TERMS OF REFERENCE

Special Committee SC-159
Navigation Equipment Using the Global Navigation Satellite System (GNSS)
(Version 6)

REQUESTOR:

Organization	Person

SC LEADERSHIP:

Position	Name	Affiliation	Telephone	Email	Change
Co-Chair	Christopher Hegarty	The MITRE Corporation	781-271-2127	chegarty@mitre.org	
Co-Chair	George Ligler	Project Management Enterprises, Inc.	(919) 346-1807	ligler1@earthlink.net	
DFO	Ken Alexander	FAA/AIR-130	202-385-4684	ken.alexander@faa.gov	
Secretary	Kyle Wesson	Zeta Associates	571-732-4083	wesson-kyle@zai.com	

BACKGROUND:

Since it was established in 1985, RTCA SC-159 has produced and maintained a suite of minimum operational performance standards (MOPS) and minimum aviation system performance standards (MASPS) for aviation equipment using the Global Positioning System (GPS) as augmented by aircraft-based, ground-based, and satellite-based augmentation systems (ABAS, GBAS, and SBAS, respectively) as defined by the International Civil Aviation Organization (ICAO). These standards are in widespread use today but only address equipment that processes one legacy GPS signal – the GPS coarse/acquisition (C/A) code that is modulated on the link 1 (L1) carrier frequency of 1575.42 MHz.

GPS is presently being modernized, and the constellation is being populated with three new civil signals (L5, L2C, and L1C) on multiple frequencies with three of the four end-state civil signals (L1 C/A, L5, and L1C) being located within bands allocated for aeronautical radionavigation services (ARNS). SBASs, such as the Wide Area Augmentation System (WAAS) in North America, are evolving to support dual-frequency user equipment. Additionally, other GNSS core

constellations have been deployed (Russia's GLONASS) or will soon be deployed (Europe's Galileo and China's BeiDou). ICAO's Navigation System Panel (NSP) has already started updating Standards and Recommended Practices (SARPs) contained within Annex 10 to the International Convention on Civil Aviation to incorporate GPS and GLONASS modernization as well as the new core constellations. However, equipment standards are still required.

DELIVERABLES:

Product	Description	Due Date	Change
DO-253D	Updated GBAS MOPS.	March 2016	
DO-246E	Updated GBAS ICD.	March 2016	
GPS/GLONASS L1-only MOPS	New MOPS for GPS/GLONASS (FDMA + antenna) L1-only airborne equipment.**	March 2016	
GNSS-Aided Inertial Systems MOPS	New MOPS for GNSS-aided inertial navigation systems.	July 2017	
DO-235C	Updated L1 interference environment report.	December 2017*	
DO-292A	Updated L5 interference environment report.	December 2017*	
GNSS L1/L5 Antenna MOPS	New GNSS dual-frequency (1575/1176 MHz) antenna MOPS for airborne equipment	December 2017*	
GNSS(SBAS) L1/L5 MOPS	Initial MOPS for Verification and Validation Validated GPS/SBAS MOPS for dual-frequency equipment including, if possible, at least one additional core constellations.**	2019-2020* 2021-2022*	

GNSS(GBAS) L1/L5 MOPS	Initial MOPS for Verification and Validation Validated GPS/GBAS MOPS for dual-frequency equipment and including, if possible, at least one additional core constellations.**	2020-2021* 2022-2023*	

*These dates are based upon the current schedule for deployment of L5-capable GPS satellites.

**The level of detail of requirements for additional core constellations will be dependent upon multiple prerequisites as discussed in the Specific Guidance Section below. Additionally, in the case of the GNSS (SBAS or GBAS) L1/L5 MOPS, constellation providers will be advised to provide final needed technical information at least two year priors to the completion of Initial MOPS for Verification and Validation in order to have their constellations included in the MOPS.

SCOPE:

RTCA SC-159 shall develop equipment standards for GNSS augmented by ABAS, GBAS, and SBAS, as well as associated interference environment reports and interface control documents (ICDs).

ENVISIONED USE OF DELIVERABLE(S)

The guidance developed by this special committee will be referenced by the Federal Aviation Administration (FAA) in certification guidance material including Technical Standard Orders (TSOs).

SPECIFIC GUIDANCE:

1. The following core constellations should be addressed:
    a. The U.S. Global Positioning System (GPS)
    b. The Russian Federation Global Orbiting Navigation Satellite System (GLONASS).
    c. Europe's Galileo
    d. China's BeiDou
2. The incorporation of the foreign core constellations listed above within equipment standards shall be contingent upon multiple prerequisites being satisfied for operational use.
3. The following augmentations should be addressed:
    a. Aircraft-based augmentation system – as defined by ICAO, this includes receiver autonomous integrity monitoring (RAIM), which uses GNSS information exclusively, and aircraft autonomous integrity monitoring (AAIM), which uses

information from additional on-board sensors (e.g., barometric altimeter, clock and inertial navigation systems). Consideration should be given to advanced RAIM (ARAIM) methods currently under development, including for horizontal-only applications.

b. SBAS.
c. GBAS.

4. Particular attention should be given to meeting integrity and availability requirements especially for all phases of flight.
5. New MOPS should address, to the extent practicable, the threats of intentional interference and spoofing.
6. New MOPS should address, to the extent practicable, the possibility of higher levels of adjacent-band interference in the future operational environment.
7. The work of the committee should be coordinated with the European Organization for Civil Aviation Equipment (EUROCAE) Working Groups 28 and 62, as well as with ICAO's Navigation System Panel (NSP).

INITIAL DOCUMENTATION - the following documents should be made available to this committee.

Documents	**Intended Use**
DO-228 and DO-301	Basis for updated antenna MOPS.
DO-229	Basis for updated GPS/SBAS MOPS.
DO-245, -246D, -253C	Basis for updated GPS/GBAS MOPS and ICD.
DO-208, -316	Basis for updated GPS/ABAS MOPS.
DO-235B, -292, -327	Basis for updated interference environment assessments.

TERMINATION:

This Special Committee will terminate its activities upon Program Management Committee (PMC) approval of the committee's final deliverable and following specific termination direction from the PMC. Any change/extension in the committee's work program requires prior PMC approval.