Vessel Traffic Information Systems (VTIS)

Advances in information management have certainly caused the world to shrink over the past few decades. Moving into the turbulent 2000’s, a wide spectrum of vessel traffic management systems have become commonplace at ports worldwide.

The range is broad- at one extreme a camera tied to a CCTV system, at the other extreme multiple radar imaging feeding a central console with capabilities to input a variety of data feeds. The VTIS world has been a Tower of Bable, with each bespoke installation reflecting an adaptation for a particular port, waterway or coastline. Happily, the coming advent of mandatory AIS will now begin to impose a lingua franca that will enable the realization of a decades old dream, where different local traffic systems can begin to talk to each other.

The internet boom beginning in the mid 1990’s did spill over into maritime safety. As part of an ambitious research programme, the European Union had a vision of ports throughout North Europe and the Med implementing a common network of traffic management schemes- with ancillary benefits of supply chain efficiencies. Ideally, individual ports and waterways could share non proprietary information over a common platform, keeping cargo throughput humming as ETAs and voyage information were transmitted ahead. After all, Vessel Traffic Systems (VTS, sometime VTIS, and lately VTMIS) had been around since the 1950’s, and of concern to the IMO since in the mid 1980’s. Regional groupings such as Balticom, made of several countries and ports bordering the Baltic Sea, have also looked at enhancing flows within their spheres.

While several handfuls of innovative demonstration projects were developed by the EU, the very knotty questions on the economics of information sharing were never solved, and real commercialization of the research failed to materialize. VTIS systems were developed for individual ports, but without standardization. Security and surveillance, brought to the forefront since 9-11-2001, are increasingly the leading drivers. Ships are nodes on large systems that are positioned as information network hubs. New SOLAS regulations have tasked shipowners with the obligation to install now standardized Universal Shipborne Automatic Identification System (AIS) devices by mid 2004, and ports are now gearing up to manage the sudden flood of information that will be emanating every few seconds from vessels.

As security issues have moved to the forefront, governmental agencies’ interest has shifted to questions of how traffic control and collision avoidance systems might be re-purposed to also enhance regulators’ maritime domain awareness. In the U.S.A., the Coast Guard (USCG) now resides in the recently formed Department of Homeland Security, reflecting the shift in its mission.

At the forefront of the new VTIS focus is Lockheed Martin Company (LMCO), a vendor to both the military and to the commercial transportation sectors. The crossover from purely safety into the security arena can be seen by LMCO combining several business areas into its new MS3 Group, encompassing Maritime Security, Safety and Surveillance Group, under Mr. Greg Larioni. As part of a USCG acquisition contract to ultimately service 17 U.S. ports, LMCO sets the standard in VTIS systems, now built around a core software hub running on Windows NT. The hub, named MTM100, enables fusion of inputs from relational databases, sensors and from vessels, with the ability to build modularly. Many of these capabilities have been honed from decades supplying the US Navy and Coast Guard. Commercial mariners may already be familiar with LMCO’s attaché case sized AIS, using the STDMA protocol, units used by pilots.

The first system was deployed in the Lower Mississippi River, near the Port of New Orleans, a congested area traversed each day by dozens of deepsea ships and innumerable towboats and river craft, followed by installations at Prince William Sound near Valdez in Alaska, and in the...
Great Lakes near Sault Ste. Marie. Systems are pending at Houston and in the Port of New York, and preliminary survey work has been done in San Francisco and in the Puget Sound. According to the Coast Guard, a recent site survey in the Pacific Northwest also included a feasibility study of linking the Puget Sound VTS with Canadian systems in Vancouver and Victoria. LMCO’s reach extends out to the Mediterranean, with projects underway in Marseilles, The Ionian Sea and Piraeus, Istanbul and Canakkale Straits (featuring extensive AIS input), and the Gulf of Suez in Egypt, where traffic management is complemented by a Search and Rescue installation.

LMCO’s Laroni talked about the role that VTIS systems can play in maritime security, expressing LMCO’s strategy of “…expanding our capabilities to include improved small target identification and tracking needed for security missions, search and rescue operations, and coastal surveillance.” He is also quick to point out the MTM100 can easily take AIS feeds, whose accelerated implementation timetable, enacted at the Dec. 2002 IMO meetings, was spurred by security concerns.

These same consolidation in the US Defense marketplace that brought Lockheed together with what was Martin Marietta, has also spawned the agglomeration of giant Northrup Grumman. Well known brands Sperry Marine, Plath and Litton all now sit under vast the Northrup Grumman umbrella, and trade under their well recognized brand names. Though best known for radars, Voyage Data Recorders and Integrated Bridge Systems, Litton Marine, which in turn absorbed Dutch based International Navigation Aids, has developed its “Master W” VTS system, running on a Windows NT platform, aimed at canals, locks and waterways.

The Master W provides an upgrade path for customers of some 300 previous installations. The system is also described as modular, and, according to the company, “…can be expanded from a basic low-cost radar-based traffic observation system into a comprehensive VTMIS with multiple radar transceivers and monitoring stations networked via fiber optic cables, telephone lines or VHF/UHF channels.” Its features include advanced video compression technology for transmitting radar images to a console, combined and displayed on an operator console.

One deliverable from the Balticom project, mentioned earlier, was a demonstration of an installation in the Gulf of Finland, where AIS units aboard vessels would enable a display on the Navi HarbourVTS installation in Saint Petersburg. Navi Harbour, a product of Transas, best known for electronic charts and simulators, is a commercial off the shelf product designed for small harbors that enables a radar display to be superimposed on a chart at the operator's console.

Another market leader in the space is Oslo based Norcontrol IT (NCIT), which like LMCO was developing large systems back in the early 1980's. Indeed, the NCIT installations can be found in heavy traffic regions of Singapore, Hong Kong, the Oslofjord and the Gibraltar Straits as well as Los Angeles/ Long Beach. They describe their entry, mid and professional level products, all built around a database, as a port management system, designed to gather and feed relevant information to stakeholders.

A very powerful endorsement came last year when the UK Maritime Coast Guard (MCA) chose a Norcontrol IT package for the Traffic Separation Scheme at the Straits of Dover- where literally hundreds of vessels transit daily. Using the language of IT managers, NCIT talks about its ability to combine varied information feeds, distribute to users in a port, and, now, to hand off to neighboring systems. At the end of the day, a common situation display- encompassing feeds from AIS, radar and VHF direction finding sensors, will be available to on workstations to all viewers, including both the UK and the French Coast Guard. Its latest version enables web based delivery, using a browser such Internet Explorer, supporting the HTML, DHTML and XML which fuel the display.
AIS integration is also a top priority, having been involved with one of the earliest AIS integration schemes, at the Port of London in the early 1990's, and then in the Oslofjord a few years later, using Digital Selective Calling, the predecessor to the more robust STDMA. The upgraded Oslofjord installation, about a year ago, tied the VTIS to Saab's AIS units, now adhering to recently agreed standards. NCIT is also working other leading manufacturers of Universal Shipborne AIS, such as affiliate Seatex, and expects to be delivering meteorological data, and data from navigational aids to viewers on shore and afloat.

Norcontrol IT's Senior Developer, Mr. Geir Jegstad, who sits on the IALA group that developed AIS standards, makes it clear that the firm’s early experience with AIS integration is more than just a conversation starter at sales meetings. Talking about the vast knowledge and special processing methodologies, accumulated over more than two decades, Jegstad says, “The algorithm is based on the special know-how built-up within NCIT over many years, which allows for continuous tracking if either AIS signals or radar tracks are missing for some period.” With ports or waterways Dover Straits in mind, he says, “It’s especially useful in close or high density ship traffic situations with tugs and pilot ships.”

With many installations farther afield than the Channel, NCIT has implemented an enhanced CRM knowledge base system internally, and has begun an e-Learning program to serve its new and existing customers in far flung ports.

I asked Sandra Borden at the USCG, Project Manager for Port And Waterway Safety System (PAWSS), about how VTIS and AIS will impact maritime information management, for supply chains and security. She said, “Current VTIs and VTIS will be Automatic Identification System (AIS) based. AIS is a large technological leap whose full impact and opportunities are still to be discovered…” After discussing the emergence of the PC from its beginnings in the early 1980's, and how proprietary networks spawned the Internet, she then commented further, “…the digital exchange of maritime information via AIS will be a powerful communication tool when the tool is fully explored and used, <as well as> an important part of the integrated bridge.”

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**Screen Shots**
- From LMCO?
- From Norcontrol?
- From Coast Guard?

**Glossary**

AIS
An acronym for Universal Shipborne Automatic Identification System, AIS is a maritime mobile band VHF broadcast system that can send both dynamic and static ship information such as MMSI, call sign, position, course, and speed to other AIS transponders and to base stations on the shore. Recent years have seen AIS functionality expand to include the sending of a variety of additional information, such as ETA, waypoints, data from navigational aids such as buoys and lighthouses, rate of turn, time stamp, ship type, type of cargo, draught, dimensions, passengers, and text messages.
DSC
Digital Selective Calling DSC is, basically, a paging system that is used to automate distress alerts sent over terrestrial VHF, MF and HF marine radio systems. The DSC system's digital processing techniques, combined with the relatively narrow receiver bandwidths used, provide a DSC signal with resistance to noise and fading over the radio path, resulting in increased range compared with radiotelephone transmissions.

STDMA
A self-organizing time-division multiple access (STDMA) system that uses the precise timing data in the GPS signals to synchronize multiple data transmissions from many users on a single narrowband channel. It’s this STDMA technology that’s the key to AIS and the transponder at the heart of the shipboard AIS is sometimes referred to as the STDMA transponder. This protocol is favored, compared to DSC, in crowded waterways and ports.

VTIS
A VTIS is a service implemented by a Competent Authority, designed to improve the safety and efficiency of vessel traffic and to protect the environment. The service should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area.

IALA
International Association of Lighthouse Authorities

AIS Transponder Manufacturers
Saab TransponderTech, Sweden
Lockheed Martin
Marine Data Systems, South Africa
L3 Aviation Recorders, USA
SeaTex, Norway (NorControl/Kongsberg)
Racal, USA
Observation Technologies (ObsTek) Inc.
Furuno
JRC
Transas Marine
CNS Systems, AB, Sweden
MARCOM Marine Communication Systems GmbH, Germany
Jotron Maritime Communication, Norway
NautiCast, Austria
STN-Atlas
UAIS compatible ECDIS
Transas Marine
STN Atlas
Furuno
UAIS compatible ECS
ICAN, Canada
MaxSea, France

Websites
Lockheed Martin [www.lockheedmartin.com/syracuse/]
Norcontrol IT [www.norcontolit.com]
Litton [www.litton-marine.com]
Transas [www.transas.com]
US Coast Guard [http://www.uscg.mil/hq/g-a/avt/]
Balticom Project [http://www.balticom.org/]