

Satellite AIS from USCG

The United States Coast Guard has begun the contracting stage of an ambitious nationwide project that will eventually allow it to collect AIS data via satellite up to 2,000 miles from shore. *Digital Ship* examines how the system will operate

THE UNITED STATES Coast Guard (USCG) has announced plans to initiate a novel and innovative maritime security system that will involve collecting vessels' AIS (automatic identification system) data by satellite from up to 2,000 nautical miles away from the shore, to give authorities maximum warning of approaching ships.

Formal approval from the US Department of Homeland Security (DHS) to issue solicitations and award contracts to establish initial operating capability for the project has been issued, and work on the system can now begin in earnest.

The new approach is part of a three-stage Nationwide Automatic Identification System (NAIS) project, being carried out on behalf of DHS, that is designed to enhance the capabilities of units tasked with Maritime Domain Awareness (MDA) and vessel tracking services, according to NAIS spokesman, George Kardulias.

"NAIS will be an integrated network of AIS receivers, transmitters, and data processing and storage centres that will collect, integrate, and analyse information, and exchange data with AIS equipped vessels operating on, or bound for, waters subject to the jurisdiction of the United States," added NAIS deputy project manager, Commander Keith Ingalsbe.

Multi-phase

The first phase (or 'increment') of the project will involve harvesting AIS information from shore-based facilities, through the use of existing and newly established AIS sites on USCG-owned or leased facilities (96 existing and 86 new). The network will be 'receive only', and is expected to be operational at 55 critical ports and 9 coastal areas around the US by October 2007.

This network will subsequently be enhanced in the second phase, to become a nationwide system expected to include

approximately 350 land-based sites envisioned to provide receive capability out to 50 nautical miles and transmit capability out to 24 nautical miles.

"Again, the USCG will seek to utilise existing infrastructure to establish these AIS sites", said Cmdr Ingalsbe. The second phase is expected to be fully operational by the fourth quarter of fiscal year 2013.

While these phases are in progress, the US government intends to start work on the move towards extreme long range tracking with satellites to cover up to 2,000 nautical miles from shore. 2,000 nautical miles roughly equates to the 96 hour notice of arrival already in place, at a ship speed of 20 knots.

According to Lieutenant Commander George Ruwisch, technical director of the NAIS Project Office, the eventual aim is to procure these services through a satellite communications provider who will provide the AIS data as a 'subscription-type' service.

Initial Operational Capability (IOC) of the satellite AIS system is on track, and scheduled to be in place by the first quarter of 2010, moving to Full Operational Capability (FOC) by the fourth quarter of fiscal year 2013.

How it will work

The USCG has been studying the feasibility of receiving maritime automatic identification system signals from space since 2001.

William R Cairns, principal engineer for LRIT (long-range identification and tracking) with the USCG Office of Navigation Systems explained some of the theory behind the satellite system, originating with data from studies by the Coast Guard Research and Development Centre on how to improve AIS reception.

"Personnel conducted measurements on AIS shore-side reception to determine apparent coverage area," he told us. "At one

typical site, 50 per cent of the time, the maximum reception range was 140 nautical miles, and 10 per cent of the time the maximum reception range was 220 nautical miles."

"The distances recorded were only achieved intermittently, but that may be enough for security applications."

Having established some parameters for distance, the USCG then contracted with the Johns Hopkins University Applied Physics Lab in 2003 to determine if a low earth orbit (LEO) satellite might be capable of capturing these AIS transmissions.

"This study examined the feasibility of receiving and deciphering a large number of simultaneous signals, with due regard to satellite receiver saturation," said Mr Cairns.

"It showed that receiving automatic identification system signals at a satellite is feasible, and a significant number of signals could be received simultaneously, without loss of message content."

Satcom contracts

Having established that, at least theoretically, the system could be the basis for an effective security programme, the government contracted with satellite communications company ORBCOMM in May 2004 to develop and build the capability to receive, process and forward the AIS signals through a receiver on a communications satellite, and make it ready for testing.

The final proof that the system was a workable technology came with the December 16, 2006, launch by the US Department of Defence of its TACSAT-2 satellite, which was equipped with an AIS receiver.

ORBCOMM has reported that its own satellite with AIS capability is scheduled to be launched in the summer of this year, and that the company plans to include AIS-capable receivers in future satellites. ORBCOMM will also provide the ground services necessary to get the information back to where USCG wants it.

Political issues

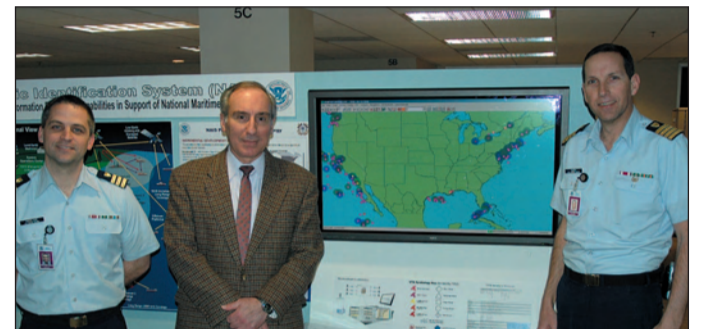
While the issue of tracking systems that extend such a long way as 2,000 miles from the coast, and stretch across other sovereign territories, has caused some political discomfort in the past, USCG believes that its set-up should not cause any such problems and may, in fact, be beneficial to other nations.

Mr Kardulias explained, "Our prime vendor for the satellite-based component of the system is ORBCOMM. They are taking care of the various legal permits for the launch and orbital route of the satellite."

"The Coast Guard already requires vessels arriving to a US port from a foreign port to provide a notice of arrival 96 hours prior to entrance into the US port. Foreign countries have been familiar with this requirement for several years, and the fact that AIS will confirm the arrival digitally via satellite in the future is not only beneficial to the US but an aid to other nations' maritime commerce as well."

USCG stresses the point that as it does not own the satellite nor control how it will operate, and will have access only to the AIS data received from its satellite provider.

"Our plan is to 'buy' the data stream,"



Planning to capture AIS signals via satellite - NAIS project members Commander Keith Ingalsbe, George Kardulias, and Captain Kurtis Guth

said LCDR Ruwisch. "The vendor [is free to] market the same data to other countries or governmental authorities for appropriate uses. The satellite collects messages, sends them to their ground station, and routes them to the USCG, where they are processed and stored."

Effectiveness

It remains to be seen as to whether AIS will prove to be an effective tool for maritime security. AIS equipment will only transmit what it is told to by the operator, and the evidence of any number of piracy incidents will tell you that those that are ill-intentioned may not be likely to transmit their details to their intended victims.

USCG hopes, however, that other users will act as a voluntary reporting system if they notice AIS irregularities at sea.

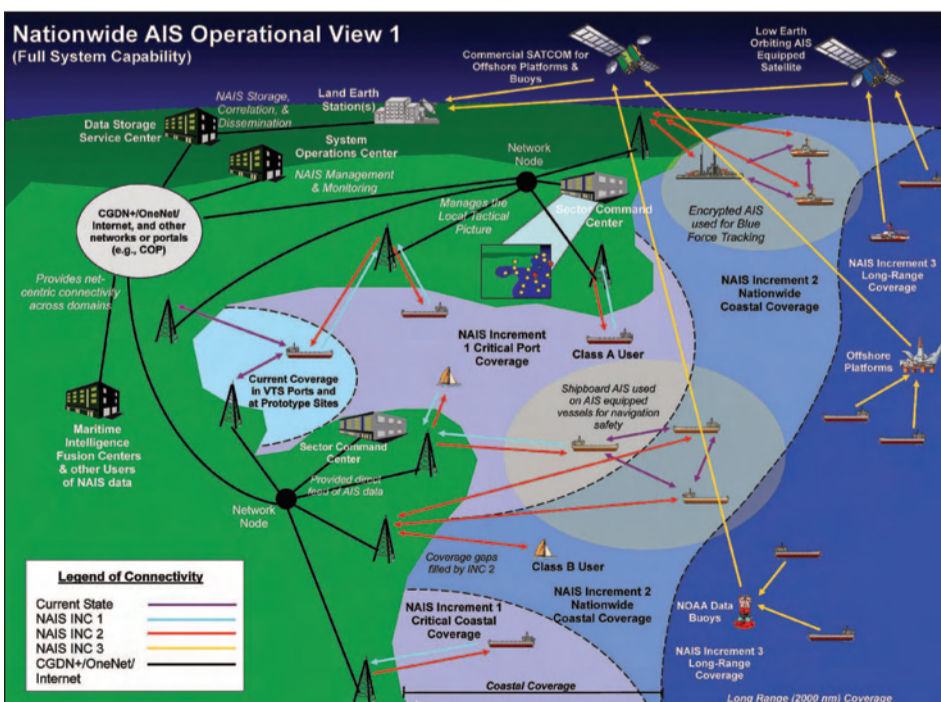
"Proper carriage and operation of AIS is both an international (through the SOLAS Convention) and US domestic requirement," said LCDR Ruwisch. "Despite this, vessel operators could disable their AIS unit or transmit incorrect information."

"However, these are things users would want to detect. For example, if a user sees a large ship on radar but there is no corresponding AIS position, that could be an indicator that may need investigating."

USCG also hopes that the fact of using a system which causes no extra inconvenience or cost to the ship operator, but could improve maritime security, will help to make it a development that is easily accepted by the industry.

"There is no negative impact to the ship owner other than the actual installation of the system," said Mr Kardulias. "They will have to pay for [their own AIS] hardware and installation."

"Their equipment (that they are mandated to carry by IMO) operates in accordance with an international standard (ITU-1371)," added LCDR Ruwisch, "[and the] satellite simply intercepts the signals they would be transmitting whether the satellite was there or not."



A USCG outline of how the satellite network will be expected to collect and forward AIS data