EDLORAN - ENHANCED DIFFERENTIAL LORAN

The Dutch company Reelektronika B.V. has, at the request of the Dutch Pilots Corporation (Nederlands Loodswezen), developed and tested successfully Enhanced Differential Loran (eDLoran) to backup GNSS in cases of jamming or spoofing of the satellite system. Reelektronika has for more than 15 years specialized in developing Loran equipment.

An unprecedented but required absolute accuracy of five metres has been achieved at sea and in the Rotterdam Europoort harbour area. A complete test system has been implemented which includes the eDLoran reference station and the eDLoran receiver for the pilots. This small and lightweight receiver can wirelessly co-operate with the standard software of the pilot’s GPS-RTK equipment. Differential Loran data are in real-time and available via the mobile telephone network. No modifications to the existing Loran transmitters are required.

The Dutch Pilots’ Corporation made these joint project facilities available, in their pilot cutter Polaris and for the location of an eDLoran reference station.

Reelektronika performed the research on eDLoran, and developed the equipment for the pilots and the low cost reference station. The position corrections (ASF) database will automatically be expanded and refined by any new trip the pilots make, using their collected GPS-RTK and Loran data when returning from a trip. Possible disturbing effects of new industrial installations and buildings in the harbour area are thereby adaptively incorporated. This nearly continuously upgrading of the eLoran ASF database does not require any special measuring equipment or procedures.

The Dutch pilots offer a contribution to the safe and rapid pilotage of ships to and from Dutch ports and Flemish ports on the Scheldt River. Each year, they assist about 100,000 ships. Loodswezen aims to play a leading role by excelling in terms of service provision, training and education, efficiency, technology and customer satisfaction. The highly-trained maritime pilots and other staff members work closely together to ensure safe and efficient operations in all circumstances.

By law, ships navigating the Eurogeul and Maasgeul shipping channels in the North Sea are required to carry an autonomous navigation system. Satellite positioning is the basic element for the current navigational aid. Two years of intensive development and testing off the Hook of Holland have resulted in an electronic navigational aid: eDLoran (enhanced Differential Loran). The
Harbour Master’s Division of the Port of Rotterdam Authority contributed financially

**Alternative to satellite**
The basis for the eDLoran system is the LOng RAnge Navigation System or LORAN. Should the satellite navigation system experience failure or disruption, then the system falls back on eDLoran. This makes use of signals transmitted by towers in England, France and Germany. Based on these signals, a location can be determined with an accuracy of less than five metres such that this system meets the HANAS (Port Approach Systems) specification of the Dutch Government.

The Port of Rotterdam is one of the busiest ports in the world. To ensure nautical safety and a smooth traffic flow, the vast majority of vessels must have a pilot on board when entering and leaving the port. For extra-deep draught vessels, known as *geulschepen* in Dutch, additional requirements apply. With the development of eDLoran, a next step has been taken towards keeping the port of Rotterdam safely and optimally accessible.