



Trinity House

Advances in Aids to Navigation Technology



The development of lighthouses

Early lighthouses could be very ineffectual as they gave mixed signals. There was no regulation of the brightness or position of the light and they rarely marked the real hazards seafarers faced. Being generally fuelled by wood or coal they were also highly dependent on people keeping the fire burning.

The real breakthrough with marking dangers came when Henry Winstanley built the first lighthouse on Eddystone Rocks. Pioneers in the field of building lighthouses on hazardous rocks were also Smeaton (Eddystone) and Stevenson (Bell Rock in Scotland). Yet while the towers themselves were impressive constructions of interlocking rock, the light emitted wasn't much better than previously shone.

The Smeaton tower was lit by a candelabra, which gave out poor luminosity, but was better than the oil lamp he had previously used. The soot the burning of the oil lamp gave off defeated the object of having a light. When Trinity House acquired the tower in 1807 it replaced the candelabra with 'Argand' lamps, named after the Swiss inventor Ami Argand who discovered that the effect of placing a burning oil wick in a glass tube was a significantly brighter flame as the confined space meant the flame had to draw in more air to keep alight. This light was further improved when the Argand lamp was fuelled by the cleaner-burning sperm oil.

The use of reflectors to not only increase the light's intensity but to help differentiate the light from its neighbours was the next breakthrough and improved navigation for the exhausted seafarer. Bending brass sheets in to arcs helped refract the light and in the 19th century Swede Johan Nordqvist devised a way of making the apparatus turn using a clock-like mechanism and pendulum creating the first flashing lights. The sources of the light changed including the use of electricity in selected lighthouses from the late 1800s and the use of paraffin from the early 1900s.

Following this the advances came in the form of improvements to glass lenses which concentrated the light in a horizontal beam, a method which can still be seen today.

Technology now sees the sources of electricity developed with some of the 71 lighthouses under Trinity House's jurisdiction having been adapted to solar power or scheduled to be converted in the next few years.

Technology also allows lighthouses to be monitored remotely from the Operations and Planning Centre in Harwich 24 hours a day, with access by maintenance staff available to the most remote lighthouses by helicopter.

Key Dates:

1514 – Royal Charter granted for the Corporation of Trinity House

1566 – Elizabeth I empowers Trinity House to set up 'so many beacons, marks and signs for the sea... whereby the dangers may be avoided and escaped and ships the better come unto their ports without peril'

1604 – James I conferred on Trinity House rights concerning the compulsory pilotage or shipping, and the exclusive right to license pilots in the River Thames

1609 – Trinity House builds its first lighthouse at Lowestoft

1698 – *First rock lighthouse in Europe (Eddystone) built by Winstanley*

1759 – *Smeaton builds tower on Eddystone*

1807 – *Trinity House takes over Smeaton's lighthouse*

1812 – *Stevenson's Bell Rock lighthouse built on the Firth of Forth*

1836 – *Trinity House given compulsory powers to acquire and maintain all private lights*

1867 – *Electricity introduced to the first lighthouse – South Foreland*

1901 – *Vaporised paraffin gas introduced to lights without electric connections*

1913 – *First compressed air fog horn installed – St Trevoze Head, Cornwall*

1969 – *First reliefs of lighthouse keepers by helicopter trialled*

1977 – *Last oil burner removed from a Trinity House lighthouse – St Mary's Bay, Tynemouth*

1986 – *Use of solar power allows Trinity House fleet to shrink to the use of two MFTs (multi-functional tenders)*

1989 – *In May, the last manned lightvessel withdrawn from the Channel station*

1991 – *Capability to remotely monitor aids to navigation in place*

1998 – *On the 26th November keepers are withdrawn from North Foreland, the last manned Trinity House lighthouse*

2002 – *On the 1st July, the DGPS network, provided by the GLA's, becomes operational*

Daymarks

To make lighthouse structures more visible in daylight lighthouses on shore are usually painted white while stations on low lying land or at the foot of chalk cliffs are often striped with red or black to make them more conspicuous.

Hazard warnings in poor visibility

Early warning systems concentrated on the use of sound, for example by the use of cannon fire and detonations. Light vessels used a hand-turned emitter that passed air over a reed creating a mournful sound.

One of the lesser known feats of William Thomson (soon to become the first Baron Kelvin) is the discovery of the use of compressed air to make an audible warning. The success of his design of the massive iron trumpet installed at Trevoze Head (Cornwall) in 1913 brought about the development of the diaphone, an ear splitting emitter providing the basic fog signal during most of the 20th century.

Air driven fog horns have been replaced by electrical diaphragm emitters which do not require heavy engines and so are more suitable for use at automated lighthouses.

Radar technology

Audible fog signals have their limits and the racon, a development that stems from the success of radar uses radar as a beacon ('racon' comes from shortening these words). Simply, the racon responds electronically to the signal coming from a ship's radar. The response shows on the radar screen informing the ship's crew of not only a 'nearby' hazard, but identifies the hazard location and the site of the racon. Racons are very power efficient, remaining passive until they are activated by a ship's radar signal.

Global Positioning Systems (GPS)

The advent of GPS has witnessed improvements in the monitoring of aids to navigation. Mariners use GPS to navigate their way around the world.

Advances in technology have also meant that aids to navigation can be monitored remotely and Trinity House manages its aids from its Operations and Planning Centre in Harwich.

The General Lighthouse Authorities' (GLA's) marine Differential Global Positioning System (DGPS) is a satellite based navigation system. It is the newest element of the mix of visual, audible and electronic aids to navigation provided by the three GLA's.

DGPS is a network of 14 ground-based reference stations providing transmissions with coverage of at least 50 nautical miles around the coasts of the United Kingdom and Republic of Ireland. It is an open system – available to all mariners – and is financed from light dues charged on commercial shipping and other income paid into the General Lighthouse Fund.



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