

IFR GPS REGULATIONS

There aren't a lot and they seem to be written with common sense in mind. Here's a concise review of the regulations for using GPS to fly IFR.

by Fred Simonds

Fortunately for those of us looking to the future of IFR, the rules for operating under IFR with GPS are not terribly lengthy and are largely based on a pleasant amount of common sense. Here's a thumbnail look at the current regulations.

The Basics

Any approach procedure you want to fly must be retrievable from the current airborne navigation database which is updated every 28 days. It has to say GPS in the title of the procedure, otherwise you have to fly it as a conventional approach between the FAF and MAP.

You can't make up your own approaches, nor can you edit the ones in the database. Because there is the chance that your database will expire when you are traveling somewhere that you can't arrange for the update, carry a paper backup. Of course nothing can go wrong, can go wrong, . . .

While it is not legal for approaches, you can use an expired database for en route and terminal operations, as long as you verify the data is still correct, generally by reference to paper charts.

For approaches, you are required to use paper and not the expired database. While you are not required to carry paper charts, putting all your eggs in the one database basket just seems a little optimistic.

In-flight, and especially on approaches, verify that the database waypoints can also be identified on the procedure chart. Small differences

in spelling matter less than being logically located, in correct order, and oriented to each other as on the procedure chart, laterally and vertically.

Database Dilemmas

Naming inconsistencies between databases, including those of approaches and nav aids are common because the data comes from many sources and passes through several manipulators.

In further fact, the presentation to

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you is not standardized; it's up to the manufacturer even though the underlying data itself is standard.

If there is significant difference between what you see in the database and on the paper chart, don't fly the procedure until you sort it out.

A remaining, and nagging inconsistency between databases is course information. This is due to differences in the way magnetic variation is computed within the GPS receiver and the approach plate.

Most GPS receivers use a dynamic magnetic variation algorithm based on interpolating lines of variation. The differences should be negligible, but in every case the published approach plate and its associated NOTAMs, if any, take precedence.

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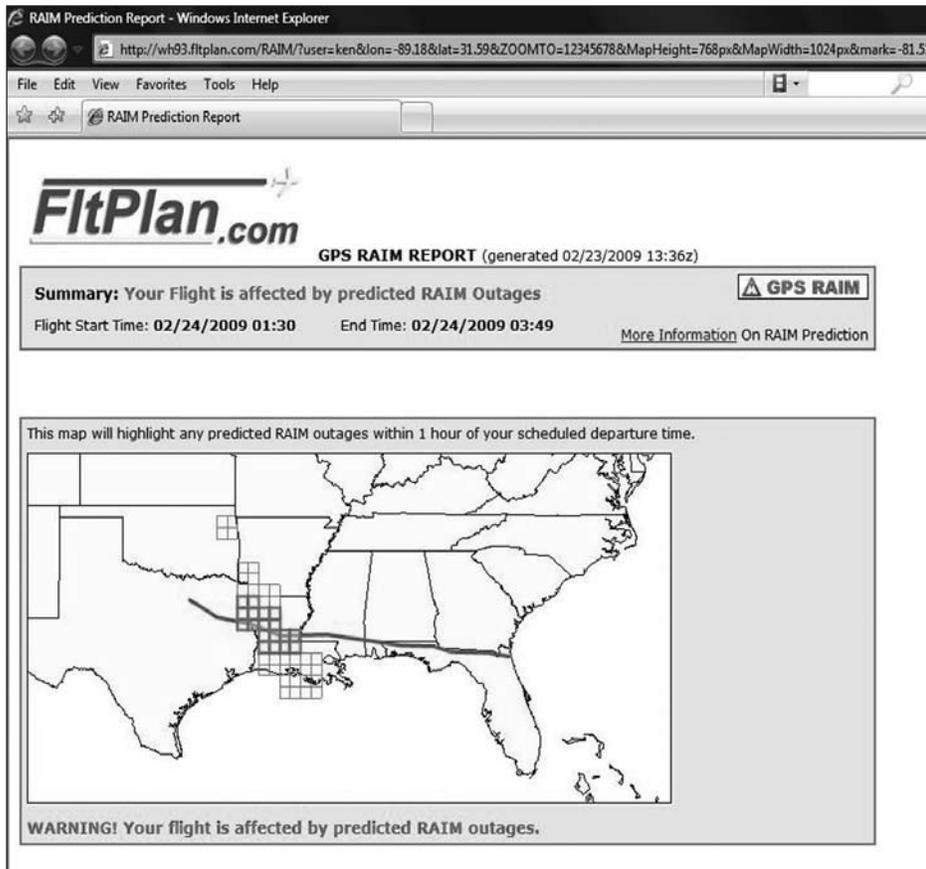
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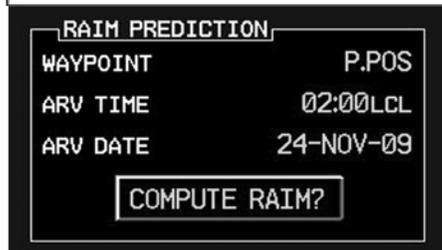
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FltPlan.com
GPS RAIM REPORT (generated 02/23/2009 13:36z)

Summary: Your Flight is affected by predicted RAIM Outages **GPS RAIM**
 Flight Start Time: 02/24/2009 01:30 End Time: 02/24/2009 03:49 [More Information](#) On RAIM Prediction

This map will highlight any predicted RAIM outages within 1 hour of your scheduled departure time.

WARNING! Your flight is affected by predicted RAIM outages.



RAIM PREDICTION

WAYPOINT P.POS
 ARV TIME 02:00LCL
 ARV DATE 24-NOV-09

COMPUTE RAIM?

Two sources of RAIM check before flight; a warning on FltPlan.com (above) and the Garmin G1000 RAIM prediction button (left).

holds; flying approaches with radar vectors and especially recognizing and knowing what to do if you experience a RAIM failure before and after the final approach waypoint.

Non-WAAS Rules

Basic GPS equipment for IFR is approved under Technical Standard Order C-129. Handheld receivers do not meet C-129 in part because they lack Receiver Autonomous Integrity Monitoring (RAIM) which warns of GPS inaccuracies.

Two additional concerns are that the batteries will die when you need them the most, and that the inside antenna may not pick up satellites reliably enough for IFR use.

While not legal as a primary navigational aid for IFR operations, a hand-

held is nevertheless an excellent tool for enhancing situational awareness.

FAA conservatism requires non-WAAS units to be backed up with an approved and working alternate means of navigation including ground-based nav aids. For most of us this means VORs.

It isn't necessary to monitor the VORs if the GPS receiver uses RAIM. Should the RAIM's internal logic fail, active monitoring of alternate means becomes mandatory.

Non-WAAS IFR GPS receivers conduct a RAIM check at least two miles before reaching the final approach waypoint. If the RAIM check fails, the approach will not switch from armed to approach mode. Should this happen, don't descend, but fly to the missed approach waypoint, execute the missed approach procedure and contact ATC.

Interestingly, if the failure occurs after the final approach waypoint, the receiver will continue to operate without a RAIM warning for up to five minutes to allow completion of the approach. However, if a RAIM warning occurs, execute the miss immediately. Consult your receiver's operating manual for specifics as to what your manufacturer recommends.

Lacking WAAS, if an alternate is required, it must have a non-GPS approach that is expected to be working and available at the estimated time of arrival, and one which the aircraft is equipped to fly. For instance, if the approach calls for DME, then you must have one on board.

Check RAIM Before Launch

Among other things, RAIM warns of bad satellite geometry. These anomalies are predictable, and a recent regulatory change now requires a RAIM check on the ground before departure for non-WAAS units.

This can be done by speaking with AFSS, consulting GPS NOTAMS, or via many flight planning web pages.

Many GPS receivers can do a

RAIM check for a predicted time. If you plan to fly a published GPS departure, obtain a RAIM prediction for your departure airport. Be aware that not all GPS receivers contain departure procedures in their database.

GPS operations must be conducted in accordance with the FAA-approved aircraft flight manual (AFM) or flight manual supplement. The AFM specifies, for instance, what kind of GPS approaches can be flown.

GPS Is Not RNAV

GPS is one form of area navigation or RNAV; the terms are not synonymous. File as /G in an IFR flight plan. If the GPS avionics fail, advise ATC as required by FAR 91.187 and amend your equipment suffix.

GPS approaches can only be flown in U.S. airspace; elsewhere the use of GPS must be approved by the FAA Administrator.

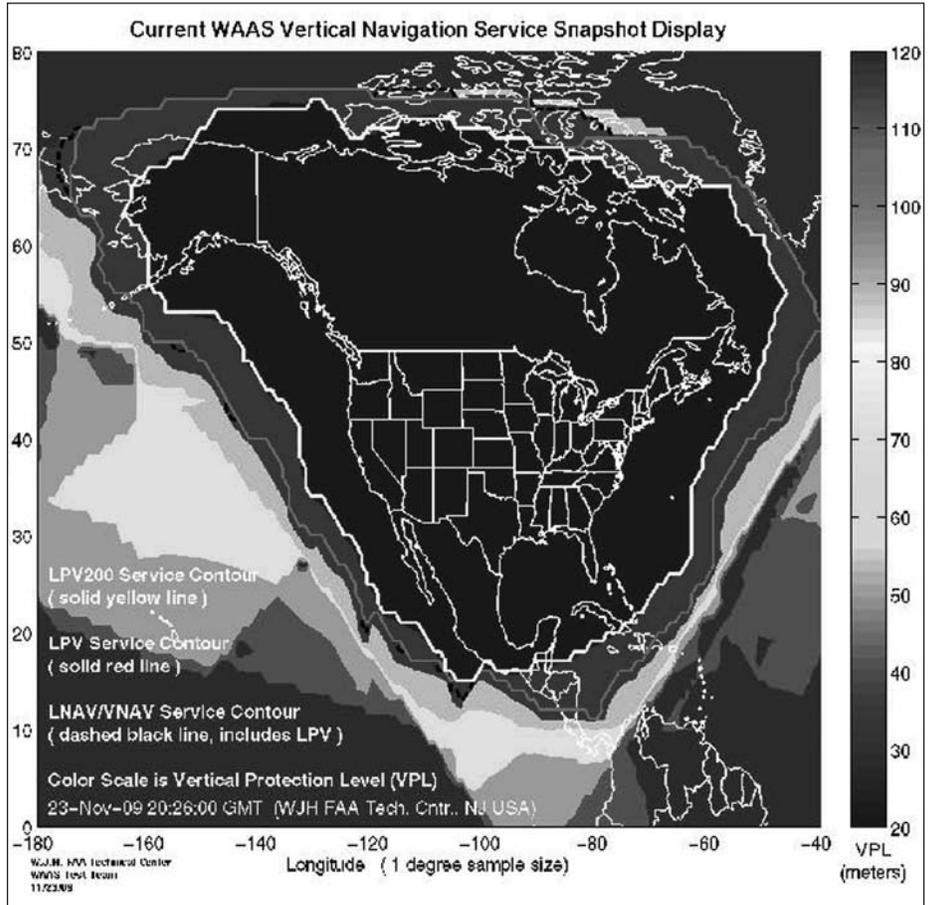
Similarly, GPS instrument approach operations outside the U.S. must be approved by that country. Some countries may have limitations on the use of their WAAS, known internationally as a Ground Based Augmentation System or GBAS.

WAAS-Equipped Rules

WAAS avionics are certified to meet TSO-C145A, TSO-C145B, TSO-C146A or TSO-C146B. In exactly the same manner as C-129, WAAS operations must be in accordance with the aircraft flight manual.

Beyond GPS NOTAMs, WAAS NOTAMs must also be checked before flight. The equivalent to RAIM for WAAS units is Fault Detection and Exclusion. FDE prediction is only required for oceanic or remote operation where GPS will be the primary source of navigation.

Probably the greatest difference between C-129 and C-145/146 is that WAAS avionics are evaluated without consideration of other systems. As a result, WAAS-qualified units do not require alternate equipment.



A panel-mounted, WAAS-equipped GPS can count on coverage throughout most of North America (above).

This added flexibility extends further since you can use a WAAS approach at an alternate airport provided that you flight plan for an LNAV approach or a conventional procedure that says "or GPS" in the title. Nonprecision alternate minima apply.

In furtherance of this notion, the FAA is selectively removing the Alternate-Not Authorized symbol from certain approaches so they can be used as WAAS alternates.

WAAS is available over 95% of the U.S. 95% of the time. Like its conventional cousin, WAAS unavailability is predictable, but can be area-wide or site-specific.

If you arrive at your destination and the receiver offers you an approach with vertical guidance, take it. You



can fly an LPV approach if it's available with the same FAR 91.175 missed approach rules we know so well.

However if the WAAS should fail during the approach, then you may have to use higher LNAV minima, just like a glide slope failure on an ILS.

A WAAS approach plate may have a white-on-black rectangular W symbol annotation. This warns you that verti-

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approach course?

Charles Tannenbaum
Springfield, Oregon

Hey I don't make the rules! You have to do the PT no matter how ludicrous the concept unless on vectors, the plate states NoPT or PT NA, on a timed approach, or no PT is depicted.

David Ison

Best Simulator?

What is the best PC flight simulator to practice IFR at home? A review of those available would be informative.

Kyle Scott
Via E-mail

That's a great question. Readers, we want to hear from you. Let us know which you like and don't like and why.

DME Arc

I'm a semi-retired corporate/charter pilot. I use IFR Refresher to help keep me current. I would like to add to the November issue article involving the DME arc approach, "Let's do the Twist".

It does a good job of identifying the pitfalls of this approach but is a little short on how to fly it. A hundred years ago the Air Force gave me some rules of thumb that have served me well.

First the obstacle limits of the arc are two miles either side. Think full scale deflection on the OBS. Flying the arc, then, is a matter of flying a series of straight lines while staying within the two miles of the arc.

The distance to lead your turn onto the arc is about one percent of your ground speed to give a comfortable, half-standard rate turn. A GA aircraft flying at about 120 knots with no wind, would have a lead point of 1.2 nm; if a standard rate turn is used,

halve the distance, making it .6 nm.

Ed Pekowski
Via E-mail

Zero-Zero Departure

Thank you for the excellent article about zero-zero departures in the November issue. It was a wake-up call to not take stupid risks while giving a lot of instruction on the subject.

Some time ago, I had occasion to ride with a pilot who had an instrument arrival reservation for the EAA airshow at Oshkosh. Because of the weather in Wisconsin, IFR was the only way to get into Oshkosh.

At the appointed departure time there was fog severely limiting visibility at the departure airport.

The decision was made to takeoff. There were two pilots in the front seats of the airplane; both focusing on the instruments for the takeoff roll and climbout.

In less than one minute we broke out into clear skies and continued a safe trip.

Bill Zeilstra
Grand Rapids, Michigan

Consistent with the sentiments expressed by Mr. Vilches in his article, we are not big fans of takeoffs in seriously restricted visibility unless the visibility is sufficient to return to the departure airport or get into another within a few minutes of takeoff.

Correction

In Tina Gonsalves' article, "Keeping the Rating Shiny" in the October issue, I inserted a header that said IFR currency required six hours of instrument time in the previous six months, something that is no longer the case under the regulations.

Several alert readers caught that error. I then compounded it in the November issue by indicating it slipped past the editors. The mistake in the article was made by the editor, not the author, who had it right in the first place.

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cal guidance may or not be available because the airport is at the edge of WAAS coverage. It's best to use LNAV minima for flight planning, but even so, it is a legal alternate if not otherwise noted. An area-wide WAAS NOTAM including such airports means that vertical guidance is not available.

Filing Direct

Controllers like it when you file direct. They move more tin that way, and it reduces their workload.

The logic of filing GPS direct is inescapable. Since the FAA computer is going to give you whatever it wants anyway, there is little point in doing extra work to no point...to a point.

First, it is smart to familiarize yourself with your route of flight. It is up to you to avoid special use airspace by at least 3 nm, so you will likely need a turn point to comply.

It's also up to you to choose a safe altitude. The OROCA, or Off Route Obstruction Clearance Altitude is there mainly for emergencies and situational awareness. It does not assure radio communications as does an MEA, and is not as well-surveyed. Check a VFR sectional for accurate obstruction information.

You can file airport-to-airport. There is no need to file to an initial approach fix. File direct for as far as you care to go. You are asked to file at least one waypoint for each ARTCC through which you will fly, within 200 NM of the preceding center's boundary. It is also recommended that you account for a departure procedure, if any, on your way out.

GPS has brought unprecedented safety, efficiency and convenience to IFR flying. The comparatively few rules that encumber it are a small price in exchange.

Fred Simonds is a Gold Seal CFII and factory-certified G1000 instructor. See his web page at www.fredonflying.com.