The Marine Electronic Highway: A new concept for an old problem

John Cumming, Chairman, Marine Transport & Navigation Group, Royal Institute of Navigation, London, UK

Despite a long gestation, at the end of this year, if all goes well, the very first Marine Electronic Highway (MEH) trial will launch. It will cover the Singapore and Malacca Straits and heralds a new future for vessel traffic management in congested waters. It builds on experience gained in port and harbour management together with offshore schemes such as the Channel Navigation Information Service at Dover. It is a large project coming with an initial tab close to US$16 million adding crucial links to millions spent earlier on infrastructure.

In maritime terms this is a project with a difference as it covers straits used for international navigation where freedom of navigation is enshrined in treaties such as UNCLOS (Law of the Sea Convention). It also links with a full range of electronic bridge equipment (including ECDIS, not yet a carriage requirement under SOLAS) and interfaces to the latest onshore technology (see Table 1).

It is a scheme involving three littoral states where total cross-border imperatives, understandings and involvement has proven difficult to coordinate.

Hazards to the environment

The choice of the Straits to demonstrate a MEH originates from a number of important sources. Paramount is an environmental concern with ecosystems such as corals and mangroves at risk from marine pollution. Figure 2 shows the aftermath of a collision between the Evoikos and the Orapin Global in 1999 with the former (photographed) carrying a full cargo of heavy fuel oil. The accident occurred off Singapore with close to 30,000 tonnes spilling instantly. Large volumes of glutinous fuel oil proceeded to contaminate nearby beaches and facilities.

Today studies show an increase of shipping activities and rapid development and industrialisation in coastal areas. Together these threaten the environment.

At approximately 500 miles in length the Malacca and Singapore straits comprise the longest strait in the world for international shipping. Taken together the Straits provide the main seaway connecting the northern Indian Ocean with the China Sea and are the shortest passage for most routes to and from the Far East. The waterway runs through the territorial seas of Indonesia, Malaysia and Singapore. The shorter, but navigationally more tortuous, Singapore strait joins at the southern end of the Malacca strait for connection to the China Sea. Navigable widths at channel choke points are critical – measured in meters rather than miles. For eastbound shipping there is a through route of 23 meters water depth but with 3½ meters under-keel clearance (UKC) ships' drafts top at 19½ metres, unless tidal staging applies, encouraging some of the world's largest ships to make the transit.

Alternative routes

Although the Straits are a shallow maze of narrow channels and fraught with irregular tides and shifting seabeds, they are the preferred international route for the majority. This is due partly to the presence of major services and active ports such as Singapore, compared to other routes. There are two alternative long-haul routes via Lombok and Sunda straits; both add about three days to

Figure 1. The Malacca and Singapore Straits.

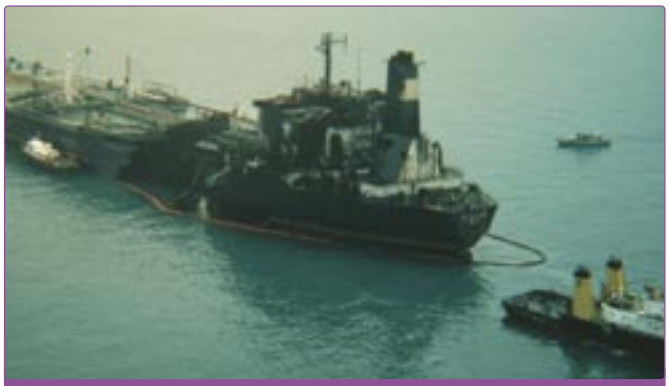

Photo courtesy of ITOPF

Figure 2. The tanker Evoikos suffered severe damage after a collision in the Singapore Strait. She lost almost 30,000 tonnes of her heavy fuel oil cargo.

TABLE 1: EXISTING 'STRAITS' FACILITIES

Facility or System	Coverage in the Straits			
	Indonesia	Singapore	Malaysia	Straits-wide
VTS	•	•	•	•
Radar System		•	•	•
ENCs	•	•	•	
DGPS Broadcast Systems		•		•
STRAITREP Ship Reporting Scheme	•	•	•	•
Ship Routeing System	•	•	•	•
GMDSS	•	•	•	•
GIS*-based Environmental Database	•	•	•	•
Pollution Dispersion Model				•
Oil Spill Trajectory Model	•	•	•	•

* Geographic Information System

Photo courtesy of Norcontrol

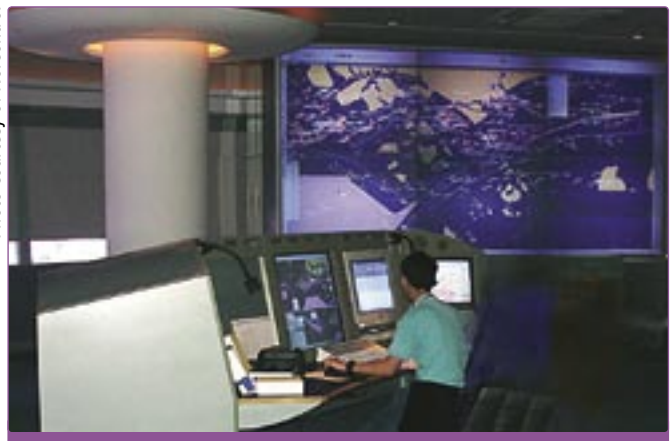

Figure 3. Singapore VTS Centre.

voyages but, at least in the case of Sunda, provide no improvement in water depth.

Other advantages of the Malacca straits are reliable navigational aids and available support facilities including emergency response systems and good quality charting information.

The concept of an MEH

The MEH concept stems from older Canadian work in the St. Lawrence Seaway where, several decades ago, shore stations and local Lake Trading vessels were specially fitted with electronic equipment including charts and an early form of AIS. Here the aims were similar to today's but, in addition, the Seaway had ship scheduling much in mind. Eventually the system in Canada faltered as newer electronic equipment became mandatory outdating existing systems.

The idea behind this newer MEH follows from its Canadian predecessor but emanates from IMO in concert with the Global Environment Fund (GEF) and the World Bank. In the case of the Straits, IMO masterminds the project, but relies on finance from the World Bank and GEF. These primary developers are joined in the project by the International Hydrographic Organization (IHO), the International Association of Independent Tanker Owners (INTERTANKO) and the International Chamber of Shipping (ICS). As project partners, the non-government organisations participate in the scheme with hydrographic input together with several hundred ships suitably equipped for sensible participation in the trial. Shipowners too, recognise current risks and seek solutions.

As mentioned above, project funding is predicated mainly on environmental concerns rather than on navigational safety alone. However, high on the list of regional concerns is rampant pirate activity in the Straits. Within the MEH, the hope is that better awareness of legitimate traffic can make the identification of illegal activity easier and more efficient.

To help justify expenditure, a geographic assessment of the value of the Straits, considered the main artery to the Far East, was performed against its status as a regional resource where ecosystems, tourism and other industries co-exist with shipping. Analysis proved successful. Accordingly, an announcement of scheme-launch was expected at the IMO's headquarters during the Marine Environmental Protection Committee (MEPC).

Equal Partners

Prime beneficiaries of the MEH are the littoral States; namely Singapore, Malaysia and Indonesia. However other nations rank as equally keen partners aware of a continuing need for safe navigation. Today they include Korea and Japan and these nations contribute to the project in terms of hard cash. Doubtless China can't be far behind.

Figure 4. One Fathom Bank Lighthouse – constructed 1999 – (new light in foreground).

Indeed the concern of Far Eastern nations in safe navigation in the Straits is historic. In the past assistance from Japan extended to hydrographic surveys, chart production and the installation of fixed and floating marks.

For example, concluding in 1982, the Malacca Strait Council (a Japanese organisation) and the three coastal states conducted hydrographic surveys and produced new charts to a common datum. Again, finalising in 1998, a resurvey under similar arrangements cost US$ 46 million. Its findings and those from the 1982 survey led to IMO's approval for extending the traffic separation scheme between One Fathom Bank and Horsburgh Lighthouse. Accordingly, since 1998 the Traffic Separation Scheme (TSS) has formed a continuous zone from One Fathom Bank to Horsburgh Lighthouse, some 240 miles.

More than three-fifths of the aids to navigation used by mariners in the Straits were installed by Malacca Strait Council under international cooperation agreements. These installations cost more than US$ 42 million, with over 40 buoys, beacons and lighthouses. The Malacca Strait Council also works closely with the coastal states in the maintenance and replacement of these aids and in 2002 donated a buoy tender to Malaysia.

To ensure navigational safety, Malaysia too has installed numerous navigational aids. In addition, they have established a vessel traffic management system and further aids in the Straits include DGPS.

Vessel traffic management is also a feature for the Singapore Strait and the adjacent photograph shows the control room at Singapore with the display showing all Singapore waters.

The TSS is already covered by a mandatory ship reporting scheme (STRAITREP).

While Singapore's range of electronic charts is complete, further work in the Malacca Straits on electronic chart production is necessary.

IMO argue that the success of the MEH must include the adoption of new technologies and management systems to enhance navigational safety and to minimise pollution. At the same time they wish to ensure better commercial performance. They go on to emphasise that this shift requires a coherent prevention and response programme.

Figure 5. Horsburgh Lighthouse – Established at the eastern extremity of the MEH.

Current project objectives are to specify options for full implementation of a MEH. Priorities include identification of the technical, financial, economic and social benefits of the system. The integration of environment protection with precision navigation will be assessed. Objectives include frameworks for financial systems and details on system management and administration.

Expected outputs of the trial are as follows:

1. An effective and financially viable trial forming the foundation of a full-scale system
2. Overall enhancement of navigational safety for through and cross traffic
3. Overall improvement of chemical and oil spill prevention and response
4. Availability of high quality large-scale electronic navigational charts of the TSS
5. Establishment of MEH data centres, to act as focal points and to house network servers
6. Demonstration of the technical, financial and economic benefits of the MEH
7. Integration of marine environment systems for effective monitoring and response of marine pollution
8. Enhanced national and regional cooperation on maritime safety and marine pollution management

Figure 6. Raffles Lighthouse – Standing sentinel off Singapore at the narrowest section of the MEH.

The concept of a Marine Electronic Highway should become clearer at the end of trial. However, it includes all new navigational aids such as electronic charts and automatic identification systems (AIS). It also involves high quality surveys by the littoral states to meet exacting IHO requirements. It also requires shore stations to monitor traffic and advise on upcoming close quarter situations, as already happens off Singapore.

As a guide, shore-based systems and equipment already in place in the Straits is listed in the table below this giving a broad indication of software and hardware needs. As important, of course, are human elements and the national commitment to the scheme.

The MEH as described above may be just the beginning. This is said to be just Phase 1. Optimists see it extending further, as follows:

Phase 1 Setting up a prototype system in the Straits of Malacca and Singapore (as described)

Phase 2 Network construction in priority waters from the Straits to Sea of Japan/East Sea

Phase 3 Completion of the entire network with emphasis on oil and gas transportation routes

Although today we write on the MEH project in the Straits, there are yet other similar projects under consideration and high on the agenda is a complete system for the European coast from Gibraltar to the Baltic. Integration and national cooperation are the themes.

So, what we witness now in the Far East is something unique. It is a step beyond a traffic separation scheme. Indeed, it is a step beyond known treaties between littoral states. It may be the beginning of something akin to air traffic control. Is a whole new world opening unto us?

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ENQUIRIES

Royal Institute of Navigation
1 Kensington Gore
London SW7 2AT
UK

Tel: +44 (0)20 7591 3130
Fax: +44 (0)20 7591 3131
E-mail: info@rin.org.uk
Website: www.rin.org.uk