



Policy Letter (PL)

Global Positioning System (GPS) Equipment and Installation Approval

File No.	5009-32-0	PL No.	551-003
RDIMS No.	1019349-V5	Issue No.	01
Issuing Branch	Aircraft Certification	Effective Date	2005-05-09

1.0 INTRODUCTION..... 2

1.1 Purpose 2

1.2 Guidance Applicability..... 2

1.3 Description of Changes..... 2

1.4 Termination 2

2.0 REFERENCES..... 2

2.1 Reference Documents 2

2.2 Cancelled Documents 3

3.0 BACKGROUND..... 3

4.0 EQUIPMENT AND INSTALLATION REQUIREMENTS 4

4.1 GPS Equipment Qualification Requirements..... 4

4.2 Acceptance of FAA Advisory Material for GPS Installation in Canadian Registered Aircraft 4

4.3 Acceptance and Approval of Foreign Design Changes for GPS Installations 5

4.4 TCCA Flight Test and Engineering Support..... 5

4.5 Regional Flight Testing 5

4.6 Human Factors Requirements 5

4.7 Placards 6

4.8 Data Requirements 6

5.0 HEADQUARTERS CONTACT 6

APPENDIX A – ACCEPTED IFR APPROACH CAPABLE GPS EQUIPMENT 7

1.0 INTRODUCTION

1.1 Purpose

The purpose of this Policy Letter (PL) is to provide guidance on those activities that are necessary for installation of Global Positioning Systems (GPS) on Canadian registered aircraft. This PL also highlights deviations from the accepted Federal Aviation Administration (FAA) guidance material and provides clarification with regard to current Transport Canada Civil Aviation (TCCA) policies.

1.2 Guidance Applicability

This document is applicable to Headquarters (HQ) and Regional Aircraft Certification personnel, including delegates and Aircraft Maintenance and Manufacturing personnel.

1.3 Description of Changes

This document is a new issue, replacing Aircraft Certification Policy Letter (ACPL) 17.

1.4 Termination

This document does not have a terminating action. It will however, be reviewed periodically for suitability of content.

2.0 REFERENCES

2.1 Reference Documents

It is intended that the following reference materials be used in conjunction with this document:

- (a) Part VI of the Canadian Aviation Regulations (CARs)—*General Operating and Flight Rules*;
- (b) Part VII of the CARs—*Commercial Air Services*;
- (c) Advisory Circular (AC) 500-014 Issue 01, dated 2004-12-01—*Aircraft Flight Manuals*;
- (d) Staff Instruction (SI) 513-008 Issue 01, dated 2004-10-20—*Flight Test Division Support of Regional Flight Test Activities*;
- (e) Policy Letter (PL) 523-008 Issue 01, dated 2004-06-30—*Design Guidelines and Human Factors Considerations for Installation of IFR GPS/GNSS Receivers*;
- (f) Aircraft Certification Staff Instruction (ACSI) 23 Issue 1, dated 2000-10-02—*Acceptance and Approval of Foreign Designed Changes*;
- (g) Aircraft Certification Policy Letter (ACPL) 11 Issue 1, dated 1998-03-17—*Selection and Announcement of Multiple Navigation Sources*;
- (h) Commercial and Business Aviation Advisory Circular (CBAAC) No. 0123R, dated 2004-03-25—*Use of Global Positioning System for Instrument Approaches*;
- (i) Federal Aviation Administration Advisory Circular (FAA AC) 20-138A, dated December 22, 2003—*Airworthiness Approval of Global Navigation Satellite System (GNSS) Equipment*;
- (j) Federal Aviation Administration Technical Standard Order (FAA TSO) TSO-C115b, dated 9/30/94—*Airborne Area Navigation Equipment Using Multi-Sensor Inputs*;
- (k) FAA TSO-C129, dated 12/10/92—*Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)*;
- (l) FAA TSO-C129a, dated 2/20/96—*Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)*;

- (m) FAA TSO-C145a, dated 09/19/02—*Airborne Navigation Sensors Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)*; and
- (n) FAA TSO-C146a, dated 09/19/02—*Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS)*.

2.2 Cancelled Documents

As of the effective date of this document, Aircraft Certification Policy Letter (ACPL) 17 Issue 2, dated 2000-10-05—*Global Positioning System (GPS) and Flight Management System (FMS) Equipment and Installation Approvals* is cancelled.

3.0 BACKGROUND

Approval of installations of GPS navigation systems is now common and the systems have matured considerably since ACPL 17, Issue 2 was issued. New capabilities are being introduced, such as the Wide Area Augmentation System (WAAS), which will improve the integrity, availability and accuracy of GPS performance through real time monitoring, additional satellite signal and differential corrections.

Both TCCA and the FAA have done recent work to improve the understanding of GPS installation requirements by designers and installers, particularly with respect to human factors and pilot interface with the equipment. The FAA revised and reissued FAA AC 20-138 as FAA AC 20-138A in December 2003. In June 2004, TCCA published PL 523-008 to address human factors problems seen primarily in small aircraft installations. This document is intended to complement existing FAA guidance material and to clarify certain issues, which are not well addressed in the FAA guidance.

TCCA's Headquarters Flight Test Division (TCCA Flight Test) involvement in evaluating new GPS installations has decreased in recent years. However as GPS technology has matured, it has also become increasingly complex and integrated with other systems. With this increased complexity and integration, new concerns have arisen and more attention must be given to reviewing the human factors aspects of these installations. TCCA involvement may be deemed necessary in certain cases where new features are introduced, which result in an impact on the pilot-system interface.

The FAA has been approving new avionics installations in a large number of aircraft by use of an Approved Model List (AML) Supplemental Type Certificate (STC). The very nature of these approvals means that installation requirements have to be generalized so they can be applied to different aircraft. Accordingly, achievement of good human factors design criteria is a significant challenge.

TCCA maintains a list of standalone Instrument Flight Rule (IFR) approach capable GPS equipment. This equipment has been reviewed and deemed acceptable for use in Canada once applicable installation requirements have been met. This list is shown in Appendix "A" of this document and includes TSO-C129 equipment and their specific software versions, which have been found acceptable for Instrument Flight Rule (IFR) approach operations. This list is maintained for reference purposes only and will not be regularly updated.

All TSO-C129 equipment listed in Appendix "A" and all TSO-C129a equipment may be installed and certified for IFR approach operations. TSO-C129 equipment that is not identified on the list cannot be certified for IFR approach operations.

4.0 EQUIPMENT AND INSTALLATION REQUIREMENTS

4.1 GPS Equipment Qualification Requirements

GPS equipment may be used for IFR operations if they meet FAA TSO-C129a, TSO-C145a or TSO-C146a, or later accepted revisions. Additionally, the equipment class (i.e. A1, A2, B, etc.) must be appropriate to the intended use. TSO-C129 equipment certified listed in Appendix "A" is also eligible for IFR installations.

4.2 Acceptance of FAA Advisory Material for GPS Installation in Canadian Registered Aircraft

As a matter of policy, TCCA has accepted advisory material developed by the FAA and identified in section 2.0 of this document. In particular, FAA AC 20-138A, for GPS, has been accepted **except** that:

- (a) TCCA human factors guidance provided in PL 523-008, is to be met where practical and, if not, a flight evaluation of the installation may be required;
- (b) Installations classified by the FAA as a major alteration, by paragraph 8.(c)(1)(ii) of FAA AC 20-138A, require the issuance of an STC or a Limited STC (LSTC), in place of the field approval identified in the FAA AC;
- (c) Installations classified by the FAA as a minor alteration, by paragraph 8.(c)(1)(iii) of FAA AC 20-138A, are considered major modifications by TCCA, but may be done using specified data, rather than approved data, to substantiate compliance with the applicable standards of airworthiness. For information on the acceptance of specified data, please contact the responsible TCCA Regional Engineer, Aircraft Certification;
- (d) TCCA Flight Test guidance on GPS airplane/rotorcraft flight manual supplement (A/RFMS) content, as provided in AC 500-014, is to be used in place of that provided in Appendix 4 of FAA AC 20-138A. A TCCA approved or accepted (e.g. FAA approved) A/RFMS will be required for Instrument Flight Rules (IFR) installations;
- (e) Data approval and certification testing requirements shown in paragraphs 8.(c)(1)(i), (ii) and (iii) of FAA AC 20-138A are to be replaced by the information provided in this document; and
- (f) Installations should take account of the following Canadian considerations:
 - (i) **Navigation in True North Airspace**

For GPS equipment that is not designed to navigate with reference to "True Tracks" or cannot interface to other installed equipment when operating with reference to "True Tracks", an appropriate limitation is required in the A/RFMS.
 - (ii) **Navigation Source Switching**

Aircraft with multiple navigation sources that share a display device (e.g. the Course Deviation Indicator or the Horizontal Situation Indicator) should incorporate a dedicated "navigation source selector". Refer to ACPL 11 for further guidance on this topic.
 - (iii) **Compliance with Operational Requirements**

Aircraft operators and installers of GPS equipment should be aware that design approval of the equipment installation does not necessarily include compliance with the requirements of Part VI and Part VII of the CARs. In particular, CBAAC No. 0123R should be consulted to determine if there are any additional operational requirements for GPS instrument approach capable installations.

Appendix 5 of FAA AC 20-138A may be used as stated for installation of enroute GPS equipment for Visual Flight Rules (VFR) use only, **except** in TCCA terms the "Minor Alteration" may be considered a "Minor Modification". If the operations are later upgraded to IFR, all the applicable

paragraphs in FAA AC 20-138A and the applicable paragraphs in this document must be addressed.

4.3 Acceptance and Approval of Foreign Design Changes for GPS Installations

Acceptance of foreign STCs for VFR and IFR GPS installations will be governed by the criteria of Aircraft Certification Staff Instruction (ACSI) 23, which specifies that:

- (a) FAA STCs may be accepted without a type design examination for aircraft where the U.S.A. is the State of Design, unless TCCA deems that the installation is novel or unusual in its design complexity, pilot interface, or capabilities; and
- (b) A Canadian approval, such as an STC or an LSTC, is normally required for installations on Transport Category aircraft, and any non-U.S.A. State of Design aircraft. The optional Level 1 review allowed by ACSI 23 is normally not appropriate in this case.

Installations based on an FAA Field Approval are to be reviewed on a case-by-case basis as indicated by ACSI 23. Evidence of Designated Engineering Representative (DER) involvement is required for pressure vessel penetrations, but may not otherwise be required for GPS installations.

4.4 TCCA Flight Test and Engineering Support

The guidelines for TCCA Flight Test and Engineering involvement in the system evaluation at the HQ or Regional levels are as follows:

- (a) Required for all "First Time" GPS approvals;
- (b) Required for all TSO-C146a (WAAS) systems on Commuter and Transport Category aircraft;
- (c) Recommended for all installations with complex interfaces to autopilots or flight directors;
- (d) Recommended for all installations that fall outside the guidance of PL 523-008;

Where TCCA Flight Test participation is required, SI 513-008 should be consulted to ensure that all data is provided in advance and conformity inspections, flight authorities and conditions for the conduct of the flight test have been satisfied.

4.5 Regional Flight Testing

TCCA Flight Test participation in flight evaluation of GPS equipment installed on Very Light Aircraft (VLA), Normal, Utility or Aerobatic category aircraft will not be required, in most cases, if the installation meets the human factors installation criteria shown in PL 523-008.

Test flying is to be coordinated by the Regional Manager, Aircraft Certification (RMAC) and the Regional Aircraft Certification Engineers. They may designate a suitably qualified individual to conduct and/or witness any required flight evaluation. The individual must have demonstrated knowledge of the GPS system installation, installation requirements and guidance, test requirements and have demonstrated a capability to conduct, witness and record the data and results. TCCA Flight Test may be consulted for guidance as necessary.

4.6 Human Factors Requirements

The increase in complexity and capability of navigation and flight instrument installations has made good human factor design more important to the effectiveness and safety of the installation. Navigation systems with many functions and limited space or controls can be quite complicated, demanding on pilot memory and difficult to use.

TCCA Flight Test guidance on human factors aspects of GPS installations published in PL 523-008 is intended to supplement the FAA advisory material. PL 523-008 is targeted at location of displays, controls and annunciations in normal category airplanes. Some previously accepted installations were not, and some of the AML STC installations are not, in accordance with this policy. However, installers and engineers are strongly encouraged to design installations

that meet the TCCA human factors criteria to help improve interface characteristics and the quality of the installation. This will make the pilot interface as effective as possible and will allow the pilots to meet their operational goals without undo workload or reliance on exceptional skill and memory, and therefore operate more safely.

When aircraft are imported, the importing organization is also encouraged to make modifications to bring the GPS installation up to the level asked for in the TCCA guidance document.

The PL 523-008 guidance for cockpit installations applies to Part 23, normal category airplanes and makes allowances due to the difficulty in retrofitting modern systems in older, small aircraft. In transport category aircraft, TCCA expects that the most rigorous principles for equipment location, readability, attention-getting capability for annunciations, controls and displays will be maintained.

If an installation is not aligned with this guidance a review of the installation, and possibly a flight evaluation, by TCCA Flight Test may be necessary as previously indicated. Additional guidelines for system installations and human factors are provided in FAA AC 20-138A.

4.7 Placards

A placard is required for VFR operations unless the equipment automatically displays a "VFR Only" message on start-up and pilot action is required to clear the message, or unless there is an FMS which includes the limitation. The placard must be installed in the vicinity of the GPS and in clear view of the pilot, stating, "GPS for VFR use only", or words to that effect.

4.8 Data Requirements

Documentation and approval requirements for GPS equipment are as identified in section 4.1 of this document.

The GPS installation shall be performed in accordance with either approved or specified data. For information on the acceptance of specified data, please contact the responsible TCCA Regional Engineer, Aircraft Certification.

5.0 HEADQUARTERS CONTACT

For more information please contact:

Policy Standards Coordinator (AARDH/P)

Phone: (613) 990-5742

Facsimile: (613) 996-9178

E-mail: AARDH-P@tc.gc.ca

Original signed by Gilles Morin

for

Maher Khouzam
Chief, Regulatory Standards
Aircraft Certification Branch

APPENDIX A – ACCEPTED IFR APPROACH CAPABLE GPS EQUIPMENT

Manufacturer	Model	Hardware Part No.	Software Part No. / Version¹	Additional AFM Limitations*	Date Accepted
Bendix/King	KLN 89B		Version ORS-01		
	KLN 90B		Version ORS-20		
	KLN 94 GPS Navigator	069-01034-0101	Version 01/01		Jan. 16, 2001
	KLN 900		Version ORS-01		
Garmin	GPS 155		Version 3.06		
	GPS 155xl		Version 2.0x ²		
	GPS 165		Version 3.06		
	GNS 430		Version 2.07 (Main SW)		
	GNS 530				
Ilmorrow/UPS	2001/2101 NMC		Version 5.0		
Aviation Technologies	GX50/GX60		Version 2.1		
Trimble	TNL 2000 Approach		Version 237		Dec. 17, 1996
	TNL 2101 Approach		Version 237		Dec. 17, 1996
	TNL 2101 I/O Approach		Version 238		Dec. 17, 1996
	TNL 8100		Version 003A		

* In addition to any limitations outlined in FAA AC 20-138.

¹ Or later version approved by TC or FAA.

² The "x" may be 0 to 9 and typically denotes a minor software change.

The above list includes TSO-C129 equipment, and the specific software versions, that have been found acceptable for IFR approach operations. The list is retained for reference purposes.

All TSO-C129 equipment identified on the list, and all TSO-C129a equipment, may be installed and certified for IFR approach operations. TSO-C129 equipment that is not identified on the list cannot be certified for IFR approach operations.

For Canadian-designed certified GPSs, it is necessary to consult the Appliance Type Certificates, which can be found on the below Transport Canada Internet website:

<http://www.tc.gc.ca/aviation/applications/nico-celn/>.