5 months) installation capacity.

Operators were queried by a Fax-Back Form in October about participating aircraft, expected major maintenance dates, and preferred installation schedule. As of the date of this report, October 22, 1999, 12 operators had responded to this query and their information is included in this report.

4. Neutral Priority System

In the event that more than one operator requests installation by the same installer at the same time in excess of the installer's capacity to perform installations, a method of deciding which aircraft will be installed on the preferred date will be established. The criteria for making this decision will be in "layers", with more important factors being assessed first, less important later, until all conflicts are resolved. The objectives in creating this priority system are to result in the lowest total expense to operators and to have a neutral method that is fair across all classes of operators. Aircraft should be scheduled when the operator signs a letter of intent to participate under the terms of the Owner Agreement.

The criteria layers are as follows:

a. Annual flight hours in the Bethel area.

b. Whether the aircraft is based at Bethel.

c. Whether it has a scheduled major maintenance activity the week installation is requested.

d. Alphabetical order by name of operator.

5. Contingency System

If there are unplanned changes in avionics delivery schedules, actual installation capacity, or operator aircraft availability, contingency plans will be as follows:

a. Early avionics deliveries. Operators will be informed that earlier installations are possible and will be asked to volunteer for earlier installations. UPSAT should know 30 days before 1/15/00 if avionics can be delivered earlier than the contract dates listed above.

b. Late avionics deliveries and consequent reduced installation capacity. Operators should be called to see who is most disadvantaged by the delay that would result from rescheduling, and schedule adjustments should be made based on this information to minimize operator loss.

6. Accountability for property.

a. All avionics should be shipped from UPSAT, FOB Anchorage, direct to an installer location specified by the FAA. The mechanism for directing the shipment should be an e-mail message sent to Larry Lichtenberger (Larry.Lichtenberger@at.UPS.com), the UPSAT Capstone Program Manager, that releases an Order against the Purchase Agreement with a specified installer and location and identifies the operator and the airplane N-number. He will transmit the order to the UPSAT order entry system, which will cause the avionics ship set(s) to be shipped.

b. All avionics will be shipped via UPS, which tracks all of its shipments, and delivery can be confirmed through a signature of the party accepting the shipment. This will insure that avionics are accounted for from the time the order is released until accepted by the installer.

c. Each operator/installer to whom avionics are shipped shall be responsible for the security of the avionics from the time they sign for them. This should be a normal commercial responsibility, as applies whenever UPSAT ships products to any operator/installer. The operator/installer should provide a receipt to the FAA for each set of avionics when received from UPSAT.

d. In order to keep track of all of the Capstone avionics, the FAA should employ the methods customarily used by the Airway Facilities to track FAA property.

7. Transportation and secure storage costs minimization.

The UPSAT contract provides for delivery FOB to the operator/installer. Thus, the UPS shipping charge is paid by UPSAT. There should be no storage costs, as the avionics will be delivered when needed to the operators/installers. If avionics deliveries occur in advance of the dates required by the contract, the installation schedule should be accelerated, which will avoid any lengthy storage time.

8. Procedure for submission of approved Form 337, and a detailed breakdown of actual installation cost, and invoice.

The installer should submit the Form 337 directly to the FAA to return the aircraft to service. The process regarding installation cost and invoicing should be as follows:

a. Before any installation work is done, the installer will perform an assessment of the aircraft and prepare a written estimate of the time and materials to accomplish the Capstone installation on the aircraft.

b. The installer will fax the estimate to both the FAA Capstone Program office and to the operator.

c. If the estimate is acceptable to the Capstone office a letter authorizing installation will be FAX'ed, and the installation may proceed without any further approval.

d. If the estimate is not acceptable to the Capstone office, the operator will be given the option of paying the difference. If the operator agrees to pay this difference, the installation will proceed. If the operator does not agree to pay the difference, the FAA will pay for the assessment and the aircraft will be removed from the program.

e. Once the installation has begun, if the installer determines that the actual installation cost is likely to exceed the cost estimate based on the initial assessment, the installer must contact the FAA and operator immediately to discuss the amount of and reasons for the excess cost. If the revised cost estimate exceeds the Maximum Sum, go back to step 3 above.

f. Once the installation is complete, the most direct and expeditious method of payment should be employed to pay the installer, such as electronic funds transfer or credit card.

9. Configuration Management process to track by N-number and avionics serial number, status of hardware and software upgrades.

Configuration management is the method used to keep track of any hardware or software modifications of a particular avionics unit. UPSAT has a data-base for tracking all of the avionics they have sold, by their serial number. The avionics are tracked forever, including all hardware and software changes to each unit. The FAA can access this data-base by requesting UPSAT to perform a search by customer, in this case Capstone, and, therefore, does not need to establish a separate configuration management system.

10. Minimize downtime and owners inconvenience.

The principal means for minimizing downtime and owner inconvenience are:

a. Having a schedule for each installer, listing the aircraft to be installed by week.

b. Performing installations in Bethel, especially for slower aircraft.

c. Minimizing the involvement of operators who are not performing installations in the invoicing and payment actions. It is recommended that the FAA be invoiced directly by the installer and make payment directly to the installer, without any payment documents going through the operators. Installers would like to have en Electronic Funds Transfer made directly to them for the payment.

11. Optimum sequence of equipment installation

In general, it appears the operators may want to schedule specific aircraft for installation depending on what they expect the demand for that airplane on that week. Also, it appears that operators will want to spread out the installation downtime, by doing one airplane on week 1, then skipping week 2, then doing another airplane on week 3, skipping week 4, etc.

12. Correlate with routine maintenance.

Operators have been queried about scheduled major maintenance, and this will be one of the priority selection criteria.

13. Potential for return to service after partial installation.

Piecemeal installations are planned by some operators. They would be convenient where there is a maintenance facility where the aircraft are based where the avionics could be installed. These types of installations will not require any FAA planning action.

14. Management of subsequent repair work by manufacturer under warranty.

UPSAT is providing a 3-year warranty, from the date of first installation (the warranty period is not extended by the performance of any warranty work). A currently unresolved issue is whether the FAA or UPSAT will pay to ship units in need of repair from the location where they are removed from aircraft to Salem, OR. UPSAT will pay to ship them back to the operator after the repair is made.

There is no provision for on-site repair by UPSAT. Avionics must be removed and shipped to UPSAT for repair as described above. There is no provision for reimbursement for the cost of removal and reinstallation of avionics in need of repair, but removal of the panel units or UAT should take only a few minutes. The FAA should have a few ship sets of avionics on hand in Bethel for immediate replacement of units needing repairs.

15. Other Issues

ADS-B Transmission Testing Apparatus. There is no provision for testing apparatus in the UPSAT contract. If the ADS-B transmission system is not operating properly (such as because of a damaged cable to the UAT unit) and this is not discovered until the aircraft is back in Bethel (and fails to communicate with the ground units there), it may be necessary to remove the aircraft interior to address the problem. In addition, it is not clear how the airplane may be returned to service until the proper function of the UAT is ascertained.

The ADS-B transmissions can be tested by the installer before the interior is reinstalled by installing a UAT unit in each city where installations are being performed, and using this to verity accurate ADS-B transmissions. For example, in Anchorage, the first ship set should be installed with an antenna on top of the Capstone office building, and a display in the Capstone office which would show the location of any Capstone aircraft transmitting its position. The installer would call the Capstone office during normal business hours to verity transmissions from the proper GPS coordinates at the installer's location.

16. Master Installation List

This document provides the Master Installation Schedule for Capstone Avionics. It will be revised by the Capstone office as more operators indicate their intent to participate, and their preferred installation weeks and installer.

a. The first entry on each page states the delivery schedule of avionics under the FAA's contract with UPSAT, and the number of units that can be installed by week based on these deliveries.

b. The other entries on each page are the installation slots by week for that shipment of avionics.

c. If avionics are delivered in advance of the contract schedule, installations can be advanced, but the order of installations will be as provided in the list, unless operators opt to move down the list.

d. Aircraft have been placed on the first version of the list based on responses to the Fax-Back Forms, provided by October 15.

e. Where more installations are requested that there is capacity for, either because of delivery limitations or because of avionics shop limitations, aircraft will be selected based on the following priority method:

- Annual flight hours in the Bethel area.
- Whether the aircraft is based at Bethel.
- Whether it has a scheduled major maintenance activity the week requested.
- Alphabetical order by name of operator.

Revised: October 28, 1999

Installation Master List

Week	Operator Name	Operator Identifier	Aircraft Type / Number	Installer	Installer Designator
1/10	**UPSAT 20**				
1/10	Capstone				
1/10	PenAir		CE-208 / N9481F	PenAir BCON	
1/17	PenAir		PA-31 / N15PR	PenAir BCON	
1/17	Grant		CE-207 / N9973M	Grant	
1/17	Ptarmigan		DHC-2 / N144Q	Tailwind	
1/17	Ptarmigan		PA-18 / N8976D	Tailwind	
1/17	Hageland		CE-207 / N104K		
1/17	Yute		CE-207 / N73036		
1/24	Grant		CE-207 / N1864	Grant	
1/24	Ptarmigan		DHC-2 / N73Q	Tailwind	
1/24	Ptarmigan		PA-18 / N7513K	Tailwind	
1/24	Yute		CE-207 / N1704LL		
1/24	Larry’s				
1/24	CraigAir		CE-172 / N20109	(Bethel)	

1/31	PenAir		PA-32 / N81844	PenAir BCON	
1/31	Grant		CE-207 / N1581U	Grant	
1/31	Hageland		CE-207A / N7373U		
2/7	Grant		CE-207 / N48CF	Grant	
2/7	Hageland		CE 207A / N6439H		
2/7	Yute		CE-207 / N9933M		

Week	Operator Name	Operator Identifier	Aircraft Type / Number	Installer	Installer Designator
2/9	**UPSAT 35**				
2/14	PenAir		CE-208 / N9530F	PenAir BCON	
2/14	Grant		CE-207 / N562CT	Grant	
2/14	Hageland		CE-207A / N327CT		
2/14	Larry's				
2/14	CraigAir		CE-182 / N6736M		
2/14	Arctic Circle		CE-207 / N917AC	AEI or NLA	
2/14	Arctic Circle		CE-207 / N6080H	AEI or NLA	
2/14	Arctic Circle		SC-7 / N1906	AEI or NLA	
2/14	Tanana		PA 32-200 / N4798S	Galena Avcs	
2/21	Grant		PA 31-350 / N27472	Grant	
2/21	Hageland		CE 207A / N9499M		
2/21	Yute		CE-207 / N7336U		
2/21	CraigAir		CE-207 / N91170		
2/21	Cub Drivers		CE-185 / N2658S	Tailwind	
2/21	Arctic Trans		CA-212 / NN424CA	ERA	
2/21					
2/21					
2/21					

2/28	PenAir		PA-31 / N27663	PenAir BCON	
2/28	Grant		PA 31-350 / N4105D	Grant	
2/28	Hageland		CE-172L / N7564G		
2/28	Larrys				
2/28	Craig		CE-207 / N91193		
2/28	Yukon		CE-207 / N7318U		
2/28	Arctic Trans		CA-212 / N437CA	ERA	
2/28					
2/28					
3/6	Grant		PA 31-350 / N77HV	Grant	
3/6	Hageland		CE-207 / N207SE		
3/6	Yute		CE-107 / N755AB		
3/6	CraigAir		CE-207A / N91190		
3/6	Yukon		CE-207 / N91060		
3/6	Arctic Trans		CE-207 / N9956M	NLA	
3/6					
3/6					

Week	Operator Name	Operator Identifier	Aircraft Type / Number	Installer	Installer Designator
3/10	**UPSAT 35**				
3/13	PenAir		PA-32 / N8259V	PenAir BCON	
3/13	Grant		PA 31-350/ N27739	Grant	
3/13	Hageland		CE-207A / N17GN		
3/13	Larrys				
3/13	Arctic Circle		CE-207 / N73467	AEI or NLA	
3/13	Arctic Circle		CE-207 / N9936M	AEI or NLA	
3/13	Arctic Circle		SC-7 / N2088Z	AEI or NLA	
3/13	Arctic Circle		CE-206 / N456ta	AEI or NLA	
3/13	Arctic Trans		CE-207 / N73217	NLA	
3/20	PenAir		CE-208 / N9602F	PenAir BCON	
3/20	Grant		PA 31-350 / N12721	Grant	
3/20	Hageland		CE 297A / N9869M	Hageland	
3/20	Yute		CE-207 / N6470H		
3/20	Yukon		CE-172 / N48106		
3/20	Tanana		PA 32-200 / N4803S	Galena Avcs	
3/20	Arctic Trans		CE-207 / N26TA	NLA	
3/20					
3/20					

3/27	Hageland		CE-207A / N5277J		
3/27	Larry’s				
3/27	Yukon		CE-185 / N2997		
3/27	Arctic Trans		CE-207 / N9475M	NLA	
3/27					
3/27					
3/27					
3/27					
3/27					
4/3	PenAir		PA-32 / N82455	PenAir BCON	
4/3	Hageland		CE-207 / N23CF		
4/3	Larry’s				
4/3	Yute		CE-107 / N7384L		
4/3	Yukon		B-206 / N150HH		
4/3					
4/3					
4/3					

Week	Operator Name	Operator Identifier	Aircraft Type / Number	Installer	Installer Designator
4/8	**UPSAT 35**				
4/10	Hageland		CE-207A / N7340U		
4/10	Larry's				
4/10	Arctic Circle		CE-207 / N9965M	AEI or NLA	
4/10	Arctic Circle		CE-207 / N916AC	AEI or NLA	
4/10	Village Air		CE-207A / N73894		
4/10					
4/10					
4/17	Hageland		CE-207 / N7326U		
4/17	Yute		CE-206 / N60491		
4/17	Larry's				
4/17	Village Air		CE-207A / N73188		
4/17	Neitz Aviat.		CE-185 / N4710Q	NLA	
4/17					
4/17					
4/24	Hageland		CE-207 / N75703		
4/24	Arctic Circle		SC-7 / N101WA	AEI or NLA	
4/24	Village Air		CE-207A / N6314H		
4/24					

4/24					
4/24					
4/24					
5/1	Hageland		CE-207 / N6207		
5/1	Yute		PA 32-300 / N4466T		
5/1	Arctic Circle		CE-208 / N5187B	AEI or NLA	
5/1	Arctic Circle		CE-207 / N7305U	AEI or NLA	
5/1	Village Air		CE-207A / N6312H		
5/1					
5/1					
5/8	Hageland		CE-208B / N407GV		
5/8	Village Air		CE-207A / N1668U		
5/8					
5/8					
5/8					
5/8					
5/8					

Week	Operator Name	Operator Identifier	Aircraft Type / Number	Installer	Installer Designator
5/9	**UPSAT 35**				
5/15	Hageland		CE-208B / N411GV		
5/15	Village Air		CE-206 / N7353Q		
5/15	G. Walters		CE-185 / N1576H	AE	
5/15					
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5/15					
5/15					
5/15					
5/22	Hageland		CE-208B / N1232Y		
5/22	Village		CE-172N / N73788		
5/22					
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5/22					
5/22					

5/22					
5/22					
5/22					
5/22					
5/22					
5/22					
5/29	Hageland		F-406 / N406GV		
5/29	Village Air		CE-172N / N476620		
5/29					
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5/29					

Table 3 Installation Master List.