

No. 2838**AC 20-138B Compliance
Evaluation Summary for WAAS/SBAS FMS****Applicability**

This Service Letter applies to Universal Avionics Systems Corporation (UASC) Flight Management System (FMS) Software Control Numbers (SCNs) 1000.0/1100.0 through 1000.5/1100.5.

NOTE: Revision A to this service letter adds mitigation strategies for each Partial Compliance, Non-Compliance, and Conditional Compliance item listed.

Description

Advisory Circular (AC) 20-138B, *Airworthiness Approval of Positioning and Navigation Systems*, provides guidance material for the airworthiness approval of installed positioning and navigation equipment. FMS SCNs 1000.0/1100.0 through 1000.5/1100.5 comply with the requirements of AC 20-138B in all but the following specified areas:

Compliance**9-4.b (3) - Multisensor Systems that rely on Ground-Based NAVAIDS**

Compliance: The FMS supports RNP operations using GPS, DME, VOR, and IRS sensors. The FMS will meet this requirement at most locations depending upon the ground navigation sensor density. Compliance to this section is dependent upon the FMS, aircraft installation, and ground navigation equipment availability in the vicinity of the airplane. When in adequate GPS coverage the FMS meets the requirements of this section. If GPS fails and the FMS is only relying on DME, VOR, and IRS sensors, position accuracy may degrade in response to poor navaid coverage and normal IRS divergence over time. Compliance may be an issue when in poor VOR/DME coverage. The FMS will always appropriately warn the crew when ANP exceeds RNP regardless of the cause.

Partial Compliance**A2-2.a – RNP AR Operations – Performance Requirements (Path Definition)**

Partial Compliance: The FMS does not support fixed-radius turns. However, fixed-radius turns are not currently implemented in any airspace.

SERVICE LETTER

Non-Compliance

10-2.f (9) - Baro-VNAV Equipment Performance for Operations under IFR (correct vertical path guidance when interfaced with lateral navigation equipment)

Non-Compliance: The FMS does not compute the anticipation based upon the bisector. Therefore, the FMS induces a small error on the vertical path guidance which may exceed the vertical error limits if the VNAV path exceeds the turn angle limits at speeds and altitudes listed in the suggested AFMS/RFMS limitations section below.

Suggested AFMS / RFMS Limitations for Baro VNAV

If implementing Baro-VNAV for IFR operations, the AFMS should state that VNAV is limited for use in accordance with the table below. Suggested language for the AFMS:

“The Baro-VNAV function is compliant with the required system error if the course flown meets the limitations in the table below. VNAV operations outside of these limitations may not be compliant and may deviate outside of the required total system error.”

Altitude (ft)	True Airspeed (TAS) - kts	Max Turn Angle - deg	Phase of flight
Below 5K	150	110	Terminal
5K – 10K	200	105	Terminal
Above 10K	250	97	Enroute
Above 10K	500	51	Enroute

Conditional Compliance

NOTE: UASC SBAS FMS Systems are TSO approved per TSO C-146b and as such are capable of supporting RNP approaches with required performance down to and including RNP 0.3. As noted below, single FMS systems or FMS + LPV monitor systems will not support the integrity needed for RNP AR approaches to levels less than RNP 0.3. Other installation positioning and guidance requirements listed in Appendix 2 of AC 20-138B must also be met and demonstrated for the installation to be qualified for the operator to seek an RNP AR operational approval. Operational approvals are separate and apart from the aircraft performance, functions, and installation considerations. Installation approval does not constitute an Operational Approval.

A2-5.b – Requirements for RNP AR Approach Values less than 0.3 (hazardous (severe-major) display of misleading lateral or vertical approach guidance)

(and)

SERVICE LETTER

A2-5.c – Requirements for RNP AR Approach Values less than 0.3 (hazardous total display loss of lateral approach guidance and minor loss of vertical approach guidance)

Conditional Compliance: The FMS software design assurance (as applies to RNP) is consistent with a major hazard level (level C, Do-178()). A single FMS installation does not have the integrity to support RNP operations less than 0.3 NM, however a dual FMS installation may. If seeking RNP AR operations approval, an installation system safety analysis will be required to address the specific installation, and provide required mitigation in the form of redundant systems or other equipment installations.

Summary

UASC FMS SCN 1000.6/1100.6 will implement improvements to address the Baro VNAV limitations listed above. This Service Letter will be revised or another Service Letter will be issued upon any change in FMS compliance status.

Material, Cost, and Availability

Questions and concerns about the identified compliance items or the FMS in general may be directed to Product Support:

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