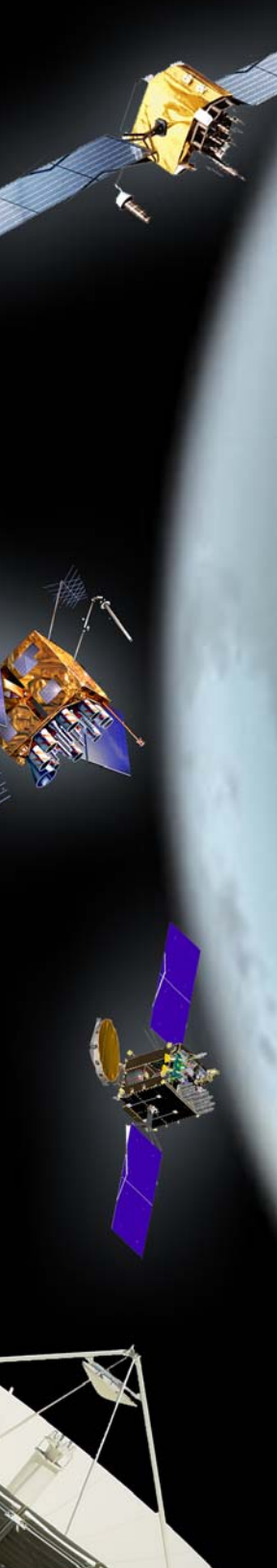




**Federal Aviation  
Administration**

# **Maximizing Airport Operations Using the Wide Area Augmentation System (WAAS)**



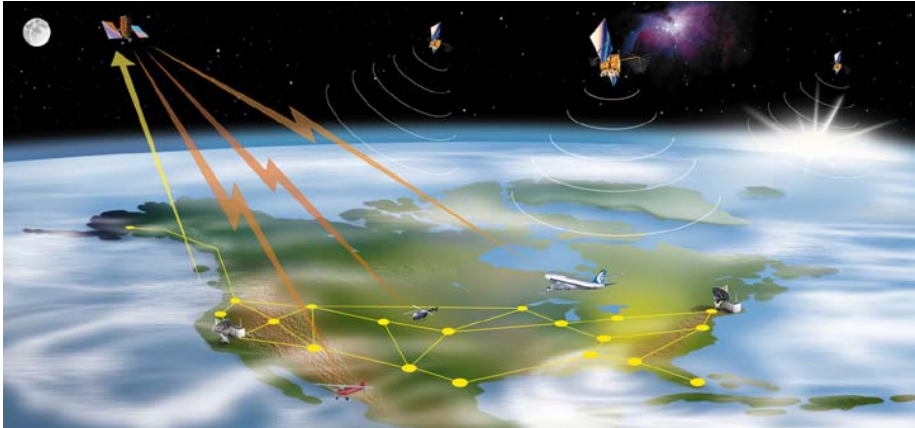
The Wide Area Augmentation System (WAAS) offers an opportunity for airports to gain Instrument Landing System (ILS)-like approach capability without the purchase or installation of any ground-based navigation equipment at the airport. Today, WAAS is already being used at more than 900\* runways across the U.S. to achieve minimums as low as 200' height above touchdown and ½ mile visibility. The purpose of this document is to provide an overview of the benefits that WAAS offers to airports and provide information on the steps that airports can take now to begin realizing these benefits.

## BENEFITS of WAAS in the airport environment

WAAS is a navigation service using a combination of Global Positioning System (GPS) satellites and the WAAS geostationary satellites to improve the navigational service provided by GPS. WAAS achieved initial operating capability (IOC) in 2003 and will complete full operating capability (FOC) in 2008. The system is owned and operated by the Federal Aviation Administration and provided free of direct user charges to users across the U.S. and most of Canada and Mexico.

WAAS improves the navigational system accuracy for en route, terminal, and approach operations over all the continental United States and significant portions of Alaska, Canada and Mexico. This new navigational technology supports vertically-guided instrument approaches to all qualifying runways in the U.S. Vertically-guided approaches reduce pilot workload and provide safety benefits compared to non-precision approaches.

*\*as of September 2007*



The WAAS-enabled vertically-guided approach procedures are called LPV which stands for “localizer performance with vertical guidance” and provide Instrument Landing System (ILS) equivalent approach minimums as low as 200 feet at qualifying airports. Actual minimums are based on an airport’s current infrastructure, as well as an evaluation of any existing obstructions. The FAA plans to publish 300 WAAS approach procedures per year to provide service to all qualifying instrument runways within the U.S. National Airspace System (NAS).

## ADVANTAGES of WAAS-enabled LPV approaches

The advantages of WAAS-enabled LPV approaches include:

- ❖ LPV procedures have no requirement for ground-based transmitters at the airport.
- ❖ No consideration needs to be given to the placement of navigation facility, maintenance of clear zones around the facility, or access to the facility for maintenance.



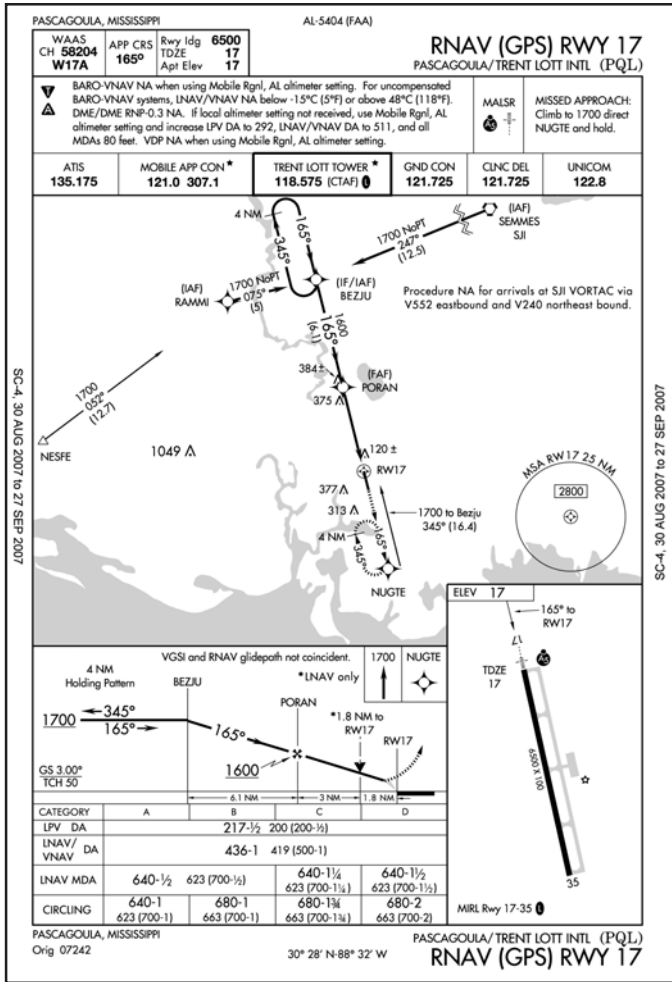
- ❖ LPV approaches eliminate the need for critical area limitations associated with an ILS.
- ❖ From a pilot's viewpoint, an LPV approach looks and flies like an ILS, but the WAAS approach is more stable than that of an ILS.
- ❖ WAAS equipped users can fly area navigation (RNAV) and basic required navigation performance (RNP) procedures, as well as LPV procedures, and the avionics costs are relatively inexpensive considering the total navigation solution provided.

The figure on the next page depicts a typical LPV approach procedure that the pilot refers to while flying the aircraft.

The title denotes the approach as an RNAV procedure. Notice that each RNAV procedure typically includes three approach types; LPV, LNAV/VNAV, and LNAV. This enables as many GPS-equipped aircraft to use the procedure as possible and provides operational flexibility if WAAS becomes unavailable.

Some aircraft may only be equipped with GPS receivers so they can fly to the LNAV decision altitude. Some aircraft equipped with GPS and FMS (with approach-certified barometric vertical navigation, or Baro-VNAV) can fly to the LNAV/VNAV decision altitude. Flying a WAAS LPV approach requires an aircraft with WAAS-LPV avionics. If for some reason the WAAS service becomes unavailable, all GPS or WAAS equipped aircraft can revert to the LNAV decision altitude and land safely using GPS-only, which is available nearly 100% of the time.

In 2008, the FAA will also begin publishing lateral precision (LP) procedures at runways where LPV procedures may not qualify. The LP procedure is a non-precision approach with lateral guidance equivalent to the localizer portion of an ILS. LP approaches will provide the lowest possible minimum descent altitude (MDA) at airports where obstructions and/or infrastructure prevent an LPV procedure.





## PREPARING an airport for WAAS

The WAAS navigation service is fully operational and ready to provide the capability. Even though no navigational equipment is required on the airport, there are still some airport infrastructure requirements to get a LPV approach. The FAA needs to help an airport determine if they can accommodate this type of approach procedure.

### **National Plan of Integrated Airport System (NPIAS) Airports**

The airport sponsor's first step in pursuing a WAAS LPV approach is to contact the local FAA Airports Office, or your state aviation agency, to discuss the available options based on the current and planned development shown on the facility's approved Airport Layout Plan. This evaluation will consider any changes that may be required for the airport to support an LPV approach to the lowest possible minimums. Even without the requirement for physical navigation equipment on the airport, compliance with the design standards of Advisory Circular 150/5300-13 "Airport Design" are necessary. Since the LPV approach may improve the existing capability, the airport infrastructure may require upgrading to accommodate the new procedure. An evaluation should be performed to determine if further actions, such as land acquisition, obstacle clearing, and upgrading the runway markings are required to achieve the full benefit of the LPV procedure. Once the scope of the infrastructure needs are understood, the local FAA Airports Office, state aviation agency, and the airport sponsor can

discuss the feasibility of implementation of the approach, along with options for funding the needed improvements.

### **Non-NPIAS Airports**

The availability of WAAS, or LPV approaches, is not limited to just NPIAS airports. Non-NPIAS airports can also receive these benefits. The process for a non-NPIAS airport should begin with a discussion with the state aviation agency. Non-NPIAS airports are not eligible for federal funding; however, some states may want to fund improvements necessary to achieve full LPV approach capability at non-NPIAS airports. Private use airports must initiate and complete a reimbursable agreement with the FAA for the cost of developing and maintaining the LPV approach before the development begins.

### **Determining Minimums or How Low Can We Go?**

Several factors determine the minimums for an instrument approach and implementing a LPV approach is no different.

The two driving factors are the obstacle environment

surrounding the airport and the airport

infrastructure. The height above

touchdown (HAT) of the approach is

based solely on the obstacles (natural

or manmade) and how close they

come to penetrating the glide slope

obstacle clearance surfaces. Often

these are beyond the control of the

airport manager to clear and will affect





the HAT for the approach. The visibility requirement for the approach is partly dependent upon the airfield infrastructure. Achieving the lowest visibility requires a benign obstacle environment and appropriate airport infrastructure to support the approach. Typically, airport infrastructure requirements are based on desired minimums and establish requirements for runway length, lighting, and all-weather markings, as well the need for a parallel taxiway. Details relating to the airport infrastructure requirements can be found in Advisory Circular 150/5300-13. The goal is to cost effectively provide an infrastructure allowing for the lowest minimums and greater access to the airport in all weather conditions. Since these items are cost drivers, the airport sponsor in consultation with the State and FAA will need to discuss the costs and benefits associated with various visibility minimums.

### **Survey Requirements**

Once the airport infrastructure requirements are determined, the next step is to collect the appropriate airport data to develop the instrument approach. Requests for new or revised instrument approach procedures (IAP) require the submittal of accurate airport data meeting FAA requirements. The data collection effort begins by reviewing the guidance provided in the following FAA advisory circulars:

- ❖ AC 150/5300-16 - General Guidance and Specifications for Aeronautical Surveys: Establishment of Geodetic Control and Submission to the National Geodetic Survey



- ❖ AC 150/5300-17 - General Guidance and Specifications for Aeronautical Surveys: Airport Imagery Acquisition and Submission to the National Geodetic Survey
- ❖ AC 150/5300-18 - General Guidance and Specifications for Submission of Aeronautical Surveys to NGS: Field Data Collection and Geographic Information System (GIS) Standards

Using this guidance, the airport can determine what information it has, how current the information is, and what information to collect or update. With the requirements determined, the airport sponsor can now begin working toward collecting the required data. Generally, most airports will require a new high accuracy survey to gather the most current data on the airport and the obstacles surrounding the airport. The procedure development process requires a considerable amount of time, typically 12-18 months. The development process cannot begin until the survey data is provided and verified. The options for funding these types of surveys should be discussed with the local FAA Airports Office, as well as with the state aviation agency.

The FAA provides a sample Statement of Work (SOW) for use by airport sponsors or state aviation authorities get the work completed. This SOW is available through the local FAA airports





office or at <http://airports-gis.faa.gov>. These resources also have other information the sponsor can use in determining their local needs to meet the national requirement.

### **Applying for the Procedure**

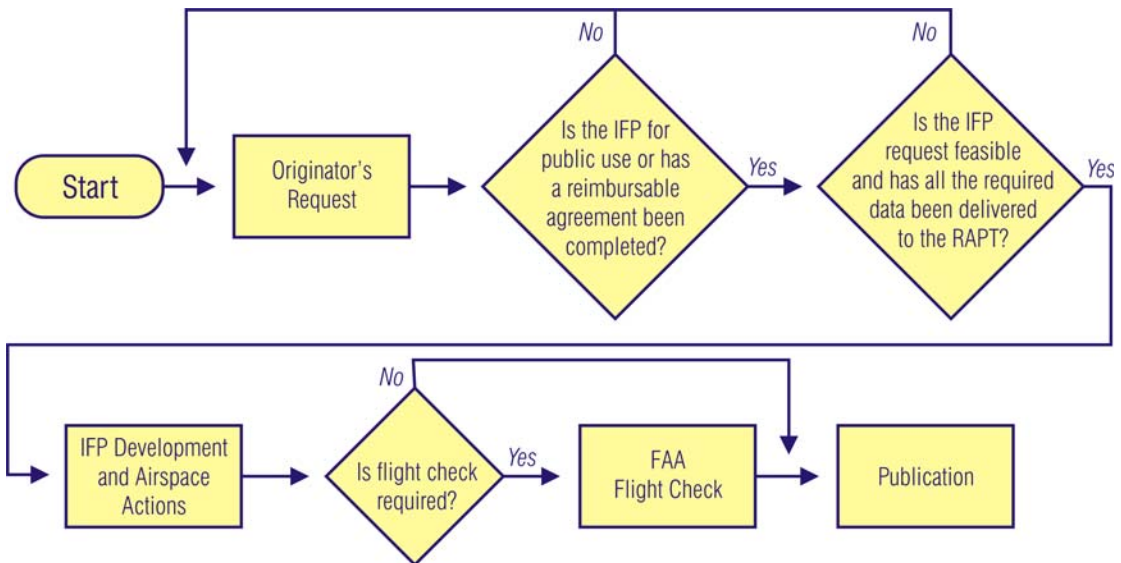
Once the appropriate data is collected, the airport sponsor or state aviation authority needs to submit an official request for development of the procedure to the FAA. The application process is a straight forward process and available on the World Wide Web at <http://avn.faa.gov/index.asp?xml=ifp/requests>. This submission must include specific airport data as well as the originator's information. Once submitted, the request is reviewed by the FAA's Regional Airspace and Procedures Team (RAPT). This review incorporates FAA airports, flight procedures, flight standards, and air traffic control to provide a single coordinated review of the request. Once approved by the RAPT, the priority for publication is established and the procedure development scheduled.

With the request, including the current survey and the RAPT's schedule recommendation, the package is sent to the FAA's flight procedures group located in Oklahoma City. Here, the procedure is designed, checked, and handed off for flight inspection. After successful flight inspection, the procedure is scheduled for charting in the next available cycle.

More information on this process can be found at FAA's Aviation System Standards (AVN) website at <http://avn.faa.gov/index.asp?xml=ifp/index>.

## When the Procedure is Published

The new instrument approach is published as a RNAV (GPS) RWY XX in the instrument approach charts. Once published, the LPV approach is immediately available for public use by all WAAS LPV equipped aircraft. Pilots will see the new LPV minimum line on the new or updated charts. Air traffic control will also receive the updates and will be able to clear pilots requesting the approach. Pilots can request clearance for your airport's new "service" by requesting clearance for the specified "RNAV/GPS" approach. Providing this new capability to your airport will improve access when the weather conditions deteriorate. Since WAAS can service more than a single runway at an airport (every runway for which a procedure is developed), it can offer air traffic control more options than existing ILS approaches when handling traffic during poor weather.





800 Independence Avenue, SW Washington, DC 20591

Please visit <http://gps.faa.gov>