NAVIGATION

RADIO NAVIGATION
Radio navigation is defined as navigation using radio waves for determination of position or a line of position. Speed and direction may also be derived from positional information. Many Radio navigation Systems exist today. The most widely used available systems are: Global Positioning System (GPS)

GPS is a satellite position-fixing system operated by the US Department of Defence (DoD), which is space-based with a constellation of 24 satellites. The system is used for general navigation on land, sea and air. It also has survey and timing applications. GPS provides worldwide three-dimensional coverage. GPS provides two services for position determination. The Precise Positioning Service (PPS) will provide predictable positioning accuracy of 22m horizontally but is limited to the US and allied military and federal government use. The Standard Positioning Service (SPS) is available to civil, commercial and other users at the highest level of accuracy that is consistent with the international interest of the USA. The current policy of the US DoD is to provide the SPS at a horizontal accuracy of 100m with 95% probability. The signal is degraded deliberately by use of "Selector Availability" (SA). President Clinton before he went out of office, agreed to desist from this deliberate degrading. However, the U.S. Government can always introduce it again. GPS signals are liable to interruption without prior notice

Global Navigation Satellite System (Glonass)
Glonass is a space-based radio positioning system operated by the former USSR for worldwide use. The system is similar to GPS and may be used for general navigation by aircraft and ships, etc. The accuracy is 100m-horizontal, 150m vertical and 15cm/s velocity (all 95% probability).

Decca Navigator System (DNS)
The Decca Navigator System, generally known as Decca, is a hyperbolic radio navigation system currently available in UK, Ireland and Baltic area of Europe. The system uses groups of at least three ground transmitter stations called chains. Each chain comprises one Master and two or three Slave stations, 80 -110 km from the Master station. The accuracy of Decca ranges from 50 -800m and decreases as the distance from the baseline increases. The accuracy is also subject to night and seasonal effects, which generally reduces the accuracy by a factor of 6 to 8. There is very poor accuracy to the south of Ireland. Currently 24 separate transmitting masts provide coverage over the UK and Ireland. Decca stations are being closed down throughout Europe. The UK stations are scheduled to terminate in March 2000. The mast at Mizen Head was closed in 2000 and the Irish Coastguard for radio communications in emergencies now uses the mast.

Loran-C
Loran-C is an all weather, highly accurate and reliable hyperbolic radio navigation system that covers most of the Northern Hemisphere. The system uses groups of at least three ground transmitter stations called chains. Each chain comprises one Master and two or three Secondary stations, several hundred kilometres from the Master station. Unlike Decca, Loran-C is unaffected by night and seasonal effects and coverage remains the same throughout the year and also by day and night. The Northwest European Loran-C System (NELS) is part of the European Union plan for an independent European Radio navigation System. A predicted accuracy of 463m (0.25 nautical miles) will extend up to 1000 km off the south and west coasts of Ireland while an accuracy of greater than 100m is predicted for the Irish Sea, the Celtic Sea and the seas to the north of Ireland as well as all Irish coastal waters. Loran-C accuracy of greater than 100m will also extend over the whole of Ireland for aero and civil users. The repeatable accuracy of Loran-C is impressive, allowing a return to a marked position with greater accuracy time and time again. All Loran-C signals are constantly being monitored. A code within the signal, which is known as Blink, will warn users of any abnormality.

Radio Beacons

The Commissioners of Irish Lights have been providing radio beacons since the first one was established at Mizen Head in 1931. The number and characteristics of radio beacons have changed over the years to its present complement of eight, as well as three Calibration beacons. A radio beacon transmits a Morse code signal, unique to its location, Mizen Head Morse Code MZ (-- -- ..)Tuskar Rock Morse Code TR (- .-.). This signal is repeated in a set sequence. The signal allows receivers to take a bearing of the source transmitters to help determine position. The frequency of all radio beacons operated by the Commissioners of Irish Lights is in the band 285-315 kHZ. The emission type is A1A (simple keyed carrier signal) and the range of each radio beacon is 50 or 100 nautical miles. The Calibration radio beacons transmit only on request and are of lesser range (nominally 5 nautical miles). They are used to calibrate ships' Direction Finding (DF) equipment. Except when providing a Differential GPS overlay , .-. radio beacons are scheduled to close down in February 1999.

Differential GPS

Differential GPS (DGPS) is a system where the ground reference station is able to analyse the GPS signal and correct the effect of Selective Availability (SA). It then re-broadcasts this correction to suitably equipped receivers. This allows a far better accuracy than the 100m horizontal accuracy of raw GPS.

Radio beacon DGPS Service

Marine radio beacons are a suitable means of transmitting differential corrections including integrity messages to suitable GPS receivers. Many authorities worldwide, including the General Lighthouse Authorities for UK and Ireland, have implemented or plan to implement this service. The accuracy is better than 5m at the present time. Such radio beacons have a useful range of 100 to 150 nautical miles.

Eurofix

Eurofix is a method by which differential corrections to GPS, including integrity messages are transmitted within the Loran-C

signals. It has been agreed in principle to provide Eurofix from the Northwest European Loran-C System thereby providing complete coverage of DGPS over Northwest Europe. A combined receiver would therefore allow a position fix to be computed using 3 methods - Loran-C, GPS and Eurofix, DGPS, with each system checking the others.

Radar Target Enhancers

A Radar Target Enhancer (RTE) is designed to respond to interrogating radar with an amplified signal, which is transmitted on the same frequency with minimal time delay. The effect of this is to provide the structure on which it is mounted with a consistent radar return where otherwise, without enhancement, it would have become intermittent, difficult or impossible to detect.

Racons

The term Racon is derived from the first and last .--. syllables of the words Radar beacon. This is an accurate description of the use and purpose of Racons. In their basic form they receive signals from ships' radars, which trigger the Racon to emit a characteristic signal, which is in turn received by the ship's radar. This characteristic signal is in the form of a series of response pulses which will show up on a ship's radar as a Morse coded trace and allow easy identification of the particular Racon being interrogated, eg: Kish Bank Morse code T (-); Codling Lanby Morse code G (--.). Racons can be placed on any navigational mark (eg: lighthouses, beacons, perches, buoys, etc). The return on the ship's radar will clearly identify the mark from surrounding targets and allow the mariner to accurately measure his range and bearing. The Commissioners of Irish Lights are presently implementing major improvements in the provision of Racons on the Irish coast. When completed, some 22 high specification Racons will be in place. The Racons provided are state of the art and will respond on standard 3cm ships' radars (X-band 9300 -9500 Mhz) and on 10cm radars (S-band 2900- 3100 Mhz). They are strategically placed to serve through traffic, the approaches to major ports, and fishing and leisure interests.