

MAIB recommends watch alarms

In the wake of the grounding of cargo vessel Jambo in Scotland, June 2003, when the chief officer fell asleep, the UK's Maritime Accident Investigation Board is recommending that ships fit watch alarms

THE UK MARITIME Accident Investigation Board has published its report on the running aground of cargo vessel Jambo, on June 29, 2003 off the West Coast of Scotland, recommending that ships should fit alarms making sure the officers don't fall asleep.

As a result of this, the UK's Maritime and Coastguard Agency (MCA) will be taking recommendations to IMO for compulsory fitting of bridge watchkeeper alarms.

However it notes, "that these devices are an attempt to address the symptoms, rather than the causes of, fatigue in watchkeepers.

The bridge watchkeeper is required to reset a timer on the system at regular intervals, often around 10 minutes.

If the timer is not reset then an alarm sounds in the master's cabin and in the deck officer's accommodation, indicating that the watchkeeper may have fallen asleep, had a heart attack, been taken over by pirates or has forgotten to reset the alarm.

MAIB says that over six groundings a year occur in UK waters due to watchkeepers being incapacitated, for various reasons.

"The only way to establish without doubt that it is safe for the officer on the watch (OOW) to be the sole lookout, is to ensure that should he become incapacitated in any way, this fact is brought to the attention of the remaining deck officers without delay," says MAIB.



Chart showing the Jambo's intended and actual track (source MAIB)

"It is not sufficient to have the lookout 'on the end of a radio', when MAIB experience shows that one of the prime dangers is that of the OOW being unable to call the lookout because he is incapacitated by fatigue or some other reason."

"Therefore, if lookouts are not maintained on the bridge at all times, it is essential that such vessels are fitted with watch alarms."

Jambo was not equipped with any such alarm, although of the 8 vessels operated by Reederer Hesse, only Jambo and a sister vessel did not have such an alarm.

Background

The MV Jambo was Cypriot registered and German owned, carrying 3300 tonnes of zinc concentrate from Dublin, Ireland to Odda, Norway, and sank following the grounding.

It carried 7 crew, but all crew were safely evacuated by coastguard lifeboat. The

master was Croatian and he rest of the crew Polish.

The chief officer fell asleep while alone on the bridge and missed his intended change of course. He was woken by the impact of the vessel grounding.

The AB assigned to the watch was absent from the bridge for "at least an hour" before the vessel grounded, MAIB reports.

The master and chief officer were running 6 to 12 and 12 to 6 watches, which MAIB describes as being "tiring in any event."

The problem was compounded by regular port visits when the chief officer was required to work, regardless of how it fitted in with his sleep pattern.

The vessel's normal route was between Sweden, the Baltic ports and the North Sea ports, UK and Ireland, with passages of 1-3 days and 1-2 days in port.

Fatigue

In port, the master dealt with paperwork and officials; the chief officer was responsible for cargo operations. This work always disrupted the 6: 6 pattern.

The chief officer's routine was to come off watch at 6pm, have a daily meal, going to his cabin at 2030 for a few hours sleep.

He reported that he was unable to sleep on this day, although his cabin was quiet, his bunk comfortable and there was nothing specific on his mind.

The company's safety management instructions about fatigue state, "The officer in charge of the first watch when leaving port should be adequately rested prior to going on watch to ensure that a safe and efficient watch is maintained. This is necessary from a health, as well as a safety consideration.

The Master is expected to interpret this requirement in a reasonable manner and with the safety of the crew and ship firmly in mind. Masters must make suitable watch arrangements to ensure an adequate amount of

rest while maintaining a reasonable momentum of work."

Story in detail

According to MAIB, the chief officer was assigned to sleep 6am to 12 midday, work midday to 6pm, sleep 6pm to midnight and work midnight to 6am. However after his evening meal he had been unable to sleep 6pm to midnight.

The mate had been working for around 12 hours a day for at least the 10 days prior to the incident

While watchkeeping, the chief officer also worked on the bridge computer for a few minutes at a time, completing and printing voyage reports, conducting cargo stability calculations, and doing safety management system paperwork.

According to MAIB, "he thought much of the paperwork associated with the safe-

ty management system pointless and a waste of time. He found the printer to be slow and the monitor's screen difficult to read in daylight."

The master's normal practise was to require AB's to be additionally on the bridge from 10pm until 6am, also during periods of restricted visibility or when close to land. There were two AB night shifts, 10pm to 2am and 2am to 4pm.

At 2.20am, the AB on watch, who was a heavy smoker, asked if he could leave the bridge and have a smoke in the mess room during his hourly "rounds" of the ship, which also included checking the accommodation an engine room. The AB returned at 3am.

At 3.55am, the AB again asked the chief officer if he could go on his rounds. The chief officer agreed and asked the AB to bring him up a cup of Turkish coffee when he returned because he was starting to feel tired.

While waiting for his coffee the chief officer walked around the bridge to keep himself awake.

The AB completed his "rounds," had another cup of coffee and cigarette in the mess room, and then went to the ship's office to do some maintenance work as discussed with the chief officer at the beginning of the watch.

The chief officer fell asleep between 0405 and 0415, being awoken at 0515, standing at the engine controls, by the grounding.

The master was also woken and was on the bridge within 15 seconds. The chief officer was slowing and stopping the engine. The AB also returned to the bridge.

The master asked the crew to check the hold for water; the chief officer reported that the fore peak tank, bow thruster compartment and double bottom port ballast tank were all flooded, with about 2 metres of water in the forward end of the hold.

The master called the shipping company's "designated person" ashore and was unable to reach him, so he called the vessel's superintendent as designated backup. At 0600 he called Stornoway coastguard by VHF radio to report the situation. Te lifeboat arrived at 0721 and took off the crew. At 0955 the master reported that the vessel has sunk with her bow out of the water.

QinetiQ research

Although the rest patterns are allowable by IMO rules, MAIB contracted the QinetiQ centre for human sciences to study the chief officer's routines and hours of work and comment on his likely level of fatigue.

QinetiQ notes that the shift pattern of

working midnight to 6am, midday to 6pm, is the most difficult, because the person has to work at the period where he is most naturally tired (midnight to 6am).

Alertness and performance for anybody tend to be at their lowest 4am to 6am, it states.

The problems become more severe during the later stages of a long period of continuous work.

It also notes that 1800 to 2400 is "not a natural time for sleep." "The mate's inability to sleep during this period is not surprising," it says.



The vessel after running around (source MAIB)

QinetiQ notes that in general, it is better to minimise the number of consecutive night duties to minimise sleep deficit associated with successive daytime sleeps.

The mate had been working for around 12 hours a day for at least the 10 days prior to the incident. However most of the port work had been during the daytime. There was opportunity for a full night's sleep while the vessel was berthed in Glasgow, four nights before the incident.

The continual alternation between night work at sea and short periods in port with day work is "not an ideal work pattern," QinetiQ says.

"There is little time for the body to adapt to the new routine. It is important that some recovery from the night work can be provided in port so that the crew member can be reasonably well rested before setting sail."

"Balancing the potential consequences of fatigue, against the commercial consequences of a delayed departure, demands fine judgment," QinetiQ says.

"It is likely that masters will, probably more often than not, be more influenced by commercial than by safety considerations simply because the commercial impact is immediately apparent and the risks, by their nature, are only probable."

"The master's judgment would also be influenced by whether or not he considered that regulations had been complied with. It is not, therefore, surprising that the master made no provision to compensate for the disrupted rest experienced by the chief officer in Dublin and allowed him to return to the six-on six-off schedule that night."

MAIB's full report can be downloaded free of charge from <http://www.maib.dft.gov.uk/>

HUMAN FACTORS

Being a seafarer

Digital Ship interviewed a group of serving seafarers in Delhi and found that 77 per cent think being a seafarer is enjoyable; 57 per cent are happy to be seafarers; 75 per cent said they would like a shore job given the choice

DIGITAL SHIP INTERVIEWED a group of serving seafarers at a training center in Delhi to find out how much they enjoy their time at sea.

There were in all, 35 respondents, comprising 20 engineers and 15 deck officers. The respondents were the mariners enrolled in the STCW courses or preparing for the MMD examinations.

The best ways shipping companies could make the life of seafarers more interesting, they said was to let seafarers take their families with them onboard and provide a broader range of career growth opportunities

Negatives

Some of the respondents (less than 15%) mentioned that work conditions are not that enjoyable because of hierarchical and formal work conditions.

They mentioned that rigidity / lack of flexibility shown by the senior officers onboard created an unfriendly work atmosphere. The other reasons mentioned by them were stringent STCW 95 regulations, which have increased the workload of the sailing staff with reduction in work force.

But some respondents also cited that with new regulations coming up and

tries in terms of job profile, work requirements and remuneration.

They would prefer access to food of their preference and enjoy the freedom to walk along the streets and have days off.

85 per cent of seafarers said they would like to work for a shipping company or agency ashore.

Owned or managed

When asked how recognized they feel by their employers, there was a wide range of responses.

The responses were different due to the respondents working for ownership/management companies.

The respondents working under ship-ownership companies said that they perceived their career path as well-defined.

Small aspects, such as scheduled work-days / holidays in a ship-ownership company give them a better opportunity to plan / prioritise their time and inculcate the feeling of belongingness. Moreover, respondents felt that they are better recognised / identified this way with the one organisation they work for.

The respondents in the ownership companies said that company often took care of them on a personal level too.

“The best ways shipping companies can make the life of seafarers more interesting is to let them take families onboard and provide a broader range of career growth opportunities”

Being a seafarer

Out of 35 respondents 20 indicated that they liked being a seafarer including 8, who responded that they liked this profession very much.

5 respondents mentioned that they were indifferent to the nature of profession and took shipping as just another profession and a means to earn for a decent living. 2 persons indicated that they did not like being a seafarer.

In terms of determining the career choice, 18 respondents (51%) mentioned that they took to a life at sea because they considered it a good career choice. 11 respondents (31%) mentioned that they had always wanted to be seafarers.

Some of these respondents also mentioned that they looked up to someone in their family or social circle as role models that acted as sources of inspiration and motivation for motivating them for a career at sea.

There was a general consensus that work is enjoyable on board. Around 27 of the respondents (77%) indicated a score of 3 or above (on a 5 point scale, where 1 signified strong disagreement and 5 signified strong agreement for enjoyable work).

The main reasons given for the work being enjoyable were the varied job responsibilities, the challenging job profile, and travel.

shorter port stay of ships, the career of the seafarer does not offer the same incentives as earlier.

27 of the respondents (77%) cited working in shifts and erratic work hours coupled with missing social and family life as the major reasons for increasing stress and burnouts onboard a ship.

However, some of that this problem is considerably reduced with more number of UMS class ships or on the ships where liberal family-carrying rules are allowed.

Some of the other reasons for stress onboard were less human interactions while working onboard, an uncertain work environment and huge regulatory requirements to fulfill.

Going ashore

When it came to the shore job alternatives 75% of the respondents (27 in number) mentioned that if given an option they would prefer to settle out for a shore-based job.

Some of the respondents in the 26-30 age group mentioned that they are prioritising to clear their Chief/Masters ticket as early as possible hoping that would pave way for better / more shore job options.

Some reasons attributed for going ashore were being cut-off from the social world - family and friends. Also the job structure, though challenging, tends to be monotonous at times. Some felt there were better career options in shore-based indus-



how much do seafarers enjoy their work?

12 of the respondents (35%) mentioned that they were actively looking for options for a career change. They had plans of pursuing studies in ship management, MBA, working for the IT industry as some of the career options.

Most of these 12 respondents were in the officer ranks of 4th/3rd engineer and 3rd / 2nd officers.

A further 15 of the other respondents mentioned that if they were given an option to settle for a shore job, they would take it. But till now they have not thought seriously about it.

Around 60% of the people said that career path was not very well defined. There was a general opinion that after working for some years on the higher ranks, job responsibilities reach a plateau - a saturation level.

Some of the seafarers attributed working on contractual bases, hired by ship management companies, which place them on vessels of different ship-owners (each having a unique corporate culture) every time, as a primary reason for the above.

At the operational level in ship-management companies, lower ranks did not relate to the bond with the organisation very strongly, while at higher levels like that of Chief Officer, Master, 2nd Engineer and Chief Engineer the level of recognition was high because of the company actively monitoring and communicating with them on an individual basis.

Recommending seafaring

When it came to recommending being a seafarer to someone else, 25 of the respondents (70%) said that they would.

Reasons cited include using the seagoing experience as a platform for pursuing other better career options later.

They said that the job as a seafarer provides an excellent opportunity to earn quick money. Also the Experiences acquired onboard help a person to evolve into a responsible and enduring person. Working with people of different nationalities lead a seafarer to be much more adaptive person. There are a wide range of opportunities to travel to different places.

V.Ships and Securicor

V.Ships has announced a ship security "strategic alliance" with Securicor

IF YOU WANT to improve the security of your ships, are you best going to someone with Special Forces experience or someone who knows about industrial security?

V.Ships, the largest ship manager in the world, decided on the second course and has announced a ship security tie-up with Securicor, an international security company based in the UK.

The company appointed Securicor to assist with security after listening to about 12 sales pitches from security consultants, all ex-special forces. "A lot of what they offered was quite depressing," the company says.

Securicor has already established itself as a leader in port security, having conducted port security assessments in Hong Kong, China and Malaysia, currently bidding for work in Ireland. It has a number of US customers.

V.Ships and security

V.Ships was very keen to get involved in security as soon as it became obvious that the maritime industry would have to put together ship security plans.

The first IMO working committee on ship security met in Feb 2002, 5 months after 9-11. In August 2002, V.Ships had its first version of the ship security plans.

In October 2002, the company appointed its "Company Security Officer," and in June 2003 carried out its first security assessment. In August 2003, Lloyds Register gave approval of V.Ships' first ship security plan, the first plan it had ever seen.

In October 2003 V.Ships also began carrying out its in-house training for the ISPS code and in November 2003, issued its first ever ship security certificate.

However the company notes that it still had a head-start; the company had ship security plans even before 9-11.

"It takes about 3 months to sort out a ship security plan," says V.Ships' David McFarlane. "You have to put the plan onboard and get crew used to it, and then send it back to the office. "You have to get ship staff accustomed to doing stuff like search people."

"I would allow 26 weeks [altogether] to fully comply for one vessel."

Most of the ship security officers are chief officers or chief engineers, although V.Ships says that one of its shipowners is considering putting an extra officer onboard making the security requirement a full time job.

Screening

The most complex aspect of the ISPS code is the screening issues.

There is no point in building a high security fence if it isn't of the same height for its

entire length.

So it goes with shipping; if it is possible anywhere for a non-screened person to gain access to the port facility or a ship, then the entire process is violated.

Violating the security fence leads to serious implications. For example a ship which has visited a non-ISPS compliant port, out of its last 10 port calls, can be refused entry or searched prior to entry if it aims to enter an ISPS compliant port.

This will clearly be of big concern to brokers, which will need to be thoroughly aware of which ports are not ISPS compliant so they do not fix any ships to go to them; ports which are not ISPS compliant can expect to not receive any ships.

There is a "declaration of security" mechanism, where ships can declare to the authorities in advance that they have been to non-ISPS compliant ports and wait for the authorities to make a decision about whether or not to let the ship enter.

In ports, the ISPS code is defined as covering the "port facility," the area where the ship meets the land. Anybody in this area will need a certain level of screening, to make sure unauthorised persons do not gain access to the ship from the land.

The precise definition of a "port facility" is not clear, since many ports have, for example, residential areas right in the middle of them. But what is clear is that the port facility must be a restricted zone.

V.Ships has now adopted various levels of screening for its crew and other people who might come into contact with the vessel, such as tug operators. Securicor puts

its staff through 5 year and 10 year checks.

ISPS concerns

Despite the speed with which regulators issued the requirements, they are still getting behind when helping shipping companies implement them.

IMO has recently put out its own model courses for ship security officers, which, Mr McFarlane thinks, came out far too late.

"Many flag administrations still have to issue requirements," he says. "We work with 23 flag states; I have only seen the requirements for 15 of them."

There are also confusing variations in the flag state requirements, which will be particularly annoying for ship managers or owners working with more than one flag.

"We have been putting the IMO number on the bridge front," he says. "One flag administration says they want the number on the side of the ship so that it can be seen by other ships and aircraft."

V.Ships is concerned about the attitudes of security inspectors; it is very hard to be absolutely certain that an inspector will not have a reason to detain a ship, for example is a floodlight bulb goes.

Martin Stafford, of V.Ships Consulting, has concerns about the competence of some "recognised security organisations," appointed by flag states to determine whether or not ships should be provided with ship security certificates.

He believes there can be real value to the ISPS code, but the fast timescale reduces the exercise to compliance for the sake of compliance.

Colin Atkins, project manager with Securicor, notes that the ISPS code is a risk management exercise, similar to exercises done in all kinds of other industries for many years.

However he calls for more consistency around the world in the different requirements under the code, which will make

more sense of the scalability of it, as both shipping companies and ports are expected to be able to move easily between levels 1 2 and 3.

Consulting

V.Ships has a subsidiary company, Seatec, which is providing security consulting services, in association with Securicor. Seatec has been providing safety and training services for over 12 years.

In the security arena, the services Seatec can provide include preparation of the plan, security assessment, security officer training.

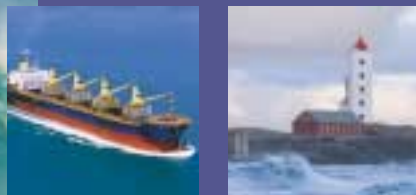
Seatec can also provide what it terms a "ship security pack," which includes hardware a ship can use for ISPS compliance, including CCTV cameras, signs, a visitors log, visitor passes, door seals, a guide to the ISPS code.

The kit is priced at \$1,000 to \$10,000 depending on the requirements; for \$1,000 you can have a kit with dummy CCTV cameras, for \$10,000 the cameras actually work.

Seatec also provides advice as to small design changes which can be made on ships which improve security, in particular installing access control systems (doors which stop intruders gaining access to the ship) and closed circuit television; also improved lighting and blast protection (eg curtains which protect windows from shattering all over rooms if there is an explosion outside).

"Why don't we create some kind of barrier at the top of the accommodation ladder," notes Mr Stafford. "Its very simple - it will only cost a few thousand dollars. Very few shipbuilders consider this."

"We can have a controlled entrance, linked back to the cargo control room; we can put a door there and improve the position of locks. I don't know if we can stop a determined terrorist but we can make it more difficult."



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HUMAN FACTORS

Tim's piracy piece

Deckhead

THE SEASON OF GOODWILL that we have just enjoyed appears not to extend to the pirate community.

The International Maritime Bureau's (IMB) piracy report for Christmas Eve includes this incident:

"At 0357 LT at 3.5 miles south of fairway buoy, Cotonou anchorage, Benin.

Five pirates armed with guns and knives boarded a bulk carrier and took watchman and c/e as hostage. They raided master's cabin and stole ship's cash, master's cash and personal belongings and two passports.

"When crew mustered pirates fired warning shots and escaped in a waiting boat. 2/o and bosun sustained gun injuries in their legs and they were sent to hospital. Master reported that almost every day pirates attempted to board."

The IMB Piracy Reporting Centre lists numerous areas as piracy prone: Bangladesh (Chittagong and Mongla), India (Chennai, Cochin), Indonesia (Anambas Island, Balikpapan, Bintan Island, Dumai, Gaspar Straits, Pulau Laut, Samarinda, Jakarta, Malacca Straits), Philippines (Manila), Vietnam (Haiphong, Vung Tau), Gulf of Aden, Somalian Waters, Bonny River,

Conakry, Dakar, Dar Es Salaam, Lagos, Tema, Warri. Brazil (Belem), Colombia (Buena Ventura), Dominican Republic (Rio Haina), Guyana (Georgetown), Jamaica (Kingston), Peru (Callao), Venezuela (Puerto Cabello).

Of these, the area of biggest activity is Indonesia with the total number of piracy attacks higher than the next three worst affected countries (Bangladesh, India and Nigeria) combined.

The IMB reports 344 actual or attempted acts of piracy in Jan-Sep 2003, up from 271 in the equivalent period in 2002. The long-term trend is more difficult to judge but looks to be rising.

The number of piracy incidents every year 1999 to 2002 were 300, 469, 335 and 370. There were 344 incidents in January to September of 2003 alone.

These statistics understate the scale of the problem significantly since they only record reported incidents.

Some masters and shipowners do not report piracy, wishing to avoid delays due to red tape and protracted investigations or increased insurance premiums.

The World Maritime Piracy Report estimated the number of unreported attacks in 1999 to be 130.

Defining piracy

The definition of piracy, which defines it as a crime committed on the high seas, also leads to the problem being underestimated; many incidents occur in coastal waters and do not fall within the definition.

It seems likely that the total number of incidents may be two or three times high-

er than the number reported by the IMB.

Researchers group incidents of piracy into three categories: small, large and hijack.

In small-scale incidents, pirates rob the crew or raid the vessel's safe and then leave. Attacks of this type usually take place whilst the vessel is at anchor or in port.

Larger scale incidents typically include thefts from the vessel, its crew and cargo. Cargo that is easily disposed of is usually targeted, such as timber, metals and minerals. Ships' equipment and spare parts are also taken.

The largest incidents of all involve the wholesale hijacking of the vessel and its cargo. The pirates re-paint, re-name, re-flag and re-register the ship and offer its services to a shipper before sailing to an undisclosed destination where they illegally sell and unload the cargo.

Chris Austen, of Maritime and Underwater Security Consultants, has extensive experience of dealing with piracy.

"Small-scale incidents are often carried out by men in desperate poverty. In countries ravaged by war in West Africa, for example, men with no work and no money turn to crime. For those in coastal villages, piracy is an obvious option," he says.

These pirates will steal anything from cash to the shoes and clothing of the crew. "West African pirates are prepared to go 50 miles out to sea in sea-going canoes" says Mr Austen. "Even the theft of a pair of branded trainers will make it worth their while."

In contrast to this sort of petty (but nonetheless highly dangerous) crime is the highly organised theft of vessels and their cargoes.

"These operations are highly sophisticated," says Jayant Abhyankar, deputy director of the IMB.

"Often the ship will be seized initially by a team of mercenaries. Once it is secured and the existing crew removed, a second crew will be brought aboard to sail the ship".

This type of operation is clearly the work of highly organised criminal gangs with a complex international network and support structure.

Hijacking

A hijacking typically involves a mother ship from which to launch the attacks, a supply of automatic weapons, false identity papers for the crew and vessel, fake cargo documents, and a broker network to sell the stolen goods illegally.

"Individual pirates don't have these resources. Hijackings are the work of organized crime rings," says Pottengal Mukundan, director of the IMB.

In some cases, these gangs have colluded with the authorities. In the past, Chi-

nese customs and navy were often been accused of working hand in glove with pirates (although Beijing has now cracked down on piracy), while local politicians in West Africa have used piracy to boost campaign coffers.

There are growing concerns that piracy might become a weapon of terrorist groups.

In an article in the Financial Times of 19th October 2003, Mansoor Ijaz cited the boarding of a chemical tanker, the Dewi Madrim, as a possible example of terrorists training themselves in the navigation



caption

and control of the vessel.

This conjures up images of tankers being used as floating bombs, capable of causing destruction on a massive scale.

According to the IMB's Jayant Abhyankar, the reality was more prosaic. "The motive of the attack was straight forward robbery and theft. Items stolen were US\$9,055 cash, binoculars, camera, communication equipment and 14 cartons of Marlboro cigarettes.

"There is nothing whatsoever to suggest that the pirates were trying to learn to steer at varying speeds. The Master's report in fact suggests that pirates knew how to navigate and handle the engines".

Abhyankar concedes though that the threat of terrorism is always present in any mode of transport and that the potential risk should not be underestimated. Austen agrees.

"During the search of terrorist sites in Afghanistan videotapes of Malaysian counter piracy operations were found. This suggests that terrorists are looking at piracy."

Technology

The development of new, cheaper communication and navigation technology has helped the pirates.

"20 years ago, pirates would have needed a fully-trained radio officer for communications," says Chris Austen.

"Now they can buy cheap long-range

radios, radar and GPS devices from a marine chandler. All this makes navigating to and coordinating the interception of the target vessel much easier for the criminal".

Technology can help the fight back too. A good example is the vessel tracking and alert system ShipLoc. The device consists of a GPS receiver, an Argos transmitter and back-up batteries that can last for several days, making the device independent of ship's power.

In its normal mode, ShipLoc tracks the ship continuously, allowing the owner to view its current location through a web browser. The software also allows the owner to monitor the ship's movements over a period of time.

Crisis mode is initiated by activating the onboard panic button, and reports are immediately sent to the Ship owner, the IMB and the competent authority. The alarm can be activated discreetly at two different locations onboard and the device is small, easy to conceal and therefore dif-

icult to deactivate.

The IMB is also advocating the use of Secure-Ship, an electric fence that surrounds the whole ship and uses a 9,000-volt pulse to deter boarding attempts. When touched, the fence gives the boarder a non-lethal electric shock and sounds the alarm.

Mr Austen suggests other technology-based solutions.

"There are often gaps in a vessel's radar arc that pirates can exploit, particularly looking astern. Plugging these with radar suitable for picking up small craft is very useful," he says.

Technology can also be used to make the crew's quarters and bridge a safe citadel. Austen suggests securing the accommodation block against attack by the use of a swipe-card access system. This can be used to determine which areas of the ship crew members can access and can be centrally controlled from the bridge.

He believes that low-tech measures can work too. Lights shining outwards from the hull can illuminate an area 50m around the vessel. This makes the detection of an impending attack easier and can also disorientate the pirates.

However Mr Austen thinks the best answer lies in training. "The cheapest and most effective counter to piracy is training and awareness among the crew", he says. "But getting owners to agree to it is the hardest thing to do."