

MARINE NOTICE

Marine Notice 29/2007
Supersedes 11/2005

Use of the Global Positioning System (GPS) and Differential GPS (DGPS)

Status and Accuracy of GPS

GPS has been fully operational since 1995 and is defined as the constellation of satellites, the navigation payloads which produce the GPS signals, ground stations, data links, and associated command and control facilities which are operated and maintained by the US Department of Defense. The Standard Positioning Service (SPS) is the civil and commercial service provided by GPS. GPS permits land, sea, and airborne users to determine their three dimensional position, velocity, and time, 24 hours a day in all weather, anywhere in the world.¹

Typically, marine GPS receivers operating in a stand-alone mode will provide positions (latitude and longitude) to within approximately 20 to 30 metres of the true position.

Differential GPS

Differential GPS involves the use of GPS reference stations ashore, whose geographical positions have been accurately surveyed. By taking the observed pseudo ranges to all satellites in view and using the surveyed position of the station's antenna marine DGPS is able to:

- Monitor the integrity of the GPS satellite transmissions and immediately notify users to disregard any satellite operating outside specification, and
- Provide differential corrections in order to improve the accuracy of the navigation solution.

AMSA's marine DGPS network provides DGPS coverage to approximately 60 per cent of the Australian coast. Accuracy of the AMSA DGPS network is specified to be better than 10 metres 95 per cent of the time.

For details of AMSA's differential network see AMSA's Internet site (Shipping Safety - Navigation Safety).

Reliance on GPS for Navigation

GPS has provided a quantum leap in navigational accuracy and reliability. However it is not infallible and it is possible for large errors caused by an "unhealthy" satellite to go undetected for several hours.

Mariners are thus advised not to put total and absolute reliance for the safe navigation of their vessel solely on GPS. Where possible the vessel's position must be independently verified by other means such as radar, gyro bearings, echo-sounder and log.

There are two IMO performance standards for GPS receiver equipment:

- If installed on board on or after 1 July 2003, units need to conform with performance standard MSC 112(73) (the "new" standard);
- If installed before 1 July 2003, units need to conform to standards specified in Res.A.819 (19) (the "old" standard).

¹ <http://www.navcen.uscg.gov/gps/default.htm>



Older GPS receivers do not have Receiver Autonomous Integrity Monitoring (RAIM), and are therefore unable to offer an indication of the integrity of the positional information. The use of marine DGPS can mitigate this. They also lack course over ground (COG) and speed over the ground (SOG) output and are less able to cope with signal interference.

Ship owners are urged not to interface 'older' GPS units to devices like AIS and ECDIS, as this has the potential to jeopardise safety of navigation, particularly when AIS information is used to assist in making collision avoidance decisions.

Geodetic Datums and Navigational Charts

GPS gives latitude and longitude on the WGS-84 geodetic datum. Many charts are on local geodetic datums and a correction must be applied to the GPS position before plotting. For example several older Aus charts are on the AGD-66 datum; the differences between it and the GPS datum are not insignificant and are variable across the country.

For some old charts, particularly those still in fathoms, the correction to be applied to GPS cannot be calculated and these charts display a specific warning to this effect. Even within some charts drawn on the WGS-84 datum, particularly in remote regions, there may be areas based upon

old or inadequate surveys. Reference should therefore be made to Zone of Confidence diagrams or ENC data quality indicators as these can vary from place to place. Use of GPS alone on these charts is hazardous, with additional reference to terrestrial features necessary to help ensure safe navigation.

Many GPS receivers have the capacity to automatically convert between commonly used geodetic datums and WGS-84. Mariners need to monitor this feature closely to ensure the correct application of datum conversion for the paper charts being used.

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21 December 2007

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File No: 2007/463

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