'White noise' can help save stricken firefighters

DCFO SIMON SMITH, Suffolk Fire Service, and Chair of CACFOA's National Breathing Apparatus Group, and Professor DEBORAH WITHINGTON, Leeds University, report on a new development in Automatic Distress Signal Units

For some time, CACFOA's National Breathing Apparatus Group (NBAG) has been concerned at the effectiveness of the existing Automatic Distress Signal Units (ADSU).

The existing ADSUs, which have been changed very little over the last 20 years, have a crucial deficiency for such a potentially life-saving piece of equipment.

Current models emit a single tone, high frequency signal of approximately 3kHz. These sounds are by no means ideal in terms of perceived urgency and, more importantly, are impossible to localise. This problem could mean the loss of vital seconds for firefighters seeking to locate a colleague under emergency conditions.

In response to this concern, CACFOA and the Home Office initiated an investigation into the potential for an increase in performance that would enhance the localisation performance of ADSUs. The investigation was carried out by a team of researchers from the University of Leeds in conjunction with Sound Alert Ltd, and was headed by Professor Deborah Withington.

The aim of the field trials was to investigate the increase in localisation performance that an ADSU with broadband noise, plus the traditional alerting signal, would have over the existing units that are currently in use by fire services. Initial data had proven that an ADSU with broadband noise offers more localisation and detection acuity. However, it was not known whether such a performance enhancement would be noticeable in the field.

Therefore, field trials of both a modified and an existing ADSU were carried out at the specialised facilities of the West Yorkshire Fire Service Training Centre at Birkenshaw.

In order to evaluate the two different ADSUs, many different search scenarios were enacted using various types of protective headgear, flame hoods and BA. Additionally, in order to overcome any experimental bias, three subjects were used who had different levels of familiarity with the building used for the search trials.

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Within the grounds of the Training Centre there is a multi-purpose fire training building comprising three storeys (ground, first and second floors). A survey representation of this building would depict a spatial layout that is highly labyrinthine. Additionally, the external elevation projections of this building give no idea as to what the internal layout may be.

For the trials, three subjects were used: two experienced firefighters and one non-operational subject.

Subject 1 had some spatial knowledge of the building but his knowledge of the internal layout was more relational as opposed to detailed. Subject 2, on the other hand, had complete spatial knowledge of the building. Subject 3 had no prior knowledge of the interior layout of the building.

The subject was set the task of finding each ADSU, which was placed on any one of the three floors of the building. To simulate 'real' conditions, the building was plunged into total darkness, all subjects having to rely on their spatial knowledge of the building, the torch beams and most importantly the sound patterns emitted from each ADSU. At no time did any of the subjects know where the ADSUs were located.

The experiment proceeded as follows. Using the building plans, the location of the Sound Alert Localiser ADSU (SAL) and a traditional ADSU were decided using two separate criteria. Firstly, each ADSU was placed roughly equidistant from the entrance. Secondly, the route progression from the entrance to the ADSUs activated had to be similar, ie, the same number of doors to get to them, similar number of turns.

The subjects were then timed on finding the activated ADSU and returning to the outside of the building. The trial was repeated several times so that an accurate picture could be gained as to the performance of the SAL over the current ADSU.

To test each ADSU fully, a series of criteria were established and subsequently evaluated:

- Seek times for ADSUs. This was the primary aim of these field trials, to find out how long it would take to find each ADSU.
- Seek times for ADSUs with different headgear. It was thought that the many different types of headgear that can be used by firefighters would adversely influence the localisation ability of both ADSU types.
- Seek times for ADSUs with full breathing apparatus. Given the amount of noise associated with breathing apparatus (with the additional limited field of view), it was thought that there would be a comparable difference in seek times with and without its use.
- Seek times for multiple, simultaneously activated ADSUs. In this series of trials, two distress signal units were activated simultaneously. There always exists the possibility that two or more firefighters may 'go down' in a fire situation and that the detectability of both ADSUs would be fundamental for their survival.

In all trials, the SAL unit was located significantly faster than the old ADSU – up to 4.625 times faster.

Familiarity with the building layout had little overall causative effect on determining the location of either sounding distress signal units. Although subjects with a lesser spatial knowledge of the building did take longer to find an ADSU, their performance in finding the SAL ADSU was still significantly faster than the old ADSU.

Different types of helmet made no difference to the overall seek times.

The presence of breathing apparatus did make a significant difference to the overall detection times of both the SAL and old units (taking up to 1.44 times longer with BA). However, the SAL units could be found up to 2.44 times faster than the old units.

We are convinced that this research proves beyond doubt that it will be possible to achieve a significant reduction in the time taken to find a stricken firefighter. The retention of a traditional alert sound, overlaid with bursts of broadband noise, maintains the crucial element of familiarity, so adjustment to the new sound should not be a major obstacle for fire personnel.

However, there are still a number of issues which must be resolved before manufacturers are in a position to supply ADSUs which incorporate the new sound on a commercial basis. The Home Office specification JCDD/38, currently undergoing a major review, must be amended to permit the specification of a localisable sound feature. The Home Office has agreed to the inclusion of a suitable amendment in the revision. The revised JCDD is due for publication early in 2000.

We are confident that this work can be taken forward within a comparatively short space of time and that we will be able to report significant progress in the development of a commercially available product in the first half of this year. ■