



U.S. Department  
of Transportation  
**Federal Aviation  
Administration**

# Advisory Circular

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Subject: **DATA BASE STANDARDIZATION  
FOR THE GLOBAL POSITIONING  
SYSTEM (GPS) OVERLAY PROGRAM**

Date: 11/19/93  
Initiated by: **AFS-420**

AC No: **97-2**

**1. PURPOSE.** This advisory circular (AC) contains information and guidance to be used by data base vendors that develop data for use in the National Airspace System (NAS) for the nonprecision GPS overlay program. Most of the required data is readily available from existing documentation; however, additional waypoints may be required to ensure that aircraft fly the published, protected ground track of the existing standard instrument approach procedures (SIAP). This AC contains guidance which standardizes the development of these additional waypoints. This AC does not apply to localizer-based approaches.

**2. RELATED READING MATERIAL.**

a. Federal Aviation Administration (FAA) Order 8260.3B, United States Standard for Terminal Instrument Procedures (TERPS), stock number 050-007-00345-5. This document and changes may be purchased from the Superintendent of Documents, P.O. Box 37194, Pittsburgh, PA 15250-7954. When ordering, make check or money order payable to the Superintendent of Documents and specify the FAA Order number, title, stock number, and price. Orders may be charged to MasterCard or Visa credit cards by telephoning the Government Printing Office (GPO) order desk at (202) 783-3238 between 8:00 a.m. and 4:00 p.m. eastern time, Monday through Friday (except holidays). Price and availability information should be obtained before placing a mail order. Orders also may be placed at domestic GPO bookstores.

b. Technical Standard Order (TSO) C129, "Airborne Supplemental Navigation Equipment Using the Global Positioning System (GPS)." This document is available free of charge from the Federal Aviation Administration, Aircraft Certification Service, Technical Analysis Branch, AIR-120, 800 Independence Avenue, S.W., Washington, DC 20591. Telephone (202) 267-9546.

c. Aeronautical Radio, Incorporated (ARINC) Specification 424-9, "Navigation System Database." May be purchased from Aeronautical Radio, Incorporated, 2551 Riva Road, Annapolis, MD 20401-7465, ATTN: Documents Section. The telephone number is (410) 266-4117. The price is \$88.00.

d. Requirements and Technical Concepts for Aviation (RTCA), document number DO-200, "Preparation, Verification and Distribution of User-Selectable Navigation Data Bases." The price is \$8.00 to RTCA members and \$16.00 to others.

e. RTCA document number DO-201, "User Recommendations for Aeronautical Information Services." The price is \$12.00 to RTCA members and \$24.00 to others.

f. RTCA document number DO-208, "Minimum Operational Performance Standards for Airborne Supplemental Navigation Equipment Using Global Positioning System (GPS)." The price is \$25.00 to RTCA members and \$50.00 to others. RTCA documents (items (d) through (f) above) may be purchased by writing to Requirements and Technical Concepts for Aviation, 1140 Connecticut Avenue, N.W., Suite 1020, Washington, DC 20036, ATTN: Document Sales, or by telephone, (202) 833-9339. Orders may be charged to MasterCard or Visa credit cards.

**3. BACKGROUND.** The GPS overlay program was endorsed by the Satellite Operational Implementation Team (SOIT) in August 1992. TSO C129, which documents the minimum avionics equipment necessary to participate in the GPS overlay program, was completed in December 1992. The Director of Flight Standards

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Service authorized the GPS overlay program in June 1993. GPS accuracies have been evaluated to ensure that aircraft remain within the protected airspace of all currently published nonprecision approach procedures, excluding localizer-based procedures. These include the following:

- a. Very high frequency omnidirectional range (VOR).
- b. VOR/distance measuring equipment (DME).
- c. Nondirectional beacon (NDB).
- d. NDB/DME.
- e. Tactical air navigation (TACAN).
- f. Area navigation (RNAV).
  - (1) Long-range navigation (LORAN-C).
  - (2) VOR/DME.

#### 4. DEFINITIONS.

**a. Alongtrack Distance (ATD) Fix:** An alongtrack position defined as a distance in nautical miles (NM) with reference to the next waypoint. ATD fixes may be used in lieu of waypoints when no course change is required, and the navigation system's function does not require a waypoint. Do not use an ATD fix in lieu of an initial approach waypoint (IAWP), a fixed approach waypoint (FAWP), a missed approach waypoint (MAWP), or a missed approach holding waypoint (MAHWP). Stepdown fixes may be defined as ATD fixes.

**b. Dead Reckoning (DR):** A course or heading from a known position to an intercept point of a navigational aid (NAVAID) radial/bearing.

**c. Instrument Approach Waypoints:** Geographical positions specified in latitude/longitude used in defining GPS instrument approach procedures, including the IAWP, the intermediate waypoint (IWP), the FAWP, the MAWP, and the MAHWP.

**d. Magnetic Variation (MV) of Record:** The MV assigned to NAS system components (facilities and airports); the value to which a facility is aligned and/or the value used in the determination of flight information published relating to a facility or airport.

#### 5. GENERAL GUIDELINES.

- a. Code each overlay data base procedure with the MV of record for the facility serving the underlying approach procedure.
- b. Sequence waypoints for nonprecision approach procedures in accordance with TSO C129.
- c. Specify unnamed waypoints for the overlay data base in accordance with the criteria in ARINC Standard 424. There is no requirement to annotate published approach procedures with the data base unnamed waypoints; however, charting agencies may incorporate them at their discretion.

#### 6. ESTABLISHING WAYPOINTS.

##### a. General.

(1) Use the NAVAID/fix coordinates in the National Flight Data Center (NFDC), ATM-600, database as waypoint coordinates for all named fixes beginning at the initial approach fix (IAF) and at NAVAID facilities on nonprecision SIAP's. Changes to the NFDC data base are promulgated by the National Flight Data Digest (NFDD).

(2) Establish waypoints for all unnamed DME fixes used as the IAWP, the IWP, the FAWP, the MAWP, and the MAHWP.

(3) Establish waypoints at all unnamed turnpoints in instrument approach procedures which are based upon the intersection of two NAVAID radials or bearings.

(4) Data base vendors who are unable to resolve questions encountered during the overlay data base development of FAA nonprecision approach procedures should contact Flight Standards Service, Technical Programs Division, Flight Procedures Standards Branch (AFS-420), 800 Independence Ave., S.W., Washington, DC 20591

**b. Procedures with no Final Approach Fix (No-FAF).** No-FAF procedures, as defined in TERPS, require two waypoints to define a final approach course.

(1) Establish the MAWP at the NAVAID facility.

(2) For procedures without a stepdown fix, establish the second waypoint to define the final approach segment 4 NM from the MAWP on the final approach course.

(3) If a stepdown fix has been previously established on the underlying procedure, use it as the second waypoint if it is more than 2 NM from the MAWP.

(4) If a stepdown fix on the underlying procedure is 2 NM or less from the MAWP, establish the second waypoint to define the final approach segment 4 NM from the MAWP and put an ATD fix over the stepdown fix.

(5) Code the waypoint created by subparagraphs b(2), and b(3) and b(4) as the FAWP.

**c. Procedures with Final Approach Fix (FAF).** FAF procedures, as defined in TERPS, require the development of the following waypoints:

(1) To determine the location of the Missed Approach Point (MAP), the data base vendor should perform the following comparisons and conversions:

(i) Compare the FAF-to-MAP distance to the FAF-to-threshold distances.

(ii) If they are identical and there is no entry in the Additional Flight Data block denoting the final approach course alignment, the aiming point for the procedure is the runway threshold.

(iii) Use the runway threshold coordinates as the MAWP for approaches with straight-in and/or circling minimums.

(iv) For approaches where the conditions outlined in subparagraphs (i) through (iii) do not apply, create the MAWP coordinates from the defined missed approach point (MAP).

(v) For approaches where the FAF-to-MAP and FAF-to-threshold distances are not identical, or with circling only minimums, use the converted latitude/longitude coordinates as the MAWP.

**NOTE: If the data base developer is unable to determine the MAWP after following the procedures in subparagraphs (i) through (v), contact FAA, Office of Aviation System Standards, Flight Procedures Branch, AVN-220, 6500 South MacArthur, P.O. Box 25082, Oklahoma City, Oklahoma 73125, telephone 405-945-3382.**

(2) When arc initial segments are part of the SIAP, and the data base vendor includes arc capability as part of the data base, include the center point facility of the arc in the data base and ensure that waypoint sequencing allows the arc to be flown as published. Do not develop waypoints for the initiating radial of the arc IAF, the stepdown fixes on the arc, or the lead radials at the termination of the arc.

(3) On initial segments which incorporate DR headings, develop a waypoint at the point where the DR heading intercepts the next course segment.

(4) For VOR/DME RNAV procedures, develop and code as the FAWP an unnamed waypoint at the ATD fix designated as the FAF.

**7. DERIVING WAYPOINT COORDINATES.**

- a. The NFDC data base is the source for NAVAID/fix data used to compute waypoint coordinates.
- b. Use the construction priorities in RTCA document RTCA/DO-201 to compute unnamed waypoints.
- c. Use the National Ocean Service (NOS) geodesic computations found in RTCA/DO-208, Appendix B, to compute waypoint coordinates.

**8. COMMENTS INVITED.** Comments regarding this publication should be directed to the following address:

Federal Aviation Administration  
Flight Standards National Field Office, AFS-500  
Advisory Circular Staff, AFS-554  
P.O. Box 20034, Gateway Building  
Dulles International Airport  
Washington, DC 20041-2034

All comments submitted may not be acknowledged; however, they will be considered in the development of upcoming revisions to AC's and other related technical material.



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