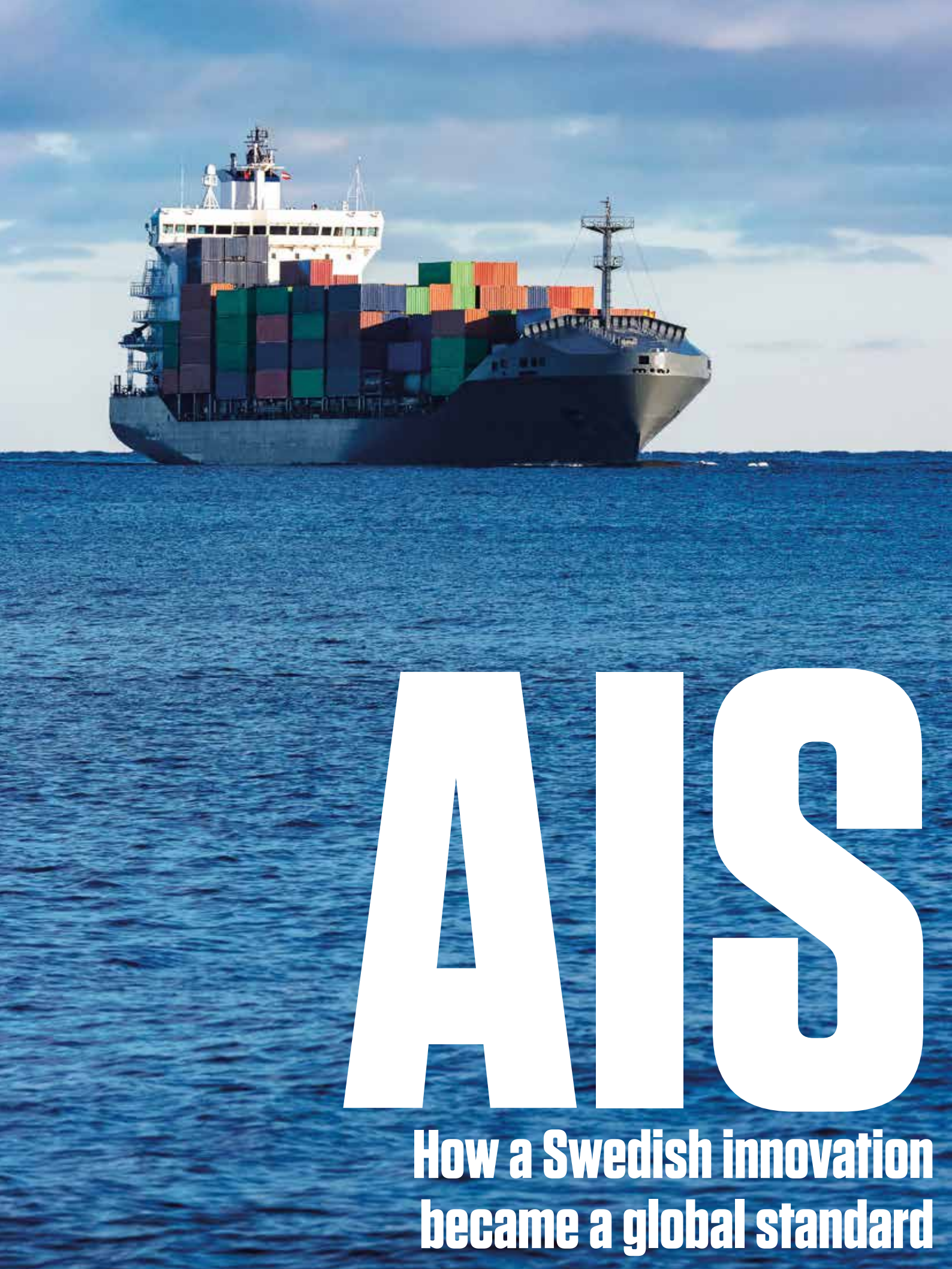


AIS

How a Swedish innovation became a global standard

Nobody wants to be without AIS today

The AIS (Automatic Identification System) monitors are centrally placed on Stena Danica's bridge. And that's the set-up on vessel bridges worldwide today. After a lengthy process and persistent work, a Swedish innovation became a new worldwide standard for improved safety at sea, thereby protecting people and the environment.

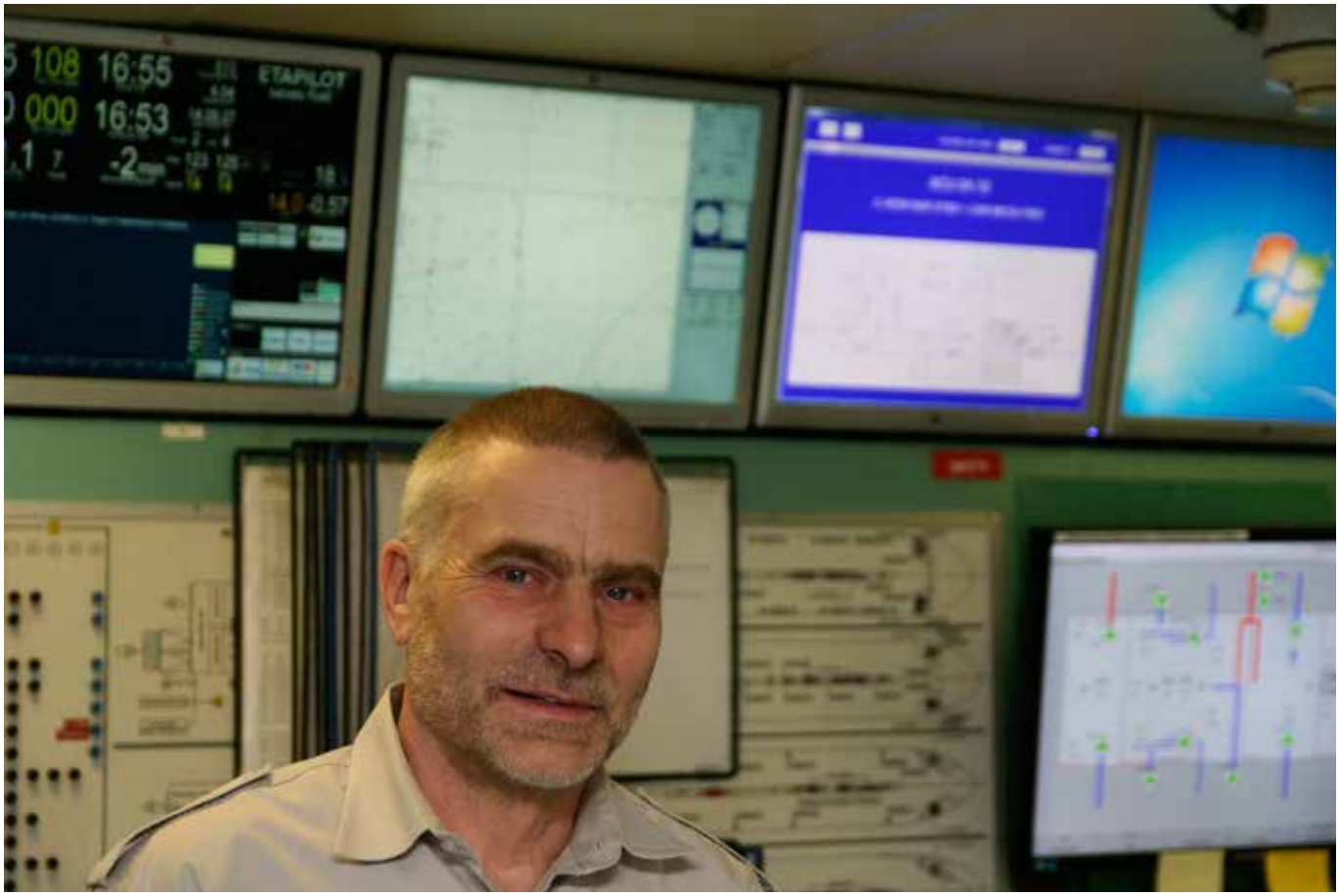
COPY **TOMMY GARDEBRING**

Wednesday at Stena's Denmark Terminal in Gothenburg; the time is approaching 09.00. Heavy trucks and cars have driven aboard and the vehicle deck is well stocked. Passengers are moving around the public spaces. On the ship's bridge and in the engine control room, preparations for the trip to Fredrikshamn are complete. Captain Bengt Viknander and Chief Officer Kristian Hansson step over to the port wing of the bridge to ensure maximum visibility when it's time to start the thrusters and depart from the quayside.

This is the routine; however, it must never become routine in a negative sense. Every trip requires complete attention. For economic and environmental reasons, the constant aim is to reduce fuel consumption. Consequently, when everything is ready, the vessel can leave the quay a few minutes ahead of schedule, subsequently reducing speed and trimming fuel consumption by one or a few per cent while still meeting the timetable.

Stena Danica slips into the Göta Älv river, pass- »

"AIS has meant a great deal for maritime safety," says Captain Bengt Viknander, shown here on Stena Danica's bridge.



Stefan Johansson, Second Engineer, can familiarize himself with traffic conditions now that the AIS information is also available in the engine control room.

ing the Eriksberg crane and the Älvsborg Bridge, sailing north of Rivö and Brännö towards Denmark. A route equivalent to the E45 on land.

Modern shipping demands maximum efficiency and safety even when vessels have been in service a long time. Built in 1983, Stena Danica has been upgraded several times and is expected to serve as an effective and appreciated vessel for years to come.

When she began operations, radar was used to track ships and other obstacles in the vicinity. And radar continues to offer similar benefits today. But AIS offers a complement that provides significantly more information about maritime traffic nearby and offers greater range than radar.

"An excellent aid," says Bengt Viknander.

Traffic is heavy on the Rivö Fjord this Wednesday. Some ships are at anchor for bunkering.

Visibility is good and we see them, but it is via the AIS data that we can identify the vessels, how they are heading and their destination. This is valuable information for planning our own route.

"We think this is good. Thanks to our situational awareness of vessel movements in the local access area, we can immediately understand why vessels suddenly change speed and/or course.

We immediately see the Copenhagen, which is destined for Gothenburg. What Bengt does not know is where Copenhagen plans to turn, which is important in determining how Stena Danica can run most efficiently while observing international maritime rules.

The data not available on the AIS display may now be gained by Bengt calling the Copenhagen via the VHF radio. This takes a few seconds and then the journey can continue smoothly. In the next stage, Sea Traffic Management (STM), which is being tested, offers the potential to identify the ship's route ahead, as all routes logged into the system are distributed via the AIS transponders.

Traffic in the area shows major seasonal variations. When the leisure craft season begins, a lot more activity will require tracking.

"It's difficult to know how good a view recreational sailors have, but considering that we move at 18 knots, I feel far too many leave very little margin," notes Bengt.

Many leisure craft are now equipped with AIS. Asked if there are perhaps too many AIS targets on the monitor, he replies:

"Not yet, but it could become so. The big benefit for us is that when we see a vessel sailing carelessly, we can identify its type."

"We think this is good. Thanks to our situational awareness of vessel movements in our local access

Stena Danica.

area, we can immediately understand why vessels suddenly change speed and/or course.

So, we are able to contact the particular vessel to point out the importance of having wide margins when navigating areas with heavy maritime traffic.

Onboard the Stena Danica, the AIS information is available in public areas for interested passengers, and in the engine control room. Stefan Johansson, Second Engineer, shows the monitor placed centrally among the other data units that indicate engine output and status.

"We think this is good. Thanks to our situational awareness of vessel movements in the local access area, we can immediately understand why vessels suddenly change speed and/or course."

The engineers are also responsible for meeting fuel-savings targets.

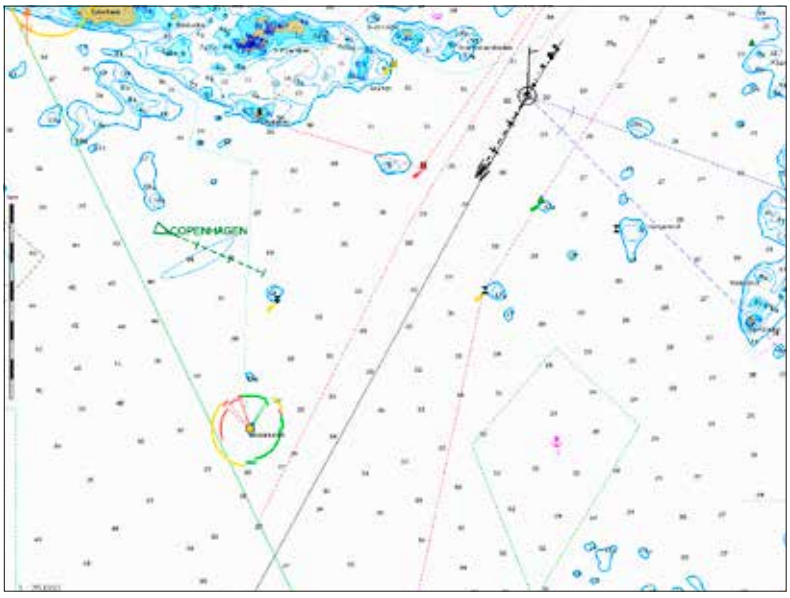
"We can always advise the bridge about adjustments to achieve fuel savings. The AIS information is useful to us in this respect."

Just over three hours have passed since we left Gothenburg.

Now it's time to dock at Fredrikshamn.

We noted that the AIS was used continuously; such information can prompt newly qualified mariners to ask the more experienced crew: How did you manage without AIS?

Of course they managed; radar was available. But nowadays no officers in charge of ship operations would wish to be without AIS.



Here we see Copenhagen on the AIS display. This information prompted Bengt Viknander to get more details, thus ensuring an optimal route plan.

His idea conquered the world

Benny Pettersson attended numerous meetings and conferences to gather support for AIS as a global standard. He's shown here at a conference in Tokyo.

Certain thoughts originated with seaman Pettersson onboard a ship amid a raging typhoon outside Kobe, Japan, in 1965. Today, these thoughts have led to a new global standard for maritime safety and reduced environmental impact.

COPY **TOMMY GARDEBRING**

Innovations that spur major improvements shape a process that requires collaboration and an exchange of ideas. But there are almost always people who get a decisive idea and push it more forcefully than others. These include Benny Pettersson who, through his know-how and commitment, pushed for technical solutions that have benefitted global shipping. Today, the AIS system is a self-evident tool for navigators on vessels worldwide.

Benny can't disguise that he is a Gotlander. Although the Gotlander aspect is now muted, it is nonetheless evident in his Stockholm apartment, with its views of both the Baltic Sea and Lake Mälaren. He mentions his upbringing in Klintehamn.

"I was born near the water. Already as a child I longed to go to sea when I saw ships pass by and wondered where they were heading."

After finishing his basic education, Benny joined the merchant navy. A few years later, a ship's master suggested he retrain as a sea captain.

"He said I was a bit of a bookworm, and there was obviously something in that. I needed to study for certain qualifications ahead of my training as a ship's captain...and after that things went smoothly."

But let's return to 1965 when Benny was a seaman and typhoon Jane hit Japan with winds of up to 70 m/s and his ship had to leave the harbour and anchor outside.

"It was a ferocious storm. We had unloaded, so we had no cargo. We lowered the booms and tied down everything that could be tied down. We were also forced to run with the engines on slow or half speed and dragging the anchors so we would not move too fast," he explains.

"It was impossible to see – by sight or by radar – if there were other ships nearby.

Everything was white. The weather was so fierce that the yellow paint on the newly painted masts blew off and all white surfaces got yellow polka dots.

Once the fierce winds died down, I realized that it was impossible to stay stationary in such conditions. Although we tried to maintain position, we drifted a nautical mile, and couldn't see where other ships were.

It was this situation that the idea of a system that permitted the sighting of other ships in the vicinity began to grow.

These thoughts stayed with Benny throughout his maritime career, both as an officer in the merchant marine and as captain on the Finland ferries

Benny Pettersson on Stena Danica's bridge 53 years after the Kobe typhoon. There, he can see that the idea hatched in 1965 has become a self-evident tool for global shipping.

and later as a pilot with the Swedish Maritime Administration.

The work has progressed gradually since then. A key step was with the introduction of Transit satellites, which utilized the Doppler effect on the signals for positioning. Benny explains:

"There were a few shipping companies that bought the satellite system for their vessels.

This was 1977 and you could get your position in this way every fourth or fifth hour... this was a step forward.

"By this time I was the chief officer on long-distance routes. When we rounded Africa's southern tip and set a north-west course, we had to have a margin of a few degrees margin to be on the safe side. There was a great risk of getting too close to the shallows off Guinea-Bissau. I wrote letters to my shipping company requesting access to the Transit system but it was obviously too costly for it."

Despite successful tests, convincing the shipping companies was a slow process.

Benny Pettersson:

"Owners of big luxury yachts showed greater interest in technology than shipping companies. The only explanation I can find is that shipping is – or at least has been – a conservative business."

However, stubborb people don't give up esily.

However, stubborn people don't easily give up, and Benny can today feel satisfied with the results of his efforts. The major breakthrough for the Swedish concept came in connection with the 9/11 terrorist attacks in 2001.

"Then resistance broke, and we won the support worldwide for the Swedish proposal for a system that would become mandatory for shipping worldwide. I even presented a lecture at the Pentagon. There were many of us at the Swedish Maritime Administration working on this; they included primarily Bo Tryggö, Håkan Lindley and Rolf Zetterberg.

Today's mariners take AIS for granted. But getting here has been an arduous journey. Benny's commitment and persistence were key driving forces for what is now seen as a self-evident tool.

"Owners of big luxury yachts showed greater interest in technology than merchant shipping. The only explanation I can find is that shipping is – or at least has been – a conservative business.

Ships in the area exchange information

AIS is an open communication system that allows all vessels within VHF radio range to exchange information with each other. The process is fully automated. Information from onboard sensors is compiled to form messages that are transmitted, with similar information being received from other vessels within range. When the ships move, new vessels enter the area and commence information exchange with surrounding vessels while others exit the area.

COPY **ROLF ZETTERBERG**

The main components of the AIS equipment are:

- A computer that captures data from the ship's position sensor (usually GPS) and gyrocompass. The computer creates messages for transmission and organizes the transmissions according to certain rules. The computer also manages the data in the messages received from other vessels and relays it to a presentation system.
- Antenna and radio equipment using a transmitter that normally switches between two frequencies, plus two receivers that receive messages on these frequencies. The two frequencies are used alternately to cut the risk of losing the connection due to disturbance, and to raise capacity. Radio frequencies are in short supply and are controlled by the UN agency ITU, which, for AIS, has reserved two radio channels with a 25 kHz-bandwidth within the maritime VHF band. For optimal use, radio technology and transmission speed have been selected to ensure sufficient capacity for the purpose, while also offering robust and secure communication.
- A GPS receiver (or receiver for some other satellite navigation system) that can work as backup for the ship's position sensor, but it also provides a very precise time. The accurate time means all AIS devices have synchronized clocks to divide each minute into 2,250 synchronized parts – or time slots – of 26.6 ms each, to which the transmissions are allocated.
- A presentation system where information is shown, usually graphically on a map display showing ship positions. Alternatively, it can be presented on a radar display. Current rules also allow the information to be presented in text form with ship name, bearing and distance from one's own vessel.

Crucial to the system's functioning is the method used to organize the transmissions when many ships use the same radio frequencies – with no central control. Each message contains (usually) information about when the vessel plans to transmit its next messages. Thus, each AIS unit creates a schedule of the time slots that are "not booked" by other vessels and then selects time slots for own messages, and notifies this in its dispatched messages. Detailed rules govern how transmissions are organized in special situations, for example on the start-up of an AIS unit, the need to quickly send new info or if no non-booked time slots exist. Such overload may occur, for example, in some cases during extreme weather conditions when radio range may expand considerably. In this case, many ships may come into range and the AIS equipment then chooses to transmit in the same time slot as a remote ship. Because the recipient vessel's receiver will pick up the strongest radio signal, this

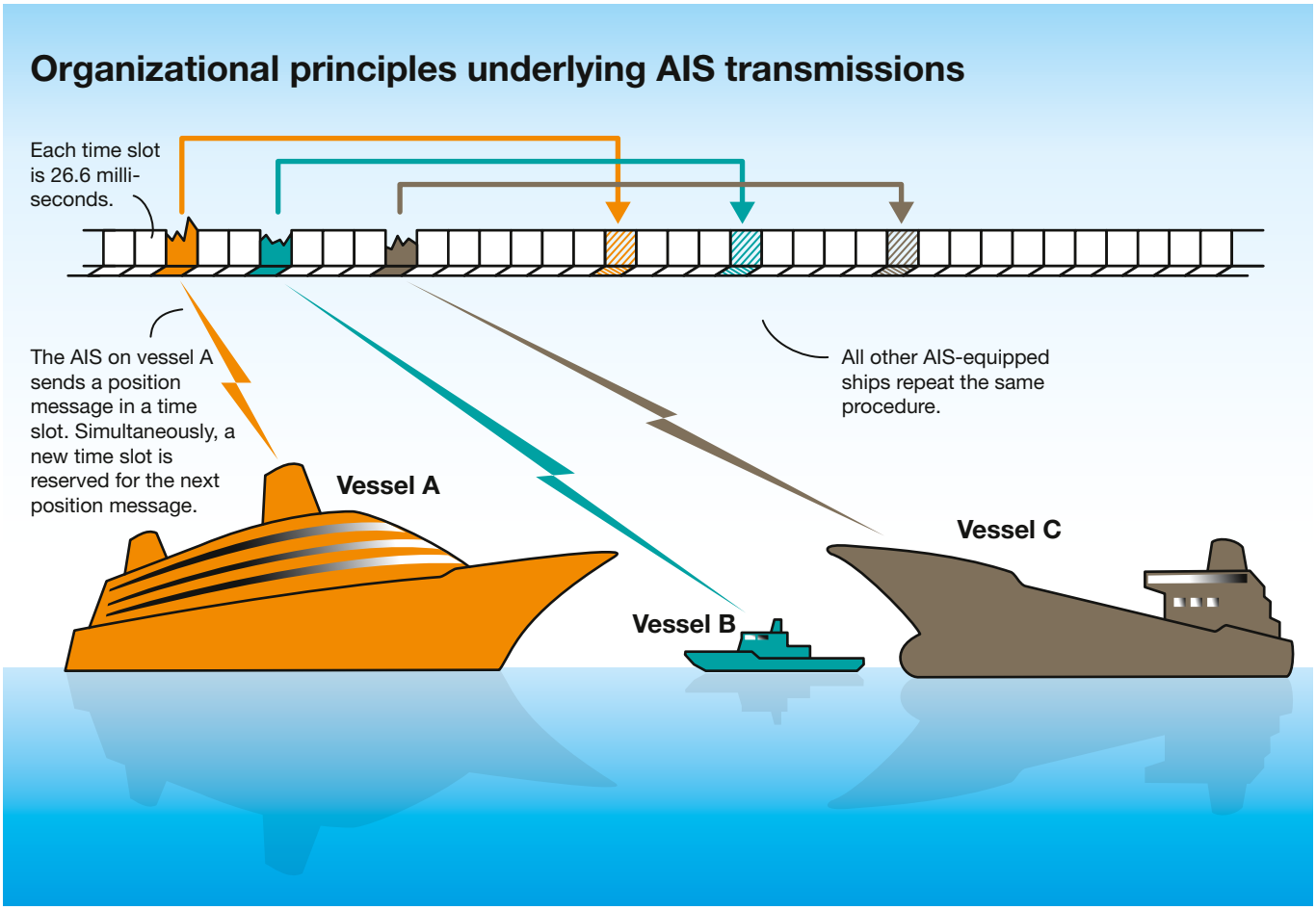


ILLUSTRATION: CLAES-GÖRAN ANDERSSON

means that even during system overloads, the data reaches the nearest vessels that most require the data, while those furthest away will not receive it.

The ships essentially send two types of messages whose content and transmission intervals are determined by the IMO Performance Standard for AIS:

- Dynamic information (position report), including position, course over ground, speed, heading, rate of turn and navigational status. These messages are sent with time intervals varying from two to twelve seconds, depending on the vessel's speed and rate of turn. A ship at anchor transmits every three minutes.
- Static and route-related information, including name, call signal, vessel dimensions and location of the position sensor, type of vessel and cargo, draught, destination and estimated ETA. These messages are sent every six minutes.

The MMSI number (Maritime Mobile Service Identity) is included in both messages to merge the static information with the accompanying position reports.

A position report is sent in a single time slot, and given the selected transfer speed of 9,600 bit/s, each time slot contains 256 data bits. Of these, 88 bits are required for the start-up and closedown of the transmitter, confirmation of reception, fault checking, organizational data for transmissions and so on. Thus, 168 bits remain for the message itself, so the data must be highly compressed, with unnecessary information stripped out. The receiving equipment unpacks and interprets the data to form legible messages.

Most countries have built up terrestrial AIS-station systems to receive and transmit data to vessels. The data received can cost-effectively supplement or replace information from radar systems for monitoring and traffic management.

Terrestrial transmissions can be made using a number of standardized messages for various purposes; for example, weather data, tidal information and fairway closed. A special message covers the use of other local radio channels for AIS. There the existing international K70 safety channel can be used to provide relevant information. The ship's AIS equipment includes a receiver for this channel, with automatic switching to local AIS frequencies according to special rules.

Terrestrial stations are usually linked via a terrestrial data network to a central server. Thus in Sweden, AIS information from all coastal areas and the Swedish Great Lakes is compiled at the Swedish Maritime Administration and made available to various stakeholders.

There is also an extensive international exchange of AIS information to provide an enhanced overview of maritime traffic.

The long voyage to success

The route from a recognized need for improved superior onboard information to a global standard that meets it was, of course, long and multi-staged. Here's a brief account of the process that led to the Automatic Identification System (AIS) becoming a universal equipment requirement.

COPY **ROLF ZETTERBERG**

Among those who saw the need for improved data on local maritime traffic was Benny Pettersson, a pilot at the Swedish Maritime Administration. Benny, who worked in the Stockholm pilotage area with its numerous long, narrow and winding fairways, came to play a key role in efforts to find a satisfactory solution. Since the mid-80s, Benny had pushed to test and develop various technical solutions with electronics manufacturers and engineers at the Administration. The results were positive but improvements were required.

Near the end of the '80s, prospects improved with the advent of GPS and superior processors. By this stage, the Administration's technology resources had been consolidated in a separate technical department, to which Benny presented his ideas for its manager, Bertil Arvidsson. Together, they convinced the Director General, Kaj Janérus, of the benefit of a system for information exchange among vessels. In 1990, the Administration decided to proceed with development, allocating SEK 2 million to this end in the years ahead.

A system called AVMS (Automatic Vessel Monitoring System) was tested on the Sweden- Finland ferries. As ship positions were to be embedded in the data exchanged, position indications were required that gave better accuracy than what GPS offered then. Thus, in a joint project between the Swedish and Finnish maritime administrations, transmission of corrections of GPS signals (DGPS)

Nowadays, it is a self-evident tool in global shipping. AIS continually provides information to support safe navigation.

was introduced in line with a standard being developed at the IALA – The International Association of Marine Aids to Navigation and Lighthouse Authorities.

As a result, Sweden and Finland became the first players worldwide to complete the implementation of a system to improve GPS positioning in shipping. In 1992, the AVMS equipment manufacturer ran into problems and the concept was sold to SAAB, which decided to target development for military applications, resulting in a suspension of trials

By this stage another interesting alternative had emerged. Inventor Håkan Lans had presented a transponder system called GP&C (Global Positioning and Communication) to the Swedish Civil Aviation Administration and the Swedish Space Corporation. The Swedish Maritime Administration's Technical Department was informed by the Swedish Space Corporation that the GP&C transponder was superior to the previously tested systems. Also, the aviation administration reported that its technology trials gave excellent results.

The Swedish Maritime Administration decided also to test the system, but now in collaboration with the Trollhättan Canal and the Lake Vänern administrations, to meet the major needs of the central management for canal traffic. The trials, which began in 1993, included only a few vessels but proved that the system worked well. Later

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that year, an agreement was signed between the Administration and Styrsöbolaget, which operates passenger ferries in Gothenburg's archipelago, on installing the system onboard its ferries and at the company's office. Ferries and offices were also equipped with a chart system to display vessel positions.

Subsequently, about ten ferries and the Administration's pilot boats in the area were equipped with the GP&C transponder. In the Administration's traffic management centre for the approach fairway to Gothenburg, the presentation system for radar information was modified by the supplier NorControl to also display data from the transponder system.

The installations in the Gothenburg area became a significant reference facility for the continued work, because now there was an international interest in transponder systems. A significant driving factor was several accidents involving tankers that caused major environmental damage. The question was raised in 1994 at the IMO, the UN agency for maritime affairs. (IMO decisions are subsequently implemented in legislation and regulations of the Member States.) The Swedish system was presented by, among others, Benny Pettersson and project manager Bo Tryggö. The system was now called the "4S" system, a reference to ship-to-ship, ship-to-shore applications.

After the meeting, the Administration concluded that the Swedish system was technically and functionally superior to other proposals and the most appropriate for fulfilling the requirements expected to be met by any new system for enhancing maritime safety. The Administration therefore decided to promote the adoption of the Swedish system by IMO as a carriage requirement for ships.

Efforts now commenced to create support for the system from other countries involved in various international organizations and who could influence decisions on transponder systems, primarily the IMO but also the ITU (International Telecommunication Union), IALA and various industry organizations. The system was presented at conferences and meetings worldwide by Benny Pettersson and Bo Tryggö, as well as by Rolf Bäckström from the Finnish Maritime Administration, who fully supported the Swedish proposal.

Work in the IMO continued during the following years, with the presentation of test results and proposals. Many documents were drafted through collaboration with foreign shipping authorities within the IALA, thereby boosting support for proposals presented to the IMO.

In 1997, the IMO decided on a requirement specification for a transponder system, referred to as AIS – Automatic Identification System. The requirement specification was based on the potential of the Swedish system, although a number of features were added as requested by other countries.

The IMO also decided to request the ITU to rapidly deploy two VHF channels for the system. Here too, preparations and lobbying were required to make the decision that the ITU made in 1997. Furthermore, the ITU was invited to develop a technical specification. The practical work on the specification was conducted within the IALA and several manufacturers offered alternative proposals.

These discussions gave rise to the issue of patents and, despite Håkan Lans accepting the ITU's Code of Practice for standardized patented systems, some countries strongly opposed the idea of making patented equipment mandatory onboard. Finally, Håkan Lans dropped the claim for compensation for the use of the patent on ships covered by the IMO's carriage requirements, thereby permitting a consensus to base the transponder system on the Swedish proposal. The ITU published the first version of the standard in 1998.

The IMO made a crucial decision in 2000 when the Safety of Life at Sea Convention was updated, including a requirement that all ships over 300 gross tonnage in international traffic should be equipped with AIS. Implementation proceeded progressively, starting with large tankers in July 1, 2002 and ending with local traffic vessels by July 1, 2008. After the terrorist attacks on September 11, 2001 the schedule was amended at the request of the US, which saw the importance of tighter maritime traffic monitoring for counterterrorism. The new completion date for implementation was 2004.

The process of developing test procedures was also initiated to ensure that recognized testing bodies could verify that AIS devices from various manufacturers met the requirements of the IMO and ITU and ensure compatibility. The work was done within the IEC, the International Electrotechnical Commission. Again suggestions were made for changes and completions of functionality. The Swedish Maritime Administration and SAAB Transpondertech, who now took over the product from the Swedish Space Corporation, participated in efforts to move it towards the desired result. A test standard was approved in 2002.

Since 1996, a lot of work has been completed by the IALA for the introduction of AIS. For Sweden's part, this mainly involved Benny Pettersson and Rolf Zetterberg from the Swedish Maritime Administration, as well as SAAB engineers. This work was transferred following the IMO's implementation decision, and involved the management and development of the technical specifications, as well as the drafting of recommendations and guidelines for the implementation and practical use of AIS.

New, special-purpose AIS versions have been added, and the IALA has organized the necessary skills to ensure functionality and compatibility with existing systems. AIS has now become a crucial component in the concept of electronic navigation (e-Navigation), developed by the IMO, with the technical issues largely managed within the IALA.

"AIS has now become a crucial component in the concept for navigation using electronic information.

AIS finds new routes

MOST INNOVATIONS emerge as a result of a specific problem. The full potential embedded in the new innovation is not always obvious.
A simple example: The original intention of the invention of the wheel may not have been its use for volume control on a car stereo. One thing leads to another … and then the ball starts rolling.

The digitization of charts offers ships the potential to share routes in real time and thus gain a shared and far superior situational awareness. As the information can now be shared with essentially all maritime actors, the basis has been laid for Sea Traffic Management, which provides almost unlimited opportunities for service functions, as well as for quality and safety enhancing measures for ships and other actors.

But STM is not the only new innovation sparked by AIS. During its 15 years of operation,
AIS has served as the base for the emergence of a full range of smart service features and skills, for example:

- **Statistics and flows:** As all traffic is captured by the coastal state's AIS base stations and logged in real-time, major opportunities are offered for monitoring flows, representing invaluable tools for planning marine resources or infrastructure, for example.
- **Satellit-AIS:** Provides a global image so that even the oceanic traffic patterns can be monitored.
- **Measuring ice thickness:** By means of AIS, icebreaker managers gain immediate situational awareness of ice formation.
- **SAR function:** Personal small portable AIS Man-Overboard Devices (PLB) are on sale. They are attached to the life vest and on contact with water, the name of the person is transmitted along with the position and time.
- **Pilotage from another location:** For example, from a pilot boat, either through ECDIS in a pilot boat or by virtual boarding of the vessels to be piloted.
- **Automatic certificate control:** With the certificates attached to the ship's AIS, the authorities can see in real time who is operating the ship, the work-time expended, or if the authorization is valid if a pilotage dispensation applies.

AIS: One of many innovations

The word innovation has occupied a place in human consciousness since the latter half of the 20th century. Sweden is viewed as a model country in innovations, especially so by state representatives.

COPY **ULF SVEDBERG**

In 1953, consumers could buy cream in the classic Tetra-design packaging, which later also became the obvious choice for milk products, and continues to be used for small packages.

Despite its relatively small population, Sweden enjoys a prominent international status as a country that consistently delivers epoch-making inventions and smart innovative ideas. Inventions by Swedish men and women have played a key role in building Swedish industrial expertise and prosperity.

Numerous examples represent this innovative spirit in various areas, such as: the Celsius scale, pacemakers, adjustable wrenches, Tetrapak, ultrasound scanning, zip fasteners, dynamite, Losec, sun valves, Johansson gauge blocks, Skype and Spotify. These are a few of the pioneering inventions that became major export successes and proved pivotal in creating a modern and prosperous Sweden.

AIS – Automatic Identification System – is one of the most decisive innovations for shipping, and for the aviation and transport sectors. In addition to GPS and radar, AIS has rapidly evolved to become one of the most useful technical tools in efforts to strengthen maritime and aviation safety systems. AIS technology has also quickly found many new application areas among other actors closely connected with transport infrastructure, logistics and systems solutions.

In the early 1900s, Gustav Dahlén blazed a trail for Swedish maritime innovations with his sun valve, whose significance for lighthouse operation won him a Nobel Prize. Racon (radar transponder) is another key invention developed by engineers at the Swedish Maritime Administration.

Developing a brilliant idea into something new and functional almost inevitably involves hard work, considerable patience, teamwork and great perseverance. Then add cost cover requirements, resistance from existing technology, legal implications, and the difficulties in convincing a globally traditional and conservative shipping sector. That the Swedish Maritime Administration managed to promote AIS to become a new global standard for shipping within just a few years is truly a success story.

A handful of visionary and devoted enthusiasts with lengthy maritime experience and expertise – combined with supportive leadership – were needed to create the right conditions for bringing an excellent sector-based concept to fruition and ensuring that it was taken to a high Technology Readiness Level (TRL).

Shipping is a particularly global form of traffic within which ships and ports with different conditions and workforces from all corners of the world cooperate to achieve maximum safety, while ensuring that the industry is environmentally safe and profitable. The global aspect also requires that local innovation projects be presented to and accepted in relevant international arenas such as the IMO, IALA, ITU, IEC and others. It involves considerable dedication and strenuous work in areas such as engineering, law, management and operational procedures for the original idea to be taken through certification and standardisation to become a functional part of the transport system.

In the international arena, most governments give priority to their own industry and local employment and act accordingly in managing new innovations. The political processes are seldom straight forward, and thus experience, routine and a little astuteness – especially regarding the minor, seemingly insignificant details – determine whether or not a nation can expect a return on its investment.

The Blockhusudden lighthouse (right) in Stockholm was Sweden's first lighthouse to be equipped with the sun valve (left). This was ingenious design that ensured that the gaslight went out automatically when the sun came up and lit up when darkness fell. The sun valve was installed in the lighthouse in 1912 and was a key factor in Gustav Dahlén winning the Nobel Prize in physics.

Swedish innovations include the Celsius scale for measuring temperature. Anders Celsius thought that 0 and 100 degrees were appropriate as the boiling and freezing points of water, respectively. It was, of course, a more practical solution offering greater precision that had a major impact throughout much of the world, with the scale adjusted so that 0 was the freezing point and 100 the boiling point, after his death in 1744.

Ideas and innovations in shipping frequently emerge in conjunction with an operational problem that must be solved by the personnel involved. The shipping container is an excellent example: this resulted from a young truck driver tiring of waiting in queue to discharge his load and got the idea of putting the load into a large metal box instead of unloading loose goods from the truck. The idea resulted in the truck returning faster for new assignments instead of standing in line.

When professionals are freely allowed to think outside the box, different aspects can be related to new features and lead to something new and innovative. Consequently, it is paramount that companies, authorities and policy approaches create the conditions for and maintain a soil in which innovative people thrive and ideas gain the opportunity to flourish and gain nutrition. Of course, major national innovation programmes, structured R&I portfolios, and real basic research at low TRL levels are necessary, but there is also room for development and innovation projects based on professional skills, craftsmanship, systems know-how and previous R&D achievements. It is the creative and innovative human aspirations that generate the inventive thinking, ideas, smart solutions and alternatives that need to be encouraged and gain scope in the planning and funding of research and innovation.

A willingness to change is not a natural trait. For survival purposes, man is sceptical of everything that is not proven, safe and recognisable. Daring to challenge established patterns carries a cost. Consequently, business executives and politicians must continually dare to move in the right direction, dare to unleash creative innovators and recognize the opportunities and not just the limitations of what is ahead. Sweden has a fantastic inventor tradition and we must continue on this trail by nurturing regrowth.

The remarkable impact of AIS technology has been truly global, despite the usual resistance to new untried ideas and the accompanying scepticism. AIS is a success story that enhances safety, simplifies maritime operations, protects the environment and saves lives. This brochure aims to reveal and highlight the extraordinary results that can be achieved when all the links fall perfectly into place in a long and frequently complex, innovation chain.

Ingenious technology, favourable financing, dedicated management, persistent negotiations, political lobbying and tireless staff spending many hours away from their homes and offices have given us AIS. More ideas are available for the future from experts active in public authorities, companies and academic institutions.

Development and renewal require commitment, creativity and ample time to ponder. We must keep the creative, innovative flame burning and not become too comfortable in our customary roles.

Footnote:
IMO = International Maritime Organization
ITU = International Telecommunication Union
IALA = The International Association of Marine Aids to Navigation and Lighthouse Authorities
IEC = The International Electrotechnical Commission
TRL = Technology Readiness Level
ECDIS = Electronic Chart and Information Display

The long voyage with AIS...

In this brochure we have provided an account of AIS from the initial idea in the 1960s, which, thanks to commitment and persistence, became a powerful tool for the benefit of shipping worldwide. AIS is a good example of the paramount importance of research and innovation work.

...and it continues here

Read more about AIS here:
Swedish Maritime Administration
www.sjofartsverket.se/sv/Snabblankar/soksida/?query=ais
IALA
www.iala-aism.org/product-category/publications (sök på AIS)
ITU
www.itu.int/rec/R-REC-M.1371-5-201402-I/en

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