U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Guidance for Localizer Performance with Vertical Guidance and Localizer Performance without Vertical Guidance Approach Operations in the U.S. National Airspace System

Date: 2/11/11 **AC No:** 90-107

Initiated by: AFS-400 **Change:**

FOREWORD

This advisory circular (AC) provides guidance for operators to conduct Title 14 of the Code of Federal Regulations (14 CFR) part 97 instrument flight rules (IFR) Area Navigation (RNAV) Global Positioning System (GPS) instrument approach procedures (IAP) with Localizer Performance with Vertical guidance (LPV) and Localizer Performance without vertical guidance (LP) lines of minima using the wide area augmentation system (WAAS). This AC applies to all operators conducting RNAV (GPS) approach procedures to LPV or LP lines of minima using WAAS navigation avionics under 14 CFR parts 91, 91 subpart K (part 91K), 121, 125, 129, 133, 135 and 137 within the United States (U.S.) National Airspace System (NAS). This AC provides operational approval information for operators flying parts 91K, 121, 125, 133, 135 and 137. For additional airworthiness guidance, refer to AC 20-138, Airworthiness Approval of Positioning and Navigation Systems (current edition).

/s/  for

John M. Allen
Director, Flight Standards Service

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1. PURPOSE. This advisory circular (AC) provides guidance for operators to conduct Title 14 of the Code of Federal Regulations (14 CFR) part 97 instrument flight rules (IFR) Area Navigation (RNAV) Global Positioning System (GPS) instrument approach procedures (IAP) with Localizer Performance with Vertical guidance (LPV) and Localizer Performance without vertical guidance (LP) lines of minima using the wide area augmentation system (WAAS).

> **NOTE: For additional airworthiness guidance, refer to AC 20-138, Airworthiness Approval of Positioning and Navigation Systems (current edition).**

2. APPLICABILITY. This AC applies to all operators conducting RNAV (GPS) approach procedures to LPV or LP lines of minima using WAAS navigation avionics under 14 CFR parts 91, 91 subpart K (part 91K), 121, 125, 129, 133, 135 and 137 within the United States (U.S.) National Airspace System (NAS). This AC provides operational approval information for operators flying parts 91K, 121, 125, 133, 135 and 137. This AC is not mandatory; and it does not change, add, or delete regulatory requirements or authorize deviations from regulatory requirements. In lieu of following the guidance in this AC without deviation, operators may elect to follow an alternative method, provided the alternative method is found to be acceptable by the Federal Aviation Administration (FAA).

3. RELATED 14 CFR PARTS.

- Part 61,
- Part 91 and 91K,
- Part 95,
- Part 97,
- Part 121, §121.567,
- Part 125, §125.203, §125.287, and §125.325,
- Part 129,
- Part 133,
- Part 135, and
- Part 137.

4. DEFINITIONS.

a. Advisory Vertical Guidance. Vertical path deviation guidance indication that is generated by any means, but is only an aid provided by some manufacturers to help pilots meet altitude restrictions. Advisory vertical guidance is an optional capability implemented at the manufacturer's discretion; not a requirement for positioning and navigation equipment.

> **NOTE: It is the pilot's responsibility to use the barometric altimeter to ensure compliance with altitude restrictions, particularly during approach operations. Advisory vertical guidance *is not* approved vertical guidance like that found on approaches with lateral navigation (LNAV)/vertical navigation (VNAV), LPV or instrument landing system (ILS) lines of minima.**

b. Approved Vertical Guidance. Actual vertical path deviation guidance indications generated by certified means for charted approach procedures that contain a U.S. Standard for Terminal Instrument Procedures (TERPS)-protected glidepath (e.g., approaches with LNAV/VNAV, LPV or ILS lines of minima).

c. Area Navigation (RNAV). A method of navigation which permits aircraft operation on any desired flightpath within the coverage of ground or space-based Navigational Aids (NAVAID) or within the limits of the capability of self-contained aids, or a combination of these.

d. RNAV System. A navigation system which permits aircraft operation on any desired flightpath within the coverage of ground or space-based NAVAIDs or within the limits of the capability of self-contained aids, or a combination of these. An RNAV system may be included as part of a flight management system (FMS).

e. Barometric Aiding (Baro-Aiding). A method of augmenting the GPS integrity solution in receiver autonomous integrity monitoring (RAIM) by using a barometric altitude input source. Baro-aiding requires four satellites and a barometric altimeter to detect an integrity anomaly (the current altimeter setting may need to be entered into the receiver as described in the operating manual). Baro-aiding satisfies the RAIM requirement in lieu of a fifth satellite.

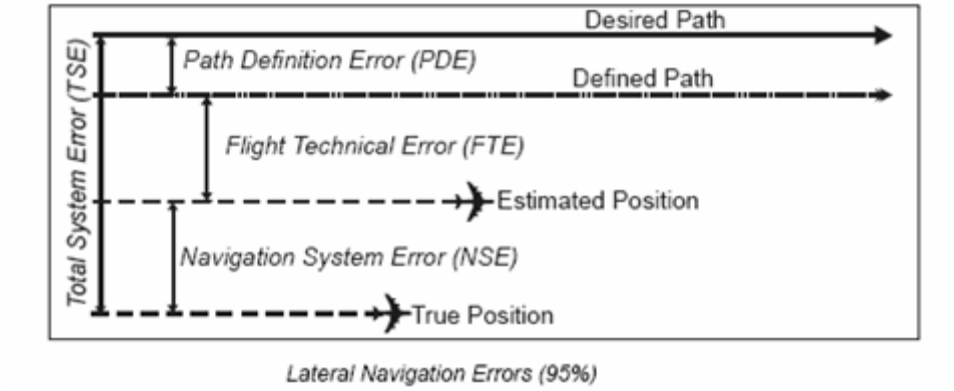
f. Barometric Vertical Navigation (Baro-VNAV). An RNAV system function which uses barometric altitude information from the aircraft's altimeter to compute and present a vertical guidance path to the pilot. The specified vertical path is computed as a geometric path, typically computed between two waypoints or an angle based computation from a single way point.

g. Decision Altitude (DA). In an approach with approved vertical guidance, DA is a specified altitude expressed in feet above mean sea level (MSL) at which a missed approach must be initiated if the required visual references to continue the approach have not been established.

h. Fault Detection and Exclusion (FDE). A receiver autonomous integrity monitoring (RAIM) algorithm that can automatically detect and exclude a faulty satellite from the position solution when measurements from six or more satellites are available. WAAS equipment uses

FDE for integrity whenever a WAAS signal is not available to permit continued operation from en route through approach operations.

i. Flight Technical Error (FTE). FTE is the accuracy with which an aircraft is controlled, as measured by the indicated aircraft position with respect to the indicated command or desired position. It does not account for procedural blunder errors.



Lateral Navigation Errors (95%)

j. Global Navigation Satellite System (GNSS). GNSS refers collectively to the worldwide positioning, navigation, and timing determination capability available from one or more satellite constellations in conjunction with a network of ground stations.

k. Global Positioning System (GPS). GPS refers to the worldwide positioning, navigation and timing determination capability available from the U.S. satellite constellation. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Performance Standard. GPS is composed of space, control, and user elements.

l. Integrity. Integrity is a measure of the trust that can be placed in the correctness of the information supplied by the total system. Integrity includes the ability of a system to provide timely and valid warnings to the user (alerts).

m. Lateral Navigation (LNAV). An RNAV function that computes, displays, and provides horizontal approach navigation without approved vertical guidance.

n. Lateral Navigation/Vertical Navigation (LNAV/VNAV). An RNAV function that computes, displays, and provides both horizontal and approved vertical approach navigation. Both WAAS vertical guidance and baro-VNAV support approaches to LNAV/VNAV lines of minima.

o. Localizer Performance with Vertical Guidance (LPV). An RNAV function requiring WAAS, using a final approach segment (FAS) data block, which computes, displays and provides both horizontal and approved vertical approach navigation to minimums as low as 200 foot ceiling and ½ mile visibility.

p. Localizer Performance without Vertical Guidance (LP). An RNAV function requiring WAAS, using a final approach segment (FAS) data block that computes, displays, and provides horizontal approach navigation using the horizontal accuracy and integrity of LPV without the

approved vertical guidance. The LP line of minima is provided at locations where issues prevent the use of LPV vertical guidance, and provides a higher probability of achieving the lowest minimum at these locations.

q. Minimum Descent Altitude (MDA). In an approach without approved vertical guidance, MDA is a specified minimum altitude expressed in feet above MSL.

r. Receiver Autonomous Integrity Monitoring (RAIM). An algorithm that verifies the integrity of the position output using measurements from five or more GPS satellites, or four or more GPS satellites and baro-aiding.

s. Required Navigation Performance (RNP). RNP is a statement of the 95 percent navigation accuracy performance that meets a specified value for a particular phase of flight or flight segment and incorporates associated on-board performance monitoring and alerting features to notify the pilot when the RNP for a particular phase or segment of a flight is not being met.

t. Required Navigation Performance Approach (RNP APCH). RNP APCH is a navigation specification based on area navigation that includes the requirement for on-board performance monitoring and alerting features to notify the pilot when the RNP for the approach phase of flight is not being met. (LPV and LP operations are found in the RNP APCH navigation specifications of the International Civil Aviation Organization (ICAO) Performance-based Navigation Manual.)

u. Satellite-Based Augmentation System (SBAS). SBAS is a wide area coverage augmentation system. The user receives GPS constellation augmentation information from a geostationary satellite-based transmitter. SBAS complements the core GPS satellite constellation by increasing navigation accuracy, integrity, continuity and availability provided within a service area. The U.S. SBAS is WAAS.

5. RELATED READING MATERIAL (current editions). The following documents are related to this AC.

a. Where You Can Find ACs/Orders/Notices. You can find this AC at http://www.faa.gov/regulations_policies/advisory_circulars and Orders/Notices at https://employees.faa.gov/tools_resources/orders_notices. Inspectors can also access this AC through the Flight Standards Information Management System (FSIMS) at http://fsims.avs.faa.gov (see the link to http://rgl.faa.gov). Operators and the public may find this information at http://fsims.faa.gov (see the link to http://rgl.faa.gov).

(1) AC 20-138, Airworthiness Approval of Positioning and Navigation Systems.

(2) AC 20-153, Acceptance of Data Processes and Associated Navigation Databases.

(3) AC 29-2, Certification of Transport Category Rotorcraft.

(4) AC 90-105, Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System.

(5) Order 8260.42, Helicopter Global Positioning System (GPS) Nonprecision Approach Criteria.

(6) Order 8260.54, The United States Standard for Area Navigation (RNAV).

(7) Order 8900.1, Flight Standards Information Management System (FSIMS).

b. FAA Technical Standard Orders (TSO).

(1) TSO-C115, Airborne Area Navigation Equipment Using Multi-Sensor Inputs.

(2) TSO-C145, Airborne Navigation Sensors Using the Global Positioning System (GPS) Augmented by the Satellite-Based Augmentation System (SBAS).

(3) TSO-C146, Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Satellite-Based Augmentation System (SBAS).

c. RTCA Documents. Copies of the following RTCA documents may be obtained from RTCA, Inc., 1828 L Street, NW, Suite 805, Washington, DC 20036, or purchased online at http://www.rtca.org/.

(1) RTCA/DO-187, Minimum Operational Performance Standards for Airborne Area Navigation Equipment Using Multi-Sensor Inputs.

(2) RTCA/DO-229D, Minimum Operational Performance Standards for Global Positioning System/Wide Area Augmentation System Airborne Equipment.

(3) RTCA/DO-236B, Minimum Aviation System Performance Standards: Required Navigation Performance for Area Navigation.

d. Additional Documents.

(1) FAA-H-8083, FAA Instrument Flying Handbook.

(2) FAA-H-8261, FAA Instrument Procedures Handbook.

(3) FAA Aeronautical Information Manual (AIM).

(4) ICAO Doc 9613, Performance-based Navigation (PBN) Manual.

6. BACKGROUND.

a. GNSS Overview. GNSS includes global constellations, augmentations and regional systems. Examples of global constellations are GPS of the United States, Russia's Global Orbiting Navigation Satellite System (GLONASS) and in the future Europe's European Satellite Navigation System (GALILEO). Examples of augmentations include the WAAS of the United States, the Multi-Functional Transport Satellite (MTSAT) Satellite-based Augmentation System (MSAS) of Japan, the European Geostationary Navigation Overlay Service (EGNOS) of Europe, and the GPS and Geostationary Augmented Navigation System (GAGAN) of India.

Additionally, both the Russian Federation and China have announced plans for ICAO Standards and Recommended Practices (SARPs) compliant SBAS systems. Finally, there are plans for regional constellations including Japan's Quasi-Zenith Satellite System (QZSS) and India's Indian Regional Navigation Satellite System (IRNSS).

b. WAAS Overview. WAAS improves the accuracy, integrity, availability and continuity of GPS signals. Additionally, the WAAS geostationary satellites provide ranging sources to supplement the GPS signals. If there are no airworthiness limitations on other installed navigation equipment, WAAS avionics enable aircraft navigation during all phases of flight from takeoff through vertically guided approaches and guided missed approaches. WAAS avionics with an appropriate airworthiness approval can enable aircraft to fly to the LPV, LP, LNAV/VNAV and LNAV lines of minima on RNAV (GPS) approaches. One of the major improvements WAAS provides is the ability to generate glidepath guidance independent of ground equipment. Temperature and pressure extremes do not affect WAAS vertical guidance unlike when baro-VNAV is used to fly to LNAV/VNAV line of minima. However, like most other navigation services, the WAAS network has service volume limits, and some airports on the fringe of WAAS coverage may experience reduced availability of WAAS vertical guidance. When a pilot selects an approach procedure, WAAS avionics display the best level of service supported by the combination of the WAAS signal-in-space, the aircraft avionics, and the selected RNAV (GPS) instrument approach.

> **NOTE: This AC does not preclude the use of WAAS receivers to fly to LNAV and LNAV/VNAV lines of minima.**

c. SBAS Interoperability. The primary purpose of WAAS is to augment GPS and support RNAV (GPS) approach operations to LPV and LP lines of minima. The design of the WAAS and associated avionics is interoperable with similar systems from other service providers. However, each State in conjunction with the service provider will determine the levels of service its SBAS implementation supports.

> **NOTE: This document addresses only U.S. WAAS-based operations. It does not cover other States' SBAS and accompanying instrument procedures, which are interoperable with TSO-C145/C146 (all revisions) avionics. There may be differences in the operational capabilities and qualifications to use these systems.**

> **NOTE: RNAV (GPS) approach operations to LNAV, LNAV/VNAV, LPV and LP lines of minima are classified as an RNP approach (RNP APCH) in the ICAO PBN Manual.**

d. LPV Lines of Minima. RNAV (GPS) approaches to LPV lines of minima take advantage of the improved accuracy of WAAS lateral and vertical guidance to provide an approach that is very similar to a Category I (CAT I) ILS. Just as with an ILS, LPV has vertical guidance and is flown to a DA. The design of the LPV approach incorporates angular guidance with increasing sensitivity as an aircraft gets closer to the runway (or point in space (PinS) type approaches for helicopters). The sensitivities are nearly identical to those of the ILS at similar

distances. This was done intentionally to allow the skills required to proficiently fly an ILS to readily transfer to flying RNAV (GPS) approaches to the LPV line of minima.

e. LP Lines of Minima.

(1) LP lines of minima take advantage of the improved accuracy of WAAS to provide approaches with lateral guidance. Lateral sensitivity increases as an aircraft gets closer to the runway (or PinS type approaches for helicopters), similar to localizer approaches. Unlike LPV, the LP line of minima is an MDA rather than a DA. Procedures with LP lines of minima will not be published with lines of minima that contain approved vertical guidance (LNAV/VNAV or LPV). Publishing a LP line of minima will only occur if terrain, obstructions, or some other reason prevent publishing a vertically guided procedure. It is possible to have LP and LNAV published on the same approach chart, but LP will only be published if it provides lower minima than the associated LNAV line of minima.

(2) LP is not a fail-down mode for LPV. The avionics integration may include advisory vertical guidance during an LP approach to an LP line of minima. (Reference subparagraph 8b below for further information on advisory vertical guidance.) Barometric altimeter information remains the primary altitude reference for complying with any altitude restrictions.

7. AIRCRAFT AND SYSTEM REQUIREMENTS.

a. Equipment Requirements. TSO-C145c/C146c operational class 3 (and the earlier revision “b”) define the avionics performance standards for WAAS equipment approved for LPV and LP lines of minima. (Reference subparagraph 7c(2) for information on revision “a” equipment.) An aircraft equipped with WAAS can operate within the coverage of the GPS constellation and WAAS service volume without the need for other radio navigation equipment. In the event of a WAAS failure, WAAS avionics revert to GPS-only operation which is equivalent in function to un-augmented GPS avionics and satisfies the requirements for IFR use of GPS. Though not required, operators may consider retaining backup navigation equipment in their aircraft to guard against potential outages or interference.

b. Aircraft Flight Manual (AFM) and Rotorcraft Flight Manual (RFM) Requirements. Operators must conduct WAAS instrument operations in accordance with the FAA-approved AFM, RFM and Aircraft Flight Manual Supplements (AFMS), as well as manufacturers’ operating guides for their avionics. The AFMS and operating guides will state the type of IAPs the avionics support. IFR approved WAAS receivers can support any approach procedure that has “GPS” in the title. The AFM, RFM or AFMS along with the manufacturer’s operating guide will specifically state any WAAS avionics limitations. Operators should be thoroughly familiar with the capabilities and limitations of their WAAS avionics.

c. Limitations. Not all WAAS avionics are capable of supporting all lines of minima on an approach chart. For example:

(1) Operational class 1 and 2 WAAS avionics do not support LPV or LP.

(2) Equipment compliant with TSO-C145a/C146a operational class 3 and class 4 provides LPV capability, but is not required to provide LP capability. In some cases manufacturers may choose to modify their equipment to provide LP capability.

(3) An FMS with WAAS integration might only provide position, velocity and time output to support RNAV or RNP operations without supporting LPV or LP.

(4) See also subparagraph 8d RNP Considerations.

8. OPERATIONAL CONSIDERATIONS.

a. Alternate Weather Minima. IFR approved WAAS installations allow operators to select an alternate airport during their flight planning using an RNAV (GPS) approach to LNAV minimums rather than an approach supported by ground-based NAVAIDs. Operators must use part 91, IFR alternate airport weather minima guidance for non-precision approach procedures (refer to part 91, § 91.169) or operations specification (OpSpec), management specification (MSpec) or letter of authorization (LOA) paragraph C055, Alternate Airport IFR Weather Minimums, or OpSpec/MSpec paragraph H105, Alternate Airport IFR Weather Minimums, as applicable. Upon arrival at the alternate airport, if the WAAS navigation system indicates availability of LNAV/VNAV, LP, or LPV service, the pilot may use that level of service to complete the instrument approach.

b. Advisory Vertical Guidance. An RNAV (GPS) instrument approach may contain both the LNAV and the LP lines of minima, and a pilot may use advisory vertical guidance when flying to either the LNAV or LP lines of minima. The vertical guidance is advisory only and pilots must use the barometric altimeter as the primary altitude reference to ensure compliance with any and all altitude restrictions during instrument approach operations. (Refer to Table 1's advisory guidance column.)

> **NOTE: Some aircraft integrations may use GPS to provide lateral path deviation indications and baro-VNAV to provide vertical path deviation indications for charted LNAV/VNAV lines of minima. This integration constitutes approved vertical guidance for charted LNAV/VNAV lines of minima. Do not confuse this integration with advisory vertical guidance. (Reference the current edition of AC 20-138 for LNAV and LNAV/VNAV based on baro-VNAV.)**

TABLE 1. LINE OF MINIMA AND GUIDANCE

Line of minima	Approved guidance	Advisory guidance
LPV	X	
LP		X
LNAV/VNAV	X	
LNAV		X*

*LPV capable equipment requires special considerations when using advisory vertical guidance, see the manufacturers' operating guides or limitations section in the AFM, RFM or AFMS.

c. Notices to Airmen (NOTAMs). The FAA NOTAM system permits operators to determine WAAS operational availability in any geographic region of the United States. Prior to WAAS IFR operation, the operator must review appropriate Aeronautical Information Services (AIS) and NOTAMs for WAAS service outages. On RNAV (GPS) instrument approach charts, the inverse W symbol  (a white W on a black background, reference figure in Appendix 2), indicates that the FAA provides no NOTAMs or air traffic advisories for outages of WAAS LNAV/VNAV or LPV vertical guidance and that WAAS vertical guidance service outages may occur frequently for short periods of time due to system coverage limitations. Operators must use LNAV minima for flight planning to these airports. If the WAAS avionics indicate availability of LNAV/VNAV or LPV vertical guidance, then pilots may use the displayed level of service to complete the approach.

d. RNP Considerations. Pilots of aircraft with a recognized RNP airworthiness capability must not fly to LPV/LP lines of minima based solely upon their RNP capability. Only operators of aircraft with an airworthiness approval for WAAS LPV/LP capability may fly RNAV (GPS) procedures using the LPV/LP line of minima. The aircraft must use WAAS to fly to the LPV/LP line of minima on an RNAV (GPS) approach.

e. Contingency Procedures. Pilots must be familiar with the fail-down capability of their WAAS integration. The operator should develop contingency procedures to react safely following the loss of GPS and/or WAAS capability (see subparagraphs (1), (2), and (3) below). Pilots must notify air traffic control (ATC) of any loss of GPS and/or WAAS capability, together with their proposed course of action.

(1) Example: LPV or LP lines of minima approach not available due to reduced WAAS service.

(a) Prior to the final approach fix (FAF):

- The LNAV or LNAV/VNAV line of minima may still be available to pilots depending on the nature of the reduced service.
- Pilots may elect to continue the approach to the LNAV or LNAV/VNAV line of minima.
- Alternatively, pilots may select a different approach using a ground-based NAVAID or fly to an alternate airport.

(b) After the aircraft passes the FAF an alert may result in a fail-down to LNAV-only operations.

- Pilots can continue to the LNAV minimums if the aircraft is above the MDA or the next step-down fix altitude for the LNAV approach.
- Pilots must initiate a missed approach if below a required altitude on the approach and cannot transition visually to land.

NOTE: TSO-C146a minimum performance requirements do not require avionics equipment to offer LNAV fail-down capability although some manufacturers have chosen to include it. If TSO-C146a equipment does not include LNAV fail-down capability, the pilot must perform a missed approach when the vertical guidance is flagged or another integrity alert is indicated. The pilot must perform a missed approach for any TSO-C146 equipment if both lateral and vertical guidance is flagged or another integrity alert is indicated.

(2) Example: No WAAS service – this situation is comparable to un-augmented GPS equipment (e.g., TSO-C196 equipment).

(a) Prior to the aircraft passing the FAF:

- The avionics will provide integrity using FDE.
- If there is no lateral flag or other integrity alert, a pilot may complete the RNAV (GPS) approach using the LNAV line of minima.
- If a pilot sees a lateral flag or integrity alert, the pilot should do one of the following:

1. Request clearance from air traffic control (ATC) to enter and remain in a holding pattern (fuel permitting) until the lateral flag or integrity alert disappears,

2. Request a clearance from ATC for a different approach using ground-based navigation aids (if available) or,

3. Request a clearance from ATC to fly to an alternate airport.

(b) After the aircraft passes the FAF, if the avionics provide a lateral flag or integrity alert, the pilot must perform a missed approach if unable to continue visually.

(3) Example: Complete GPS service outage or avionics malfunction. When a GPS service outage occurs all RNAV (GPS) approaches will be out of service. In either instance, the pilot must choose an instrument approach based on ground-based NAVAIDs such as VOR, NDB or ILS.

9. TRAINING.

a. Training Program. Training for RNAV (GPS) instrument approach operations including use of the LPV and/or LP lines of minima should include the following items (refer to list below). Operators must be familiar with how to use their avionics in compliance with the aircraft and/or avionics manufacturer's operations manuals and should take advantage of applicable training tutorials. Parts 91K, 121, 125, 133, 135, and 137 operators should address the following specific training elements:

NOTE: No special crew qualifications, other than those necessary for RNAV and ILS instrument approaches, are currently specified for WAAS operations. If RNAV approaches are already integrated into a current training program, operators are not required to have a separate program to incorporate LPV and LP-specific training elements from this AC. In the absence of a training program, operators should use this guidance to develop their training curriculum and document the training as outlined in subparagraph 9b.

(1) The information in this AC.

(2) The meaning and proper use of aircraft equipment/navigation suffixes.

(3) Procedure characteristics as determined from chart depiction and textual description.

(4) Use of navigation system including procedure selection and ILS look-alike principle:

(a) Methods to select approaches (i.e., procedure name menus or channel number) and confirming correct approach ID/reference path identifier (RPI).

(b) No manual change of waypoints included in the approach.

(c) Flying the procedure.

(5) Distinction between ILS flight guidance cues and LPV guidance cues.

(6) Required navigation equipment for approach operations using WAAS or any operational restrictions/limitations, as outlined in the AFM, RFM, AFMS, OpSpec, Mspec, or LOA.

(7) Levels of automation, mode annunciations, changes, alerts, interactions, reversions, and degradations.

(8) Functional integration with other aircraft systems.

(9) Set-up and interpretation of electronic displays and symbols.

(10) Use of LNAV mode(s).

(11) Use of VNAV mode(s).

(12) Understanding the performance requirement and the fail-down capabilities of the system.

(13) ATC procedures/phraseology.

(14) Functionality of vector to final mode.

(15) Flightcrew contingency procedures for a loss of GPS and/or WAAS capability to emphasize maintaining separation from terrain, obstacles and other aircraft.

(16) Impact of aircraft integrations that incorporate both (WAAS) LPV/LP capability and baro-VNAV capability.

(17) Alternate airport requirements and selection of an alternate airport.

b. Training Documentation. Parts 91K, 121, 125, 129, 133, 135, and 137 operators' applications for operational approval to use WAAS without restrictions or limitations on IAPs should include documentation of the WAAS-related training provided to flightcrews, dispatchers and maintenance personnel, as appropriate.

NOTE: In line with the Instrument Practical Test Standards pilots may, for the purpose of training, testing, checking and logging pilot experience, fly approaches to LPV lines of minima and qualify for precision approach credit.

NOTE: In line with the Instrument Practical Test Standards pilots may, for the purpose of training, testing, checking and logging pilot experience, fly approaches to LNAV and LP lines of minima and qualify for non-precision approach credit.

c. Training Intervals. Parts 91K, 121, 125, 133, 135, and 137 operators should reference specific instrument training requirements per applicable 14 CFR parts. For additional guidance including differences relating to type of GPS system used, reference OpSpec/MSpec/LOA paragraph C052, Straight-In Non-Precision, APV, and Category I Precision Approach and Landing Minima-All Airports, OpSpec/MSpec/LOA paragraph C053, Straight-In Category I Approach Procedures Other Than ILS, MLS, or GLS and IFR Landing Minimums – All Airports, OpSpec/MSpec paragraph H102, Basic Instrument Approach Procedure Authorization – All Airports, or OpSpec/MSpec H103, Straight-In Category I Non-Precision Approach Procedures-All Airports and corresponding guidance in Order 8900.1, Flight Standards Information Management System (FSIMS).

10. OPERATIONAL APPROVAL.

a. Part 91 Operator/Aircraft Approval. Part 91 operators should review their AFM, RFM or AFMS to establish that their aircraft meets navigation system eligibility as detailed in paragraph 7. Once the operator has established system eligibility, the operator should review the operational and training considerations as detailed in paragraphs 8 and 9. After completing these actions, the operator may conduct LPV and LP approach operations to a published DA and MDA, respectively. An LOA is not required when eligibility is based on the AFM, RFM or AFMS and provisions of this AC.

b. Parts 91K, 121, 125, 133, 135 and 137 Operator/Aircraft Approval. The Flight Standards District Office (FSDO) or certificate-holding district office (CHDO) may require the following documentation from operators to grant operational approval to fly RNAV (GPS) instrument approaches to the LPV or LP lines of minima via OpSpec, MSpec or LOA.

(1) Aircraft Qualification. Aircraft can fly the LPV or LP minima line with an AFM, RFM or AFMS statement that the installed equipment supports LPV and/or LP lines of minima. At a minimum, TSO-C145a/146a operational Class 3 or Class 4 equipment is required.

(2) Operations Manuals and Checklists. The FSDO or CHDO may require the operator to present any revisions to operating manuals for flightcrews, dispatchers and maintenance personnel, as appropriate, incorporating standard operating procedures applicable to the use of WAAS capabilities.

(3) Minimum Equipment List (MEL). If the operation requires a minimum equipment list, the operator must include any MEL revisions necessary to address WAAS flight operations in their application package. The FAA must approve these provisions, and operators must adjust the MEL, or equivalent to specify the required dispatch conditions.

(4) Training. The operator must identify any modifications to training programs for flightcrews, dispatchers and maintenance personnel, as appropriate, to incorporate the WAAS-related training elements this AC outlines.

c. OpSpecs, MSpecs, and LOAs. Parts 91K, 121, 125, 133, 135 and 137 operators receive approval to fly RNAV (GPS) instrument approaches via OpSpec/MSpec/LOA, paragraph C052, OpSpec/MSpec paragraph H102 or OpSpec/MSpec paragraph H122, Special Non CFR Part 97 Instrument Approach or Departure Procedures for Rotorcraft Operations, as applicable. If the operator has already been approved to fly IAP with vertical guidance using RNAV (GPS) or RNAV (GNSS), such as baro-VNAV, then no further authorization is required. If the operator is not already approved to fly IAP with vertical guidance using RNAV (GPS) or RNAV (GNSS), the Principal Operations Inspector will authorize LPV and/or LP operations for the operator via OpSpec/MSpec/LOA, paragraph C052, OpSpec/MSpec paragraph H102 or OpSpec/MSpec paragraph H122.

APPENDIX 1. ADDITIONAL GUIDANCE FOR HELICOPTER APPROACHES

1. Introduction. This Appendix addresses and defines additional characteristics for helicopter instrument approaches to runways and point in space (PinS) approach operations.

2. Display Scaling. Copter RNAV (GPS) procedure design and the use of the Final Approach Segment (FAS) data block provides for lateral display scaling of +/- 2 degrees for approaches (equivalent to display scaling to a 10,000' runway). Vertical scaling is consistent with runway approaches except the glidepath angle can range up to 7.5 degrees (Full-scale deflection is +/- glidepath angle divided by four).

3. Copter PinS Approach Operations. One of the main differences between helicopter approaches to a heliport and airplane approaches to a runway is the location where deceleration occurs. Unlike airplanes which accomplish deceleration from V_{ref} speed after touchdown on the runway; helicopters must slow to a hover prior to touchdown on the heliport. This characteristic necessitates an additional heliport approach requirement (deceleration distance) when helicopters are operating to LPV or LP minimums. PinS and helicopter instrument approach operations necessitate procedure design protection for the deceleration distance.

a. PinS Approach Description. PinS approach obstacle clearance and procedure design criteria are contained in FAA Order 8260.42, Helicopter Global Positioning System (GPS) Nonprecision Approach Criteria. PinS criteria deliver the helicopter to a point in space. The PinS optimum location is 0.65 nautical miles (NM) from the heliport. This provides an adequate distance to decelerate and land from an approach speed of 70 knots indicated airspeed (KIAS). Certain airframes may be certified to fly at reduced V_{mini} or below V_{min}i speeds as a result of flight control design or adherence to AC 29-2, Certification of Transport Category Rotorcraft. In these cases an approach procedure stating the minimum certified airspeed or flight below V_{mini} should be annotated on the LPV or LP approach procedure. The distance also permits optimal blending of obstacle clearance criteria with non-instrument heliport ingress areas.

b. PinS Operational Limitations. The speed on the final approach segment and the initial segment of the missed approach is usually 70 KIAS. The speed on other segments of the procedure is usually 90 KIAS. The minimum speed, unless in visual conditions, is the specific V_{mini} (or lower minimum approach speed per AC 29-2) in the helicopter flight manual. There are two types of PinS procedures. For a PinS "Proceed VFR" procedure, once the helicopter passes the missed approach point (MAP) there is no obstacle protection and the pilot must comply with visual flight rules (VFR). The pilot cancels the IFR flight plan after passing the MAP. For a PinS "Proceed Visually" procedure, the pilot must visually acquire the landing location at or before arriving at the MAP. Obstacle protection on the visual segment is provided by the obstacle identification surfaces and the obstacle clearance surface. The pilot cancels the IFR flight plan after flying into VMC with landing location in sight, passing the MAP in the visual segment of the approach, or after landing.

4. Additional Guidance. Pilots are reminded that they are responsible for operating the autopilot in accordance with the pilot's operating handbook (POH) for the specific autopilot model, in addition to the RFM.

APPENDIX 2. EXAMPLE RNAV (GPS) APPROACH CHART (LPV Line of Minima)

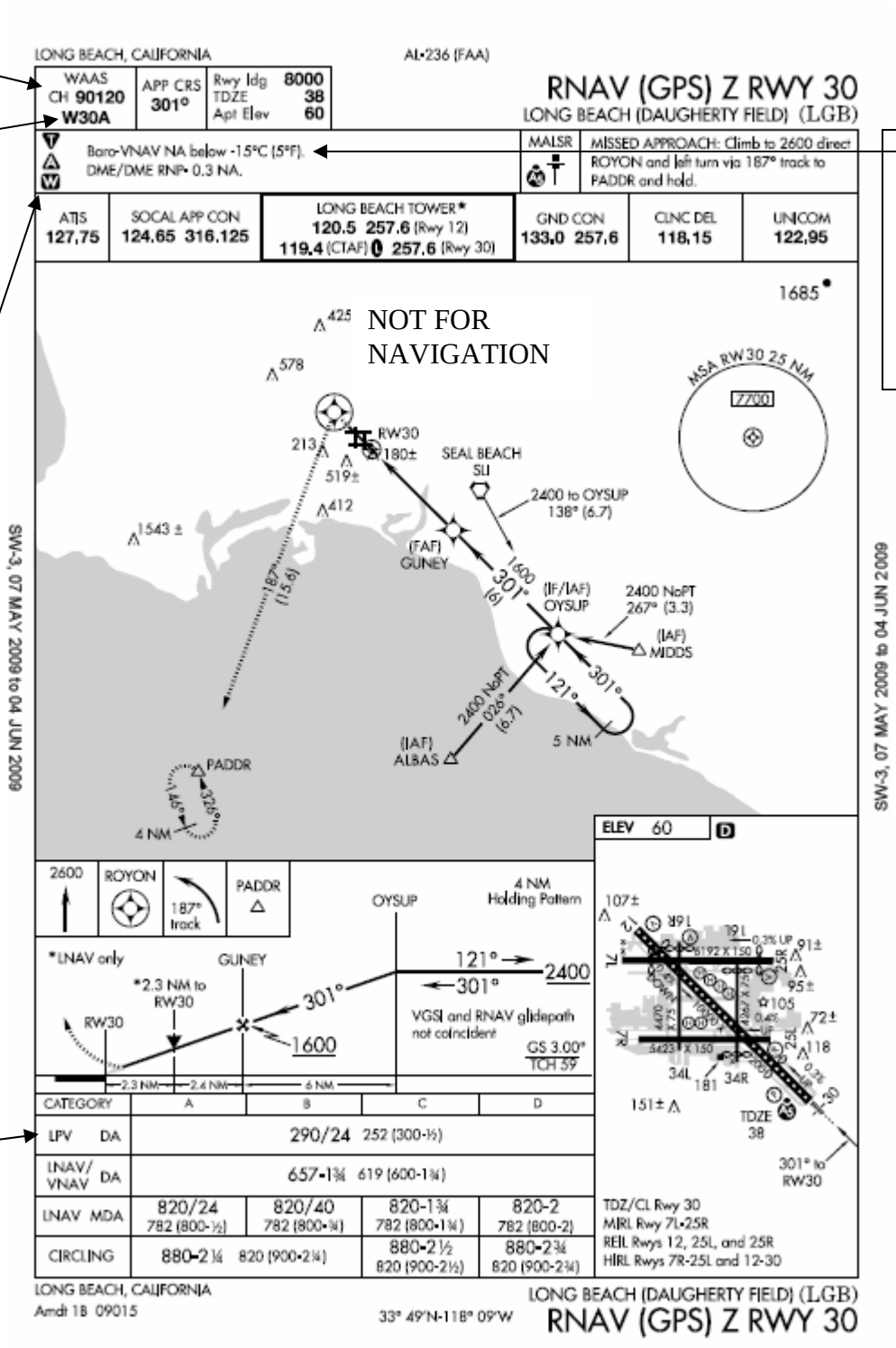
WAAS Channel Number

WAAS Approach ID/RPI
W=WAAS
30=Runway 30
A= 1st WAAS approach to runway 30

"Inverse W" – no NOTAMS or Air Traffic advisories for outages of WAAS LNAV/VNAV or LPV vertical guidance

LPV Minimum Line

Temperature Restriction does not apply to WAAS LNAV/VNAV or LPV vertical guidance



APPENDIX 3. EXAMPLE RNAV (GPS) APPROACH CHART (LP Line of Minima)