

Multi-faceted CBRN training

Bringing together different methods of detection poses significant training difficulties. Steven Pike outlines an electronic solution that provides a common technical simulation architecture.

For some time now groups responsible for the detection and identification of chemical warfare or toxic industrial substances have relied upon one or more instruments as a means of detection in order to confirm the classification or identification of a substance that they suspect may be present.

Training individuals in this art presents a number of challenges, essentially because the simulants that might be used to influence detectors to obtain a reading are of course effectively interferences and a substance that may cause interference on one particular technology will not necessarily cause interference on an alternative technology.

This means that the optimum way to teach the benefits of different types of detection technology involves the use of not only simulants but also chemical warfare agents. While ultimately it does make sense to involve live agents under strictly controlled conditions for training and it is accepted that this does take place, there are nonetheless difficulties implementing this kind of training, especially within a civil or urban environment.

The following describes an electronic solution that has been developed with a view to overcoming these difficulties and adding some additional useful features to assist instructors in their training role.

The Scenario

Let us presume that our user group has two fairly well-known detectors that are fielded in large numbers, the Smiths detection CAM and the Proengin AP2C. Readers will perhaps be familiar with the fact that the CAM uses IMS (ion mobility spectrometry) whereas the AP2C uses flame photometry as its analytical mechanism. The fundamental difference between the two technologies is that the CAM analyses the time of flight of molecules against a known reference in order to identify the class of substance present, whilst the AP2C looks for the presence of phosphorous in the G mode and sulphur in the H mode by analysing a colour change in a hydrogen flame.

There are a number of military and non-military government agencies who today use each of these two well-known detectors in order to identify the classification of a suspected substance. It is understood however that whilst these detectors, when used together, result in a very high degree of certainty in relation to the class of



substance, it is not possible to actually identify the substance without further analysis. More recently an instrument which has been used in order to provide confirmation and indeed identify the substances detected by either the CAM or the AP2C is the Inficon Hapsite, which is a man portable gas chromatograph mass spectrometer.

.....Special Focus: CBRN

In order to simulate a scenario whereby we can represent chemical warfare agents of a specific type, interference substances which are likely to result in false positives, each of which can then be identified utilising a mass spectrometer, we require a common technical simulation architecture that has the ability to influence simulation variants of each of the aforementioned instruments accordingly.

Simulation Sources

A simulation source technology has been developed that utilises an encrypted ultrasound signal to represent specific substances. The source may be pre-programmed by the instructor prior to deployment to represent the desired substance, for example; false positives, toxic industrial substance or a chemical warfare agent. The simulation ultrasound source has a variable emission that can be digitally controlled, resulting in nine different preset emission levels. The emission range of the simulation source is 30 metres at its maximum setting. A number of sources may be deployed as is deemed appropriate, either using the same or different codes to enable a larger area, representing a common substance to be simulated or different substances within the same area. These simulation sources can be used in the open or within buildings, and the sources can also be placed within vehicles, cargo or suspect packages.

An interesting example scenario is to place a couple of sources within the mock casing of fallen missile debris, such that one of the sources placed in the fuel area represents an interferent whilst another source placed in the warhead area might represent a payload. Another typical application might be deployment of sources representing various false positives around an airfield or a civil facility such as a conference centre or underground railway network in order to teach profiling. Introduction of an additional source representing a CW agent or TIC could simulate an incident.

Electromagnetic simulation sources have also been developed that can be hidden within clothing of operatives or casualties in order to teach personal contamination detection.

Simulation Detectors

The CAMSIM simulator is configured to simulate the appropriate version of CAM (CAM1, CAM2, CAMPLUS ETC); the simulator has a simulation confidence tester and is used by the trainee in exactly the same manner that they would use the genuine detector.

The trainee has to prepare the CAMSIM simulator for use in exactly the same manner they would prepare the real CAM for use. The simulator includes the capability to monitor the doctrine associated with the preparation of and use of the CAM and reports any mistakes at a later stage to both instructor and student.

The AP2C simulator is again prepared by the student in the same manner as they would prepare the real detector. The simulated start-up procedure includes ensuring that the simulated flame starts and that the detector prepares itself for its detection role. Once again the student has a simulation confidence tester and the simulator has the ability to monitor and report any incorrect student actions.

The Hapsite simulator is not a substitution instrument but a simulation probe which replaces the real probe provided with the Hapsite. The instructor replaces the original probe with the simulation probe and configures the simulation look-up tables within the Hapsite for the planned exercise prior to handing the combined simula-



tion probe and Hapsite to the student. Once again all student actions are recorded by the simulator for later review by both student and instructor. A particularly nice benefit resulting from the use of the simulation probe with the Hapsite is that consumable items such as NEG pump, carrier gas and standard are reduced by 66% resulting in cost savings to the operators. A further significant benefit is that it is impossible to damage the GC within the Hapsite as a result of inappropriately trying to sample liquids directly into the end of the simulator probe.

Initialising the scenario

The simulation system is extremely flexible and permits the instructor to in theory simulate any substance they should wish. The instructor therefore has to initially plan the substances to be simulated, determine the source codes that will represent each substance and pre-program the simulators such that they know how to interpret each of the source codes, for example; class of agent, identity of substance or not to indicate any substance at all because the real detector would not respond to that particular substance.

The Hapsite simulator requires a little more preparation. When the simulation probe is attached to the Hap-

.....Special Focus: CBRN

site, it recognises the simulation probe and runs a simulation variant of the main Hapsite software. The advantage with this approach is that as and when the Hapsite operational software is enhanced the simulator will automatically keep track with this. The hazardous material coding system can represent up to sixty-six different substances. The Hapsite simulation software has a table against which substances and codes can be allocated. For mass spectrometer only training the instructor merely has to enter in the substance type, however for gas chromatograph training, the instructor needs to ensure that a pre-recorded real chromatograph exists for the substance concerned. Inficon do provide the simulation software package with a number of standard chromatograms for a fairly wide range of chemical warfare agents and toxic industrial substances.

The Training Session

When ready our students can commence their exercise response in the same manner as they would for real. This might for example, comprise of an initial team entering an area with the CAMSIM and AP2C simulator and upon their discovery of something requiring further investigation the Hapsite simulator operator being called up, or alternatively should circumstances dictate that the probability something of interest being discovered is high, then the primary detection team involving the CAMSIM and AP2C simulator may well be accompanied with the Hapsite operator in the first instance.

Let us presume that at the first location our team visit the instructor has configured a simulation source to represent a substance that provides an interferent to CAM in the H mode, such as methylsalicyllate. Upon arrival into the area the CAMSIM operator will obtain an appropriate reading of concentration in H mode, whereas the operator with AP2C simulator will not obtain any reading at all. If the Hapsite simulator were then introduced in MS only mode, the display would identify that the substance present was methylsalicyllate. Should the Hapsite simulator operator choose a GC run could then be initiated and after approximately fifteen minutes (the time it takes for a real GC run to occur) a chromatogram would be displayed providing further information relating to the substance detected.

The instructor may well have configured a second location, such that a substance with a phosphorous content is simulated. In this instance the CAMSIM operator would not obtain any reading, however the AP2C simulator operator would receive a reading indicating a possible G agent. Once again employment of the Hapsite simulator would result in specific identification of the substance and information enabling confirmation that the detected substance was not a nerve agent.

A further source deployed in another location could however be configured to specifically represent the CW agent sarin. This time as we would expect, both the CAMSIM and AP2C simulator provide indications in the G mode. The Hapsite simulator when used in MS mode

will provide an initial indication of sarin and a subsequent GC run would confirm with a sarin chromatogram being presented.

After-Action Review and Error Reporting

Each of the simulators described includes a very powerful facility permitting the instructor to monitor the actions and any mistakes that were made by the students during the exercise. The advantage of this approach is that it ensures consistent instruction, avoids any difficulties arising from disagreements in the use or doctrine of specific instruments, and in particular avoids any contention arising from so-called experts of particular instruments, who have their own views as to how the detectors should be operated. A further benefit in the error reporting is that it does also enable students to train on their own with the comfort that the error reporting will provide them with a form of independent assessment of their actions.

The Future

The concept outlined involves implementation utilising simulators the CAM, AP2C and Hapsite. The technology is currently being implemented to produce simulators for the Bruker RAID1 and RAIDM, the SAIC SCAD, Environics Chem Pro 100, Smiths Detection LCD series lightweight chemical detector and GID-M (variant of the UK Ministry of Defence M-CAD).

The simulation technology and coding techniques employed will be consistent throughout, thus enabling a consistent scenario and appropriate detector response to be maintained.

The political ramifications associated with alleged or actual use of CW agents or aggressive use of a toxic industrial substance are now so high, that any uncertainty at all with respect to the nature of any substance that may have been deployed, is totally unacceptable. This has resulted in both military and non-military agencies reviewing their detection capability and enhancing it where appropriate, either by replacing existing or implementing additional detection technology.

The challenges associated with providing realistic training are merely exacerbated with the inclusion of additional detection technology and not to mention the tendency for detector manufacturers to continuously improve their detectors such that they are less likely to respond to false positives and no doubt in the future, move towards a truly hand portable mass spectrometer type instrument.

It is hoped that a more comprehensive approach to training, such as that which is presented here, will assist in ensuring that operatives are as well prepared and trained as is possible in the use of their suite of detection equipment for whatever scenario they may eventually be presented with. ■

Steven Pike is the founder of Argon Electronics; a world leader in hazardous material simulation. He holds a number of patents relating to the simulation of hazardous material. All Trade Marks acknowledged.

ARGON ELECTRONICS

World Leaders in CBRN and Hazmat simulation



**TO FIELD A
CAPABILITY...**



CAMSIM - Simulation of Nerve, Blister, Blood and Choking agent for use outdoors and in confined spaces. Powerful error reporting ensures high quality consistent training. Compatible with AP2C SIM, TIMs-SIM, RAID1-SIM, RAIDM-SIM, CP100-SIM and others.

GID-3 SIM / ACADASIM - simulates chemical alarms on individual or groups of detectors using a powerful simulation cloud feature. Real time trainee error reporting keeps you in complete control of your exercise.



**YOU MUST TRAIN
AS YOU FIGHT**



HAPSIM-P - compatibility with all of our chemical simulators means you can teach Hapsite use to identify vapours as agents or false positives. NEG pump, carrier and standard gas use are reduced resulting in significant cost savings whilst training.

RADSIM - gamma survey simulators allow you to teach search and survey techniques using non ionising sources. Specialist weapon accident training systems can be developed as required.



D-SIM - safe powders and liquids simulate various types of contamination and cross-contamination such as depleted uranium residue and water. As with all our simulators, the technology can be adapted to simulate other detectors.



FREE CBRN Training Equipment Guide - Our CD Rom video is packed with examples of how you can use our simulators to enhance your NBC, CBRN and Hazmat training. Contact us today for your free copy.

For further information, please contact us:

Unit 16, Ribocoon Way, Luton, Bedfordshire, LU4 9UR, UK
Tel: +44 (0) 1582-491616, Fax: +44 (0) 1582-492780
E-Mail: sales@argonelectronics.com Web: www.argonelectronics.com