

## Global positioning system (GPS)

GPS is a satellite-enabled locating system that allows users to determine their location, regardless of topography, weather or time of day, anywhere on the globe, provided the GPS receiver is not physically obstructed. GPS was originally designed for military purposes but is now commonly used in cars and on boats. GPS receivers utilise a minimum of three of the 24 network satellites to triangulate a user's location. In the case of marine equipment, this is converted into a two dimensional display overlaid on electronic charts provided within the equipment.

### A short history of GPS

GPS was originally designed and constructed by the United States of America's Department of Defence for military purposes. Research into the concept of GPS began in 1963 with land-based radio bases providing a test case for development of the more advanced satellite system. As a result of successful operation, GPS satellites were launched during the following two decades. Currently, there are 24 satellites orbiting at distances over 17 000 km above the Earth.

Public access to GPS was originally provided by a significantly downgraded signal. However, following commercial aviation disasters which were caused by inaccurate navigation information, the more accurate system was made publically available in 1995. GPS receivers are routinely able to provide locations accurate to +/- 10 m.

To improve the accuracy and integrity of GPS, the Australian Maritime Safety Authority (AMSA) has established 16 differential global positioning system (DGPS) broadcasting stations along the Australian coast. These stations broadcast in the 285-325 kHz frequency range and provide differential corrections to 'differential-ready' GPS receivers and provide signals with accuracy better than 10 m (95% of the time). Details of the available stations, including a graphical representation of their coverage around Australia, are given in the annual Notices to Mariners ([www.hydro.gov.au](http://www.hydro.gov.au)).

### How does GPS work?

GPS systems in Australia rely on a combination of satellites placed in orbit around the Earth and the land-based DGPS broadcasting system. Individual signals sent by each satellite and transmission station allow the GPS software to determine its relative location to each signal source and calculate a position. This relative position is then displayed using the base datum included in the GPS unit.

Usually, current software installed on a GPS unit includes geographic reference and can include aids to navigation marks and, in more advanced models, link to depth sounders to provide indications of water depth.

Recent incidents involving vessel collisions with maritime or navigation infrastructure have been caused by an overreliance on GPS technology or the use of an inconsistent datum applied to the GPS unit, or the electronic chart not being updated.

People are becoming more confident with road-based GPS units and are applying that same level of trust to the GPS unit onboard their vessel. On the road an inaccuracy in a GPS system can easily be recognised by the driver through referencing visual landmarks like buildings or the street. This ready reference is often not available to the vessel operator on the water and keeping a proper lookout is still vitally important. Prudent navigators use all available cues to maintain situational awareness and never rely exclusively on a single source of navigation data. It is best to remember a GPS unit is an aid to navigation not a substitute for the human eye and common sense.

### How GPS determines a location

