

Smoke gets in your eyes

Sound offers an alternative to visual evacuation aids



Prof Deborah Withington from Leeds University, the inventor of the Localizer beacons

FIRES can rapidly get out of hand and have the potential to be fatal – particularly in the confined passageways of a ship where it is often the smoke, not the fire, that kills. Most casualties die from smoke inhalation which firstly blinds those trapped in its path, making it impossible to see the emergency exits, before choking and suffocating them.

Visual signs have been proved to be not as effective as first thought, with passengers wandering aimlessly in dense smoke. Sound Alert plans to make this a thing of the past with its new evacuation alarms to combine the obvious advantages that visual signs give with new advances in sound alarms, to provide a system that works effectively in any conditions.

Modern ships and ferries are complex structures whose very design and layout can hinder speedy evacuation. Passageways can be hard enough to navigate in an emergency evacuation but add an unfamiliar emergency route to the situation and the difficulties are compounded. When smoke is added, it escalates the problem rapidly, with it being more difficult or impossible to see.

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.

However, this is rarely the quickest or most appropriate route, with many people failing to spot nearby exits and in some cases walk past visible fire exits. This results in circulation routes used for normal, everyday movement becoming overcrowded, slowing down the evacuation process.

A lot to learn

When a fire raged through the *Scandinavian Star* in April 1990, 158 died, including 29 children. Bodies were found below deck piled up in the corridors close to emergency exits, in cabins and even in the showers.

Part of the investigation concentrated on why people died even though some were so close to emergency exits, with many survivors claiming it was impossible to see the emergency exits in the 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, and some turned round on the way out.

In their summary the Norwegian researchers stated “We do know that emergency lighting and marking signs do not help to distribute people among the evacuation routes available.”

Sound answer

Scientists from Leeds University in the UK, in conjunction with a Leeds-based company Sound Alert, believe

they may have an answer to the problem by using sound to guide people, removing their total reliance on visual signs.

Although primarily visual animals, we are also extremely good at pinpointing sound.

The sound must, however, be broadband (ie multi-frequency) to ensure our ears and brain compute sound direction accurately, says Prof Deborah Withington, the inventor from Leeds University, who has in conjunction with Sound Alert, researched and developed the sound beacons.

“The beacons emit a pulse of broadband noise that we can pinpoint instantly,” she says.

“The pulse rate of successive beacons gets faster and faster as the final exit is approached – additionally, rising or falling melodic complexes directing up or down, can instruct on the direction of travel at a stairwell,” explains Withington.

The noise emitted by the beacons is white noise – the same noise as waves make, but Mike Lunch, managing director of Sound Alert Technology has assured *Solutions* that “the sound

can be customised to include an “alerting tone” which would sound more like an alarm, but with loud and very noticeable bursts of white noise as well [which are] critical for localisation.” He jokes that “this would be a very interesting area to investigate to make sure we got the ‘right sound’ – not sending passengers to sleep with the soothing sound of waves!”

Solutions’ editor was able to verify its effectiveness when subjected to the problem of evacuation from a smoke filled test building using the system. The first time he experienced it he had some reluctance to rely totally on the system.

However, the second time the system was used, he ignored anything he could see – which was very little – and evacuated the building through another route, just following the alarms, in a time which surprised even those monitoring the test.

Rigorous tests

In January, the beacons were put through rigorous tests with 20 volunteers on board a ferry in dry dock. Different routes were used to take them to two cabins in the centre corridor of an accommodation section comprising three parallel corridors.

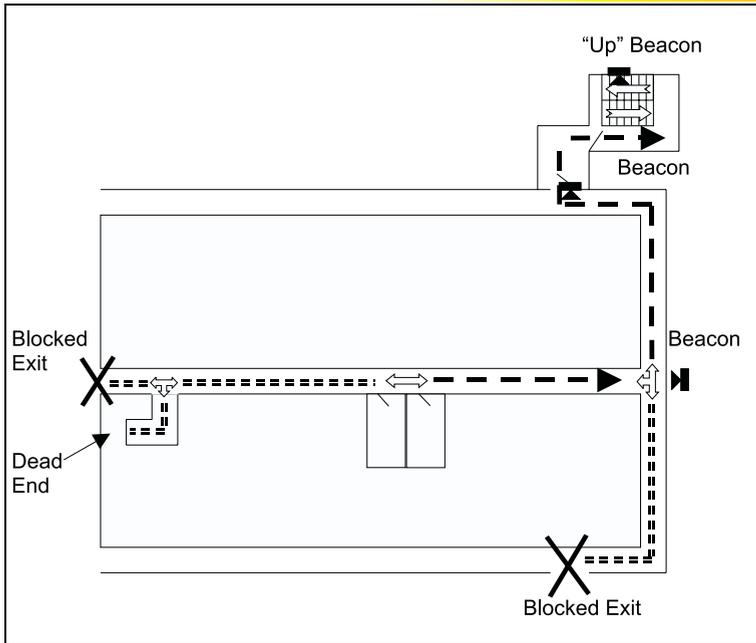
The vessel’s normal lighting remained on throughout the experiment and both groups were told that there was going to be one safe route that they could follow to escape from the smoke that would shortly fill the corridors.

Some of the potential exit routes would be “non-viable” (ie blocked) due to the location of the simulated fire.

After the corridors were filled with smoke the first group was let out of their cabin in pairs, at five-second intervals. As would be expected, about half went each way – left and right.

Those who turned left found a blind alley and a blocked exit and had to retrace their steps – something that could be potentially fatal in a real fire. Those that went right reached a T-junction and once more had to choose left or right.

Again, about half turned each way – those turning right found a blocked exit and had to retrace their route. Eventually, because it was theatrical as



Layout out of the exits when the system was tested onboard a ferry in January

opposed to real smoke, all got out.

More smoke was laid down in the corridor before the second part of the experiment began. The Localizer sound beacons were then activated. The remaining group in the cabin were briefed that the beacons were located on the exit route and then released in the same way as before, ie pairs at five-second intervals.

All turned immediately right and then immediately left at the T-junction and were out in about one third of the time it had taken the first group. No one went the wrong way.

Beacons lead the way

There was considerable excitement amongst the volunteers afterwards, with volunteers who did not have the beacons to guide them expressing how disorientating and confusing their experience had been.

Conversely, those who had used the Localizer beacons made comments like, "I couldn't believe how clear and obvious the sound beacons were – I had

no doubt which way to go."

The trials showed the potential for the Localizer beacons in the worst-case scenario of a smoke-filled environment.

It is, however, believed that even without smoke the beacons would identify clearly exits that may be ignored during non-smoke evacuations. For example, drawing people's attention to the nearest exit, which may be out of a direct line of sight.

After experiencing just how effective this system is, *Solutions* believes that this system is a major aid to safety and should be adopted by all passenger carrying ships at the earliest opportunity.

Sound Alert Technology was formed in January 2000 to acquire the property rights to the Localizer from the Leeds University start-up company and plans to raise £2.2M in a float on OFEX that will value the company at £10M.

This will allow the company to license the system for manufacture. *S*

Smoke can mask evacuation signs making it difficult to find an emergency exit without Localizer beacons

