Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

AVIATION INVESTIGATION REPORT
A09C0012

COLLISION WITH TREES ON MISSED APPROACH

SKY NORTH AIR LTD.
BEECH 100 C-GNAA
ISLAND LAKE, MANITOBA
16 JANUARY 2009

Canada

Aviation Investigation Report

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Report Number A09C0012

Summary

The crew of a Sky North Air Ltd. Beech 100, (registration C-GNAA, serial number B 24) was on a re-positioning flight from Thompson to Island Lake, Manitoba. On arrival in the Island Lake area, the crew commenced an instrument approach to Runway 12. On the final approach segment, the aircraft descended below the minimum descent altitude and the crew initiated a missed approach. During the missed approach, the aircraft struck trees. The crew was able to return for a landing on Runway 12 at Island Lake without further incident. The two crew members were not injured; the aircraft sustained damage to its right wing and landing gear doors. The accident occurred during hours of darkness at approximately 2110 Central Standard Time.

Ce rapport est également disponible en français.

Other Factual Information

History of Flight

On the evening preceding the accident, the crew of C-GNAA had been called at about midnight for a medical evacuation (medevac) flight to Winnipeg, after which they returned to Island Lake. They were released from duty in Island Lake at approximately 0700 [1] on the morning of the accident. They were called at about 1900 later that day for another medevac flight to Thompson and return. The flight to Thompson was uneventful. The occurrence flight departed Thompson for Island Lake at 2020.

The 2100 routine weather observation at Island Lake was as follows: wind 150° true at 7 knots, visibility 2 statute miles in light snow, ceiling of broken cloud at 2000 feet above ground level (agl), overcast cloud at 5000 agl, temperature -17°C, dew point -20°C, altimeter 29.72 inches of mercury.

There are three published instrument approaches at the Island Lake airport: a NDB approach to Runway 30; an Area Navigation (RNAV) approach to Runway 30; and a RNAV approach to Runway 12 (See Appendix A - RNAV Approach Runway 12 Island Lake). The wind and direction of flight were favouring Runway 12. Prior to commencing descent, the pilots decided that a straight in RNAV 12 instrument approach would be their best choice to avoid the NDB Runway 30 approach.

The first officer was the pilot flying (PF) and briefed the captain as to how they would fly the approach. The captain, the pilot not flying (PNF), selected direct to the REVEK initial approach fix on the Global Positioning System (GPS) [2], and tuned the automatic direction finder (ADF) receiver to the Island Lake non-directional beacon (NDB). The crew did not calculate a cold temperature correction to be applied to the minimum safe altitudes for the approach.

At 35 nautical miles (nm) from the Island Lake Airport, the captain manually armed the approach on the GPS unit. The aircraft crossed the REVEK initial approach fix at approximately 3000 feet above sea level (asl) and intercepted the inbound track of 121°. The aircraft crossed XESIK at 2000 feet asl. The flaps were set to approach at approximately seven nm on final approach. The landing gear was selected down at UKUGA (5 nm from the runway) which they crossed at 1500 feet asl. At this point the captain applied an estimated altitude correction of approximately 40 feet by selecting a minimum descent altitude (MDA) of 1200 feet asl [3] in the aircraft's altitude alerter [4] and silenced the aural warning. Shortly afterward the captain

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1 All times are Central Standard Time (Coordinated Universal Time minus six hours).

2 The GPS unit on board C-GNAA was a King KLN- 90B.

3 The published MDA for this approach is 1160 feet. Setting 1200 feet in the alerter resulted in a 40 foot temperature correction where a 50 foot correction was required by reference material in the Canada Air Pilot.

4 Approach procedures are designed such that the published minimum altitudes provide obstacle clearance. The segment of the approach where the accident occurred was the final approach segment where the minimum obstacle clearance required was 250 feet.

increased the propeller rpm to 1900. At approximately 3 nm from the runway, the PF requested that the flaps be set to 60%. Selection of landing gear, propeller rpm, and 60% flap all occurred within a short period of time.

Once the flaps were set to 60%, the captain briefly looked outside to see if the runway environment was visible. While doing so, he missed calling both '100 feet above' and 'at MDA' as required by the SkyNorth *Multi Crew Standard Operating Procedures* (SOPs). As he refocused his attention to the instruments, he noted that the aircraft had descended to 1000 feet asl (200 feet below MDA) and called out as much to the PF. There was no response from the first officer. The aircraft descended further to 900 feet asl and the captain indicated that they were too low and that they should pull up because of trees, and took control of the aircraft. As the captain looked outside, the first officer glanced at the GPS unit to check his lateral tracking. This interrupted his normal scan. When he attempted to resume his scan he had difficulty immediately reading his altimeter. The captain initiated a missed approach; however, while climbing away, the aircraft struck trees at an elevation of approximately 840 feet asl located approximately 2.5 nm from the threshold of Runway 12 with its right wing and landing gear doors. The aircraft was able to climb to 2000 feet asl and continue to a landing on Runway 12 without further incident.

Flight Crew

Records indicate that the flight crew were certified and qualified for the flight in accordance with existing regulations. The captain had approximately 3200 hours total flying time with 500 hours on type. He had been working for SkyNorth for approximately eight months. The first officer had 1200 hours total flying time with approximately 620 hours on type. He had been employed with the company for approximately seven months. The crew's work schedule was 5 days on with 4 days off away from base. While the crew had the required rest period between flights as set out in the *Canadian Aviation Regulations* (CARs), they found it difficult to sleep at the company accommodations. There is insufficient information to suggest that fatigue was a factor in this occurrence.

Pilot Training

SkyNorth has been in operation since December 2005. At the time of the occurrence it operated two Beechcraft King Air 100s and one Piper PA-31 Navajo Chieftain aircraft. SkyNorth does not have a formal training department. All training was overseen by the chief pilot who also performed other duties, including assisting the operations manager.

The ground portion of SkyNorth's pilot training program is mainly web-based and is comprehensive. It includes subjects such as aircraft systems, company training manuals including SOPs, occupational safety and health, dangerous goods, and critical surface contamination. This web-based training program is hosted by a third party and is used to address the training needs of all SkyNorth employees, not just its pilots.

Many operators that use computer or web-based training are large airlines and commuters that also conduct practical flight crew training in an aircraft simulator. In a simulated environment, training crews and instructors do not have to deal with other airborne traffic and there is no risk of a serious accident. Crews can be exposed to a wider range of emergency situations as

compared to training in an aircraft. Simulator training can also be used to enhance and evaluate crew understanding of SOPs. SkyNorth did not provide simulator training for its pilots; the flight portion of pilot training was conducted on actual flights in the aircraft.

The CARs require captains to have a pilot proficiency check (PPC). SkyNorth hired pilots who either possessed a PPC on type acquired at another operator or hired pilots that did not have a current PPC. Those captains in possession of a PPC acquired from another operator did not require a new PPC with SkyNorth. Captains requiring a PPC would undergo flight training, followed by a PPC administered by a Transport Canada (TC) approved check pilot (i.e. non-company), with the Sky North chief pilot performing co-pilot duties. Training for the PPC was conducted by a company training pilot. PPCs are valid for one year but can be extended for another year by completing annual training specified in the company operations manual.

New captains at SkyNorth received supervised line flying [5] of approximately 25to 50 hours with the chief pilot or senior line pilot, prior to being assigned flight duties with regular line pilots. This line training was conducted on revenue flights with passengers and therefore did not involve practice emergencies.

First officers did not require a PPC, but were given a pilot competency check (PCC) by the chief pilot. This was also followed by line flying with the chief pilot or senior line pilot prior to being assigned regular flight duties. Due to workload, the chief pilot had little time for follow up, to provide any additional training or to conduct line checks on all pilots.

SkyNorth was not approved to conduct RNAV approaches. Its pilots were, therefore, not trained as set out in subsection 723.98(21) of the Commercial Air Services Standard (CASS).

Aircraft

Records indicate that the aircraft was certified, equipped and maintained in accordance with existing regulations and approved practices.

C-GNAA was not equipped with a cockpit voice recorder (CVR) or a flight data recorder (FDR) and these items were not required by regulation. The aircraft was equipped with an altitude alerting system (Intercontinental Dynamics Corporation type 540 model 22722-034), coupled with a Sonalert alarm. The system provides continuous aural and visual warnings when the aircraft approaches a specified altitude [6]. Many altitude alerters in service today provide a brief (2 second) tone at 1000 feet above the selected altitude with a light that remains on continuously until the aircraft is within 300 feet of the selected altitude. The brief tone alerts the crew that it is approaching the selected altitude, but does not distract them from other tasks or add to their workload. The tone on C-GNAA was extremely loud and sounded continuously upon reaching 1000 feet above the selected altitude. At some point, a switch had been installed on C-GNAA's altitude alerter [7] which allowed flight crews to silence the device's aural warning. As the loud tone served more as a distraction than a warning, silencing the device prior to commencing an approach had become the norm.

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5 There is no requirement for Subpart 703 carriers to provide line indoctrination training for their pilots.

6 The specified altitude is set by the pilots on the altitude alerting unit.

7 No record of this installation could be found.

The flight instruments on the captain's and the co-pilot's stations differed. Notable differences were that the captain's altimeter was of the counter drum-pointer type which displays altitudes digitally and incorporates an analog display, and the first officer's altimeter had a three pointer analog-type display which provides altitude information using three sizes of needles: the largest showing hundreds of feet, the medium needle showing thousands of feet and the smallest displaying tens of thousands of feet. Studies have found the type of altimeter, as used by the first officer, to have a higher potential for being misread than other types [8] especially at a glance.

C-GNAA was equipped with a KLN 90B GPS unit certified for en route IFR operations. Though it could provide the navigational information required to carry out RNAV approaches, its installation did not include other displays required by CARs standard 723.08 and was therefore not approved for conducting IFR approaches. (see Appendix C – GPS Approach Requirements). The GPS unit was located in the aircraft's centre panel area, outside of the normal scan of either the PF or the PNF, and its information was not integrated with the pilots' primary flight instruments.

Company Procedures

The SkyNorth SOPs [9] manual contained an approach profile which describes how non-precision approaches are to be flown. This profile requires that, upon interception of the final approach course, approach flap (30%) is set and the first published step down altitude is called out and set in the altitude alerter. Upon reaching the step down altitude the next step down altitude is called out and set in the alerter. The landing gear is extended at the final approach fix and the PNF sets the missed approach altitude in the altitude alerter. At 100 feet above MDA, the PNF calls "100 above minimums", and upon reaching MDA the PNF calls out "minimums" and whether or not they have achieved positive visual contact with the runway environment. The SOP specifies that upon hearing the last call of "minimums", the PF must respond with "go around", "continuing" or "landing'' and then call for the final flap setting required. The approach conducted by the flight crew on the occurrence flight deviated from this standard.

In the course of this investigation, a review of RNAV approaches in Canada revealed that some incorporate step-down fixes between the Final Approach Fix (FAF) and the missed approach waypoint (MAWP) (see Appendix B - RNAV Approach Runway 08 Kenora). Step-down fixes are used where hazardous terrain or obstacles exist between the FAF and the MAWP. While they are displayed on approach procedures charts, not all step-down fixes are contained in GPS databases and, as such, may not be depicted on the cockpit navigation displays.

SkyNorth was not authorized to conduct RNAV approaches, and its training program does not provide any guidance on how to fly such approaches. The crew on the accident flight had learned how to use the GPS at previous employers and through self-study.

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8 Naval Research Lab Washington DC: Hill, J.H.; Chernikoff, R, 26 JAN 1965.

9 Page 9-5 SkyNorth SOPs.

Transport Canada Oversight

SkyNorth held an Air Operator Certificate (AOC) for air taxi operations issued under subpart 703 of the CARs. The general conditions for the issuance and amendment of an AOC are contained in Appendix D. Transport Canada conducted an initial certification audit in June 2005 and thereafter conducted audits in February 2006 and August 2007. There were no significant findings associated with these audits. In January 2009 TC placed SkyNorth under enhanced monitoring. [10]

Analysis

The crew was authorized to conduct the NDB approach to runway 30. However, that approach would have required the crew to overfly the airport, reverse course, and land with a slight down-wind component or circling to Runway 12, requiring the aircraft to circle at low altitude in marginal weather. The RNAV approach to Runway 12 was into wind and directly in line with the flight path, and, although the crew were not trained or authorized to attempt it, it became the preferred option.

Descending 300 feet below the published MDA, all obstruction clearance protection provided by the RNAV 12 approach was removed. There was no single factor identified that caused the first officer to descend below the MDA, or to prevent the captain from making the required calls. There were a number of lapses, errors and adaptations which, when combined, resulted in the mismanaged approach.

The PNF did not call "100 above minimums" or "minimums". This does not, however, relieve the PF of the necessity to stop descent upon reaching MDA. Although the aircraft had a GPS unit approved for en route operation, the installation was not optimal or approved for RNAV approaches. In particular, its track information was not integrated with the pilots' primary flight instruments. As a result, the PF was required to divert his attention away from his instruments to refer to the GPS unit to ensure proper course tracking. On final approach, the PF had difficulty reading the three-pointer altimeter after he diverted his attention away from his primary flight and navigation instruments to refer to the GPS. This likely explains why he did not react immediately when the PNF told him to go around.

Flaps 60% were called for and set prior to the crew confirming visual contact; the landing gear, propellers and flaps all being selected within a very short period of time. This substantial increase in drag close to MDA would have caused the aircraft to depart from a stabilized, shallow rate of descent, to a more-rapid rate of descent, taking the aircraft below minimums before the crew could react. The series of configuration changes performed by the crew in a short period of time near the MDA deviated from the SkyNorth SOPs and de-stabilized the approach at low altitude in the final stages of the approach.

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[10] The purpose of the enhanced monitoring program is to "provide increased oversight of organizations that have been identified as having systemic program failures or non-conformances with regulatory requirements." TC Staff Instruction no.: SUR-002.

The altitude alerter installed on C-GNAA was not optimal for the operation. The aural warning had been silenced prior to the approach, and this action precluded it from functioning as designed. It did not provide an aural warning when the aircraft was 1000 feet above MDA, or when it had descended 300 feet below MDA.

The crew applied a temperature correction to the MDA, by rounding up the altitude displayed in the altitude alerter. However, no correction was applied to the intermediate approach minimum descent altitudes, and obstacle clearance for the approach was therefore eroded during those portions of the approach.

The flight training was conducted without the benefit of a simulator. The use of non-company check pilots and the increased time between PPCs decreased management's involvement in the company flight training program. Line training was conducted on revenue flights with passengers, which did not allow for the practice of emergencies. Due to workload, managers had little time for supervisory flying. All of the above contributed to the lack of understanding and adherence to SOPs.

In a structured training environment, as is available in a simulator, the operator would have had an opportunity to present crews with the more-challenging training scenarios and to advance crews understanding and acceptance of SOPs. Also, a more-structured supervisory flying program could have improved adherence to SOPs.

The issue of step-down fixes was not considered to be a factor in this accident. The investigation determined that not all step-down fixes are published in GPS electronic databases and they may not be depicted on navigation displays or the GPS receiver. Information on approach plates may differ from that on navigation displays or GPS receivers and crews may inadvertently descend below safe altitudes during step-downs thereby increasing the risk of collision with terrain or obstacles between the FAF and the MAWP.

Findings as to Causes and Contributing Factors

1. The crew conducted an Area Navigation (RNAV) approach for which they were not trained, with an aircraft that was not properly equipped nor approved for such purpose.

2. The aircraft descended 300 feet below the minimum descent altitude (MDA) as a result of a number of lapses, errors and adaptations which, when combined, resulted in the mismanaged approach.

3. The aural warning on the aircraft's altitude alerter had been silenced prior to the approach, which precluded it from alerting the crew when the aircraft descended below minimum descent altitude.

4. The SkyNorth standard operating procedures for conducting a non-precision approach were not followed, which resulted in the aircraft descending below the minimum descent altitude. During the ensuing missed approach, the aircraft struck trees.

Findings as to Risk

1. The lack of a more-structured training environment and the type of supervisory flying provided increased the risk that deviations from standard operating procedures (SOPs) would not be identified.

2. There are several instrument approach procedures in Canada that contain step-down fixes that are not displayed on global positioning system (GPS) units. This may increase the risk of collision with obstacles during step-downs on approaches.

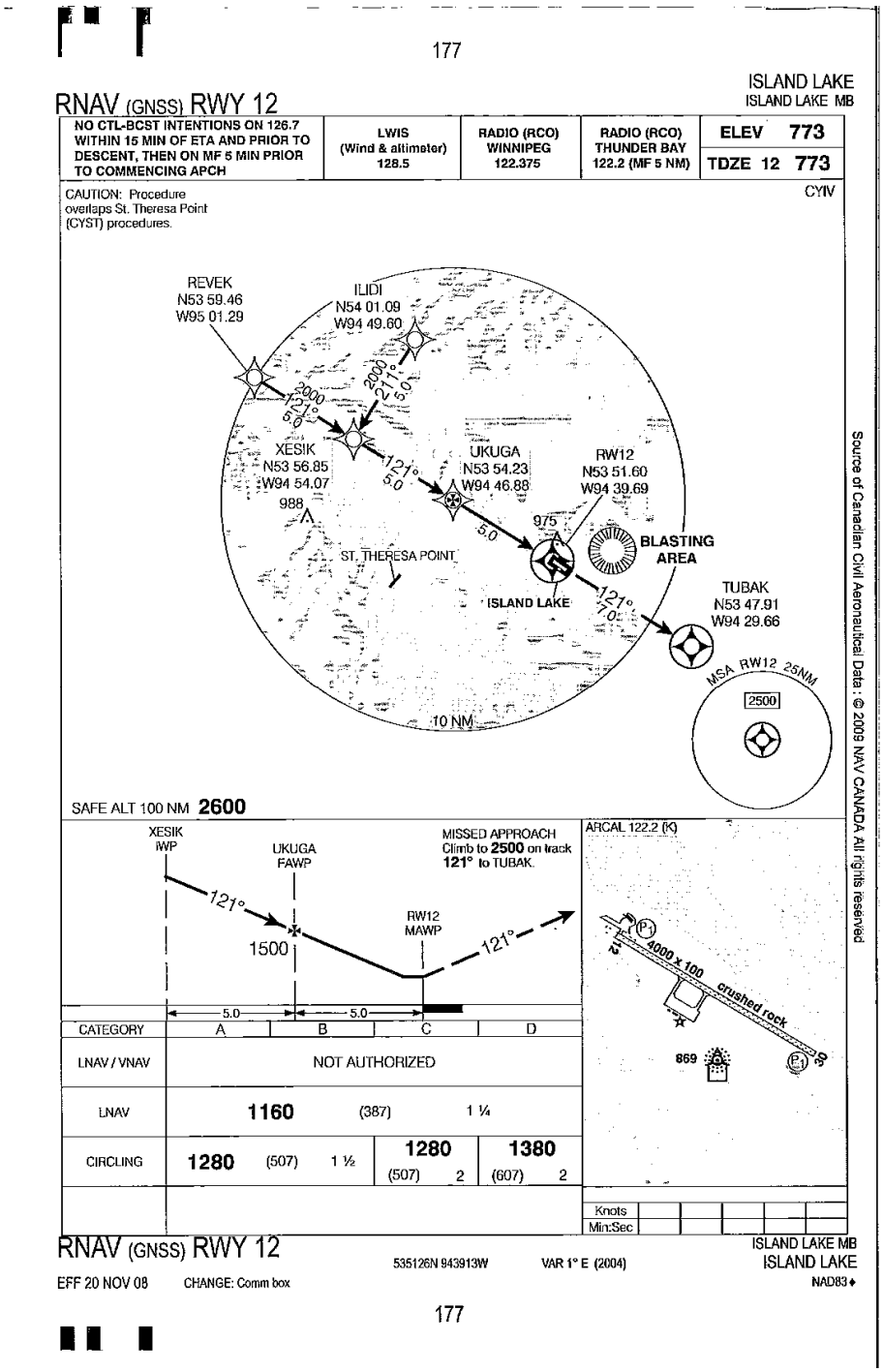
Safety Action Taken

Since the occurrence, SkyNorth has put forth a proposal to Transport Canada to approve the implementation of a six-month recurrent procedures training program, which will incorporate the use of a C90 B level C simulator.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 21 July 2010.

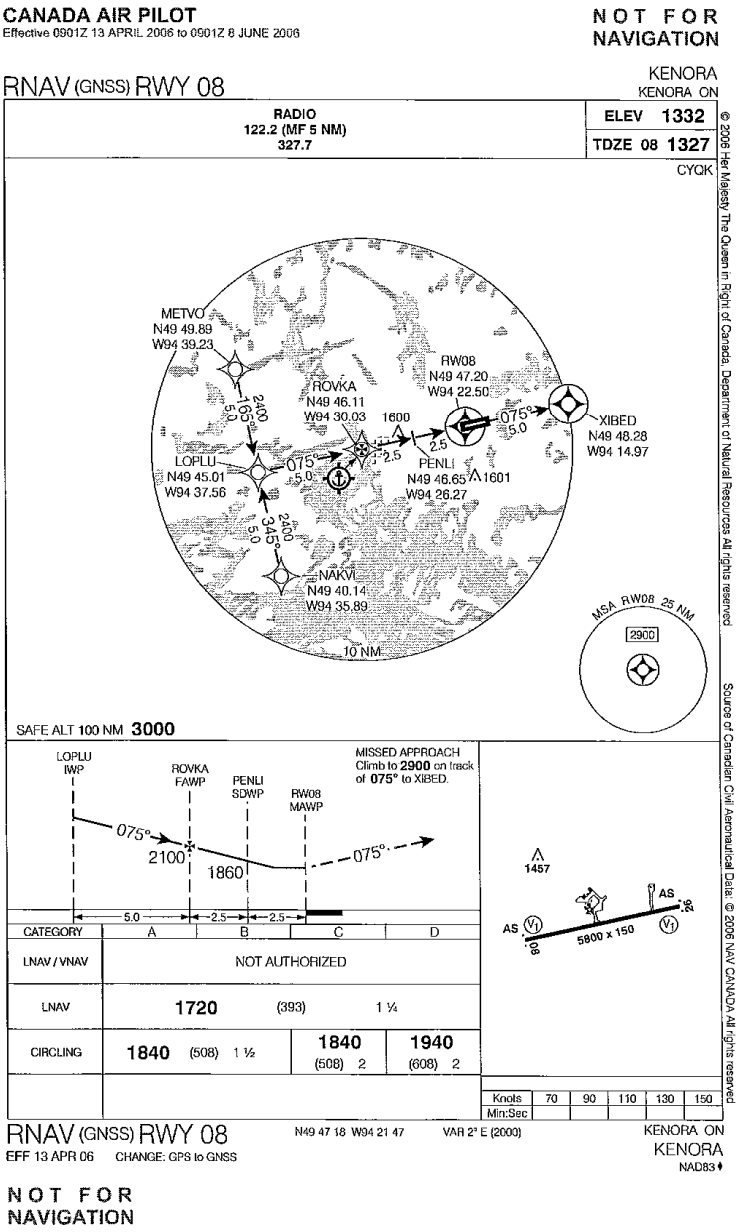
Visit the Transportation Safety Board's Web site (www.bst-tsb.gc.ca) for information about the Transportation Safety Board and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – RNAV Approach Runway 12 Island Lake



NOT FOR NAVIGATION

Appendix B – RNAV Approach Runway 08 Kenora



NOT FOR NAVIGATION

Note: In the preceding diagram PENLI is a step down fix at 2.5 nm from the runway threshold. Descent must be arrested at 1860 feet until reaching PENLI at 2.5 nm. However PENLI is not contained in most GPS data bases, and is therefore not pictorially displayed in the GPS.

Appendix C – GPS Approach Requirements

Excerpts from Commercial Air Services Standard 723 – Air Taxi – Aeroplanes:

723.08(3) Instrument Approaches - Global Positioning System (GPS)

(a) The standard requirements for authorization to fly instrument approach procedures using only GPS navigation information are:

(i) an operational evaluation in accordance with subsection 723.08(3)(b) has been completed by the Minister on each aircraft type/GPS/FMS model installation for which approach authorization is sought;

(ii) an air operator has an approved flight crew training and qualifications program for use of the GPS/FMS system that meets the requirements of subsection 723.98(21); and

(iii) standard operating procedures have been amended to reflect GPS approach operations and approved by the Minister (where required).

(b) The following items will be assessed in the operational evaluation prior to the approval of the operator's GPS approach standard operating procedures (where applicable) and training program. Identical installations of the same model of GPS in the same type of aircraft with the same operator do not need separate evaluations.

(i) Database

The geographical coverage area for the database shall be compatible with the type of operations conducted by the company. The air operator shall have procedures in place to ensure that the database will be updated in accordance with the appropriate data revision cycle. This shall include a contract with a database supplier and the inclusion, in the appropriate company manuals, of the person responsible for installing the updates in the aircraft. The company shall have a procedure in place for pilots to report database errors and for information on database errors to be passed on to other company pilots, the avionics manufacturer and the Minister.

(ii) Unit Installation and Operation

The handling and procedures associated with the GPS avionics shall be such that all operations required for GPS approach can be accomplished without an adverse impact on normal crew duties and responsibilities. GPS related tasks shall not consume the attention of the pilot not flying (PNF) during critical phases of flight (i.e. between the time the aircraft turns inbound on the final approach course and the time the aircraft is established in the climb configuration on a missed approach).

A GPS avionics installation that is used on board aircraft operated under CARs Part VII, Subpart 3 (Air Taxi) conducting single-pilot IFR GPS approaches where persons other than flight crew are carried, shall be capable of:
(amended 2000/12/01; previous version)

(A) displaying a moving-map graphical depiction of the programmed route and the instrument procedure; and
(amended 2000/12/01; previous version)

(B) being coupled to the auto-pilot for lateral guidance and control of the aircraft during the IFR approach.
(amended 2000/12/01; previous version)

(iii) Control Display Unit (CDU) and Course Deviation Indicator (CDI) / Distance Display

If the GPS/FMS control unit is not adequately accessible from each pilot position, or if GPS course deviation and distance displays are not within the primary field of view at both pilot stations, air operators shall designate in the standard operating procedures the position that the pilot flying (PF) and pilot not flying (PNF) are required to occupy during GPS approach for that type of installation. Aircraft types that are certified for operation by two crew members shall have GPS course deviation and distance displays at each pilot station. An Operations Specification authorizing GPS approaches shall not be issued unless the PNF has a means acceptable, in the Minister's opinion, of monitoring the PF during an approach.

(iv) Distance Display on the HSI

Installations where GPS guidance information (course tracking, To/From and NAV flags) are switched onto the HSI for display, but the DME distance information is not switched out (i.e. DME distance, rather than GPS distance, is displayed continuously on the HSI even when GPS source is selected to HSI), shall require air operators, in their standard operating procedures for GPS approach, to deselect other NAV/DME sources to eliminate distance displays in the pilot's primary field of vision not related to the approach procedure being flown.

(v) Annunciation

Responses to system annunciation (including Receiver Autonomous Integrity Monitoring (RAIM) warnings), the means of selecting GPS track information to the CDI/HSI and the means of coupling GPS steering information to the aircraft automatic flight control system shall be compatible with the safe operation of the aircraft type/category. Standard operating procedures shall specify the procedure whereby the control unit is programmed, approach waypoints are verified against an independent source, approach mode is armed, and cockpit NAV source and AFC guidance source switches are selected and verified. Any switch selection or programming errors that the Minister believes are likely to occur and that could lead to a serious incident shall, if possible, be identified and addressed in training and in the standard operating procedures. Otherwise, the installation shall not be approved for approach use.

(vi) Airborne Evaluation

The Minister shall observe the pre-flight and in-flight operation of the unit on at least one GPS approach and missed approach. If the PF is allowed to occupy either seat during GPS approaches, then one approach from each pilot position shall be demonstrated. An airborne evaluation in an aircraft must take place under VFR. Emphasis will be on crew co-ordination, pilot workload (PF and PNF), and switch selections.

723.08(21) Area Navigation Systems (RNAV)

(a) General Training

(i) To qualify for use of RNAV systems on IFR operations, an air operator shall have an approved flight crew training and qualifications program for use of the system. Flight crew shall have completed the appropriate training and have completed an in-flight check or an equivalent check in an approved synthetic training device. This qualification check shall be conducted by an approved check pilot.

(ii) Training shall be in the following areas:

(A) pre-flight;
(B) normal operation of the system;
(C) procedures for manually updating system;
(D) methods of monitoring and cross checking system;
(E) operation in area of compass unreliability;
(F) malfunction procedures;
(G) terminal procedures;
(H) waypoint symbology, plotting procedures, record keeping duties/practices;
(I) time keeping procedures; and
(J) post-flight.

(iii) To qualify for approval to conduct GPS approaches in IFR, an air operator shall have a flight crew training program approved by the Minister. Flight crew shall have completed the appropriate ground and flight training and have completed an in-flight check, or an equivalent check in a synthetic training device approved by the Minister prior to conducting GPS approaches. This qualification check shall be conducted by an approved check pilot.

(iv) Where pilots are required to use more than one type of GPS for approach, an air operator shall ensure the training program addresses the differences between the units, unless the units have been determined by the Minister to be sufficiently similar.

(v) An air operator shall ensure the ground training includes "hands on" training using a desk top simulator, a computer based simulation of the unit to be used, a static in-aircraft unit, or other ground training devices acceptable to the Minister.

(b) Ground Training - Non-Integrated Receivers (Panel Mount GPS Receivers)

An air operator shall ensure that the training program candidates are trained to proficiency in each of the elements associated with the following areas:

(i) Knowledge with the respect to the following:

(A) the GPS system, including:

(I) GPS system components and aircraft equipment;
(II) the composition of satellite constellation;
(III) the minimum number of satellites required for 2-D and 3-D navigation;
(IV) the basic concept of satellite ranging;
(V) factors affecting the accuracy of GPS signals;
(VI) the World Geodetic Survey 84 (WGS 84) datum and the effect of using any other datum;

(B) human factors applicable to the use of GPS and how errors may be reduced or eliminated;
(C) company standard operating procedures for using GPS units; and
(D) procedures for reporting GPS problems and database errors.

(ii) Ability to perform the following operational tasks:

(A) select appropriate operational modes;
(B) recall categories of information contained in the database;
(C) predict RAIM availability;
(D) enter and verify user defined waypoints;
(E) recall and verify database waypoints;
(F) interpret typical GPS navigational displays including latitude/longitude, distance and bearing to waypoint, course deviation indication (CDI), desired track (DTK), track made good (TMG), actual track (TK), cross track error and any other information appropriate for the equipment used;
(G) intercept and maintain GPS defined tracks;
(H) determine navigation information appropriate for the conduct of the flight including ground speed (GS), estimated time of arrival (ETA) for next waypoint and destination;
(I) recognition of waypoint passage;
(J) use of 'direct to' function;
(K) link enroute portion of GPS flight plan to approach;
(L) conduct SIDs, STARs, terminal area procedures and holds;
(M) retrieve, verify and conduct GPS stand alone approaches; and
(N) conduct GPS missed approaches.

(iii) Ability to conduct the following operational and serviceability checks:

(A) database currency and area of operation;
(B) receiver serviceability;
(C) RAIM status;

(D) CDI sensitivity;
(E) position indication; and
(F) number of satellites acquired and, if available, satellite position information.

(iv) Ability to recognize and take appropriate action for all GPS warnings and messages including, where applicable:

(A) "loss of RAIM"
(B) "2D navigation"
(C) "In Dead Reckoning Mode"
(D) "database out of date"
(E) "GPS fail"
(F) "barometric input fail"
(G) "power/battery low" or "fail"
(H) "parallel offset on"; and
(I) "satellite fail".

(d) Flight Training

(i) Pilots shall complete flight training in the use of GPS for approach and other associated duties for each crew position they are authorized to occupy. Flight training may be completed in an aircraft, or in a level A or higher simulator that is equipped with the same model of GPS receiver (or a model determined by the Minister to be sufficiently similar) that is installed in the company aircraft.

(ii) Flight training shall be conducted by a designated training pilot who has completed the company ground training program approved by the Minister, and demonstrated proficiency in the use of the model of GPS (or a model determined by the Minister to be sufficiently similar) to an approved check pilot.

(iii) The following initial flight training and checking, and currency requirements apply to aircraft operated under Subpart 703 of the Canadian Aviation Regulations conducting single-pilot IFR GPS approaches where persons other than flight crew are carried.

Before a pilot is assigned as the pilot-in-command (PIC) of a single-pilot IFR operation using GPS for an instrument approach, the following requirements shall be met:

(A) within the preceding ninety days, and while under the direct supervision of a designated training pilot, the pilot shall conduct a minimum of ten (10) GPS approaches of which:

(I) five (5) approaches are conducted in actual or simulated instrument meteorological conditions (IMC) to the prescribed landing minima,
(II) three (3) approaches including a published missed approach, at least two of which are conducted in actual or simulated IMC, and
(III) two (2) approaches are conducted using different initial approach waypoints (IAWPs);

(B) completion of all of the requirements listed in clause (A) shall be recorded in the pilot's training file together with the following information:

(I) registration and type of aircraft, or type of simulator, used for the GPS approaches;
(II) manufacturer and model number of GPS equipment used;
(III) date, name and number of approaches conducted in total, in IMC, with missed approaches and from which IAWP; and
(IV) certification by the designated training pilot attesting to the training given to the pilot;

(C) the pilot shall successfully demonstrate his/her proficiency in GPS operations as part of a PPC or as a separate check ride conducted by an approved company check pilot or a Transport Canada Inspector and shall be certified as proficient; and

(D) currency requirements shall be met by conducting GPS instrument approaches during the PPC.

Appendix D – General Requirements for Issuance/Amendment of an AOC

703.07 (1) Subject to Section 6.71 of the Act, the Minister shall, on receipt of an application submitted in the form and manner required by the Commercial Air Service Standards, issue or amend an air operator certificate where the applicant demonstrates to the Minister the ability to

(a) maintain an adequate organizational structure;
(b) maintain an operational control system;
(c) meet training program requirements;
(d) comply with maintenance requirements;
(e) meet the Commercial Air Service Standards for the operation; and
(f) conduct the operation safely.

(2) For the purposes of subsection (1), an applicant shall have

(a) a management organization capable of exercising operational control;
(b) managerial personnel who have been approved by the Minister in accordance with the Commercial Air Service Standards, are employed on a full-time basis and perform the functions related to the following positions, namely,
    (i) operations manager,
    (ii) chief pilot, and
    (iii) where the applicant does not hold an approved maintenance organization (AMO) certificate, maintenance manager;
(c) operational support services and equipment that meet the Commercial Air Service Standards;
(d) aircraft that are properly equipped for and flight crew members who are qualified for the area of operation and the type of operation;
(e) an operational control system that meets the requirements of Section 703.16;
(f) a training program that meets the requirements of this Subpart;
(g) legal custody and control of at least one aircraft of each category of aircraft that is to be operated;
(h) a company operations manual that meets the requirements of Sections 703.104 and 703.105; and
(i) a maintenance control system approved pursuant to Subpart 6.