



REASSESSMENT OF THE RESPONSE TO TSB RECOMMENDATION A96-04

Separation procedures for aircraft navigating with GPS

Background

On 1 May 1995, Air Sandy flight 3101, a Piper PA-31 Navajo with 1 pilot and 4 passengers on board, had departed Sioux Lookout on a flight to Red Lake, Ontario. Bearskin Airlines flight 362, a Fairchild Swearingen Metro 23 with a crew of 2 and 1 passenger on board, was inbound to Sioux Lookout on a flight from Red Lake. The two aircraft collided at 4500 feet above sea level, approximately 12 nautical miles northwest of Sioux Lookout. All 8 occupants were fatally injured.

The Board determined that neither flight crew saw the other aircraft in time to avoid the collision. Contributing to the occurrence were the inherent limitations of the see-and-avoid concept which preclude the effective separation of aircraft with high closure rates, the fact that neither crew was directly alerted to the presence of the other aircraft by the Flight Service specialist or by onboard electronic equipment, and an apparent lack of pilot understanding of how to optimize avoidance manoeuvring.

The Board concluded its investigation and released Aviation Investigation Report A95H0008 on 4 April 1996.

TSB Recommendation A96-04 (April 1996)

GPS has been approved for use under VFR and as a backup aid to navigation under IFR; approval as a primary IFR navigation aid is imminent. The Canadian Air Navigation System is rapidly moving toward increased reliance on this inexpensive and accurate navigation system. In 1995, the Board made 2 recommendations to TC aimed at reducing the potential for GPS-related occurrences resulting from the use of unapproved equipment, inadequate understanding of the system or lack of approved approaches. Transport Canada agreed with the recommendations and outlined several initiatives to expedite the implementation of GPS standards and raise the aviation community's awareness of the limitations and safe use of GPS. The correct use of GPS decreases the average displacement of an aircraft from the centre line of its desired track; consequently, if separation procedures fail, the probability of a mid-air collision will increase (see LP 95/95). This increased risk of collision applies to both IFR and VFR aircraft in all types of operations.

The probability of collision for aircraft using GPS could be reduced if pilots used the area navigation (RNAV) capabilities of GPS to avoid high traffic routes, either by flying at an off-set distance from the centre line of these routes or by creating their own routes. Although TC has taken some action in this regard (see 4.1.2), the action is limited in scope and short term

in nature. Given the increasing use of GPS, and the increased potential for mid-air collision associated with its use, the TSB recommends that

the Department of Transport expedite the development and implementation of safe separation procedures for the use of GPS in navigation.

TSB Recommendation A96-04

Transport Canada's response to Recommendation A96-04 (July 1996)

Transport Canada (TC) is very active on all GPS-related issues, including its safe usage in navigation; however, TC considers that the introduction of GPS does not require any change to current rules and procedures regarding aircraft separation. In VFR operations, there is no rule that requires pilots to follow specific tracks. Some pilots follow airways or air routes anchored by traditional ground aids while VFR, but GPS offers the chance to use any point-to-point route. This offers more routes if everyone uses GPS. When departing from an airport, a VFR pilot using GPS will generally take up a direct course to destination at some point after takeoff. This point may be different on each flight, depending on wind, runway in use, traffic, and aircraft performance. This automatically creates an offset. Since all RNAV systems allow aircraft to be flown on essentially random tracks, it is difficult to envision a separation criterion which would be more effective than that already provided for these systems. Once at cruise altitude, even when on the same track, separation is assured by flying at an altitude appropriate to direction of flight.

In IFR operations, air traffic control service ensures separation regardless of the navigation guidance being used. The key to avoiding collisions near airports like Sioux Lookout, where there is a mix of IFR and VFR aircraft, is communications. While arriving and departing, pilots have not reached opposite direction cruise altitudes, so must be extremely vigilant. GPS makes communications more effective because it provides pilots with more accurate position, speed, and ETA information than is possible with traditional aids. Regardless of the precision of the guidance used by the pilot, it is critical, particularly when in the vicinity of an uncontrolled airport, to communicate position and intentions.

A Satellite Navigation Program Office (SNPO) has been established to work on issues specific to GPS. Current issues of concern and study include the human factors aspects of the GPS avionics, particularly during approach operations, the reliability of the avionics data base and electromagnetic interference. The SNPO regularly updates A.I.P Canada, writes safety articles, publishes its own newsletter and has recently prepared a notice for the Canada Air Pilot, in each case advising pilots how to use GPS safely.

Transport Canada will continue to address and monitor GPS issues, and will also continue to regularly publish articles in the "Aviation Safety Letter" newsletter to sensitize the aviation community.

TSB assessment of Transport Canada's response to Recommendation A96-04 (September 1996)

Transport Canada considers that the introduction of GPS does not require any change to current rules and procedures regarding aircraft separation. Indeed, the response indicates

that GPS can aid separation by enhancing communication of (aircraft) position and (pilots) intentions.

TC does provide information on its Satellite Navigation Program Office (SNPO) and the work it does on GPS issues. However, TC has not related work of the SNPO to the deficiency highlighted by the Board concerning the increased potential for risk of collisions. Furthermore, notwithstanding the safety promotional activity by TC shortly after this occurrence to reduce traffic conflicts in a GPS navigation environment, this response indicates that TC apparently has not accepted the Board's perception of the safety deficiency.

Therefore, the response to Recommendation A96-04 is assessed as **Unsatisfactory**.

TSB reassessment of Transport Canada's response to Recommendation A96-04 (November 1997)

There is no initiative to mandate track offsets for aircraft using GPS. Procedures for the proper use of GPS have been published.

Therefore, the assessment remains **Unsatisfactory**.

TSB reassessment of Transport Canada's response to Recommendation A96-04 (February 2004)

In addition to the initial promotional material following the occurrence (in TSB final report), TC continues to address GPS usage in aviation. Aeronautical Information Circular (AIC) 2/01, "IFR Approval to use GPS in Canadian Domestic Airspace", was published 19 April 2001. Notice of Proposed Amendment (NPA) 2003-300, "Canadian Domestic Air Traffic Control Separation Standards", is a proposal to use accuracy of GPS for longitudinal and lateral separation. Despite the fact that TC did not mandate the use of "track offsets" for aircraft using GPS, the action taken should mitigate the risks associated with GPS use.

Therefore, the response to Recommendation A96-04 is assessed as **Satisfactory in Part**.

As such, **Further Action is Unwarranted** with respect to Recommendation A96-04 and the status is set to **Inactive**.

TSB review of Recommendation A96-04 deficiency file status (April 2014)

The Board requested that Recommendation A96-04 be reviewed to determine if the deficiency file status was appropriate. After an initial evaluation, it was determined that the safety deficiency addressed by Recommendation A96-04 needed to be reassessed.

A request for further information was sent to Transport Canada and a reassessment will be conducted upon receipt of Transport Canada's response.

Therefore, the assessment remains as **Satisfactory in Part**.

Consequently, the status of Recommendation A96-04 is changed to **Active**.

Transport Canada's response to Recommendation A96-04 (March 2018)

TC agrees in principle with the recommendation.

TC has issued an Exemption to the Canadian Aviation Regulations (CARs) permitting NAV Canada to use separation standards contained in the International Civil Aviation Organization (ICAO) Doc 4444, PANS ATM (Standards & Procedures) in addition to those currently contained in CARs 821 - Canadian domestic air traffic control separation standards. This will enable NAV Canada to more quickly respond to new ICAO provisions that are related to the Global Positioning System (GPS) (now referred to in the broader term Global Navigation Satellite System (GNSS)) through an authorization versus an exemption process. NAV Canada, with TC support and participation, as well as the availability of newly developed ICAO provisions, is moving to create a new Canadian Domestic airspace structure including new navigation GNSS routes that will take full advantage of this new technology.

NAV Canada with support of TC has presented several working papers to the ICAO Separation and Airspace Safety Panel on using Required Navigation Performance 2 (RNP 2) (GNSS) to reduce lateral and longitudinal separation for aircraft at the same altitude through "Enhanced Procedural Separation (ASEPS)". Working groups with the Panel and a dedicated Mathematicians Sub working group who are conducting critical risk modeling to ensure that the target level of safety is considered when reducing the spacing from its current status.

NAV Canada with support from TC have proposed a practical means to implement RNP 2 (continental) Navigation Specifications on fixed tracks in non-radar airspace. NAV Canada is to collect any available data on use of RNP2 or GNSS en-route separations as currently in use by States and bring a working paper to Separation and Airspace Safety Panel/2 (SASP/2). This will enable established tracks for RNP certified aircraft that will more easily facilitate the movement of arriving and departing aircraft at certain airports.

TC has issued an exemption that allows NAV CANADA air traffic controllers to issue clearances that enable Instrument Flight Rules (IFR) aeroplanes to fly with 50 nm lateral spacing, versus the current 60NM, based on certain aircraft navigation performance capability that employs long-range Inertial Navigation System (INS) and the GNSS, where those aeroplanes are certified to operate based on an RNP 10 or RNP 4 capability.

From TC's perspective, the risks identified in the preamble to this recommendation have been addressed. TC and Nav Canada will continue to assess and adopt technology to enhance the safety and efficiency of air transportation in Canada.

TSB reassessment of Transport Canada's response to Recommendation A96-04 (March 2019)

To date, Transport Canada (TC) has taken a number of actions to address the safety deficiency identified in Recommendation A96-04, regarding the development and implementation of safe separation procedures for the use of global positioning systems (GPS). These include the following:

- In 1995, TC developed safety material to raise awareness about traffic conflicts in a GPS navigation environment;
- In 1996, TC established a Satellite Navigation Program Office to address safety issues related to GPS avionics, such as their use during landing approaches, the reliability of their database, and electromagnetic interference;
- In 2001, TC issued Aeronautical Information Circular 2/01 - *IFR Approval to use GPS in Canadian Domestic Airspace*, in order to provide information and guidance on the use of GPS for aircraft operating in Canadian controlled and uncontrolled airspace. Since then, TC has published this information in the *Aeronautical Information Manual*;
- In 2003, TC developed Notice of Proposed Amendment 2003-300 - *Canadian Domestic Air Traffic Control Separation Standards*, proposing to use the accuracy of GPS for longitudinal and lateral separation;
- In order to take advantage of new Global Navigation Satellite System (GNSS) technology, TC is now supporting NAV CANADA in the development of a new Canadian domestic airspace structure to include new navigation GNSS routes;
- In order to harmonize Canada's GNSS standards and procedures contained in *Canadian Aviation Regulations 821 - Canadian Domestic Air Traffic Control Separation Standards* with International Civil Aviation Organization (ICAO) standards, TC issued a regulatory exemption permitting NAV CANADA to use separation standards contained in ICAO Doc 4444, *PANS ATM (Standards & Procedures)*. NAV CANADA may now issue clearances that enable some instrument flight rules (IFR) aeroplanes to fly with a 50 nautical miles (nm) lateral spacing, versus the current 60 nm; and
- NAV CANADA and TC are currently working together with ICAO to assess the safety risks associated with the reduction of spacing requirements between aircraft.

The Board believes that these actions have substantially reduced the risk associated with the safety deficiency identified in Recommendation A96-04.

Therefore, the response to Recommendation A96-04 is assessed as **Fully Satisfactory**.

This deficiency file is **Closed**.