

**RTCA SC-159
DO-253A
Minimum Operational Performance Standards for GPS Local Area Augmentation
System Airborne Equipment**

(RTCA Paper No. 182-01/SC159-875)

**REPLIES MUST BE RECEIVED BY RTCA NOT LATER THAN
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Concur

Concur with the following comments (use reverse or additional sheets, if desired):

Non-concur with the following substantive comments or objections (use reverse or additional sheets, if desired):

(see comments and letter attached – Note: WAAS letter replaced with LAAS letter 08/24/01)

.....
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DO-253A**

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Comment #	Comment Author	Section	Page	Comment	Suggested Resolution
1	Tom Foster	2.3.1	29	<p>Require output of LAAS augmented PVT, LAAS accuracy metrics and LAAS protection limits when in LAAS mode of operation.</p> <p>Rationale: Required to support surveillance applications.</p>	<p>“.... When applying LAAS differential corrections, the PVT outputs of the airborne equipment shall meet the requirements of either: 1) Section 2.3.10, or 2) RTCA/DO-229C (any of the equipment classes), or 3) RTCA/DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1.</p> <p>In table that follows, in the PVT row delete items 2) and 3) in “Applying LAAS Differential Corrections” columns.</p>
2	Tom Foster	General		Add appendix to define standard PVT output format.	Add appendix similar to Appendix H of DO-229C to define the standard output requirements for PVT.
3	Tom Foster	General		<p>Require LAAS PVT, LAAS accuracy, and LAAS integrity outputs for all LAAS equipment classes.</p> <p>Rational: Needed to support surveillance applications.</p>	All equipment classes to output LAAS PVT, LAAS accuracy, and LAAS integrity to external equipment when operating in LAAS mode.
4	Tom Foster	General		Other related changes may result from addressing the above items.	Make other changes as necessary to maintain consistency with the above changes.

To: RTCA SC159 GNSS

Date: August 3, 2001

From: Tom Foster, RTCA SC186 WG-6 Chairman

Subject: RTCA DO-253A LAAS MOPS PVT Output Requirements to Support Surveillance

Introduction

The proposed Final Draft of the revised RTCA DO-253A, Minimum Operational Performance Standards for GPS Local Area Augmentation System Airborne Equipment, is currently being circulated to committee members for review and approval. This DO-253A revision is to be presented for final approval at the August 30, 2001 SC-159 Plenary meeting. During review of this draft, issues have been identified with DO-253A with respect to LAAS equipment providing suitable PVT to support surveillance operations. The surveillance community is providing inputs to RTCA SC-159 on the LAAS MOPS regarding these issues, so that they may consider the readiness of the proposed draft revised DO-253A document for approval in its current form.

Background

The ADS-B surveillance systems require PVT inputs from on-board sensors or systems that are utilized in the broadcast messages to other ADS-B equipped aircraft or by ground receivers as a reliable position surveillance alternative for traditional surveillance methodologies, e.g. Primary and secondary radar. Since these ADS-B surveillance systems are intended to provide surveillance services to manage airspace operations in both VMC and IMC conditions, the ADS-B position data is required to meet suitable accuracy and integrity requirements. For receiving users, the accuracy and integrity of the position data for a target of concern is assessed via the message data that is broadcast. For the operational benefits to be obtained by airborne and ground users of ADS-B, the airborne ADS-B systems must be able to report the accuracy and integrity of the position sources being broadcast. GNSS sensors and systems are viewed as a primary source of airborne PVT for ADS-B.

The important GNSS sensor PVT output requirements from a surveillance perspective are:

- Best available PVT, i.e. WAAS or LAAS accuracy augmented when the sensor is operating in these modes
- Accuracy values based on 95% accuracy levels for the augmentations in effect
- Integrity values based on integrity assessment methods in effect (WAAS or LAAS when sensor is operating in these modes)

LAAS MOPS Concerns

In review of the LAAS MOPS draft, it is not clear that the document, in its current form, recognizes the role of LAAS capable airborne equipment in support of ADS-B. The primary concern is with the appropriate output of PVT to an external ADS-B device from LAAS capable GNSS equipment. In addition to access to PVT data, ADS-B needs the current assessed accuracy and integrity data from GNSS equipment to appropriately report NIC/NAC values in broadcast ADS-B messages.

The following text excerpts illustrate the concerns with the draft LAAS MOPS document. There may, however, be other sections of the document that will need to be changed to address the

surveillance needs from LAAS equipment.

From the Section 2.3.1, the LAAS Position and Navigation Function General Requirements:

“...

When applying LAAS differential corrections, the PVT outputs of the airborne equipment shall [LAAS-068] meet the requirements of either: 1) Section 2.3.10, **or 2) RTCA/DO-229() (any of the equipment classes), or 3) RTCA/DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1.**

When not applying LAAS differential corrections, the LAAS airborne equipment shall [LAAS-069] meet the requirements of either: 1) RTCA/DO-229() (any of the equipment classes), or 2) RTCA/DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1.

Note: Only RTCA/DO-229() addresses the integration of precision approach with other area navigation functions. GNSS equipment that only meets the requirements of RTCA/DO-208 may be subject to operational restrictions due to the lack of compatibility with Required Navigation Performance (RNP) requirements.

This information is summarized in the table below:

LAAS Equipment Outputs	Applying LAAS Differential Corrections		Not Applying LAAS Differential Corrections
	Approach Selected (Note 1)	Approach Not Selected	
Precision Approach Guidance	defined in Section 2.3.11 (Note 2)	not applicable	In accordance with DO-229() if applicable
PVT	Either: 1. LAAS differential PVT as defined in Section 2.3.10, or 2. In accordance with DO-229(), or 3. In accordance with DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1	Either: 1. LAAS differential PVT as defined in Section 2.3.10, or 2. In accordance with DO-229(), or 3. In accordance with DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1	Either: 1. In accordance with DO-229(), or 2. In accordance with DO-208 as modified by TSO-C129A Class B1 or TSO-C129A Class C1

Note 1: Depending upon the architecture of the avionics and the aircraft integration, the function of selecting an approach may occur either within the equipment described in this MOPS or external to this equipment. See also Section 2.3.4.

Note 2: The precision approach guidance outputs for LAAS airborne equipment are conditional in that equipment Class A (defined in Section 1.4) is not required to meet the requirements of Section 2.3.11 when the GBAS signal-in-space does not support the differential positioning service.”

Recommendation

The current draft revision to DO-253A LAAS MOPS should be changed to recognize the PVT output requirements for on-board ADS-B systems. PVT outputs should be required for all classes of DO-253A LAAS compliant equipment and should reflect LAAS accuracy augmentations when LAAS mode is in effect. These outputs should also include $HFOM_{LAAS}$, $VFOM_{LAAS}$, HPL_{LAAS} , and VPL_{LAAS} computed values when the LAAS augmentation mode is in effect. Time of applicability of the position measurements that can be correlated to UTC EPOCH is also needed.

It is critical that these changes be incorporated now to ensure that subsequent fielded LAAS equipment can support ADS-B needs. The time required to equip airborne users with ADS-B capabilities to allow needed user benefits and airspace improvements to be obtained is driven by the timely availability of adequate industry standards. Changes to the LAAS MOPS to require appropriate PVT outputs for use by external systems is critical to this objective.

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