Using sniffer bees for bulk screening of cargo

Ivan Hoo, chief executive officer, Inscentinel, Harpenden, UK

REST technology with dogs

In the UK, freight forward companies screen 100 percent of all of their parcels. The first line of screening relies on X-rays followed by REST dogs for special items which cannot be screened. REST, stands for Remote Explosives Scent Tracing. This works by sampling the air from the cargo through a specially designed filter. This filter, which can trap explosives molecules, is then presented to the most accurate explosives detector ever – dogs. This method has proven very effective to exploit the accuracy of dogs while maximizing the throughput volume of screening, which a free-running dog cannot otherwise do. According to the information found on the website of Diagnose, a subsidiary of ICTS:

'The technique has screened over 100,000 trucks and pallets and over 1.5 million metric tons of air cargo since live operations began in the UK and France. The RASCargO™ technique was specially developed to serve the mass screening cargo market that requires a solution for screening high volumes of dense cargo, with actually, no cargo size limitation, a solution that combines high detection rate with cost effectiveness.'

This method is, of course, not limited only to explosives but many other kinds of applications. The prevention of smuggling contraband, drugs and food quality control can all potentially utilize this technology. However, maintenance of dogs is high and would require a logistic setup beyond the reach of many smaller-scale operations. In addition, REST dogs have to be specially trained; it is said that it is tougher to train a REST dog than a search dog.

If we want to promote the use of REST, an alternative to dogs needs to be found. The potential sensor would need to answer the following points:

- As accurate and sensitive as dogs
- Easier to use and to maintain than dogs
- Cheaper than dogs

Replacing the dog: here comes the sniffer bee

Accuracy and sensitivity

Research into honeybees (*Apis melifera*) started in the 1960s. The researchers were interested mainly in understanding the foraging behaviour of honeybees. These tiny creatures were shown to learn almost any odour and have subsequently inspired numerous researchers to explore the practical application of sniffer bees. In early 2004, Defence Advanced Research Projects Agency (DARPA) funded a project to use the honeybees for explosives detection. They discovered that honeybees can detect TNT at a parts-per-trillion (ppt) level. Our in-house research shows that the sniffer bees can detect down to at least 78ppt of 2,4–DNT. That is as sensitive as or better than dogs.

Operational easiness

The bee sensor system was developed with the help of the Homeoffice (UK) in 2008. It begins with the capturing of honeybees, automatically loading them into bee holders, training them with explosives' scents and finally using them in a handheld detector, the Vasor136. This automation means that no special trainer or handler is required and anyone with minimal training can operate the entire system.

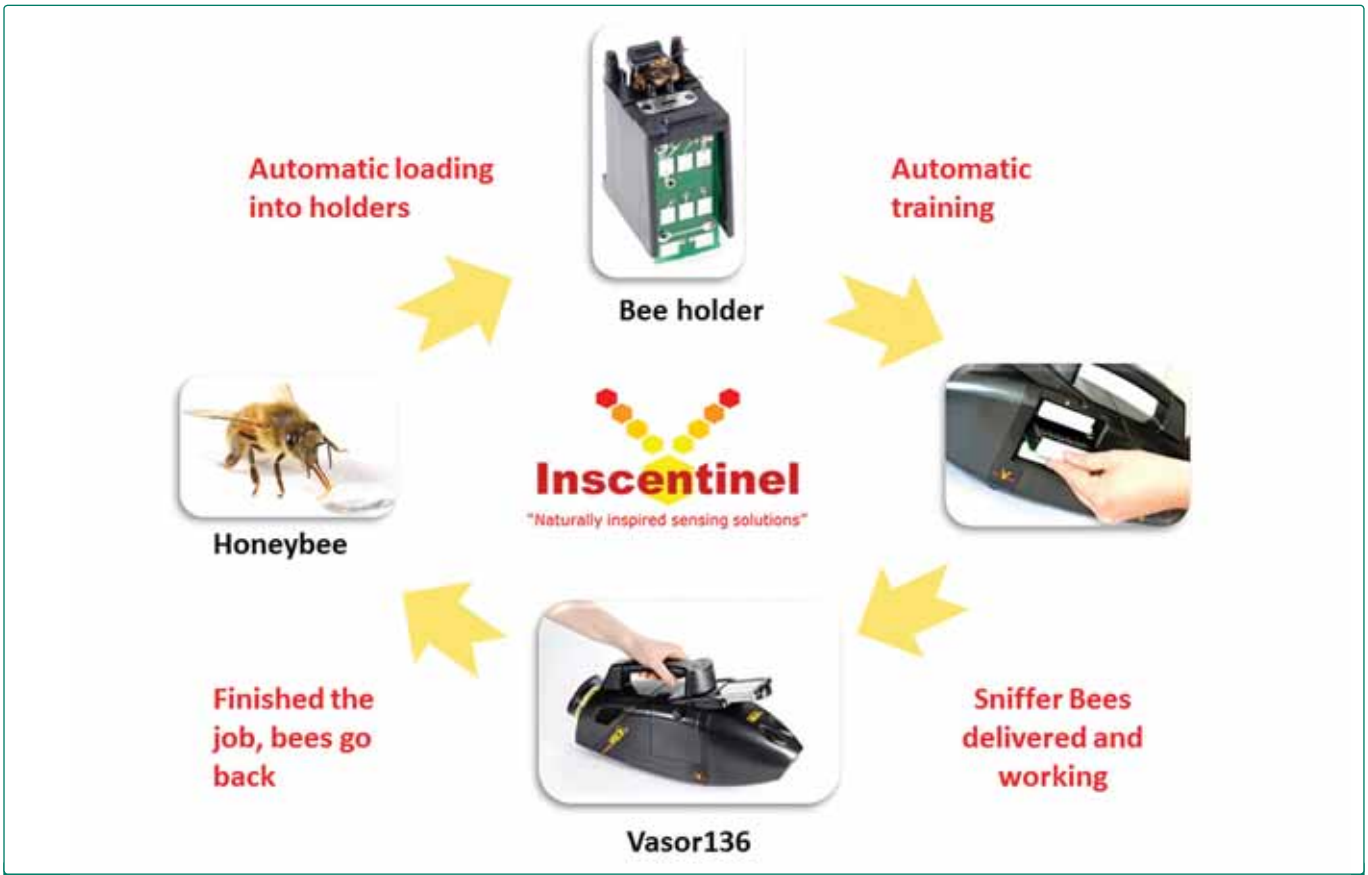
Credit: Rothamsted Research

It is quite remarkable to know that our single automatic training unit can produce 500 trained sniffer bees in just five hours; training a single sniffer dog takes up to six months.

On the detection side, there is no longer a requirement of a specialist handler or police officer at the front line. The sniffer bees inside the Vasor136 are monitored electronically through an infrared sensor. The information is displayed in easy to read: 'YES/NO' coloured squares on an LCD screen.

The advantage of a technology assisted solution is obvious in this instance.

Credit: Rothamsted Research



Bee sensor system.

Cost

We do not know the real cost of a REST dog, but we can consider search dogs' costs. It costs $118,000 for a one dog handler team in the first year and $80,000 for the subsequent year. The US federal government owns 600 sniffer dogs; that is $48 million in annual expenditure.

How does the bee fare in the cost category? The bee sensor system is a machine and, once developed into a product, the cost is low. The training of bees requires only sugar water (no more expensive than dog food). The cost of a honeybee itself is relatively cheap. A bee hive can contain up to 60,000 bees and a local beekeeper can manage 20 hives single handedly – that is 1,200,000 bees. Imagine housing that many dogs.

Extra benefit: accountability

Perhaps the single most important feature that is not available with dogs is the ability to account for the activities 24/7. Our sniffer bees, once housed in the bee holder, are monitored continuously by the electronics. Information such as the quality of training, the chemical it is trained to, the information of usage and detection can all be recorded and stored in a database of records and can used for the audit by the DFT.

How do the bees get trained?

A honeybee sticks out its Proboscis (or less scientifically, its tongue) and gets a touch of sugar water on its antenna. At that point, if it were exposed to the smell of explosives, it will associate explosives with sugar water and thereafter stick its tongue out on the exposure to TNT. The entire process takes only six seconds.

What is coming next?

The central principle of the bee sensor system is to combine technology with animals. This allows us to harness the best of both worlds. Animals are ultra sensitive and highly accurate, on the other hand, technology provides the ease of operation. Right now, Inscentinel is at the stage of attracting investors to raise finance to complete the prototyping and looking for security companies to run this technology in a field test. I have no doubt that the bees will perform brilliantly – after all, sniffer bees were not developed only in the last decade but over millennium to achieve their level of sensitivity.

ABOUT THE AUTHOR

Ivan Hoo, chief executive of Inscentinel, graduated with a BA (Hons) in Material Sciences from the University of Cambridge in 2010. His entrepreneurial strengths led to him working on a £100 million seaside resort development project before graduating, and now, along with his team, brings sniffer bees from the lab to the real world.

ABOUT THE ORGANISATION

Inscentinel (more famously known as the Sniffer Bee Company), is an Oxford VC backed British startup with huge ambitions to use honeybees to detect explosives and drugs. A spin out from Unilever and Rothamsted in early 2000, Inscentinel is established right beside the world's oldest agricultural research center. Inscentinel has since restructured in 2011 with a new team and with renewed focus.

ENQUIRIES

Inscentinel, Rothamsted Research
Harpenden, AL5 2JQ, UK
Please follow us on Twitter @inscentinel for the latest updates
Tel: +44 (0)1582 763133
Email: ivan.hoo@rothamsted.ac.uk
Web: www.inscentinel.com