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WORKING PAPER

TWELFTH AIR NAVIGATION CONFERENCE

Montréal, 19 to 30 November 2012

Agenda Item 1: Strategic issues that address the challenge of integration, interoperability and harmonization of systems in support of the concept of "One Sky" for international civil aviation
1.1: Global Air Navigation Plan (GANP) – framework for global planning
e) Avionics roadmap

AVIONICS REQUIREMENTS ROADMAP TO MEET FUTURE COMMUNICATION, NAVIGATION AND SURVEILLANCE (CNS) TECHNOLOGY ADVANCES

(Presented by Canada)

SUMMARY

This paper presents a summary of the avionics performance identified as requirements by NAV CANADA to meet its projected safety, efficiency, and environmental targets in the short term (present to 2014) and the near-term (2015-2019).

Navigation. This roadmap recognises the requirement for GNSS in Canada for most RNAV and all RNP operations. There is a short-term requirement for avionics and total aircraft system requirements for RNP AR APCH (including RF leg types) for operators to take advantage of savings resulting from more efficient approaches. As additional satellite constellations become available the plan recognizes the importance of their integrated use for improved navigation system availability.

Surveillance. The plan recognises the value of Mode S ES transponder technology and identifies an increased role for ADS-B (OUT) in the NAT and in the North remote areas as plans for satellite-based ADS-B mature and are implemented. It is anticipated that the majority of the aircraft fleet will migrate towards a DO-260B capability by 2020. In addition ACAS V 7.1 is expected to be the aircraft standard by the near-term.

Communications. The roadmap envisions VHF DCPC to remain as the primary communication technology for both the short-term and the near-term; however, increased emphasis on CPDLC (ACARS and ATN) is expected in remote areas in the short-term.

Action: The Conference is invited to agree to the recommendation in paragraph 6.2.

1. INTRODUCTION

1.1 NAV CANADA is the private sector, non-share capital corporation that owns and operates Canada's civil air navigation system. Transport Canada is Canada's regulator for the civil air navigation system.

[1]English and French translation provided by Canada.

NAV CANADA coordinates the safe and efficient movement of aircraft in Canadian domestic airspace and in international airspace assigned to Canadian control. Through its operations, NAV CANADA delivers air traffic control, flight information, weather briefings, aeronautical information, airport advisory services and electronic aids to navigation

1.2 The development of technical requirements for avionics is conducted as part of the collaborative consultation process that NAV CANADA holds on an ongoing basis with system users and stakeholders in the development and implementation of CNS services. In addition to focused customer consultation associated with major airspace requirements, frequent structured consultation meetings are conducted on a regional and national basis.

2. BACKGROUND

2.1 NAV CANADA provides air and navigation services across a wide geographic which include many remote locations as well as those with extremely hostile environmental conditions. As such the installation, maintenance and back haul of data to the applicable operational units using terrestrial communication-navigation-surveillance equipment is a constant challenge.

3. COMMUNICATION

3.1 Short-term (Present – 2014)

3.1.1 VHF DCPC will continue to be the dominant source of voice communication between the pilot and the controller. NAV CANADA has developed and deployed a high powered directional VHF capability at certain locations throughout the country and will continue to refine and develop this capability. VHF DCPC operations do not require unique aircraft avionics, and are part of standard equipment.

3.1.2 NAV CANADA will continue to use CPDLC (ACARS –ATN) in the remote areas of the country.

3.2 Near-term (2015 – 2019)

3.2.1 NAV CANADA will investigate and formulate plans for CPDLC using VDL Mode 2 during this timeframe.

4. NAVIGATION

4.1 Navigation changes by NAV CANADA are aligned with Performance-based Navigation (PBN) development. The PBN consultation process with its system users commenced shortly after the publication of the PBN Manual in 2008, resulting in the publication of a collaborative NAV CANADA PBN Concept of Operations document in 2009. Canada is dependent upon GNSS for most RNAV and all RNP operations.

4.2 Short-term (Present-2014)

4.2.1 RNP AR APCH. Total system requirement to be RNP AR APCH capable including radius-to-fix leg types in order to take advantage of associated fuel and GHG savings. NAV CANADA plans to introduce multiple RNP AR APCH procedures across the country in the short-term. To qualify participant aircraft will require integrated GNSS/FMS equipment with associated flight director and autopilot capabilities.

4.2.2 LPV/LNAV–VNAV NAV CANADA will continue to develop SBAS based procedures with Constant Descent Angles to improve the level of safety while aircraft are on approach. To take advantage of LPV

approaches operators will require a SBAS capable GNSS receiver (TSO 145-146), while to take advantage of LNAV/VNAV operators will require a GNSS receiver or a BARO/VNAV FMS capability.

4.2.3 CMMPS and RNPC Airspace. NAV CANADA is working to define CMMPS and RNPC airspace as PBN airspace. When completed operators will require a GNSS capability to operate within the modified airspace.

4.3 Near-term (2015-2019)

4.3.1 FMS/Multi-Sensor/Operation. Concurrent with the airspace changes in Toronto, NAV CANADA catalogued a number of variances in the performance of current FMS equipped aircraft. As an example; when cleared on a published leg with multiple waypoints and descending gates and or speed limitations throughout, some aircraft perform the necessary changes smoothly throughout the leg while others perform the changes abruptly. A standard needs to be developed and promulgated to direct all aircraft to behave in the same manner. Advantages associated with PBN SIDs and STARs will not be fully realised until such a change is made.

4.3.2 SIDs and STARs with radius-to fix. In March of 2012 NAV CANADA implemented a re-design of Toronto SIDs and STARs designing to an RNAV 1 specification. The next phase will introduce radius-to-fix leg-types for these procedures, also requiring their re-designation to utilize an RNP-based navigation specification. Operators will require RF capability to participate.

4.3.3 Low Level Airspace. In the near-term NAV CANADA will restructure the low level airspace which is anticipated to be based on "T" route structure. NAV CANADA will work with Transport Canada to determine the ANS strategic infrastructure that remains required in the public interest. Operators will be encouraged to employ GNSS as a primary navigation aid.

4.3.4 Multiple GNSS Constellations NAV CANADA recognises additional GNSS constellations will be fielded in the near-term. Future avionics will likely need the capacity to simultaneously receive and process all healthy, visible satellites for the aircraft's navigation solution.

4.3.5 Navigation with reference to True North only. NAV CANADA continues to investigate only the use of navigation referencing true north for aircraft operations. A significant effort is expended to update current aeronautical information with changing magnetic variation (MAGVAR). Modern avionics carry out navigation calculations with reference to true north, and then convert the information for pilot displays to Magnetic (by applying a magnetic variation based on a magnetic model), or True heading or true Track, depending on aircraft capability). Safety activity in recent months include the emergency re-painting of runways as a result of "lapsed MAGVAR data" and the cancellation of all CAT 1 through III approach because of a changing MAGVAR, and out of date MAGVAR reference tables on board the aircraft (as old as 2005) in some states. NAV CANADA believes all operations referenced to true north would enhance the overall safety floor and save considerable effort in maintaining MAGVAR tables.

5. SURVEILLANCE

5.1 Short-term

5.1.1 Radar (SSR). NAV CANADA will continue to employ SSR as the principal method of surveillance in the airspace where it provides air navigation services and has recently installed a new Mode S SSR in the Montreal area. NAV CANADA currently utilises Mode A/C information from its Mode S radar sites, for separation purposes.

5.1.2 ADS-B. NAV CANADA has recently installed ADS-B service in Hudson Bay and most recently, the East Coast, Baffin Island and Greenland. Very recently the ADS-B sites in Greenland were declared

operational with an initial separation standard of 10 NM. Previously the standard was 10 minutes. The ADS-B service provides several thousands of square kilometres of added surveillance airspace for the NAT traffic providing early climb to higher altitudes, and facilitates trajectory-based operations (TBO). To take advantage of this service Operators require a Mode S transponder with Extender Squitter (ES) and the aircraft must be equipped with a GNSS source with a capability to meet EASA AMC 20-24. Currently GNSS is the only position source available that meets ADS-B integrity requirements

5.1.3 Multilateration (MLAT). NAV CANADA has recently installed a Wide-Area Multilateration (WAM) system in Vancouver, and Fort St John. Currently NAV CANADA is completing a WAM system in Kelowna, BC. Typically WAM provides radar-like surveillance with a lower associated cost. In addition NAV CANADA has installed an A-SMGCS MLAT system at Montreal airport, and has started installing similar systems at both the Toronto and Calgary airports. For A-SMGCS operations some aircraft automatically turn the transponder to standby on landing because of the weight-on-wheels (WOW) switch. These aircraft must be modified in order to reply to interrogations while on the ground or face delays during low visibility operations.

5.2 **Near-term**

5.2.1 ADS-B. NAV CANADA recognizes the FAA ADS-B out mandate for 1 January 2020. This mandate requires aircraft flying into the United States be equipped and certified with DO 260B avionics by that date. It is expected that the majority of aircraft will upgrade to DO 260B avionics after 2015. While NAV CANADA does not currently mandate this upgrade to operate within its ADS-B service volume(s) the ADS-B infrastructure has already been upgraded to process the DO 260 B message format in addition to the DO 260 and DO 260 A message format.

5.2.2 ADS-B by Satellite. NAV CANADA has embarked on a partnership venture to provide ADS-B surveillance over large areas by LEO Satellites with the first geographical area for investigation being the NAT. To take advantage of this service Operators require a Mode S transponder with extender squitter (ES) and the aircraft must be equipped with a GNSS source with a capability to meet EASA AMC 20-24. NAV CANADA does not plan to provide system support for aircraft equipped with 978 Mhz Universal Access Transceiver (UAT) ADS-B.

6. CONCLUSION AND RECOMMENDATIONS

6.1 This paper provides a brief overview of Canada's air navigation service providers (NAV CANADA) communication, navigation, and surveillance system planning, from the present time until 2019. These considerations drive operator avionics upgrades and equipage decisions. The Conference is invited to take note of NAV CANADA's reliance on GNSS as a navigation source and increasingly as a necessary element for surveillance activities. NAV CANADA is actively engaged in motivating its system users to equip with GNSS.

6.2 The Conference is invited to agree to the following recommendation:

Recommendation 1/x - Avionics requirements roadmap to meet future communication, navigation and surveillance technology advances

That the Conference request ICAO to:

a) consider ways and means to encourage Operators to equip with a global navigation satellite system capability; and

b) consider employing navigation with reference to True North as the standard reference.

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