

# A sound safety idea

## health and safety



John Abell, left, senior lecturer at Warsash Maritime Centre, describes the development of a new system to ensure the safe evacuation of passenger ships

**SADLY** it often takes a major emergency to hasten ruling bodies to improve safety standards. The tragic, well-documented fire aboard the passenger ro-ro “Scandinavian Star” en route from Oslo to Fredrikshavn in April 1990 was no exception in April 1990.

An arsonist set two fires in the early hours of the morning. The second fire killed 156 passengers and 2 crewmembers. Bodies were found below deck piled up in alleyways close to emergency exits, in cabins and even in the showers.

Part of the investigation concentrated on why passengers died even though some were so close to the exits with many survivors claiming it was impossible to see the emergency exits in corridors when they were full of smoke.

In an attempt to understand what went so tragically wrong, the Norwegian Fire Research Laboratory performed a series of evacuation trials on a reconstructed section of the *Scandinavian Star*. Using existing emergency signs it was found that 40 per cent of their test subjects could not find the emergency exit. They either passed it or tried to get out through the wrong door with some turning round on the way out!

The Norwegian report stated in part of its recommendations that:

*‘the traditional system for directing passengers during evacuation is by visual signposting. If there is a lot of smoke, however, sight is considerably reduced, and even brightly lit signs can be invisible at a distance of one metre. Since hearing is not affected by smoke, the visual signs should be supplemented by **audible signals**, for example by sound signals placed near the exit doors of escape routes. The sound signals would have to be audible above the noise of the alarm bells, and would need to be activated at the same time as the fire alarm.’*



*Smoke gets in your eyes: an observer checks evacuation times as a volunteer takes part in the directional sound evacuation trials aboard a Caledonian MacBrayne ferry*

The report also added:

*“In the corridors, as in aircraft, there should be illuminated stripes along their floor or at ankle height along the walls showing the direction to the nearest escape route.....”*

The latter was incorporated into SOLAS regulations on 1st October 1994. Despite this new requirement as an aid for passengers escaping from smoke filled areas, it was ineffective during a fire on the passenger ship *Nieuw Amsterdam* on 23<sup>rd</sup> May 2000 whilst cruising in Glacier Bay, Alaska. An electric hot water kettle caught fire in a crew cabin and a premature effort to extinguish the fire by officers lacking proper gear and backup, contributed in allowing smoke to migrate up eight decks into crew and passenger accommodation.

In spite of instructions to proceed to their muster stations, one passenger returned from the restaurant to his cabin on B-deck, two decks above the fire, to retrieve lifejackets, medications, valuables and warm clothing. By the time the passenger re-entered the corridor, it had become filled with smoke. Crouching to move along the corridor, the passenger became disorientated and was eventually found by a crewmember and taken to safety. The ship’s electro luminescent low-location lighting system was in operation.

During practice drills, using cosmetic smoke, it has been noted that photo luminescent strip indicators can become ineffective. Open public

spaces, which do not constitute routes of escape, are required to be fitted with emergency lighting only, which can become obscured by smoke.

During the International Maritime Organisation's Fire Prevention sub-committee meeting in January 2001, Sound Alert demonstrated their directional sound evacuation system (DSE beacons) developed by Professor Deborah Withington from Leeds University.

There was considerable interest from many of the delegates. The beacons emit a pulse of broadband noise that can be instantly pinpointed. Imagine sitting in a room, eyes closed, waiting for something to happen. As soon as a beacon sounds at the back of the room its location can be immediately identified. As the demonstrator, beacon in hand, walks to the front there is no question that you can sense exactly where the sound is coming from.

Behavioural studies have shown repeatedly that one of the most natural instincts, in the event of a fire, is for people to evacuate a structure by the way in which it was entered. This is rarely the quickest or most appropriate route with many failing to spot nearby exits. Visual signs have been proved to be not as effective as first thought and passengers seldom acquaint themselves with escape routes.

Trials on directional sound evacuation (DSE) were conducted on board two Caledonian MacBrayne ferries in order to determine its effectiveness. These were observed by Strathclyde University and the Maritime & Coastguard Agency (MCA).

The results showed that DSE offered at least an equivalent level of safety to that afforded by existing requirements and the Maritime & Coastguard Agency duly submitted a paper to the 46<sup>th</sup> session of the Fire Protection sub-committee. There was general agreement that the document presented an interesting technology but one of the concerns raised was whether the directional sound beacons might not be heard above, or distinguished from, the background sounds likely to be experienced in an evacuation situation.

In conjunction with Sound Alert and the Fire Fighting School at Warsash Maritime Centre, Southampton trials were conducted using beacons on their own and later with the general alarm sounding to establish how well and at what distance communications could be passed and received by a crew member wearing breathing apparatus and a flash-hood.

Additional tests were designed to determine

whether the same crew member, under the same conditions, could locate the direction of the beacons sounding. A series of realistic phrases was read out in turn and transmitted by radio between the crew member experiencing the directional sounds and general alarm and another crew member outside of the space in a quiet environment.

After 230 tests at 8,4,2 and 1 metres from the beacon the messages passed and received were nearly 100% correct.

Following these trials, the DSE technology was presented to the IMO's Maritime Safety Committee in May 2002, supported by German and UK Administrations - where it was well received. Indeed the large passenger ship working group noted the following conclusions amongst others, from their presentation:

*– "That directional sound has been tested in very noisy environments, such as a quarry with large earth moving vehicles, where tests showed it could be detected easily as much as 17dBA below the ambient (broadband) background sounds*

*– That the system is envisaged to be manually triggered by the crew in response to a situation where evacuation is considered to be necessary*

*- That it has been demonstrated in comparative trials that directional sound is at least as effective as LLL and its use in an emergency not being diminished or obscured by smoke.*

*The group was of the view that directional sound technology was an interesting and innovative concept and that the IMO's Fire Prevention sub-committee correspondence group should further consider the proposal for application to passenger ships in general."*

The FP correspondence group is expected to debate the detailed implementation guidance for this new technology as an equivalent within SOLAS to Low Location Lighting – with changes to SOLAS in mind.

In the meantime, with the new SOLAS Chapter II-2 revisions coming into effect from July 2002, there is now the possibility to use this technology using a safety case under regulation 17 (Alternative Arrangements) and the MSC Working Group members encouraged this idea as a way to gain experience.

DSE is expected to provide a significant saving in installation and maintenance costs compared to the active LLL systems being deployed today and in trials has been shown to be very effective as a major aid to safety during evacuation in an emergency.