

ORDER

**U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION**

8400.33

9/15/05

**SUBJECT: PROCEDURES FOR OBTAINING AUTHORIZATION FOR REQUIRED
NAVIGATION PERFORMANCE 4 (RNP-4) OCEANIC AND REMOTE
AREA OPERATIONS**

- 1. PURPOSE.** This order provides guidance on procedures for obtaining authorization to operate within airspace designated as RNP-4, Oceanic and Remote Areas, whereupon meeting the criteria an applicant may be approved to operate within RNP-4 airspace. It contains navigation sensor and system, airworthiness, and operational requirements. As described within this order, additional communication, and surveillance equipage Automatic Dependent Surveillance (ADS), Controller-Pilot Data Link Communications (CPDLC), as well as aircraft and flightcrew capabilities may be required to satisfy operational performance.
- 2. DISTRIBUTION.** This order is distributed to the director level in Federal Aviation Administration (FAA) headquarters and the air route traffic control centers (ARTCC); to all regional administrators; to the branch level in the Flight Standards and Aircraft Certification Services; to the branch level in the regional Flight Standards divisions, and Aircraft Certification directorates; to all regional International Aviation Officers; and, to all Flight Standards and Aircraft Certification Service and International Aviation field offices.
- 3. BACKGROUND.** As part of a global effort to implement the International Civil Aviation Organization (ICAO) published Global Air Navigation Plan for Communication, Navigation, Surveillance /Air Traffic, Management Systems (CNS/ATM) (Doc 9750), separation standards are being reduced in oceanic regions. This will require a navigation performance standard of RNP-4. ICAO Regional Supplementary Procedures (Doc 7030/4) identifies affected regional areas. ICAO Doc 9613-AN/937 is the manual on Required Navigation Performance. To support this effort, the Informal Pacific Air Traffic Service Coordination Group (IPACG) and the Informal South Pacific Air Traffic Service Coordination Group (ISPACG), are starting the development of plans to implement 30 nautical mile (nm) lateral and/or longitudinal separation on the South Pacific (SOPAC), North Pacific (NOPAC), and Central East Pacific (CEP) routes based on authorization of an RNP-4 capability for the total route of the flight. In accordance with ICAO Annex 6, operators desiring to operate in areas bounded by RNP-4 airspace will be required to obtain operational authorization. RNP-4 implementation will provide benefits in terms of efficient use of airspace, more optimum routings, reduced delays, increased traffic flow capacity, increased flexibility, reduced costs, and reduced separation standards.

Distribution: A-WXYZ-1; A-FFS-0 (MAX); A-FAC-1 (MAX);
A-FIA-0 (MAX); A-FAF-0 (MAX); A-FAS-1 (MAX); A-FAT-1 (MAX);
A -FAT-2 (MAX); A-FAT-5 (MAX)

Initiated By: AFS-430

4. RELATED PUBLICATIONS (current editions).

a. FAA Documents.

- (1) Title 14 of the Code of Federal Regulations (14 CFR) part 121, appendix G.
- (2) Advisory Circular (AC) 20-130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors.
- (3) AC 20-138A, Airworthiness Approval of Global Navigation Satellite System (GNSS) Equipment.
- (4) FAA Order 7110.82, Monitoring of Navigation/ Longitudinal Separation/Altitude Performance in Oceanic Airspace.
- (5) FAA Order 8400.10, Air Transportation Operations Inspector's Handbook.
- (6) FAA Order 8700.1, General Aviation Operations Inspector's Handbook.
- (7) Handbook Bulletin for Air Transportation (HBAT) 95-09, 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.

b. Other Documents.

(1) Copies of the following may be obtained from: Document Sales Unit, ICAO, 999 University Street, Montreal, Quebec, Canada H3C 5H7:

- Air Navigation Plan for CNS/ATM Systems, Doc 9750
- Manual on required navigation performance (RNP), Doc 9613-AN/937
- Regional Supplementary Procedures, Doc 7030/4

(2) Copies of the following may be purchased from National Oceanic and Atmospheric Administration (NOAA), N/ACC3, Distribution Division, Riverdale, MD 20737:

- United States Government Flight Information Publication-Chart Supplement-Alaska
- United States Government Flight Information Publication-Chart Supplement-Pacific

(3) Copies of Requirements for Technical Concepts for Aviation (RTCA) documents may be purchased from RTCA, Inc., 1828 L Street NW, Suite 805, Washington, DC 20036:

- RTCA/DO-236B, Minimum Aviation System Performance Standards (MASPS): Required Navigation Performance for Area Navigation
- RTCA/DO-283A, Minimum Operational Performance Standards for Required Navigation Performance for Area Navigation

- RTCA/DO-200A, Standards for Processing Aeronautical Data

(4) Copies of Aeronautical Information Manual (AIM) may be purchased from the U.S. Government Printing Office, P.O. Box 371954, Pittsburgh, PA 15250-7954.

(5) FANS Operations Manual (FOM), <http://www.faa.gov/ats/ato/ispacg.htm> (the ISPACG Web site).

5. APPLICABILITY.

a. This guidance applies to operators conducting operations under 14 CFR parts 91, 121, 125, and 135 in RNP-4 oceanic and remote areas.

b. These requirements are consistent with 14 CFR part 91, §§ 91.703(a)(1) and (a)(2), which require each operator, operating a civil aircraft of U.S. registry outside of the United States, to comply with ICAO Annex 2, when operating over the high seas, and to comply with the regulations of a foreign country when operating within that country's airspace.

6. OPERATIONAL AUTHORIZATION PROCESS. Aircraft must be qualified, and the operator must be approved before conducting flight in RNP airspace or routes with reduced separation minima. To obtain operational authorization, aircraft eligibility must be determined, appropriate flightcrew procedures for the navigation systems to be used must be identified by the applicant, and database use and operating procedures must be evaluated. Appropriate operations specifications (OpSpecs), management specifications (MSpecs), or a letter of authorization (LOA) may be issued, as applicable to the operator.

a. **Pre-application Meeting.** Operators will schedule a pre-application meeting with either the certificate-holding district office (CHDO), Certificate Management Office (CMO), or the Flight Standards District Office (FSDO). At this meeting, the operator informs the FAA of its intentions to request RNP-4 oceanic or remote area authorization. The FAA provides the operator with the requirements for this operational approval. Operators seeking RNP-4 operational authorization should contact FAA offices as follows:

(1) **Parts 121, 125, and 135 Operators.** Notify the certificate management office (CMO) or CHDO which holds its operating certificate of its intent to request authorization for RNP-4 operations (OpSpecs B036). RNP-4 authorizations for air carriers will be addressed through issuance of approved OpSpecs. The OpSpecs will identify conditions or limitations (e.g., navigation systems or procedures required, routes or areas authorized (OpSpecs B050)). A sample letter for this request is provided in Appendix 2, Figure 1.

(2) **Part 91 Operators.** Contact their local FSDO to start the process for RNP-4 authorization. The responsible FSDO will issue the LOA, authorizing RNP-4 oceanic or remote operations. The LOA will identify conditions or limitations (e.g., navigation systems or procedures required, routes or areas authorized). A sample letter of request is provided in Appendix 2, Figure 2.

b. **Determining Eligibility of Aircraft.** New systems may demonstrate compliance with RNP-4 oceanic and remote operations as part of their airworthiness approval. For existing systems, the Aircraft Manufacturer should determine compliance with RNP-4 Oceanic and

Remote Operations capability as listed in the Aircraft Flight Manual (AFM) supplement, or additional airworthiness documentation, or as obtained per amended type certificate (TC) or Supplemental Type Certificate (STC). Confirmation from the manufacturer documenting that the aircraft meets RNP-4 performance requirements in this order will be required if the operator chooses to claim additional performance beyond original airworthiness approval or as stated in the AFM, amended TC, or STC. Navigation performance must consider the navigation infrastructure used in original airworthiness approval.

7. APPLICATION.

a. Content.

(1) Aircraft Eligibility Documents. AFM, AFM Supplement, or suitable documentation issued through the Aircraft Evaluation Group (AEG).

(2) Description of Aircraft Equipment. A configuration list detailing navigation equipment and systems intended for use in RNP-4.

(3) Training Programs, and Operational Practices and Procedures.

(a) Parts 121, 125, and 135 operators must submit training syllabi (e.g., initial, upgrade, recurrent) and other appropriate materials to the FAA showing incorporation of operational practices and procedures. Training for other personnel must be included where appropriate (e.g., dispatchers, maintenance). Practices and procedures must be standardized using the guidelines of paragraph 11 of this order.

(b) Part 91 operators must confirm that they will operate using the practices and procedures identified in paragraph 11 of this order.

(4) Operational Manuals and Checklists.

(a) Parts 121, 125, and 135 operators. Operations manuals and checklists must be revised and submitted to include standard operating procedures as detailed in paragraph 11 of this order. Appropriate manuals must include navigation equipment operating instructions and any procedures established to operate in a specific area of operations (e.g., contingency procedures).

(b) Part 91 operators. Submit appropriate documentation providing information/guidance on standard operating procedures detailed in paragraph 11.

(5) Past Performance. An operating history including any events or incidents related to reported oceanic errors and any rectified by changes in training, procedures, maintenance, or the aircraft/navigation systems used.

(6) Minimum Equipment List (MEL). Those portions of the MEL required for operational authorization must be reviewed and addressed.

(7) Maintenance. An operator must have maintenance procedures consistent with the requirements in part 91, § 91.409 for authorization, use of long-range navigation systems

(LRNS), oceanic and remote area operations. Maintenance programs will vary with certificate privileges, e.g., part 121, § 121.367, part 125, § 125.245, and part 135, § 135.411 or 135.419 establish requirements for additional maintenance and inspection programs.

b. FAA Review of Application for Content. When all the application requirements are met the FAA will accept the application and begin the evaluation process.

8. FAA EVALUATION OF PROPOSAL.

a. Aircraft Eligibility Groups.

(1) Group 1. Aircraft with formal approval of RNP integration accounting for oceanic and remote area operations in the AFM or airworthiness documentation. Airworthiness documentation will address demonstrated RNP levels and any related provisions applicable to its use (e.g., navaid sensor requirements).

(2) Group 2. Aircraft with prior navigation system approval can equate their certified level of performance, under previous standards, to the RNP-4 criteria. The standards listed in subparagraphs a and b below, can be used to qualify an aircraft under Group 2. Other standards may also be used if they are sufficient to ensure that the RNP-4 requirements are met. If other standards are to be used, the FSDO or certificate management office (CMO) should consult with Flight Technologies and Procedures Division, AFS-400, to determine the appropriate operational authorization and limitations.

(a) Global Navigation Satellite Systems (GNSS) as primary navigation. Aircraft having GNSS as the **primary** LRNS for oceanic and remote operations approval must meet performance requirements. AFMs or airworthiness documentation should indicate if the GNSS system installation meets these requirements. Dual independent GNSS equipment is required and an approved dispatch fault detection and exclusion (FDE) availability prediction program must be used. The maximum allowable time for which FDE capability is projected to be unavailable is 25 minutes. Maximum outage times will be included as a condition of the operational authorization. (See FAA HBAAT 95-09, Guidelines for Operational Approval of GPS to Provide the Primary Means of Class II Navigation in Oceanic and Remote Areas of Operation.)

NOTE: If predictions indicate that the maximum allowable FDE outage will be exceeded, the operation must be rescheduled when FDE is available.

(b) Multisensor Systems Integrating GPS.

i. GPS integrity provided by receiver autonomous integrity monitoring (RAIM). Multisensor systems integrating GPS with RAIM and FDE that are accepted under AC 20-130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, or equivalent, providing +/- 4 nm, 95 percent accuracy, meet performance requirements.

ii. Aircraft Autonomous Integrity Monitoring (AAIM). AAIM uses the redundancy of position estimates from multiple sensors, including GNSS, to provide integrity performance that is at least equivalent to RAIM. These airborne augmentations may be certified

in accordance with TSO-C115B. An example is using an inertial navigation system or other navigation sensors as an integrity check on GPS data when RAIM is unavailable but GPS positioning information continues to be valid. In this case, the inertial navigation system (INS) or Inertial Reference Units (IRU) must be approved in accordance with part 121 appendix G. Appendix 1 provides additional IRU airworthiness information.

(3) Group 3. New Technology—navigation systems meeting the performance requirements of this order for operations in airspace designated as Oceanic/Remote Areas RNP-4.

b. MEL. MELs must identify the navigation and communication equipment required for dispatch into RNP-4 oceanic and remote area airspace, to provide the performance and functionalities stipulated in subparagraphs c and d.

c. Maintenance Requirements. Aircraft in Group 1, Group 2, and Group 3 must have established maintenance procedures for all LRNS intended for use in oceanic and remote area operations.

d. Required Performance.

(1) Flight Technical Error (FTE). The accuracy with which the aircraft is controlled as measured by the indicated aircraft position, with respect to the indicated command or desired position is the FTE. It does not include blunder errors.

(2) Path Definition Error. This is the difference between the **defined path** and the **desired path** at a specific point and time.

(3) Display Error. These errors may include error components contributed by any input, output or signal conversion equipment used by the display as it presents either aircraft position or guidance commands (e.g., course deviation or command heading) and by any course definition entry device employed. For systems in which charts are incorporated as integral parts of the display, the display system error necessarily includes charting errors to the extent that they actually result in errors in controlling the position of the aircraft relative to a desired path over the ground. To be consistent, in the case of symbolic displays not employing integral charts, any errors in waypoint definition, directly attributable to errors in the reference chart used in determining waypoint positions, should be included as a component of this error. This type of error is virtually impossible to handle and in general practice, highly accurate, published waypoint locations are used to the greatest extent possible in setting up such systems to avoid such errors and reduce workload.

(4) Navigation System Error (NSE). This is the root sum square of the ground station error contribution, the airborne receiver error and the display system contribution.

(5) Total System Error (TSE). This is system use error. $TSE = \sqrt{(NSE)^2 + (FTE)^2}$

(6) Position Estimation Error. This is the difference between true position and estimated position.

(7) Accuracy. Each aircraft operating in RNP-4 airspace shall have total system error components in the cross-track and along-track directions that are less than ± 4 nm or ± 7.4 km for 95 percent of the flying time. Accuracy is defined relative to a geodesic path along the published route or defined procedure. The three error components that must be considered in complying with the accuracy requirement are the Flight Technical Error (FTE), the position estimation error, and path definition error. The accuracy requirement must be met for the specific length of route.

(8) GNSS Monitor. The GNSS navigation system must detect the satellite failures before they cause the aircraft to exceed the defined airspace or obstacle clearance area. This requirement is derived from the overall effect of a GNSS failure, and applies to all navigational uses of GNSS. The probability of missed detection of satellite failures must be less than or equal to 10^{-3} per flight hour, and the effective monitor limit for these failures on the navigation solution, known as the horizontal alert limit, must consider the other normal errors that may exist during a satellite fault, the latency of the alert, the crew reaction time to an alert and the aircraft response. An acceptable means of compliance is to use a Horizontal Alert Limit (HAL) as follows: oceanic (RNP-4): 4 nm.

e. Required Functionalities. The following functionalities are mandatory for progress data:

(1) Course Deviation Indicator (CDI) in Pilot's "Field of View" (FOV). The display of navigation data must use either a lateral deviation display or a navigation map display, meeting the following requirements:

(a) A non-numeric lateral deviation display (for example, CDI, electronic horizontal-situation indicator display ((E)HSI)), with a To/From indication and a failure annunciation, for use as primary flight instruments for navigation of the aircraft, for maneuver anticipation, and for failure/status/integrity indication, with the following four attributes:

i. Must be visible to the pilot and located in the primary field of view (± 15 degrees from pilot's normal line of sight) when looking forward along the flight path.

ii. Lateral deviation scaling should agree with any alerting and annunciation limits, if implemented.

iii. Lateral deviation display must be automatically slaved to the Area Navigation (RNAV) computed path. The lateral deviation display must also have a full-scale deflection suitable for the current phase of flight and must be based on the required track-keeping accuracy. The course selector of the deviation display should be automatically slewed to the Area Navigation (RNAV) computed path, or the pilot must adjust the CDI or HSI selected course to the computed desired track.

NOTE: The normal function of stand-alone GNSS equipment meets this requirement.

iv. Display scaling may be set automatically by default logic or set to a value obtained from a navigation database. The full-scale deflection value must be known or must be available for display to the pilot commensurate with en route, terminal, or approach values.

(b) A navigation map display, readily visible to the pilot, with appropriate map scales (scaling may be set manually by the pilot), and giving equivalent functionality to a lateral deviation display.

(2) **Track to Fix.** Track to fix leg is a geodesic path between two fixes. The first fix is either the previous leg termination or an initial fix leg. The termination fix is normally provided by the navigation database, but may also be a user-defined fix.

(3) **Direct to Fix.** Direct to fix leg is a geodesic path starting near the area of initiation and terminating at a fix.

(4) **Direct to Function.** The direct-to function shall be able to be activated at any time by the flightcrew, when required. The direct-to function shall be available to any fix. The system shall be capable of generating a geodesic path to the designated “To” fix. The aircraft shall capture this path without “S-turning” and without undue delay.

(5) **Course to Fix.** Course to fix leg is a geodesic path terminating at a fix with a specified course at that fix. The inbound course at the termination fix and the fix are provided by the navigation database. If the inbound course is defined as a magnetic course, the source of the magnetic variation needed to convert magnetic courses to true courses is required.

(6) **Parallel Offset.** The system shall have the capability to fly parallel tracks at a selected offset distance. When executing a parallel offset, the RNP type and all performance requirements of the original route in the active flight plan shall be applicable to the offset route. The system shall provide for entry of offset distances in increments of 1 nm, left or right of course. The system shall be capable of offsets of at least 20 nm. When in use, system offset mode operation shall be clearly indicated to the flightcrew. When in offset mode, the system shall provide reference parameters (for example, cross-track deviation, distance-to-go, time-to-go) relative to the offset path and offset reference points. An offset shall not be propagated through route discontinuities, unreasonable path geometries, or beyond the initial approach fix. Annunciation shall be given to the flightcrew prior to the end of the offset path, with sufficient time to return to the original path. Once a parallel offset is activated, the offset shall remain active for all flight plan route segments until removed automatically, until the flightcrew enters a direct-to routing, or until flightcrew (manual) cancellation. Parallel offset function shall be available for en route Track to Fix (TF) and geodesic portion of Direct to Fix (DF) leg types.

(7) **Fly-by Transition Criteria.** Navigation system shall be capable of accomplishing fly-by transitions. No predictable and repeatable path is specified, because the optimum path varies with airspeed and bank angle. However, predictable and repeatable boundaries of the transition area are defined. Path definition error is defined as the difference between the defined path and the theoretical transition area. If the path lies within the transition area, there is no path definition error. Fly-by transitions shall be the default transition when the transition type is not specified. The theoretical transition area requirements are applicable for the following assumptions:

(a) Course changes do not exceed 120 degrees for low altitude transitions (referred as when the aircraft barometric altitude is less than Flight Level (FL)195); and

(b) Course changes do not exceed 70 degrees for high altitude transitions (referred as when the aircraft barometric altitude is equal to or greater than FL 195).

(8) User Interface Displays. General user interface display features must provide for presentation of information, provide situational awareness and be designed and implemented to accommodate human factors considerations. Essential design considerations include:

(a) Minimizing reliance on flightcrew memory for any system operating procedure or task;

(b) Developing a clear and unambiguous display of system modes/submodes and navigational data with emphasis on enhanced situational awareness requirements for any automatic mode changes if provided;

(c) Use of context sensitive help capability and error messages (for example, invalid inputs or invalid data entry messages should provide a simple means to determine how to enter “valid” data);

(d) Fault tolerant data entry methods rather than rigid rule based concepts;

(e) Placing particular emphasis on the number of steps and minimizing the time required to accomplish flight plan modifications to accommodate Associate Administrator for Air Traffic Services (ATS) clearances, holding procedures, runway and instrument approach changes, missed approaches and diversions to alternate destinations;

(f) Minimizing the number of nuisance alerts so the flightcrew will recognize and react appropriately when required;

(g) Each display element used as a primary flight instrument in the guidance and control of the aircraft, for maneuver anticipation, or for failure/status/ integrity annunciation, shall be located where it is clearly visible to the pilot (in the pilot’s primary field of view) with the least practicable deviation from the pilot’s normal position and line of vision when looking forward along the flight path. For those aircraft meeting the requirements of 14 CFR part 25 /Joint Aviation Requirements (JAR)-25, it is intended that provisions of certification documents such as AC 25-11, 25-11 AMJ, Electronic Display Systems, and other applicable documents should be satisfied. All system displays, controls and annunciations shall be readable under normal cockpit conditions and expected ambient light conditions. Night lighting provisions shall be compatible with other cockpit lighting; and

(h) All displays and controls must be arranged to facilitate flightcrew accessibility and usage. Controls that are normally adjusted in flight shall be readily accessible with standardized labeling as to their function. System controls and displays shall be designed to maximize operational suitability and minimize pilot workload. Controls intended for use during flight shall be designed to minimize errors, and when operated in all possible combinations and sequences, shall not result in a condition whose presence or continuation would be detrimental to the continued performance of the system. System controls shall be arranged to provide adequate protection against inadvertent system shutdown.

(9) Flight Planning Path Selection. The system shall provide the capability for the crew to create, review and activate a flight plan. The system shall provide the capability for modification (for example, deletion and addition of fixes and creation of along-track fixes), review and user acceptance of changes to the flight plans. When this capability is exercised, guidance outputs shall not be affected until modification(s) is/are activated. Activation of any flight plan modification shall require positive action by the flightcrew after input and verification by the flightcrew.

(10) Flight Planning Fix Sequencing. The system shall provide the capability for automatic sequencing of fixes.

(11) User Defined Course to Fix. The system shall provide the capability to define a user-defined course to a fix. The pilot must be able to intercept the user-defined course.

(12) Path Steering. The system shall provide data to enable the generation of command signals for autopilot/flight director/CDI, as applicable. In all cases a Path Steering Error shall be defined at the time of certification, which will meet the requirements of the desired RNP operation in combination with the other system errors. During the certification process, the ability of the crew to operate the aircraft within the specified PSE shall be demonstrated. Aircraft type, operating envelope, displays, autopilot performance, and leg transitioning guidance (specifically between arc legs) should be accounted for in the demonstration of PSE compliance. A measured value of PSE may be used to monitor system compliance to RNP requirements. For operation on all leg types, this value shall be the distance to the defined path. For cross-track containment compliance, any inaccuracies in the cross-track error computation (for example, resolution) shall be accounted for in the total system error.

(13) Alerting Requirements. The system shall also provide an annunciation when the manually entered RNP type is larger than the RNP type associated with the current airspace as defined in the navigation database. Any subsequent reduction of the RNP type shall reinstate this annunciation. When approaching RNP airspace from non-RNP airspace, alerting shall be enabled when the cross-track to the desired path is equal to or less than 1/2 the RNP value and the aircraft has passed the first fix in the RNP airspace.

(14) Navigation Data Base Access. The navigation database shall provide access to navigation information in support of the navigation systems reference and flight planning features. Manual modification of the navigation database data shall not be possible. This requirement does not preclude the storage of "user defined data" within the equipment. When data are recalled from storage they shall also be retained in storage. The system shall provide a means to identify the navigation database version and valid operating period.

(15) World Geodetic System (WGS) 84 Geodetic Reference System. WGS-84 or an equivalent earth reference model shall be the reference earth model for error determination. If WGS-84 is not employed, any differences between the selected earth model and the WGS-84 earth model must be included as part of the path definition error. Errors induced by data resolution must also be considered.

f. Recommended Functionalities. The following additional functionalities are recommended for navigation data:

- Display cross-track error on the control display unit (CDU)
- Display present position in distance/bearing to selected waypoints
- Provide time to waypoints on the CDU
- Display Along Track Distance
- Display ground speed
- Indicate track angle
- Provide automatic navigation aids selection
- Manually inhibit a navaid facility
- Automatic selection and tuning of distance measuring equipment (DME) and/or very high frequency omnidirectional range (VOR)
- Estimate of position uncertainty
- Display current RNP level and type selection
- Capability to display flight plan discontinuity
- Display Navigation sensor in use and display of de-graded navigation

g. Automatic Radio Position Updating. Automatic updating is considered to be any updating procedure that does not require crews to manually insert coordinates. Automatic updating may be considered acceptable for operations in airspace where RNP-4 is applied provided that:

- (1) Procedures for automatic updating are included in an operator's training program.
- (2) Crews are knowledgeable of the updating procedures and of the effect of the update on the navigation solution.

h. Investigation of Navigation Errors. Demonstrated navigation accuracy provides the basis for determining the lateral spacing and separation necessary for traffic operating on a given route. Accordingly, lateral and longitudinal navigation errors are investigated to prevent their reoccurrence. Radar observations of each aircraft's proximity to the centerline and altitude before coming into coverage of short-range navaids at the end of the oceanic route segment are typically noted by Air Traffic Service (ATS) facilities. If an observation indicates that an aircraft was not within an established limit, the reason(s) for the apparent deviation from centerline or altitude may need to be determined and steps taken to prevent a recurrence.

i. Removal of RNP-4 Authorization. Oceanic Navigational Error Reports (ONER) and Oceanic Altitude Deviation Reports (OADR), for example, are established in FAA Order 7110.82, latest edition and in FAA Order 8700.1. When appropriate, the FAA may consider these reports in determining remedial action. Repeated ONER or OADR occurrences

attributed to a specific piece of navigation equipment, may result in withdrawal of OpSpecs or MSpecs or rescinding an LOA, for use of that equipment. Information that indicates the potential for repeated errors may require a modification of an operator's training program. Information that attributes multiple errors to a particular pilot crew may necessitate remedial qualifications or airmen certification review.

9. OPERATIONAL REQUIREMENTS.

a. Navigational Performance. The navigation accuracy requirement for issuance of an RNP-4 authorization requires that the aircraft navigate with a cross-track and along-track Total System Error (TSE) no greater than ± 7.4 km (± 4 nm) for 95 percent of the total flight time. All aircraft shall meet a track keeping accuracy equal to or better than ± 7.4 km or ± 4 nm for 95 percent of the flight time in RNP-4 airspace.

b. Navigation Equipage. All RNP-4 operations in oceanic and remote areas shall have at least dual independent long range navigation systems of integrity such that the navigation system does not provide misleading information.

(1) Aircraft Incorporating GPS. GPS avionics installed by one of the following three methods provide an acceptable means of compliance for aircraft using GPS.

(a) FAA Aircraft Certification Office (ACO) (or US Military equivalent) letter meeting performance requirements of FAA N 8110.60, GPS as a Primary Means of Navigation for Oceanic/Remote Operations, canceled December 4, 1996.

(b) FAA ACO (or US Military equivalent) letter meeting performance requirements of FAA AC 20-138A, Airworthiness Approval of Global Navigation Satellite System (GNSS) Equipment, Appendix 1.

(c) GPS avionics marked with TSO-C145A/146A and installed in accordance with AC 20-138A.

(2) The equipment configuration used to demonstrate the required accuracy must be supportable in RNP-4 oceanic and remote airspace. For example, the statistical benefit of estimating position using INS position data filtered with DME data will not be considered.

(3) The equipment configuration used to demonstrate the required accuracy must be identical to the configuration, which is specified in the MEL.

c. Flight Plan Designation. Operators should use the appropriate FAA or ICAO flight plan designation specified for the RNP route flown. The letter "R" should be placed in block 10 of the ICAO flight plan to indicate that the pilot has reviewed the planned route of flight to determine RNP requirements and the aircraft and operator have been approved by the FAA to operate in areas or on routes where RNP is a requirement for operation. Additional information needs to be displayed in the remarks section that indicates the accuracy capability such as RNP-4 versus RNP-10. It is important to understand that additional requirements will have to be met for operational authorization in RNP-4 airspace or routes. Controller-Pilot Data Link Communication (CPDLC) and Air Data System (ADS) will also be required when the separation standard is 30 nm lateral and/or longitudinal.

d. Availability of GNSS. At dispatch or during flight planning, the operator should ensure that adequate navigation capability is available en route to enable the aircraft to navigate to RNP-4.

e. Navigation Database. The navigation database updating process shall comply with European Organization for Civil Aviation Equipment (EUROCAE) ED-76/Radio Technical Commission for Aeronautics (RTCA) DO-200A, or equivalent approved procedures. The navigation database should be obtained from an approved supplier complying with EUROCAE/RTCA document ED-76/DO-200A, Standards for Processing Aeronautical Data. Until such approved suppliers become available, prior to the effective date of the navigation database, as a minimum, the operator must implement navigation database integrity checks using appropriate software tools or approved manual procedures to verify data relating to waypoints below the applicable minimum obstacle clearance altitude. Such checks are in addition to any previously performed by the Aeronautical Information Services (AIS), unapproved navigation database suppliers, or navigation equipment manufacturers. The integrity checks need to identify any discrepancies between the navigation database and the published charts/procedures. Integrity checks may be performed by an approved third party. Discrepancies that invalidate a procedure must be reported to the navigation database supplier and affected procedures must be prohibited by an operator's notice to its flightcrew. Aircraft operators should consider the need to continue their own database checks even for products obtained from approved suppliers.

10. TRAINING PROGRAMS, OPERATING PRACTICES AND PROCEDURES.

a. Introduction. The following items (detailed in subparagraphs b through e) should be standardized and incorporated into training programs and operating practices and procedures. Certain items may already be adequately standardized in existing operator programs and procedures. New technologies may also eliminate the need for certain crew actions and if this is found to be the case, then the intent of this section has been met.

b. Flight Planning. During flight planning, the flightcrew should pay particular attention to conditions, which may affect operations in RNP-4 oceanic and remote area airspace (or on RNP-4 oceanic and remote area routes). These include, but may not be limited to:

(1) Verifying the aircraft is approved for RNP-4 oceanic and remote area operations.

(2) Verifying the operator is authorized for RNP-4 oceanic and remote area operations. This authorization supports the 30 nm lateral and 30 nm longitudinal (or other) separation minima requiring RNP-4.

(a) It should be noted that it addresses only the navigation requirements associated with these standards.

(b) It does not address the communications or surveillance requirements.

(c) Such requirements are listed in a State's Aeronautical Information Publication (AIP) and the Regional Supplementary Procedures (Doc 7030) for specific airspace or ATS routes.

(3) Verifying the letter “R” is annotated in block 10 (Equipment) of the ICAO Flight Plan.

(4) Requirements for GNSS, such as FDE, if appropriate for the operation.

(5) Accounting for any operating restriction related to RNP-4 approval, if required for a specific navigation system.

c. Preflight Procedures at the Aircraft. The following actions should be completed during preflight:

(1) Review maintenance logs and forms to ascertain the condition of equipment required for flight in RNP-4 airspace or on an RNP-4 route.

(2) Ensure that maintenance action has been taken to correct defects to required equipment.

(3) Emergency procedures for operations in RNP-4 airspace or on RNP-4 routes are no different than normal oceanic emergency procedures with one exception, crews must be able to recognize and ATC must be advised when the aircraft is no longer able to navigate to its RNP-4 approved capability.

d. En Route.

(1) At least, two independent LRNS capable of navigating to the RNP should be operational at the oceanic entry point. If this is not the case, the pilot should consider an alternate routing or divert for repairs.

(2) Operator in-flight operating procedures must include mandatory crosschecking procedures to identify navigation errors in sufficient time to prevent aircraft from an inadvertent deviation from ATC cleared routes.

(3) Crews shall advise ATC of any deterioration or failure of the navigation equipment below the navigation performance requirements or of any deviations required for a contingency procedure.

e. Flightcrew Knowledge.

(1) Part 121, 125, 135, and part 91, subpart K operators should ensure their programs contain training for flightcrews on equipment requirements, normal and non-normal operations and flight procedures, and limits of their navigation capability for operations in RNP-4 oceanic and remote area operations.

(2) Part 125, 135, and 91 K operators requesting RNP-4 authorization must show the FAA that crewmembers are knowledgeable on the material contained in this order. FAA Order 8700.1, General Aviation Inspector’s Handbook, addresses training for part 91 operators. It states that specific training is not required by 14 CFR or by Annex 2 to the ICAO Rules of the Air and gives inspectors latitude in determining pilot qualifications. It further states that on the LOA, the statement, “Crew training conducted by,” can be completed with an entry

of: none, self, company training, or the name of a commercial training course. Training “acceptable” to the FAA is not a prerequisite for issuing an RNP-4 authorization. It is also not a requirement that a part 91 operator provide a certificate of training that says it is FAA-approved. What can be considered as acceptable is for an operator to show that crews have adequate knowledge of the following:

- (a) FAA inspectors may accept training center certificates without further evaluation.
- (b) FAA inspectors may elect to evaluate a training course before accepting a training center certificate from a specific center.
- (c) FAA inspectors may accept a statement in the operator’s application for an RNP-4 LOA that the operator has and will ensure that crews are knowledgeable on RNP-4 operating practices and procedures contained in this order.
- (d) FAA inspectors may accept a statement by the operator that it has conducted or will conduct an in-house RNP-4 training program.

ORIGINAL SIGNED BY
James J. Ballough
Director, Flight Standards Service

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APPENDIX 1. AIRWORTHINESS OF INERTIAL REFERENCE UNIT PERFORMANCE

1. Inertial Reference Units (IRU) accuracy and reliability must be analyzed in conjunction with the flight management system interface. An analysis performed on a specific manufacturer's aircraft model is not necessarily applicable to other aircraft operating the same equipment. However, other aircraft may be analyzed using the same or equivalent methodology as proposed herein.

a. The radial navigation error distribution for IRUs is modeled by a Rayleigh Distribution. The 95 percent statistic of radial position error will be used when demonstrating compliance. It is assumed that cross-track and along-track errors are Gaussian, independent, and have equal variances.

b. The radial position error will be evaluated for the range of the independent time variable (time in navigation), as certified for the IRU navigation maximum time (e.g., 18 hours).

c. Time-dependent position error data will be presented. Other non-inertial error sources will not be considered as part of IRU airworthiness approval (i.e., flight technical error). Therefore, the maximum time duration of flight operations in RNP-4 airspace will be evaluated and determined as part of the operational authorization.

d. The assessment of navigation performance may employ system analysis, IRU error modeling (covariance analysis), and system simulation. Analytical findings may be validated with empirical data from laboratory testing and aircraft flight testing, as applicable.

2. When credit is required for IRU performance that is superior to the original airworthiness approval, the existing IRU specification control drawings for the IRU type designs should be revised to account for the new tighter tolerance system error budgets. If it has been determined that all IRU's for a given part number meet the minimum requirements of the new performance standard, then the IRU part number may remain the same. When only some of the IRU's for a given part number meet the minimum requirements of the new performance standard, then screening is required and part number updates will be required to identify the IRU's which are compliant to the new performance standard.

3. Airworthiness documentation must be modified to reflect the performance of IRUs to tighter accuracy requirements, consistent with AC 25-4, Inertial Navigation System (INS), paragraph 5b(4). The AFM should provide sufficient time dependent information so that the maximum time in RNP-4 airspace can be assessed as part of the operational approval.

4. In addition, production and field acceptance test procedures will require an update by the supplier, to ensure that the installed IRU meets the tighter accuracy tolerance required.

5. Operator maintenance procedures will require updating to ensure appropriate monitoring of IRU performance to the new requirements contained in this order, and replacement of IRUs on aircraft that do not meet the navigation performance of these new criteria.

**APPENDIX 1. AIRWORTHINESS OF INERTIAL REFERENCE UNIT
PERFORMANCE (continued)**

6. Procedures for flight operations should be identified and applied to ensure IRU alignment before extended range flights and time-in-navigation for the intended time duration of flight in RNP-4 airspace.

**APPENDIX 2. DOCUMENTATION REQUIRED TO COMPLETE THE
NAVIGATIONAL AUTHORIZATION PROCESS**

**FIGURE 1. SAMPLE LETTER OF REQUEST BY AN AIR CARRIER TO OBTAIN
RNP-4 OPERATIONAL AUTHORIZATION**

SUBJECT: Request for Required Navigation Performance (RNP) - 4 Authorization

TO: Appropriate principal operations inspector (POI)

[*Insert Airline Name*] request that operations specifications (OpSpecs) authorization be issued to conduct en route operations on RNP [*insert number*].

The following [*Insert Airline Name*] aircraft meet the requirements and capabilities as defined/specified in Federal Aviation Administration (FAA) order [*insert the number of this Order*], dated [*insert the date of this Order*] for a RNP-4 qualification.

AIRCRAFT	RNP-4	NAVIGATION COMMUNICATIONS
<u>TYPE/SERIES</u>	<u>EQUIPMENT</u>	<u>EQUIPMENT</u>
B-747-400	List Nav Equip by Name and Type/Manuf/Model	List Com Equip by Name and Type/Manuf/Model
B-737-500	List Nav Equip by Name and Type/Manuf/Model	List Com Equip by Name and Type/Manuf/Model
MD-11	List Nav Equip by Name and Type/Manuf/Model	List Com Equip by Name and Type/Manuf/Model

NOTE: The above listed aircraft are samples only.

Training of flightcrews has been accomplished in accordance with applicable FAA regulations and guidance material.

Sincerely,

[*insert typed name and signature*]
[*insert title*]

**APPENDIX 2. DOCUMENTATION REQUIRED TO COMPLETE THE
NAVIGATIONAL AUTHORIZATION PROCESS (continued)**

**FIGURE 2. REQUEST BY A GENERAL AVIATION OPERATOR TO OBTAIN RNP-4
OPERATIONAL AUTHORIZATION**

Operators must submit requests by letter to the appropriate Flight Standards District Office with a separate page containing the “Format for an LOA to Operate at RNP-4” as shown on the following page.

LOAs

Aviation safety inspectors (ASI) can administratively issue an LOA to any general aviation operator that has an aircraft-navigation system meeting the requirements of this Order. The procedure for the issuance of the LOA is identical to the procedure contained in FAA Order 8700.1, with the exception that the format for the LOA has been modified to meet the specific requirements of an RNP authorization. The LOA for authorizing RNP-4 is located in the Operations Safety Subsystem (OPSS) as template B036 and must be issued from that document management system. A sample of that LOA is contained on the following page. If you need guidance for putting your operator into the OPSS, please contact the OPSS Help Desk at 405-954-7272.

APPENDIX 2. DOCUMENTATION REQUIRED TO COMPLETE THE NAVIGATIONAL AUTHORIZATION PROCESS (continued)

FIGURE 3. FORMAT FOR AN LOA TO OPERATE AT RNP-4

Letter of Authorization (B036)

Operations in Required Navigation Performance Airspace

1. Authorization. The operator listed at the bottom of this document is authorized to conduct operations within airspace designated as RNP airspace in accordance with the limitations and provisions of this LOA and is subject to the conditions that all operations conducted within the designated RNP airspace are in accordance with

a. Title 14 of the Code of Federal Regulations (14 CFR) part 91 and the flight rules contained in International Civil Aviation Organization (ICAO) Annex 2, and

b. All operations outside of the United States comply with 14 CFR § 91.703 and Annex 2.

2. Authorized Airplanes. The operator is authorized to use the airplanes listed below for operations in designated RNP airspace when the required equipment is approved and maintained in accordance with an approved maintenance program.

TABLE 1. AIRPLANES AND EQUIPMENT

A/C Serial Number	Registration Number	Airplane M/M/S	Long-Range Navigation Systems		Communications Equipment		RNP Type (Selectable)
			M/M	Date Installed	M/M	Date Installed	
							RNP-4

3. Crew Training. Crew training conducted by (enter as appropriate).

4. Airplanes Base of Operations. The base of operations for the airplanes listed in Table 1 is:

APPENDIX 2. DOCUMENTATION REQUIRED TO COMPLETE THE NAVIGATIONAL AUTHORIZATION PROCESS (continued)

TABLE 2. BASE OF OPERATION

City	State	Zip Code

5. Responsible Person. The responsible person for crew operations may be either an agent for service (who must be a U.S. citizen) or a person who is a U.S. citizen or holds a U.S. pilot certificate and accept responsibility for complying with the stated regulations by signing this document.

a. In accordance with § 91.3 and 91.703 (a)(1)(2) and ICAO Annex 2 (Rules of the Air), paragraph 2.3.2 (Pre-flight action) crews are responsible for policies and procedures in areas of operations where flights are conducted.

b. This document is considered invalid until signed by the person responsible for crew operations. If the person signing this document relinquishes responsibility, changes mailing address, or the airplanes change ownership or base of operation, this authorization becomes invalid and the responsible person should immediately notify the issuing office of the change.

c. Enter the name, address (cannot be a post office box), city, state, and zip code for the Responsible Person in Table 3:

TABLE 3. RESPONSIBLE PERSON

Name	Address	City	State	Zip

6. Deviations to RNP Requirements. The Administrator may authorize an operator to deviate from RNP requirements for a specific individual flight in airspace where an RNP type is specified if the Air Traffic Service (ATS) provider determined that the airplane would not interfere with, or impose a burden on other operators. Operations conducted under such authority will be conducted in accordance with the following limitations and provisions:

a. If fuel planning is predicated on en route climb to flight levels where RNP is normally required, an appropriate request must be coordinated in advance of the flight with the ATS provider.

b. The appropriate information blocks in the ICAO flight plan filed with the ATS provider must show that the airplane is **not** approved for the specified RNP type.

7. Special Preflight Requirements for RNP-4 Authorization. Operators should list any procedures that are utilized which are pertinent to the accuracy and time limit of the navigation

**APPENDIX 2. DOCUMENTATION REQUIRED TO COMPLETE THE
NAVIGATIONAL AUTHORIZATION PROCESS (continued)**

capability (e.g., an approved Fault Detection and Exclusion (FDE) program is required if global positioning system (GPS) is to be used. If utilizing a procedure detailed in another FAA document, that document may be referenced and a copy attached to the application).

HQ Control: 11/19/04

HQ Revision: 010

This Waiver or Authorization is Issued by the Federal Aviation Administration and approved by the direction of the Administrator.

Date Approval is effective:

Amendment Number:

I hereby accept and receive this Waiver or Authorization.

Date:

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APPENDIX 3. CHECKLIST AND JOB AID FOR THE RNP-4 AUTHORIZATION APPLICATION PROCESS

OPERATOR FUNCTIONS:

1. OPERATOR PREPARES AN APPLICATION PACKAGE AS DESCRIBED IN PARAGRAPH 8 OF THIS ORDER.

2. OPERATOR SELF-EXAMINATION. It is advisable that operators become familiar with paragraphs 8 and 9 of this order before contacting the Federal Aviation Administration (FAA). These sections provide the criteria for authorizations by placing aircraft/navigation systems in groups. Having knowledge of these sections provides the operator with an indication of how much time might be required in obtaining an authorization. Group 1 authorizations are administrative and can be granted as quickly as district office workloads will permit. Group 2 authorizations may be made quite rapidly or may take longer depending upon the aircraft/navigation system configurations. Group 3 authorizations will usually involve an extended time for evaluation and an authorization may or may not be granted.

3. OPERATOR SCHEDULES A PREAPPLICATION MEETING. The operator schedules a pre-application meeting with either certificate-holding district office (CHDO) for commercial operators, or Flight Standards District Office (FSDO) for general aviation.

4. OPERATOR SUBMITS A FORMAL APPLICATION FOR AUTHORIZATION. The operator submits a formal application for authorization in accordance with the FAA expectations discussed in the pre-application meeting. The formal application should be made in writing in a manner similar to those shown in Appendix 2.

- Figure 1 for Air Carriers
- Figure 2 for General Aviation

5. OPERATOR TRAINS FLIGHTCREW. An RNP-4 airspace or an RNP-4 route is a special airspace. There are no legal requirements for general aviation operators to have specific training for RNP-4 operations, however, International Civil Aviation Organization (ICAO) rules demand that States ensure that the crewmembers are qualified to operate in special airspace. Thus, general aviation operators will be required to satisfy the Administrator that they are qualified.

6. OPERATORS RECEIVE OPERATIONS/MANAGEMENT SPECIFICATIONS OR AN LOA. The operators receive operations/management specifications or letter of authorization (LOA) to operate in an RNP-4 airspace or on an RNP-4 route.

7. FLIGHTCREWS ARE AUTHORIZED TO PERFORM RNP-4 OPERATIONS. Flightcrews are authorized to perform RNP-4 operations for the time authorized within the parameters established for their navigation system configuration.

**APPENDIX 3. CHECKLIST AND JOB AID FOR THE RNP-4 AUTHORIZATION
APPLICATION PROCESS (continued)**

INSPECTOR FUNCTIONS:

INSPECTOR'S JOB AID

PTRS CODE	APPLICANT _____ -	Para & Pg	INSP INIT.	DATE
	1. Inspector familiarization with the authorization process			
1366	2. Set up applicant meeting date			
1366	3. Application meeting: Inspector _____ Applicant orientation to FAA Order 8400.RNP Oceanic Check of Documentation <ul style="list-style-type: none"> • Airworthiness documentation • Current Operations/Management Specifications, if applicable • Current LOA, if applicable • Copy of pertinent sections of the Airplane Flight Manual • List of number and type of long-range navigation (LRN) units (e.g., 3- Litton 92, inertial navigation system (INS)) • Description of LRN system (LRNS) integration. • Review of training program • RNP-4 Operations Issues • RNP-4 Contingency Procedures • Evaluate Operator's LRNS 			
1442	4. Issue operations/management specifications or an LOA* to the operator.			
1442	5. Complete a Program Tracking and Reporting Subsystem (PTRS) report noting the issuance of the RNP-4 authorization for a specified time <ul style="list-style-type: none"> • The National Use Field is a 9 space Alpha Numeric Field. The following entry must be made in the field: "RNP-4" followed by 3 spaces. 			

*** NOTE: Guidance for the Issuance of a LOA, in Order 8700.1, provides the aviation safety inspector (ASI) with details relative to the issuance of an LOA.**