EUROCONTROL guidance notes for pilots

8. GPS Navigation

EUROCONTROL

AIRSPACE INFRINGEMENT

Infringement of controlled airspace, danger and restricted areas etc. is a serious aviation hazard and occurs when an aircraft enters the airspace without permission. This happens several times a day in the busiest areas of European airspace.

This is one of a series of Guidance Notes (GN) intended to help you keep out of trouble. The others are listed at the foot of the next page.

A major cause of airspace infringement is navigational error. This GN contains some advice on navigation using Satellite Navigation Systems.

CHARACTERISTICS OF GPS

A large and increasing number of European General Aviation pilots already use GPS and find it an extremely useful aid to safe navigation. Aviation equipment characteristics (and prices) vary from a pocket-size portable to a panel mounted fully integrated system. Most are sold with aviation databases, and some are certified for use in IFR flight. Many feature a moving-map display, and most of those have a facility that warns you if you are approaching airspace reservations. Some equipment offers vertical navigation guidance, including minimum safe altitude identification.

Navigation satellites in space continuously transmit their positions and the exact time. The GPS receiver compares the transmitted time with the received time and calculates the range from the satellite. It presents the information as a position over the earth, or compares it with other stored information to provide guidance.

"Waypoints" are positions stored in the equipment's memory. They may be included by the database provider or loaded by the user (take great care - and double check - when doing so!), and usually remain in the memory until deliberately deleted. A series of waypoints can be stored as a "route" or "flight plan", and owners can maintain a library of frequently used (or intended) routes. Almost all GPS sets allow you to fly direct to a selected way-point ("GO TO").

International standards require pilots to carry "suitable charts for the route of the proposed flight and all routes along which it is reasonable to expect that the flight may be diverted". GPS must only be used as an aid to other forms of navigation, unless specifically approved otherwise. GPS positions and tracking should be regularly checked using visual pin-points or fixes from radio navigation aids, especially when flying close to controlled airspace, danger areas, etc. GNs 6 and 7 give advice on visual navigation and the use of VOR, DME and ADF.

SELECTING A GPS

Make sure your equipment does what you want it to; for example if you want to fly IFR, chose an approved set with an approved database. If you only intend using it as a back-up to visual navigation, a simple combined GPS/communications set or even a hand held GPS may be sufficient. Either borrow an example of the equipment you are considering, or ask to fly in an aircraft similar to your own which has the set fitted. Check it for ease of use, and make sure you can read the display in bright sunlight. However, probably the most important factor is how well you can understand the instructions!

LEARNING TO USE YOUR GPS

At present, formal guidance on GPS use is difficult to find, and GPS instruction manuals are often complex and difficult to understand. If you cannot find a suitable training course, take advantage of any computer based training from the manufacturer, and practise using the equipment on the ground with the instruction book. Most of GPS units have a "simulator mode" which allows you to "fly" while sitting at your desk. Use this mode to save time, money and nerves. When trying it in the air, have someone else fly the aircraft navigating by other means while you make yourself familiar with the equipment. The problem is particularly difficult for the pilot who does not own an aircraft and may encounter differing equipment in the aircraft he/she hires.

PROBLEM AREAS

Several particular problems have been found in the use of GPS.

- **Equipment Installation.** Battery failure, unintentional aerial disconnection and poor reception may cause poor performance, unlikely when the equipment is correctly installed.

- **Data Programming.** Errors are common, especially when loading information in flight. Even on the ground, always double check the information you put into your GPS memory, and

cross-check the information you take out.

- **Use of the "GO TO / DIRECT TO / DCT" Function.** GO TO means "take me directly from here to the selected way-point". That direct track has led many pilots to infringe controlled airspace.
- **Poor Database Accuracy.** Errors have been found in the data from the provider. Some controlled airspace boundaries may not be marked, but more frequently information may have become out-of-date. It is essential that pilots cross-check information with a current chart, which is easier if you have an up-to-date database pur-chased from the manufacturer. Always check the date of the GPS database, especially if you are hiring an aircraft.
- **Interference.** The GPS signal is very weak and has travelled a long dis-tance. Antenna position is important, and even a low powered accidental (or deliberate!) interfering transmission can cause loss of the navigation signal.
- **Lookout.** Loading, or trying to find, information in the air involves looking inside the cockpit. Minimise that time by learning how to use your equip-ment properly. Do not try to enter the GPS coordinates of your new waypoint while squeezing between clouds and ground.
- **Excessive reliance on GPS.** GPS is not infallible. If the information is incorrect or not available, the pilot must still be able to navigate accurately.
- **Pressing on.** Because of the accuracy of GPS, pilots have been known to "press on" in poor weather, where pre-viously they would have diverted

when map reading was their main source of navigation. Several have died. Many pilots have also planned to fly very close to controlled airspace boundaries in the mistaken belief that their instrument indications (and their flying) will be as accurate as the GPS signal.

USING GPS AS A NAVIGATION BACK-UP

1. Set up your GPS to recognise when you have flown past a waypoint rather than showing you have flown over it.
2. Plan the route as normal, using an up-to-date chart.
3. Load your turning points (and fix points) as GPS waypoints, and con-struct the route.
4. Check that the route in the GPS agrees with the original plan.
5. Before take-off, check your GPS posi-tion agrees with where you are.
6. Make sure the route is activated.
7. Navigate as normal, but glance at your GPS display for confidence.

HINTS FROM EXPERIENCE

- Learn how does your GPS work and how to programme a route in the GPS. There are too many pilots relying on their GPS without knowing how to use it and how to reprogram the planned route.
- Train yourself in programming the GPS so that in bad weather and even in emergency situation you can easily reprogram the GPS route to your alter-nate.
- Familiarise yourself with the menu structure of your GPS and learn how to

navigate trough the menus. If you rely on your GPS as a useful tool in-flight - update the database before a flight into an unfamiliar area.

- Be aware that most databases contain errors even if up to date.
- When using a handheld GPS, don't take navigation decisions without checking the indications of the other navigational instruments, such as VOR, DME and onboard GPS. You should always use a back-up.

HAVE A SAFE FLIGHT

We hope you have found this useful. If you have any suggestions for improvement, please let us know.

OTHER GUIDANCE NOTES

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2. Flight preparation
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4. Getting Meteorological Information Before Flight
5. Using Meteorological Information for Planning
6. Visual Navigation
7. VOR / DME / ADF Navigation
8. GPS Navigation
9. Getting Aeronautical & Met Information In Flight
10. Entering Controlled Airspace
11. Getting the Most out of your Transponder

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