



[4910-13]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 91, 121, 125, 129, and 135

Proposed Provision of Navigation Services for the Next Generation Air Transportation System (NextGen) Transition to Performance-Based Navigation (PBN)

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of proposed policy and request for comments.

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SUMMARY: The Federal Aviation Administration (FAA) seeks comments on a proposed transition of the U.S. National Airspace System (NAS) navigation infrastructure to enable performance-based navigation (PBN) as part of the Next Generation Air Transportation System (NextGen). The FAA plans to transition from defining airways, routes and procedures using VHF Omni-directional Range (VOR) and other legacy navigation aids (NAVAIDs)<sup>1</sup> towards a NAS based on Area Navigation (RNAV) everywhere and Required Navigation Performance (RNP) where beneficial. Such capabilities will be enabled largely by the Global Positioning System (GPS) and the Wide Area Augmentation System (WAAS). The FAA plans to retain an optimized network of Distance Measuring Equipment (DME) stations and a minimum operational network (MON) of VOR stations to ensure safety and continuous operations for high and low altitude en route airspace over the conterminous US (CONUS) and terminal operations at the Core 30 airports<sup>2</sup>. The FAA is also conducting research on Alternate Positioning, Navigation and Timing (APNT) solutions that would enable further reduction of VORs below the MON.

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<sup>1</sup> Includes Tactical Air Navigation (TACAN) Azimuth, VOR/TACAN (VORTAC), VOR/DME, Non-Directional Beacon (NDB) operated by the FAA.

<sup>2</sup> Core 30 airports are those with significant activity serving major metropolitan areas and also serve as hubs for airline operations, found at [http://aspmhelp.faa.gov/index.php/Core\\_30](http://aspmhelp.faa.gov/index.php/Core_30)

In addition, the FAA plans to satisfy any new requirements for Category I instrument operations with WAAS localizer performance with vertical guidance (LPV) procedures. A network of existing Instrument Landing Systems (ILS) would be sustained to provide alternative approach and landing capabilities to continue recovery and dispatch of aircraft during GPS outages.

This transition would be consistent with the FAA's NextGen Implementation Plan (NGIP), NAS Enterprise Architecture (EA), and other documentation. More information is available on the FAA's NextGen website at <http://www.faa.gov/nextgen> and the EA website at <https://nasea.faa.gov>.

DATES: Comments must be received on or before March 7, 2012.

ADDRESSES: Send comments identified by Docket No. FAA-2011-1082 using any of the following methods:

- Federal eRulemaking Portal: Go to <http://www.regulations.gov> and follow the online instructions for sending your comments electronically.
- Mail: Send comments to Docket Operations, M-30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC 20590-0001.
- Hand Delivery or Courier: Take comments to Docket Operations in Room W12-140 of the West Building Ground Floor at 1200 New Jersey Avenue, SE, Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.
- Fax: Fax comments to Docket Operations at 202-493-2251.

*Privacy:* The FAA will post all comments it receives, without change, to <http://www.regulations.gov>, including any personal information the commenter provides. Using the search function of the docket website, anyone can find and read the electronic form of all comments received into any FAA dockets, including the name of the individual sending the comment (or signing the comment for an association, business, labor union, etc.). DOT's complete Privacy Act Statement can be found in the

Federal Register published on April 11, 2000 (65 FR 19477-19478) as well as at <http://DocketsInfo.dot.gov>.

FOR FURTHER INFORMATION CONTACT: Mr. Greg Joyner, AJW-911, Navigation Services, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591; telephone: (202) 493-5721.

SUPPLEMENTARY INFORMATION:

The Proposal

Purpose

This notice announces the FAA's proposed strategy to meet requirements for air navigation service in the United States. The FAA is committed to maintaining the highest levels of safety, capacity, and efficiency in the NAS while transitioning from the legacy station-referenced system of airways, routes and procedures to a performance-based system providing flexible point-to-point navigation enabled by geospatial positioning, navigation, and timing (PNT) infrastructure and aircraft advanced navigation systems.

Transition to PBN for En Route, Terminal and Approach Operations in CONUS

Many NextGen benefits depend on PBN, specifically RNAV and RNP routes, arrivals, departures, instrument approaches and other procedures to increase capacity and efficiency, and reduce aircraft noise and emissions while enhancing safety. All of these operations are enabled primarily by GPS and WAAS.

GPS provides a level of service that supports lateral navigation for en route through non-precision instrument approaches. GPS is an internationally accepted navigation system, standardized by the International Civil Aviation Organization (ICAO), and has been approved for use by many countries. Additional information concerning GPS can be found at [www.gps.gov](http://www.gps.gov) and [www.pnt.gov](http://www.pnt.gov). The U.S. government has committed

to maintaining GPS services in accordance with the Standard Positioning Service Performance Standard of September 2008. The U.S. is improving GPS services by adding a second frequency which will make GPS more resistant to unintentional radio frequency interference (RFI) sources.

WAAS is a GPS augmentation system for aviation use that has been operational since 2003 and is used to improve the accuracy, integrity, and availability of GPS. WAAS also improves the availability of GPS to support PBN operations, even if several GPS satellites were to go out of service. WAAS is a satellite-based augmentation system (SBAS) standardized by ICAO. Compatible systems are operational in Japan and Europe, and other SBASs are in development in India and Russia.

Even though basic and augmented GPS services enable all of the PBN capabilities for NextGen, the signals are vulnerable to scheduled and unscheduled outages. For example, the U.S. government regularly conducts scheduled testing in the NAS that impacts GPS use in selected regions. Unscheduled GPS outages have been caused by interference from intentional or unintentional sources of RFI. The FAA will ensure sufficient infrastructure is provided to mitigate the effects of scheduled GPS outages in designated areas and unscheduled outages which could otherwise significantly disrupt air commerce.

The FAA also provides a network of distance measuring equipment (DME) that enable aircraft with suitable RNAV avionics to fly RNAV routes and terminal procedures where sufficient DME coverage exists. (See FAA Advisory Circular (AC) 90-100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations.) In the near term, the FAA plans to enhance DME facilities to provide unrestricted RNAV operations for DME/DME and DME/DME/Inertial Reference Unit (IRU) equipped aircraft operating in Class A airspace over the CONUS and in the vicinity of the Core 30 airports. Over the longer term, the FAA is investigating other

APNT solutions to satisfy PNT requirements for all users in the event of a loss of GPS.

Since VORs do not enable RNAV, RNP, or Automatic Dependent Surveillance-Broadcast (ADS-B) operations, the FAA plans to reduce costs by drawing down the number of FAA-provided VORs. Currently, over 80% of the 967 VORs in the NAS inventory are past their economic service life and cost the FAA more than \$110M per year to operate. Likewise, replacement parts are becoming increasingly difficult to obtain. The replacement of all of the VORs would cost over \$1.0B. Therefore, the FAA is planning a gradual discontinuance (removal from service) of VOR facilities in CONUS to a minimum operational network (MON). The MON would enable aircraft anywhere in the CONUS to proceed safely to a destination with a GPS-independent approach within 100 nm. MON coverage is planned to be provided at altitudes above 5,000 feet above ground level (AGL). The FAA would also retain VORs to support international arrival airways from the Atlantic, Pacific, Caribbean, and at the Core 30 airports. The existing U.S. legacy navigation aids outside CONUS will be retained until a longer-term solution can be coordinated with users. The drawdown of VORs to a MON would be completed no later than January 1, 2020.

In considering VORs for discontinuance, each facility will be evaluated on its own merits. The FAA will convene a working group that will develop a candidate list of VORs for discontinuance using relevant operational, safety, cost, and economic criteria. As part of the process, this working group will engage aviation industry stakeholders and other members of the public for input.

Suitably equipped RNAV aircraft can continue to fly the existing Victor Airways and Jet Routes, Standard Terminal Arrivals (STAR), and Departure Procedures (DP) even if their associated VORs are not operating, by the use of RNAV substitution as described in AC 90-108, Use of Suitable Area

Navigation (RNAV) Systems on Conventional Routes and Procedures. Existing airways, routes, and procedures eventually would be replaced by RNAV Q (high) and T (low) Routes, and RNAV STARs and DPs. VORs are also used for the Hazardous In-flight Weather Advisory Service (HIWAS) broadcast and voice communication with FAA Flight Service Stations. These services are not planned to be impacted by this proposal.

WAAS supports vertically-guided approach operations, called Localizer Performance with Vertical guidance (LPV). These approaches are equivalent to Category I ILS, but do not require any radionavigation equipment at or near the airport. WAAS provides LPV coverage throughout CONUS, Alaska, and most of Canada and Mexico. By 2016, the FAA expects to provide instrument approach procedures with LPV or localizer performance (LP) non-precision lines of minima to all qualified instrument runways in CONUS and Alaska (see Advisory Circular AC 150/5300-13, Airport Design, Appendix 16). In order to maximize operational benefits and take advantage of the cost savings associated with WAAS, the FAA no longer intends to establish new Category I ILSs using Facilities and Equipment (F&E) funding.

ILSs that are funded by grants from the Airport Improvement Program (AIP) will continue as an eligible project per the authorizing statute. However, the FAA is considering programmatic changes under AIP that would favor WAAS for new precision approaches at airports, rather than ILS. The FAA Office of Airports will engage with airport stakeholders and associations on these potential changes.

Existing ILSs would provide an alternative approach and landing capability in support of recovery and dispatch of aircraft during GPS outages. ILSs would provide the precision approach and landing segment for APNT.

For all approach procedures, airports will continue to be required to meet airfield design and infrastructure requirements appropriate for the approach visibility levels set forth in AC 150/5300-13.

#### Future Plans

Unaugmented GPS is capable of providing the accuracy and integrity required by the FAA's ADS-B Out regulations (14 CFR paragraphs 91.225 and 91.227) that were effective August 31, 2010 and have a compliance date of January 1, 2020. However, at this time, WAAS augmentation is the only service that provides the 99.9 percent availability (equivalent to radar) needed for ADS-B. Operators that equip with other position sources, such as Receiver Autonomous Integrity Monitoring (RAIM) based GPS, may experience periods of unavailability that limit their access to the airspace. The FAA expects that positioning from GPS combined with future positioning sources such as the L5 GPS signal and/or other GNSS signals, and GPS tightly integrated with inertial navigation systems, will also provide 99.9 percent availability.

The FAA is conducting research on APNT for service beyond 2020. The FAA will consider, in consultation with the users, whether the MON may be further reduced after an APNT solution is selected and available. The FAA is also evaluating the use of the Ground-Based Augmentation System (GBAS) in addition to ILS to provide Category II/III approach services.

#### Review of Navigation Equipage Requirements

FAA regulations addressing the operational requirements to carry navigation equipment in aircraft are set forth in 14 CFR parts 91, 121, 125, 129, and 135. Operators should be familiar with their specific requirements. The following paragraphs provide an overview of those requirements to assist in understanding the context for the radionavigation services described in this Notice.

### Suitable Equipage for the Route to be Flown

The aircraft equipage rules are performance-based and the aircraft must have equipment appropriate for the route to be flown, including en route, departure, arrival, and instrument approach procedures. Operators planning to fly a variety of different routes and procedures must carry equipment suitable for the different routes and procedures.

FAA guidance describing the navigation equipment "suitable" to the route to be flown is provided in the Aeronautical Information Manual and in a series of advisory circulars (see AC Nos. 90-100, 90-101, 90-105, and 90-107). Equipment is considered suitable if it has been demonstrated to provide the accuracy, integrity and reliability for the operation and the necessary radionavigation service is provided for the planned route of flight. For conventional ground-based routes and procedures, suitable equipment can be directly inferred from the type of procedure (e.g., a VOR receiver would be suitable for operation on a Jet Route). RNAV systems, enabled by GPS, WAAS, or DME/DME/IRU (DDI), are suitable for a variety of operations including:

- o Operation on Victor Airways, Jet Routes, terminal arrivals, departures, and approach procedures, including the initial and missed approach portions of an ILS instrument approach (based on AC 90-108);
- o Operation on RNAV routes (Q routes and T routes);
- o Operation on RNAV arrivals and departures;
- o Operation on RNAV (GPS) approaches (excluding DDI);
- o Operation on RNAV (RNP) approaches (excluding DDI).

Operators must ensure that performance requirements can be met for the intended operations during flight planning. Due to integrity limitations of unaugmented GPS, aircraft using unaugmented GPS navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation so that the aircraft can proceed safely to a landing at a suitable airport. This limitation also applies to required

alternates: when a planned alternate is required, that alternate cannot be predicated on GPS in any way (as the primary approach aid, or as the means to accomplish the initial, intermediate or missed approach of an ILS, RNAV, or VOR approach).

General aviation aircraft using WAAS equipment under IFR do not require an alternate means of navigation, due to the improved reliability of WAAS. However in non-normal conditions resulting in the loss of WAAS services (for example catastrophic failure of the WAAS satellites), the FAA will advise WAAS users that the GPS-only restrictions should be applied until such time as WAAS service can be restored. Aircraft equipped only with WAAS would be supported by air traffic control in the event of a catastrophic failure of satellite navigation.

The planned use of GPS or WAAS during periods when GPS may be unavailable (e.g., test events identified through NOTAM as areas in which GPS may be unavailable) is not appropriate. In those areas and during the test, aircraft must be equipped with other equipment suitable for the planned operation (route of flight, altitude, etc.). However, pilots may use GPS or WAAS during flight if onboard equipment indicates service is available.

RNAV systems using multiple DME signals are also suitable for many of the same operations. DME has several limitations compared to GPS or WAAS: the coverage of the service is not universal, so the operator must verify that it is available over the planned route of flight; and DME navigation is not currently capable of providing the more precise accuracy that is needed for approach and departure operations.

#### Two Independent Systems

FAA regulations applicable to domestic operations for commerce or for hire require a second system capable of reversion or contingency operations during non-normal conditions, including regional- or system-

wide effects that could reasonably occur. The rules applicable to those operations require two independent navigation systems appropriate to the route to be flown, or one system that is suitable and a second, independent backup capability that allows the operator to proceed safely and land at a different airport, and the aircraft must have sufficient fuel (reference 14 CFR 121.349, 125.203, 129.17, and 135.165). These rules ensure the safety of the operation by preventing a single point of failure.

The requirements for a second system apply to the entire set of equipment needed to achieve the navigation capability, not just the individual components of the system such as the radionavigation receiver. For example, in order to use two RNAV systems to comply with the requirements, the aircraft must be equipped with two independent radionavigation receivers and two independent navigation computers (e.g., flight management systems). Alternatively, to comply with the requirements using a single RNAV system with an installed and operable VOR capability, the VOR capability must be independent of the FMS. The MON described in this notice would continue to allow this equipage to fulfill the above requirements for operating within U.S. airspace.

To satisfy the requirement for two independent navigation systems, if the primary navigation system is GPS-based, the second system must be independent of GPS (e.g., VOR or DDI). This allows continued navigation in case of failure of the GPS or WAAS services. Recognizing that GPS interference and test events resulting in the loss of GPS services have become more common, the FAA requires operators conducting IFR operations under 14 CFR 121.349, 125.203, 129.17 and 135.165 to retain a non-GPS navigation capability consisting of either DME/DME, IRU or VOR for en route and terminal operations, and VOR and/or ILS for final approach. Since this system is to be used as a reversionary capability, single equipage is sufficient.

### Instructions for submission of comments

Interested parties are invited to provide comments on the proposal. Comments that provide the factual basis supporting the views and suggestions presented would be particularly helpful in developing reasoned decisions on the proposal.

Communications should identify docket numbers (FAA Docket No. FAA-2011-1082 and be submitted in triplicate to the Docket Management Facility (see ADDRESSES section for address and phone number).

All communications received on or before the specified closing date for comments will be considered before taking action on the proposal. The proposal contained in this action may be changed in light of comments received. All comments submitted will be available for examination in the public docket both before and after the closing date for comments. A report summarizing each substantive public contact with FAA personnel concerned with this proposal will be filed in the docket.

### Availability of Proposal

An electronic copy of this document may be downloaded through the Internet at <http://www.regulations.gov>.

You may review the public docket containing the proposal, any comments received, and any final disposition in person in the Dockets Office (see ADDRESSES section for address and phone number) between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. An informal docket may also be examined during normal business hours at the office of Docket Operations, M-30; U.S. Department of Transportation (DOT), 1200 New Jersey Avenue, SE, Room W12-140, West Building Ground Floor, Washington, DC 20590-0001.

Issued in Washington, DC, on December 1, 2011.

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