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**Minimum Operational Performance
Standards (MOPS) for
GNSS Aided Inertial Systems**

RTCA DO-384
December 17, 2020

Prepared by: SC-159
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FOREWORD

This document was prepared by Special Committee 159 (SC-159) and approved by the RTCA Program Management Committee (PMC) on December 17, 2020

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- developing consensus on the application of pertinent technology to fulfill user and provider requirements, including development of minimum operational performance standards for electronic systems and equipment that support aviation; and
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EXECUTIVE SUMMARY

RTCA DO-384 was prepared by RTCA Special Committee 159 (SC-159). It was approved by the RTCA Program Management Committee on December 17, 2020.

The purpose of this document is to provide minimum operational performance standards (MOPS) for Global Navigation Satellite System (GNSS) aided inertial systems including GNSS-aided attitude heading reference systems. Previously, Appendix R in RTCA DO-229 (any revision) and RTCA DO-316 contained the only reference material for GNSS-aided inertial systems, but only covered inertial reference systems qualified per 14 CFR Part 121 Appendix G using a tightly-coupled integration intended for long-range operations such as the oceanic environment. This document provides performance standards for an expanded range of inertial sensor technologies and integrations from short-range, loosely coupled to long-range, tightly-coupled covering a wider range of operations. Additionally, this document includes GNSS-aided performance standards used for attitude, heading and velocity information which is not covered by RTCA DO-334.

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TABLE OF CONTENTS

1	PURPOSE AND SCOPE	1
1.1	Introduction	1
1.2	System Overview	2
1.3	Equipment Categories	3
1.4	Goals	4
1.4.1	Goals for Category A and Category B	5
1.4.2	Goals for Category C	5
1.5	Definition of Key Terms	5
1.6	Assumptions	5
1.7	Aircraft Equipment Information Vulnerabilities	6
2	EQUIPMENT PERFORMANCE AND TEST PROCEDURES	9
2.1	General Requirements Applicable to All Equipment Categories	9
2.1.1	Airworthiness	9
2.1.2	Intended Function	9
2.1.3	Federal Communications Commission Rules	9
2.1.4	Fire Protection	9
2.1.5	General Human Factors Requirements	9
2.1.6	Effect of Test	10
2.1.7	Design Assurance	10
2.1.8	Complex Electronic Hardware Compliance	10
2.2	Requirements Applicable to Category A, B and C	10
2.2.1	Positioning	11
2.2.2	Additional Navigation Parameters	14
2.2.3	Other Aiding Sources	17
2.2.4	Receiver Oscillator Performance	18
2.2.5	Performance under Extreme Ionospheric Conditions	18
2.2.6	Performance under RFI Conditions	20
2.2.7	Performance in the Presence of Gravity Deflections	20
2.2.8	Discriminator Averaging	21
2.2.9	URA Based Bounding	21
2.2.10	Fault Mode Based Positioning Requirements	21
2.3	Signal Modeling	21
2.3.1	Inertial Sensor Modeling	21
2.3.2	GPS Signal Modeling	22
2.3.3	Receiver Clock Modeling	23
2.4	Environmental Conditions	23
2.4.1	Environmental Tests	23
2.5	Test Methods and Procedures for Categories A, B and C	28
2.5.1	Categorization of Detection and Exclusion Mechanisms	28
2.5.2	Availability Testing	30
2.5.3	False Detection Rate	31
2.5.4	Fault Free Accuracy Performance	32
2.5.5	Off-Line Rare Normal Verification	32
2.5.6	Off-Line Detection and Exclusion Verification	33
2.5.7	Testing Additional Claimed Parameter Performance	40
2.5.8	Testing under Extreme Noise Conditions	42
2.5.9	Robustness	45
2.5.10	On-Line Validation	46

2.5.11	References.....	48
3	MANUFACTURER CONSIDERATIONS FOR INSTALLED EQUIPMENT.....	49
3.1	Equipment Installation.....	49
3.1.1	Accessibility.....	49
3.1.2	Aircraft Environment.....	49
3.1.3	Display Visibility.....	49
3.1.4	Dynamic Range.....	49
3.1.5	Failure Protection.....	49
3.1.6	Interference Effects.....	49
3.1.7	Inadvertent Turnoff.....	50
3.1.8	Aircraft Power Source.....	50
3.2	Installed Equipment Performance Considerations.....	50
3.2.1	Characterization of Position Accuracy & Integrity.....	50
3.2.2	Determination if Position Meets Operational Requirements.....	51
3.2.3	Coasting Performance.....	53
3.2.4	Availability.....	53
3.3	Attitude and Heading Outputs.....	53
3.4	Test Procedures for Installed Equipment Performance.....	53
4	AIRCRAFT OPERATIONAL PERFORMANCE CHARACTERISTICS.....	55
5	MEMBERSHIP.....	57
APPENDIX A:	GLOSSARY AND ACRONYMS.....	A-1
APPENDIX B:	INERTIAL SENSOR CHARACTERIZATION AND MODELING.....	B-1
B.1	General.....	B-1
B.2	Modeling Inertial Output Data Characteristics.....	B-1
B.2.1	Flight Test Data Collection.....	B-1
B.3	Ground Test Data Collection.....	B-2
B.4	Inertial Sensor Error Model.....	B-3
B.5	Determining Inertial Sensor Error Model Parameters using Measured Data.....	B-4
B.6	Considerations in Error Modeling for Externally Integrated Systems.....	B-4
B.7	Post Test Simulation.....	B-5
B.8	Post Flight Simulation Verification.....	B-6
B.9	Performance Evaluation with Environmental Errors.....	B-6
B.10	Performance Evaluation under Sensor Faults.....	B-7
B.11	Summary.....	B-7
APPENDIX C:	HFOM, HPL AND HEL DEFINITIONS FOR INTEGRATED SYSTEMS.....	C-1
C.1	General.....	C-1
C.2	Fault-Free Performance.....	C-1
C.3	Failed Performance.....	C-3
C.4	Exclusion Performance.....	C-4
C.5	Corresponding Snap Shot FDE.....	C-5
C.6	Reference RAIM Models.....	C-5
C.7	Covariance Simulations.....	C-5
APPENDIX D:	BENEFITS AND LIMITATIONS OF INTEGRATION.....	D-1

D.1	Introduction.....	D-1
D.2	Integrity versus Continuity.....	D-1
D.3	Special Effects for Velocity and Heading.....	D-2
APPENDIX E: ACCURACY AND INTEGRITY COASTING		E-1
E.1	General	E-1
E.2	Accuracy Coasting.....	E-1
E.3	Integrity Coasting	E-3
APPENDIX F: INTEGRATION METHODS		F-1
F.1	General.....	F-1
F.2	Pre-residual (Innovation) Screening	F-1
F.3	Post-Residual Monitoring	F-1
F.4	Additional Measurement Bias States	F-2
F.5	Multiple Kalman Filters.....	F-2
F.6	Extrapolation Method	F-2
F.7	Solution Separation.....	F-2
F.8	Mixed Method	F-2
F.9	Discriminator Averaging	F-2
F.10	Transient Detection/Exclusion for Navigation Grade Systems	F-2
F.11	Satellite Redundancy	F-3
F.12	Integrity Coasting	F-3
F.13	Gravity/Schuler Coupling.....	F-3
F.14	Other Schuler Coupling Related Effects.....	F-4
APPENDIX G: GNSS FAULT MODES.....		G-1
G.1	General.....	G-1
G.2	Assumed Fault Mechanisms	G-1
G.2.1	IFMEA from Year 2000.....	G-1
G.2.2	Observed Satellite Faults from the Period 1999 to 2016	G-2
G.2.3	The 2020 GPS service history from a review.....	G-3
G.2.4	Fault Modes to be Used for Testing Position Bounding via Detection and Exclusion	G-3
G.3	Assumed Fault Mechanisms for Velocity and Attitude Parameters.....	G-4
G.4	Sat-Zap.....	G-6
APPENDIX H: GNSS RECEIVER INTERFACE CONSIDERATIONS		H-1
H.1	Objectives.....	H-1
H.2	Recommendations on Measurement Block Parameters	H-1
H.2.1	Satellite Measurement Status (label 060) & Extended Satellite Measurement Status (label 050).....	H-2
H.2.2	Satellite Range (labels 061 & 062)	H-4
H.2.3	Satellite Position (labels 065, 066, 070, 071, 072 & 073).....	H-4
H.2.4	Measurement Time (label 074)	H-5
H.2.5	Satellite Range Rate (label 064 or 063)	H-5
H.2.6	Satellite Range Error (label 052 or 051 and 057).....	H-6
H.3	Recommendations on Measurement Block Parameters (for Attitude/Heading)	H-6
H.3.1	Raw Carrier Phase (label 225)	H-7
H.3.2	Time Alignment Status (label 147 bits 11 & 12)	H-7
H.4	Recommendations on Navigation Block Parameters	H-7

H.4.1	Position (labels 110, 120, 111, 121, 370 & 076)	H-8
H.4.2	Velocity (labels 112, 166, 174 & 165)	H-8
H.4.3	Track Angle (label 103)	H-9
H.4.4	UTC Time (labels 125, 150, 140 & 141)	H-9
H.4.5	Date (label 260)	H-9
H.4.6	Time Mark (analog signal)	H-9
H.4.7	Constellation Geometry (labels 101 & 102)	H-9
H.4.8	Position Integrity (labels 130, 237 & 133)	H-9
H.4.9	Position Accuracy (labels 247 & 136)	H-9
H.4.10	GNSS Status (labels 273, 355)	H-10
H.5	Recommendations on CLOCK FREQUENCY (OSCILLATOR) ERRORS	H-10
H.5.1	Minimum Requirements on Clock Frequency Errors	H-10
H.5.2	Actual Requirements on Clock Frequency Errors	H-10
H.5.3	Requirements on Clock Frequency Errors Testing Conditions	H-11
H.6	Recommendations on Timing	H-11

APPENDIX I: SIGNAL MODELING I-1

I.1	Ionosphere	I-1
I.1.1	International Reference Ionosphere (IRI) Model	I-1
I.1.2	Randomization	I-3
I.1.3	Klobuchar Coefficients for the Required Testing Period of November 2001	I-4
I.2	Troposphere	I-5
I.3	Satellite Clock and Ephemeris	I-5
I.4	Carrier-based Smoothing	I-5
I.5	In-Air Thermal and Broadband Noise	I-6
I.6	In-Air Multipath	I-7
I.7	Scintillation Model	I-10
I.8	Ionosphere Storm Data	I-12
I.9	Depletion Bubble Model	I-14
I.10	RFI (broadband to CW)	I-16

APPENDIX J: MAGNETIC SENSING AND MODELLING J-1

J.1	General	J-1
J.2	Earth's Magnetic Field	J-1
J.2.1	Requirements and Testing	J-2
J.3	Installed Equipment Environment	J-2
J.4	Requirements and Testing	J-2
J.5	References	J-3

APPENDIX K: AIR DATA SENSING AND MODELLING K-1

K.1	General	K-1
K.2	Altitude and vertical speed parameters computed by the aircraft systems	K-1
K.2.1	Air Data System	K-1
K.2.2	Inertial System	K-6
K.2.3	GNSS System	K-10
K.3	Calibration of the Barometric Altitude	K-11
K.3.1	Calibration using GNSS Data (and error estimation based on equation)	K-12
K.3.2	Calibration using local QNH pressure and local MSL geoid undulation	K-12
K.3.3	Calibration Using GNSS Data (and error estimation based on Kalman filter)	K-13
K.4	Temperature Correction	K-15
K.4.1	Barometric Altitude	K-15

K.4.2	Barometric Vertical Speed.....	K-16
K.5	Requirements and Testing.....	K-18

APPENDIX L: SATELLITE-BASED ATTITUDE/HEADING SENSING AND MODELING ..L-1

L.1	General	L-1
L.2	Mechanization	L-1
L.3	GNSS Heading Determination in a Commercial Aircraft	L-2
L.4	Threats	L-2
L.5	Guidelines.....	L-3

APPENDIX M: TRAJECTORY BASED OFF-LINE SIMULATION METHODS M-1

M.1	General	M-1
M.2	Monte Carlo Test Setup.....	M-1
M.2.1	Simulated Inputs.....	M-1
M.2.2	Number of Trials and Pass Criteria	M-3
M.3	Test and Evaluation	M-6
M.3.1	False Detection Rate.....	M-6
M.3.2	Fault Free Accuracy Performance	M-7
M.3.3	Fault Detection and Exclusion for Positioning.....	M-7
M.3.4	Fault Detection and Exclusion for Other Parameters	M-8
M.3.5	Availability Evaluation.....	M-9
M.3.6	Inertial Coasting	M-10
M.3.7	Robustness Testing.....	M-11

APPENDIX N: ACCEPTABLE TRAJECTORIES FOR TESTINGN-1

N.1	General.....	N-1
N.2	Flight profiles description	N-3
N.2.1	Instrument Approach.....	N-4
N.2.2	RNP Approach	N-5
N.2.3	RNP-AR Approach	N-6
N.2.4	Typical Instrument Flight and Typical RNP-AR Flight.....	N-6
N.3	Test Trajectories description	N-17
N.3.1	Test Trajectory Type I.....	N-17
N.3.2	Test Trajectory Type II	N-17
N.3.3	Test Trajectory Type III.....	N-18
N.3.4	Test Trajectory Type IV.....	N-19
N.3.5	Test Trajectory Type V	N-19
N.3.6	Test Trajectory Type VI.....	N-22
N.3.7	Test Trajectory Type VII	N-28

APPENDIX O: GRAVITY MODELINGO-1

O.1	General.....	O-1
O.2	Gravity Models and Databases.....	O-2
O.3	Simulation of Gravity Model Error.....	O-10
O.4	Example Model Development.....	O-13
O.5	References.....	O-18

APPENDIX P: CLAIM TABLES..... P-1

P.1	Parameters Claim Table.....	P-1
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P.2	Accuracy and Integrity Claim Table for Hybrid Parameters	P-2
P.3	Availability Claim Table for Hybrid Parameters.....	P-3
P.4	Coasting Claim Table for Hybrid Parameters.....	P-5

APPENDIX Q: ALTERNATE TRAJECTORIES.....Q-1

Q.1	General.....	Q-1
Q.2	Mechanization Methods.....	Q-1
Q.3	Alternate Trajectory Scenarios.....	Q-2
Q.4	Test Scenarios	Q-4
Q.5	Alternate Trajectory Claims Table.....	Q-19

TABLE OF FIGURES

Figure 1-1:	GNSS-Aided Inertial System Diagram Example.....	3
Figure B-1:	Flight Test Data Collection	B-2
Figure B-2:	Post Test Simulation Block Diagram	B-6
Figure C-1:	Gaussian Approximation Illustration.....	C-3
Figure C-2:	Worst-Case Satellite	C-4
Figure D-1:	Snapshot Versus Integrated System	D-1
Figure G-1:	Fault Mode Illustration in SPS	G-5
Figure H-1:	Timing Recommendations Summary.....	H-12
Figure I-1:	Ionospheric Error Encountered by PRN 14 in 50 Flights	I-3
Figure I-2:	Generated Multipath	I-8
Figure I-3:	GBAS/SBAS Smoothed Multipath.....	I-8
Figure I-4:	Power Spectral Densities	I-9
Figure I-5:	Mean Time Between Loss of Lock.....	I-10
Figure I-6:	Mean Time to Reacquisition.....	I-11
Figure I-7:	WAAS Stations Providing Storm Data.....	I-13
Figure K-1:	Barometric Altitude and Vertical Speed Error, Function of Air Static Temperature and Pressure.....	K-3
Figure K-2:	Maximum & Typical Barometric Altitude Error, Function of A/C Altitude & Mach	K-6
Figure K-3:	Baro-Inertial Vertical Loop, Without Air Temperature Effect Correction	K-7
Figure K-4:	Baro-Inertial Vertical Loop, With Air Temperature Effect Correction (Solution 1)	K-8
Figure K-5:	Baro-Inertial Vertical Loop, With Air Temperature Effect Correction (Solution 2)	K-8
Figure K-6:	Stochastic Pressure Altitude Bias and Bias Rate Process	K-19
Figure K-7:	Stochastic Pressure Altitude Bias Process Definition	K-19
Figure K-8:	Geographical Spread of Flights.....	K-21
Figure K-9:	Statistics for Pressure Altitude Minus Geometric Altitude	K-21
Figure K-10:	Statistics for Temp. Corrected Pressure Altitude Minus Geometric Altitude	K-22
Figure K-11:	Typical Altitude Profile Generating Second Peak	K-22
Figure K-12:	Simulated Bimodal Distribution.....	K-23
Figure K-13:	Simulated Pressure Altitude Bias	K-24
Figure K-14:	Simulated Pressure Altitude Bias Rate.....	K-25
Figure M-1:	Number of Expected Failures for 99% of Bad Units and 50, 90 and 99% of Good Units	M-3
Figure M-2:	Histograms of Good Units with 99.9% Probability of Success (Green) and Bad Units with 99.8% Probability of Success (Red)	M-5
Figure M-3:	CDF of Simulated Trials for Good Units with 99.9% Probability of Success and Bad Units with 99.8% Probability of Success.....	M-5
Figure N-1:	Instrument Approach (IA) Segments	N-4
Figure N-2:	A/C Category “Mean” & typical Instrument Flight – Whole Flight - Altitude & IAS	N-9
Figure N-3:	A/C Category “Mean” & typical Instrument Flight – Whole Flight –	N-9

Figure N-4: A/C Category “Mean” & Typical Instrument Flight – Whole Flight - Pitch & Roll/Bank Angles.....	N-10
Figure N-5: A/C Category “Mean” & Typical Instrument Flight – Whole Flight - Position	N-10
Figure N-6: A/C Category “Mean” & Typical Instrument Flight – Taxi – Position & GS	N-11
Figure N-7: A/C Category “Mean” & Typical Instrument Flight – Taxi + Take Off – Position & GS	N-11
Figure N-8: A/C Category “Mean” & Typical Instrument Flight – Departure – Position & GS.....	N-12
Figure N-9: A/C Category “Mean” & Typical Instrument Flight – Arrival – Position & GS	N-12
Figure N-10: A/C Category “Mean” & Typical RNP-AR Flight – Whole Flight - Altitude & IAS	N-13
Figure N-11: A/C Category “Mean” & Typical RNP-AR Flight – Whole Flight - Altitude & GS.....	N-13
Figure N-12: A/C Category “Mean” & Typical RNP-AR Flight – Whole Flight - Pitch & Roll/Bank Angles	N-14
Figure N-13: A/C Category “Mean” & Typical RNP-AR flight – Whole Flight - Position.....	N-14
Figure N-14: A/C Category “Mean” & Typical RNP-AR Flight – Taxi – Position & GS.....	N-15
Figure N-15: A/C Category “Mean” & Typical RNP-AR Flight – Taxi + Take Off – Position & GS	N-15
Figure N-16: A/C Category “Mean” & Typical RNP-AR Flight – Departure – Position & GS	N-16
Figure N-17: A/C Category “Mean” & typical RNP-AR flight – Arrival – Position & GS	N-16
Figure N-18: Type I Trajectory.....	N-17
Figure N-19: Type II Trajectory	N-18
Figure N-20: Type III Trajectory	N-19
Figure N-21: Type V Trajectories - Heading changes (scenarios #1 to 4)	N-21
Figure N-22: Type V Trajectories - Speed changes (scenarios #5 and 6).....	N-21
Figure N-23: Type VI Trajectory (RTCA DO-334 Table 2-9) - Whole Flight – Position	N-23
Figure N-24: Type VI Trajectory (RTCA DO-334 Table 2-9) – Taxi + Take Off – Position.....	N-24
Figure N-25: Type VI Trajectory (RTCA DO-334 Table 2-9) – Departure – Position	N-24
Figure N-26: Type VI Trajectory (RTCA DO-334 Table 2-9) – Phase 7. Cruise Maneuvers – Position	N-25
Figure N-27: Type VI Trajectory (RTCA DO-334 Table 2-9) – Arrival – Position	N-25
Figure N-28: Type VI Trajectory (RTCA DO-334 Table 2-9) - Whole Flight – Altitude & IAS	N-26
Figure N-29: Type VI Trajectory (RTCA DO-334 Table 2-9) - Whole Flight –.....	N-26
Figure N-30: Type VI Trajectory (DO-334 Table 2-9) – Whole Flight - Pitch & Roll/Bank angle.....	N-27
Figure N-31: Type VI Trajectory (RTCA DO-334 Table 2-9) – Maneuvers - Pitch & Roll/Bank angles	N-27
Figure N-32: Type VI Trajectory (RTCA DO-334 Table 2-9) – Whole flight - Heading Angle	N-28
Figure O-1: Block Diagram Showing the Gravity Residual Simulator to Generate Data for Navigation System Testing.....	O-2
Figure O-2: Illustration Showing the Relationship Between the Reference Ellipsoid, Geoid, and the Deflection of the Vertical.....	O-3
Figure O-3: North-South DOV at the Ellipsoid as Calculated by the WGS84 Ellipsoidal and J2 Gravity Models	O-6
Figure O-4: North-South DOV 10 000 Feet Above the Ellipsoid as Calculated by the WGS84 Ellipsoidal and J2 Gravity Models.....	O-7
Figure O-5: Example Trajectory Flown into Runway 33 Ted Stevens Anchorage International Airport in Alaska	O-8
Figure O-6: EGM2008 Estimates of DOV for an Example RNP-AR Approach into Runway 33 Ted Stevens Anchorage International Airport in Alaska	O-8
Figure O-7: DOV Profile for an Example RNP Approach into Ted Stevens Anchorage International Airport in Alaska Showing the EGM2008 and DEFLEC Estimates of Gravity and the Difference Between the Two (i.e. Residuals)	O-9
Figure O-8: Block Diagram Depicting the Deterministic and Stochastic Portions of the Gravity Residual	O-11
Figure O-9: Block Diagram Demonstrating System Identification Process Inputs and Outputs.....	O-12

Figure O-10: Pole-zero Plot Showing the Poles Resulting from Performing System Identification on the Along-Track and Cross-Track Residuals	O-14
Figure O-11: Histogram and Gaussian Bound of Along-Track Residuals of North-South Runs	O-15
Figure O-12: Histogram and Gaussian Bound of Along-Track Residuals of North-South Runs (Zoomed-In).....	O-16
Figure O-13: Complementary CDF Showing the Gaussian Distribution Bounds the Tails of the Residuals	O-16
Figure O-14: Block Diagram Illustrating Example Gravity Residual Simulator	O-17
Figure O-15: Example Output of the Gravity Residual Simulator Simulating the Residual Between the EGM2008 and DEFLEC Datasets (i.e. the Stochastic Model of the Reference Model Error)	O-18
Figure Q-1: Simulation Block Diagram.....	Q-7
Figure Q-2: Example Plot of the Number of Faults for a Good Unit with 99% Success Rate and a Bad Unit with 98% Success Rate, at 333 Trials the Screening Criteria is Met	Q-9
Figure Q-3: Example Plot of the Number of Faults for a Good Unit with 99% Success and a Bad unit with 98% Success, at 945 Trials is Required for 90% Confidence	Q-11
Figure Q-4: Example of Arbitrary Bins with One Bin Having Twice the Failure Probability of the Next: Highest	Q-12
Figure Q-5: Over 90% Accurate Identification in 10,000 Runs with 945 Trials Each	Q-12
Figure Q-6: Position Step Example	Q-13
Figure Q-7: Velocity Step Example.....	Q-15
Figure Q-8: Acceleration Step Example	Q-18

TABLE OF TABLES

Table 1-1: Summary of Bounding Capabilities	4
Table 2-1: Summary of Positioning FDE Requirements	11
Table 2-2: Summary of FDE Requirements for Other Parameters	14
Table 2-3: Environmental Test Conditions for Separate Integration Units	24
Table 2-4: Sensor Error Model Required Environmental Categories	27
Table 2-5: Required Number of Trials for Each Fault Mode.....	38
Table E-1: Sensor Performance Example for Category A, B, C Used for Performance Predictions.....	E-2
Table E-2: 95% Accuracy Coasting Performance Example	E-2
Table E-3: Integrity Coasting Performance Example	E-4
Table F-1: Equivalent Altitude Accuracy	F-3
Table G-1: Summary of Fault Type Probabilities for Block I, II and IIA	G-1
Table G-2: Summary of Observed Faults for IIA and IIR	G-2
Table G-3: Summary of Observed Faults	G-3
Table G-4: Summary of Assigned Fault Rates for Position Testing.....	G-4
Table G-5: Recommended Fault Modes for Velocity and Attitude	G-5
Table H-1: Measurement or Supplementary Measurement Block Parameters	H-1
Table H-2: Additional Measurement Block Parameters (Attitude/Heading).....	H-6
Table H-3: Navigation Block Parameters	H-8
Table I-1: IRI versions as of 2020	I-1
Table I-2: Klobuchar Coefficients Starting at Day 305	I-4
Table I-3: Storm Data Description Per Column.....	I-13
Table K-1: Barometric Altitude and Vertical Speed Error, Function of Air Static Temperature	K-3
Table K-2: Barometric Altitude and Vertical Speed Error, Function of Air Static Pressure.....	K-4
Table K-3: Airbus Navigation Data Flights.....	K-20
Table M-1: Number of Trials Required to have 99% Confidence for a Given Required Percent Success.....	M-4
Table M-2: Maximum Number of Observed Violations for a Given Simulation Time, Consistent with False Alarm Rate of 10^{-5} /hour or less	M-6

Table M-3: Maximum Number of Observed Violations for a Given Simulation Time, Consistent with Rate of Exceeding HPL _{FF} of 10 ⁻⁷ /hour	M-7
Table M-4: Maximum Number of Observed Violations for a Given Number of Trials, Consistent with a P _{md} of 0.001 or less	M-8
Table M-5: Maximum Number of Observed Violations for a Given Number of Trials, Consistent with a P _{md} of 10 ⁻² , 10 ⁻³ , 10 ⁻⁴ and 10 ⁻⁵	M-9
Table N-1: Test Trajectories	N-1
Table N-2: IAS for an Instrument Approach, function of approach Segment, for all A/C Categories (ICAO 8168 PANS-OPS)	N-5
Table N-3: General Altitude, IAS & Mach profile for an Instrument flight, function of flight phase, for an A/C Category D (commercial jet)	N-5
Table N-4: RNP values for each RNP operation and each flight phase.....	N-6
Table N-5: IAS for a RNP-AR approach, function of Approach Segment, for all A/C Categories (AC90-101A).....	N-6
Table N-6: A/C dynamic for a typical Instrument flight and a typical RNP-AR flight, function of Flight Phase, for all A/C Categories	N-7
Table N-7: Type VI Trajectory	N-22
Table N-8: Type VII Trajectory	N-29
Table P-1: Typical Parameters Claim Table	P-1
Table P-2: Typical Accuracy and Integrity Claim Table	P-3
Table P-3: Typical Availability Claim Table for hybrid parameters	P-4
Table P-4: Typical Coasting Claim Table for hybrid parameters	P-6
Table Q-1: Number of Trials for Robustness Screen Testing	Q-10
Table Q-2: Number of trials used to find a worst-case parameter	Q-11
Table Q-3: Example Claims Table Format Showing Arbitrary Data.....	Q-19
Table Q-4: Example Claims Table Format Showing Unclaimed Capability.....	Q-20

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1 PURPOSE AND SCOPE

1.1 Introduction

This document contains minimum operational performance standards (MOPS) for GNSS integrated with inertial reference systems (IRS) or attitude heading reference systems (AHRS). It is not meant to be a replacement or substitute for RTCA DO-334 (MOPS for Strapdown Attitude and Heading Reference Systems). A key assumption is that any AHRS used for compliance with the performance requirements in this MOPS first meets the performance standard described in RTCA DO-334. That is, RTCA DO-334 is the starting point for any AHRS used to comply with requirements in this MOPS.

RTCA DO-334 provides standards for strap-down AHRS equipment intended to output attitude (pitch, roll), heading, turn and slip information along with presenting this information to the pilot (see Figure 1-1) but does not provide detailed requirements for GNSS aiding. The 14 code of federal regulations (CFR) Part 121 Appendix G provides requirements for INS/IRS, but an AHRS (including those with air data computer inputs) is not presently accepted for navigation.

The 14 CFR 121 Appendix G requirements were developed in the 1970's primarily for self-contained oceanic long-range area navigation (RNAV) capability and pre-dates performance-based navigation concepts as well as GNSS. RTCA DO-229() (MOPS for GPS/SBAS Airborne Equipment) and RTCA DO-316 (MOPS for GPS/Aircraft Based Augmentation System Airborne Equipment) both include an Appendix R that describes tightly-coupled GPS/inertial requirements and tests intended for integrations with inertial sensors satisfying the 14 CFR Part 121 Appendix G requirements. This MOPS is intended to replace Appendix R in RTCA DO-316 (RTCA DO-229) and expand beyond tightly-coupled, 14 CFR Part 121 Appendix G compliant inertial integrations.

In this document, the term “shall” is used to indicate requirements. An approved design will comply with every requirement, which can be assured by inspection, test, analysis, or demonstration. The term “must” is used to identify items that are important but are either duplicated somewhere else in the document as a “shall”, or are considered to be outside the scope of this document. The term “should” is used to denote a recommendation that would improve the equipment, but does not constitute a requirement. The term “may” is used to denote an optional implementation at the manufacturer's discretion.

The requirements in this document define minimum performance, functions and features for both GNSS-aided inertial references systems and enhanced attitude heading reference systems. Due to the wide range of possible capabilities, it is important for manufacturers using this MOPS to characterize the equipment's intended function and expected performance. There are three performance categories and three associated Sub-categories within this MOPS. The word “equipment”, as used in this document, includes all components or units necessary (as determined by the equipment manufacturer) to properly perform the intended function.

Compliance with these standards by manufacturers, installers and users is recommended as one means of assuring that the equipment will satisfactorily perform its intended functions under conditions encountered in routine aeronautical operations. The regulatory application of these standards is the responsibility of appropriate government agencies. In the United States, the Federal Aviation Administration (FAA) plans to publish a Technical Standard Order (TSO) to reference the requirements and test procedures for each equipment category.

Section 1 of this document provides information and assumptions needed to understand the rationale for equipment characteristics and requirements stated in the remaining sections.