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BULLETIN TITLE: Guidelines for Operational Approval of Global Positioning System (GPS) to Provide the Primary Means of Class II Navigation in Oceanic and Remote Areas of Operation

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1. PURPOSE. The purpose of this bulletin is to provide interim guidance to principal operations inspectors in granting operational approval of GPS to provide the primary means of Class II navigation in oceanic and remote areas including North Atlantic Minimum Navigation Performance Specification (MNPS) airspace.

2. BACKGROUND. The approval of GPS to provide the primary means of Class II navigation requires equipment approval, installation approval and operational approval. This HBAT provides inspectors with Information on the performance standards, procedures, and operational restrictions for using the GPS as a primary means of Class II Navigation and guidance in the process to be used in granting operational approvals for the use of GPS.

3. OPERATIONAL REFERENCES

A. AC 120-33, Operational Approval of Airborne Long-Range Navigation Systems For Flights Within The North Atlantic Minimum Navigation Performance Specification Airspace;

B. FAA Order 8400.10, Air Transportation Operations Inspector's Handbook;

C. FAR Section 91.703, Operations of Civil Aircraft of U.S. Registry Outside of the United States;

D. FAR Section 91.705, Operations Within The North Atlantic Minimum Navigation Performance Specifications Airspace;

E. FAR Part 91, Appendix C, Operations in The North Atlantic (NAT) Minimum Navigation Performance Specifications (MNPS) Airspace;

F. FAR Part 121, Subparts N and O; and

G. FSAT 94-04, Certification of the Operational Use of the U.S. NAVSTAR Global Positioning System (GPS).

4. DEFINITIONS.
A. Primary Means of Navigation - Navigation equipment which provides the only required means on the aircraft of satisfying the necessary levels of accuracy, integrity, and availability for a particular area, route, procedure, or operation.

B. Class II Navigation - Any en route flight operation or portion of an en route operation (irrespective of the means of navigation) which takes place outside (beyond) the designated Operational Service Volume of ICAO standard airway navigation facilities (VOR, VOR/DME, NDB).

C. Fault Detection and Exclusion (FDE) - Capability of GPS to:

(1) detect a satellite failure which effects navigation; and

(2) automatically exclude that satellite from the navigation solution.

D. Algorithm - A step-by-step procedure for solving a problem.

5. GPS EQUIPMENT APPROVAL AND INSTALLATION. The PAI must determine that the GPS equipment is approved and installed in accordance with the following.

A. GPS EQUIPMENT APPROVAL. The equipment must be approved by the FAA Aircraft Certification Office (ACO) in accordance with Advisory Circular (AC) 20-138, Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment For Use As A VFR And IFR Supplemental Navigation System; or AC 20-130, Airworthiness Approval of Multi Sensor Navigation Systems for use in the U.S. National Airspace System (NAS) and Alaska; and Notice N8110.57, GPS As A Primary Means of Navigation For Oceanic/Remote Operations.

B. INSTALLATION. The applicant must obtain initial installation approval of GPS equipment for primary use on a specific make and model aircraft via the Type Certificate (TC) or the Supplemental Type Certificate (STC) certification process. The FAA Form 337 or forms acceptable to the Administrator for those operators with acceptable engineering organization will be used for the installation of the same GPS equipment in the same make/model aircraft provided the data developed for the initial certification is used.

C. AIRCRAFT FLIGHT MANUAL SUPPLEMENT (AFMS). Once the installation has been approved, the AFMS must be updated to state: "The ____ GPS equipment as installed has been found to comply with the requirements for GPS primary means of Class II navigation in oceanic and remote airspace, when used in conjunction with the ____ prediction program. This does not constitute operational approval." Detailed requirements for AFMS content are contained in FAA Notice N8110.57.

6. OPERATIONAL APPROVAL. The POI must use the following guidance in granting operational approval.

A. TECHNICAL/OPERATIONAL ASSISTANCE: POI's should contact one of the FAA Navigation Specialists to obtain assistance. The contacts are:

(1) David Maloy: New York City Flight Standards District Office (NYC.FSDO); phone

(516) 228-8033 (ext. 229); and

(2) Anderson Davie: San Francisco International Field Office (SFO.IFO); phone (415) 876-2771.

B. TRAINING AND MANUALS: (Reference: FAR Part 121, Subpart N, and FAA Order 8400.10, Volume 3, Chapter 2). Crew training must be modified to include modules that ensure crews are familiar with navigation equipment operations, data base updating procedures, pre-departure procedures, standard en route procedures, and contingency procedures.

C. CREW QUALIFICATION: (Reference: FAR Part 121, Subpart O, and FAA Order 8400.10, Volume 3, Chapter 2). The required flight crew must have received training in the use of dual GPS as the only means of long-range navigation when completing PIC/SIC Initial New Hire and Initial Equipment Flight Training or when completing the latest Recurrent Training.

D. PRE-DEPARTURE PROCEDURES. POI's must ensure that the following policies and procedures are incorporated into pilot and where appropriate, dispatcher training/qualification programs and manuals:

(1) FDE AVAILABILITY PREDICTION PROGRAM. All operators conducting GPS primary means of Class II navigation in oceanic/remote areas under FAR Parts 91, 121, 125 and 135 must utilize an FAA-approved FDE prediction program for the installed GPS equipment that is capable of predicting, prior to departure, the maximum outage duration of the loss of fault exclusion, the loss of fault detection, and the loss of navigation function for flight on a specified route. The "specified route of flight" is defined by a series of waypoints (to include the route to any required alternates) with the time specified by a velocity or series of velocities. Since specific ground speeds may not be maintained, the pre-departure prediction must be performed for the range of expected ground speeds. This FDE prediction program must use the same FDE algorithm that is employed by the installed GPS equipment and must be developed using an acceptable software development methodology (e.g., RTCA/DO-178B). The FDE prediction program must provide the capability to designate manually satellites that are scheduled to be unavailable in order to perform the prediction accurately. The FDE prediction program will be evaluated as part of the navigation system's installation approval. The requirements for the FDE prediction algorithm can be found in FAA Notice N8110.57.

(2) OPERATIONAL CONTROL RESTRICTIONS:

(i) Any predicted satellite outages that affect the capability of GPS equipment to provide the navigation function on the specified route of flight requires that the flight be canceled, delayed, or re-routed. (See paragraph 5D(3)).

(ii) If the fault exclusion capability outage (exclusion of a malfunctioning satellite) exceeds the acceptable duration on the specific route of flight, the flight must be canceled, delayed, or re-routed. (See paragraph 5D(4).)

(3) DETERMINATION OF THE CAPABILITY TO NAVIGATE. Prior to departure, the operator must use the FDE prediction program to demonstrate that there are no outages in the capability to navigate on the specified route of flight (the FDE prediction program determines whether the GPS constellation is robust enough to provide a navigation solution for the specified route of flight).

(4) DETERMINATION OF AVAILABILITY OF EXCLUSION. Once navigation function is assured (the equipment can navigate on the specified route of flight), the operator must use the FDE prediction program to demonstrate that the maximum outage of the capability of the equipment to provide fault exclusion for the specified route of flight does not exceed the acceptable duration (fault exclusion is the ability to exclude a failed satellite from the navigation solution). The acceptable duration (in minutes) is equal to the time it would take to exit the protected airspace (one-half the lateral separation minimum) assuming a 35-nautical mile per hour cross-track navigation system error growth rate when starting from the center of the route. For example, a 60-nautical mile lateral separation minimum yields 51 minutes acceptable duration (30 nautical miles divided by 35 nautical miles per hour). If the fault exclusion outage exceeds the acceptable duration, the flight must be canceled, delayed, or re-routed.

E. ENROUTE PROCEDURES POI's must ensure that the following policies and procedures are incorporated into pilot and where appropriate, dispatcher training/qualification programs, and manuals:

(1) DEGRADED NAVIGATION CAPABILITY. If the GPS displays a loss of navigation function alert, the pilot should immediately begin using dead reckoning procedures until GPS navigation is regained. The pilot will report degraded navigation capability to Air Traffic Control (ATC) in accordance with FAR Section 91.187. Additionally, flight crew members operating under FAR Part 121 will notify the appropriate dispatch or flight following facility of any degraded navigation capability in accordance with the air carrier's FAA approved procedures.

(2) SATELLITE FAULT DETECTION OUTAGE. If the GPS displays an indication of a fault detection function outage (Receiver Autonomous Integrity Monitoring (RAIM) is not available), navigation integrity must be provided by comparing the GPS position with a position computed by extrapolating the last verified position with true airspeed, heading, and estimated winds. If the positions do not agree to within 10 nautical miles, the pilot should immediately begin using dead reckoning procedures until the exclusion function or navigation integrity is regained and report degraded navigation capability to ATC in accordance with FAR Section 91.187.

(3) FAULT DETECTION ALERT. If the GPS displays a fault detection alert (failed satellite), the pilot may choose to continue to operate using the GPS-generated position if the current estimate of position uncertainty displayed on the GPS from the FDE algorithm is actively monitored. If this number exceeds 10 nautical miles or is not available, the pilot should immediately begin using dead reckoning procedures until the failed satellite is excluded and report degraded navigation capability to ATC in accordance with FAR Section 91.187.

7. APPROVAL FOR OPERATION IN NORTH ATLANTIC MINIMUM NAVIGATION PERFORMANCE SPECIFICATIONS AIRSPACE.

A. Until further notice, the Pass/Fail graphs contained in AC 120-33 should be used confirm the operator's capability to meet the requirements of FAR Section 91.705. The FAA Navigation Specialists will provide guidance on process and procedures for the Pass/Fail graphs and aid the POI in determining whether Figure 2 or Figure 3 should be utilized. The operator is not required to collect navigation performance data in NAT MNPS AIRSPACE to apply to the Pass/Fail graphs.

8. VALIDATION TESTS.

A. GENERAL. Validation Tests are required. Such tests may consist of a single flight or series of flights. The following references are provided:

(1) FAR Sections 121.93, 121.113, 135.13(a)(2).

(2) FAA Order 8400.10:

(i) Volume 3, Chapter 9, Section 8

(ii) Volume 4, Chapter 1, Section 2

B. PROGRAM/DOCUMENT EVALUATION. As an element of the evaluation process, the POI should ensure that operator training programs and manuals contain the policies and procedures detailed in paragraph 5 of this HBAT. (See FAA Order 8400.10, Volume 4, Chapter 1, Section 2,).

C. TECHNICAL SUPPORT. It is recommended that, whenever possible, one of the FAA Navigation Specialists participate in the validation of operator programs and procedures for use of GPS as the primary means of Class II navigation.

D. FLIGHT(S) REQUIRED FOR VALIDATION TESTS.

(1) GENERAL. The following is intended to provide broad guidance for the development of GPS/Class II navigation validation tests. The POI should consider each application on its own merit and apply judgment when developing validation test requirements. The POI should communicate the objective, duration and number of validation test flights required to the operator during Phase One of the approval process (see FAA Order 8400.10, Volume 4, Chapter 1, Section 2.

(2) OPERATOR WITHOUT PREVIOUS CLASS II NAVIGATION EXPERIENCE. If an operator is requesting approval to conduct Class II Navigation with GPS, but has no previous experience in conducting Class II navigation, then the operator must conduct at least one flight in the Class II area of navigation where it intends to operate. This flight must be conducted as a non-revenue operation with the exception that cargo may be carried.

(3) OPERATOR WITH PREVIOUS CLASS II NAVIGATION EXPERIENCE. If an operator is requesting approval to conduct Class II Navigation with

an aircraft/GPS equipment combination with which it has not previously conducted Class II operations, the operator should be required to conduct a validation test flight(s). If the flight(s) is conducted in a Class I navigation area to simulate operation in a Class II Navigation area, then the flight(s) may be conducted in revenue operations. If the flight is conducted in a Class II Navigation area, then it must be conducted as a non-revenue flight with the exception that cargo may be carried.

(4) CONDITIONS OF VALIDATION TEST FLIGHTS. The following conditions apply to validation test flights:

(i) At least one flight should be observed by an FAA aviation safety inspector.

(ii) Dispatch procedures must be demonstrated for the Class II Navigation area(s) where operations are intended to be conducted.

(iii) The flight(s) should be of adequate duration for the pilots to demonstrate knowledge of dispatch requirements, capability to navigate with the system, and to perform normal and non-normal procedures.

(5) POLICY DEVIATIONS. Requests to deviate from this policy should be forwarded to AFS-430, FAA National Headquarters, Washington, DC, for consideration.

9. ISSUANCE OF OPERATION SPECIFICATIONS: Operation specifications authorizing flight in Class II airspace using GPS as the only means of Long-Range Navigation must be issued or modified, as appropriate, prior to any air carrier operations being conducted in the Class II airspace. The operation specification paragraphs must be issued as indicated in Appendix 1 to this HBAT.

10. INQUIRIES. This HBAT was developed jointly by AFS-200 and AFS-400. Any questions or comments concerning the information in this bulletin should be directed to AFS-200 at (202) 267-7579 or AFS-400 at (202) 267-3734.

11. EXPIRATION. This HBAT will expire when incorporated into FAA Order 8400.10.

/s/
David R. Harrington

Appendix 1

1. Issuance of En Route Authorization for Use of only a Single GPS for Class II Navigation.

Note: This authorization may only be issued for operations in the Caribbean Ocean, Gulf of Mexico, the Atlantic Ocean west of MNPS airspace, and for Special Contingency Routes in MNPS airspace.

a. Log on to the subject's Operation Specifications (OpSpecs) in the Flight Standards Automation Subsystem (FSAS), Operation Specifications Subsystem (OPSS).

b. Mark the Operation Specification checklist to check the appropriate block. Paragraph B36 requires Question 4c and (5n or 5o) to be checked, as appropriate.

c. In paragraph B36, subparagraph a(l), insert the aircraft make, make, and model of GPS receiver.

d. Change the signature block of paragraph B36 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number field to reflect the next sequential number.

e. In paragraph B50, access the Limitations, Provisions, and Reference Paragraphs, for the Caribbean Sea, Gulf of Mexico, Atlantic Ocean West of MNPS airspace, and/or for Special Contingency Routes in MNPS airspace, as applicable, and enter the following statement adjacent to the existing referenced paragraphs:

"CLASS II NAVIGATION WITH THE APPROVED SINGLE GPS LISTED IN PARAGRAPH B36(l) IS LIMITED TO THIS SPECIFIC GEOGRAPHIC AREA."

f. Change the signature block of paragraph B50 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number to reflect the next sequential number.

g. Print paragraphs B36 and B50 in final form.

h. Present the documents to the operator for acceptance, and recover the existing documents.

2. Issuance of En Route Authorization for Use of a Dual GPS System as the Only Long-Range System for Class II Navigation.

a. Log on to the subject's OpSpecs in the Flight Standards Automation Subsystem (FSAS), Operation Specifications Subsystem (OPSS).

b. Mark the Operation Specification checklist to check the appropriate block. Paragraph B36 requires Question 4c and (5n or 5o) to be checked, as appropriate.

c. In paragraph B36, subparagraph a(l), insert the aircraft make and the makes and models of GPS receivers.

d. Change the signature block of paragraph B36 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number field to reflect the next sequential number.

e. Print paragraph B36 in final form.

f. Present the documents to the operator for acceptance, and recover the existing documents.

3. Issuance of En Route Authorization for Use of GPS in North Atlantic Minimum Navigation Performance Standards (MNPS) Airspace.

Note: This authorization may only he used if en route authorization for use of dual GPS for Class II Navigation has been issued as described in paragraph 2 of these instructions.

a. If unrestricted routing is to be authorized:

(1) Log on to the subject's OpSpecs in the Flight Standards Automation Subsystem (FSAS), Operation Specifications Subsystem (OPSS).

(2) Mark the Operation Specification checklist to check the appropriate block. Paragraph B39 requires question 4a and 4c, checked, 5k checked and 5n or 5o checked, as appropriate.

(3) Change the signature block of paragraph B39 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number field to reflect the next sequential number.

(4) In paragraph B39, subparagraph c, insert the aircraft make and the makes and models of both GPS receivers.

Note: Normally operators receiving authorization under paragraph B39c should also receive authorization in Paragraph B39d for ferry and contingency
purposes.

b. If restricted routing over special contingency routing:

(1) Log on to the subject's OpSpecs in the Flight Standards Automation Subsystem (FSAS), Operation Specifications Subsystem (OPSS).
(2) Change the signature block of paragraph B39 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number field to reflect the next sequential number.

(3) In paragraph B39, subparagraph d, insert the aircraft make, and the make and model of GPS receiver.

(4) Print paragraph B39 in final form.

(5) Present the documents to the operator for acceptance, and recover the existing documents.

4. Issuance of En Route Authorization for Use of GPS in Areas of Magnetic Unreliability.

a. Log on to the subject's OpSpecs in the Flight Standards Automation Subsystem (FSAS), Operation Specifications Subsystem (OPSS).

b. Using the "Additional Text" feature for paragraph B40, insert the aircraft make and the makes and models of GPS receivers in the navigation equipment table.

c. Change the signature block of paragraph B40 to reflect the Effective Date anticipated for paragraph approval. Change the Amendment Number field to reflect the next sequential number.

d. Print paragraph B40 in final form.

e. Present the documents to the operator for acceptance, and recover the existing documents.