Satellite Communications

Managing huge volumes of complex, confidential data would be quite impossible without a reliable and affordable means of communicating between ship and shore. Fulfilling this crucial role is satellite communications.

As ship management IT systems become more comprehensive and pervasive, the vessel is becoming more and more like a floating mobile office with shipboard Local Area Networks (LANs) allowing ease of access to all systems. These links are not only within the vessel but also from ship to shore, supporting the principle that data should be captured once, at the front line, and then fed seamlessly to other enterprise systems. Shipnet's Marine Workstation is a good example of the application of this principle.
It manages all manner of forms, manuals, and data and provides vessel-based reporting and documentation system with full integration to shore based control and legacy systems. Capturing data on the vessel and feeding it automatically to shore allows ShipNet to tie up systems that would previously have stood alone.
ShipNet's SNOPS system takes data automatically from Vessel Reports to populate the Position Book module. This in turn feeds data to the Voyage and Disbursement Account modules, providing control of voyage related cash flow and facilitating the logging of all voyage related activities, this in turn provides a basis for both sea and port performance recording and analysis.

The infrastructure that enables satellite communication starts high above the earth. Inmarsat's primary satellite constellation consists of four Inmarsat-3 satellites in geostationary orbit, each following a circular orbit in the plane of the Equator at a height of 35,600km, so that it appears to hover over a chosen point on the Earth's surface. Between them, the main beams of the four satellites provide overlapping coverage of the whole surface of the Earth apart from the poles. Lower down are constellations of Low Earth Orbit (LEO) satellites.

These satellites, which orbit at an altitude of 870 miles require less power to reach and reduce messaging costs but because they move across the sky at a comparatively high speed, often require a switch from one satellite to another. Back on terra firma is the second element of the infrastructure, the gateways on the ground known as Land Earth Stations (LES) that link the satellites to the terrestrial networks. Finally there is the onboard installation, a Mobile Earth Station (MES), typically a small, self-contained satellite earth station comprising a parabolic antenna, electronic units, power supply interface, and direct-dial telephone, fax and telex connections.

A voice or data transmission goes from a vessel directly to the satellite overhead. The satellite routes it back down to the LES, which in turn passes it to the terrestrial network, completing the connection. All transmission nodes and links are constantly monitored by the infrastructure operators' network co-ordination centres.

Built on this infrastructure is a variety of services, sold and supported through distributors throughout the world, that support ship to shore communication. These distributors include companies such as France Telecom, Telenor, Stratos, EasyLink and Xantic. As a sample, France Telecom's offering is set out in Table 1.

The market leading satellite network operator, Inmarsat, was formed as a maritime-focused intergovernmental organization over 20 years and was the world's first global mobile satellite communications operator. Starting with a user base of 900 ships in

the early 1980s, it now supports links for phone, fax and data communications at up to 64kbit/s to more than 250,000 ships, vehicles, aircraft and portable terminals. That number is growing at several thousands a month.

Inmarsat's first generation product, the 20 year-old Inmarsat-A mobile satellite communications system, uses analogue technology to provide two-way direct-dial phone, fax, telex, electronic mail and data communications to and from anywhere in the world (with the exception of the poles). It also provides distress communication capabilities. Data transmission rates vary between 9.6 kbps and 64 kbps depending upon the precise configuration of all the links in the transmission. Inmarsat-B provides the same capabilities using digital technology.

Inmarsat's latest development is Inmarsat Fleet, which brings maritime satellite communications into the Internet age. The flagship product, Fleet 77, supports ISDN for voice, fax and the transfer of larger data files and Mobile Packet Data Services (MPDS) for regular e-mail, web browsing, smaller file transfers and other standard networking activity. MPDS provides an "always on" connection with costs dependent not on time connected but on the volume of data transmitted. In addition to 77, Fleet has other variants, Fleet F55 and Fleet F33, which offer global ship-to-shore communications with reduced-size antennas and above-deck equipment, more suitable for medium to smaller vessels. Fleet 77 was successfully trialled on a number of vessels in 2002, including *Chastine Mærsk*, a 6,600 TEU container vessel operated by Mærsk Sealand and the P&O Nedlloyd *Genoa*.

Vessels using sophisticated computer systems typically send about 300-400kB of data per day to head office. Existing communication methods are becoming too slow to support this level of data transfer. The use of Fleet's ISDN service makes data transmission on this scale a lot faster, reducing download times from minutes to seconds. At the same time, MPDS allows the shipowner to bring his ships into the company's global intranet and treating them just like other networked workstations, opening up all sorts of possibilities. At a basic level, the vessel can use this route to communicate in real time information about arrival and departure times, vessel condition, fuel levels and replenishment requirements.

More sophisticated applications are enabled too. These connections could, for example support an onboard engineer through an online link with the manufacturer. The engineer could take advantage of instant chat messaging and send diagnostic data together with digital images, could greatly aid fault finding.

Onboard equipment performance data can be more efficiently shared with the shore. Satpool 's PreMaster Pro Planned Maintenance System uses a Sybase communications module that replicates all databases offline; these are then synchronised according to a preset schedule, ensuring the uniformity of data throughout the shipowner's organisation. This allows shore-based superintendents to see and work from the same data as the vessel's chief engineer.

Improved connections can also plug the vessel more effectively into the marketplace. Laycan offers a range of post-fixture applications that connect brokers, charterers, agents and shipping companies to the vessel. For these applications to work efficiently, information needs to go straight into the relevant system. Laycan supports this with a web-based performance report that can be sent via satellite to voyage calculators or ERP systems ashore.

Navigation can also benefit. The United Kingdom Hydrographic Office (UKHO) is in the process of improving its range of electronic products with Electronic Chart

Display and Information Systems (ECDIS) and electronic chart updates are now becoming available both through email messages and as downloads from the UKHO website.

Reaction to the new Fleet services has been mixed. Ship operators are expressing interest in the new capabilities but reservations on price. This mix was reflected in the comments of a number of owners at a conference organised by *Digital Ship* magazine this April to look at the applications of Inmarsat Fleet.

Hanseatic Shipmanagement reported that Fleet 77 had been used to replace an Inmarsat A installation on one vessel. The crew, and in particular the master of the vessel, were very happy with the system; the voice service was of excellent quality and data transfers smooth. Despite this enthusiasm, Hanseatic is not planning to increase its use of Fleet as long as Inmarsat A is still in operation.

By contrast, Maersk Line has embarked on a program to fit its vessels with Fleet 77 terminals, following its participation in the Fleet 77 field trials referred to previously. Maersk is particularly interested in Fleet's ISDN capability, which it regards as the best feature of Fleet 77 and which suits its current software, much of which was developed in-house by Mærsk Data.

While Inmarsat services rely on geostationary satellites at an altitude of 37,000 km, Iridium uses a constellation of 66 LEO satellites, operated by Boeing, flying at 780 km altitude to provide a global wireless telephone service. Because the LEO satellites are at lower altitude, the power of a hand-held device is sufficient to reach them. The satellites work like mobile phone towers in orbit, relaying signals between them to move the transmission across the globe and routing them to land earth stations.

The simplicity and ease of set up and use of Iridium, which works essentially just like a mobile phone, is very attractive. The limitation is slower transmission rates (2.4 kbps, or 9.6 kbps with data compression), which places this technology firmly in the narrow band category. Despite these limits there is plenty of scope. The crew calling market is an area where Iridium has made progress, with a service that enables the handset to be used for both operational and crew purposes. Crew calls can be made with pre-paid scratch cards, greatly simplifying the billing process and assisting with control. Iridium also supports SMS messaging, which, although it does not allow the transfer of large quantities of data, is enough for alerts and other short communications and is becoming an increasingly popular element in crew calling.

Following its bankruptcy in 2001, Iridium's new incarnation is on a much stronger financial footing with little debt and the support of a significant defence contract, which is said to cover half the company's running costs.

Another mobile phone service provider is Thuraya, which combines satellite and GSM services in its mobile phones. The Thuraya-1 satellite, the first satellite initiated from the Middle East, was successfully launched from the equator in the middle of the Pacific Ocean in October 2000. Designed for a lifespan of 12 to 15 years, Thuraya's satellite is in geo-synchronous orbit, positioned 36,000 km above the earth where it will be joined by two other units to complete the network.