Unopened coloured containers are screened for explosives with Resolve, a new handheld system for through-barrier Hazmat, Explosives and Narcotics ID.

CBNW Xplosive Deputy Editor David Oliver talks to Dr Robert J. Stokes, Product Manager for Detection at Cobalt Light Systems.

Cobalt was acquired by Agilent Technologies in July 2017.

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INSIGHT AND RESOLVE

Headquartered near Oxford in the UK, Cobalt Light Systems develops and produces instruments across a range of Raman applications for laboratory and industrial analysis. The underlying technology is exclusive to the company and was invented at the Science and Technology Facilities Council's (STFC) Rutherford Appleton Laboratory in the UK.

CBNW Xplosive: Could you provide a short history of the company – and how it became involved in the market?

RJS: Cobalt spun out of the Rutherford-Appleton Laboratory in Oxfordshire, UK in 2008. The core intellectual property (IP) is all based around novel variations on Raman spectroscopy. Agilent Technologies acquired the company in July of this year.

Raman is a widely used technique whereby a laser is used to illuminate a material of interest. Some of the light is scattered back and can be used to generate a unique spectrum, allowing the material to be identified.

> An important and unique strand of Cobalt's IP is based around a variant, spatially offset Raman spectroscopy (SORS). This allows Raman to be used through coloured and opaque barriers, such as plastics, packaging, and coloured glass – removing the requirement to open or disturb potentially hazardous items in order to take a sample.

The first products were deployed in the pharmaceutical industry in 2010, measuring content uniformity in manufactured tablets and verifying raw materials used in manufacturing: This continues as a major part of the business today.

The liquids ban

In 2006 the failed plot to bring down an airliner resulted in a ban on liquids, aerosols and gels (LAGs) in cabin baggage. Since then there has been a desire within European and other regulatory bodies to lift this ban, creating a requirement to screen and clear alarms on liquid explosives and precursors.

Cobalt developed the 'Insight' series of desktop liquid explosives detection systems (LEDs) to meet this demand. The technology quickly established itself as the best performing on the market in terms of detection and false alarm rate, whether used stand alone or in combination with other technology such as X-ray. To date, hundreds of Insight systems have been deployed worldwide both at small regional airports and major international hubs.

> Cobalt won the Royal Academy of Engineering MacRobert Award for the Insight100 in 2014

As Insight was becoming established in the aviation security market, Cobalt responded to a demand from the UK and US governments for a portable version of the same 'through-barrier' detection technology that would operate with a large library of 12,000-plus items in a wide range of conditions.

From this programme the hand-portable 'Resolve' unit was developed and launched in 2016. This system dramatically increases Cobalt's exposure to the market due to the huge range of applications a handheld SORS unit has.

To date Resolve systems are successfully deployed in all of the fields it was originally intended for, including EOD, hazmat, CWA, search/recon, narcotics, ports and borders, and policing.

CBNW Xplosive: How many staff does Cobalt employ and how many are involved in research and development?

RJS: The Cobalt headcount is currently around 55, split across the HQ in Oxfordshire, UK plus satellite offices in Reston Virginia USA, Hong Kong, and Germany. Around 25 are active in R&D.

CBNW Xplosive: Can you explain the different explosive detection systems marketed under your main brands?

RJS: The Insight series of systems are desktop-sized and are deployed almost exclusively at airports in fixed, cooperative, security checkpoints. They are targeted specifically against liquid explosives and precursors and are highly tuned to that application.

Resolve is a much more versatile, handheld system meaning it can be deployed in a much wider range of scenarios. The library is much larger and covers a wider range of threats. Both systems use Cobalt's unique SORS technology to penetrate all non-metallic containers.

Resolve can take as little as ~1min to scan an item and this is limited by the fact that it has to deal with a complex set of environmental conditions. This compares with the desktop, less environmentally challenged Insight systems, which take about five seconds to screen a container. The Insight also has an additional capability to screen metal containers- this feature is not available on Resolve.

CBNW Xplosive: What are the advantages of your explosive detection systems over other products on the market?

RJS: Resolve's primary advantage is SORS. Most handheld Raman systems use a standard 'point-and-shoot' mode, limiting substance ID to thin, transparent bottles and bags, and sampling vials. Resolve can operate in point-and-shoot and vial modes too, but SORS enables a brand new capability, allowing the operator to quickly identify materials concealed behind a wide range of barriers – including coloured plastics, dark glass, paper, card, wrapping, sacks and fabrics.

It does this without having to open or disturb containers to obtain a sample, and without compromising the integrity of the packaging in any way. This means there is no risk of unknown material release, improving operator and public safety, and reducing any potential

The Insight200M liquid explosive detection system used for scanning at an airport security checkpoint.

The Insight200M screens all containers, including metals (Tetra Paks are foil lined).

environmental impact due to spillage.

Some homemade explosives, such as triacetone triperoxide (TATP), look like benign white powders but can be sensitive to disturbance, and many materials can become less stable and more hazardous when a container is opened and the contents mixed with air. So keeping hazards contained during an operation, where possible, is often a good thing. Quick substance ID without taking samples also increases operational efficiency, and time spent by operators in protective gear can be kept to a minimum.

A further advantage is that, due to our unique SORS optics, we don't use a focused laser beam like other Raman systems on the market. This means that the energy is not focused in one place and sensitive explosives can be scanned with a significantly reduced risk of detonation or deflagration.

We also use a longer-wavelength 830 nm laser coupled to a very efficient optical system. This means we can scan many materials that exhibit fluorescence- a common form of interference in conventional Raman spectroscopy using 785 nm or lower, the wavelength typically used by most handheld Raman systems.

CBNW Xplosive: Who are your main customers in the civil sector?

RJS: Airports are the major customers for the Insight series of instruments. Your readers will be able to see them deployed in checkpoints at major hubs such as London Heathrow, Amsterdam Schiphol and Paris Charles de Gaulle.

In the civil sector Resolve is mainly deployed with Police forces and at ports and borders. In border applications the systems often screen for incoming new psychoactive substances (NPS), synthetic opioids- including fentanyls and precursors.

Synthetic opioids in particular have hit the headlines recently due to their extreme toxicity in small doses. The combination of a fatal dose measured in micrograms combined with the possibility for transdermal absorbance means that they present a significant hazard. Resolve's ability to scan through a range of packaging and containers reduces the risk of exposure to the operator. This makes it an ideal tool for these applications.

Our Police customers also deal with hazardous narcotics identification at manufacturing sites. These manufacturing sites can often be co-located with other activities, including explosives. Police operators also come across explosive manufacturing sites where again the through-barrier advantage is significant.

TATP for example can look like a relatively benign material, but there have been examples of this being discovered in locations where there was no other indication of bomb-making activity. Therefore scanning with a Resolve without disturbing the container and without using a focused beam is a significant safety advantage.

CBNW Xplosive: What percentage of your business is in the military/para-military sector?

RJS: I'm not able to say, but it's significant.

CBNW Xplosive: Who are your main customers in the

military/para-military sector?

RJS: It is a matter of public record that during the development programme we were funded by and worked with a branch of the US Department of Defense called the Technical Support Working Group (TSWG) or Counter Terrorism Technical Support Office (CTTSO). As part of this, we worked with organizations within the 'Five Eyes' network. Our initial customers were focused in the US, UK, Canada and Australia.

Since then we have deployed systems in many other countries for explosives applications. I'd refer your interested readers to test reports generated by the relevant authorities in those countries. Unfortunately I can't openly share details of the organizations currently using Resolve.

The system is operated via seven large buttons designed for use in level A PPE.

Resolve's through-barrier SORS technology works with coloured and opaque plastics, dark glass, paper and plastic sacks and envelopes as well as clear plastic bags and clear glass vials.

CBNW Xplosive: Can you explain what training you offer to customers?

RJS: We have trained hundreds of staff at many airport fixed security checkpoints. Here the objective is to operate the system efficiently within a predefined system of multiple technologies. The key here is a CONOP (concept of operations), which is a one-page description of best-practice use of the system.

Resolve is different as it can sometimes be deployed in isolation and in a wide range of operating procedures. We offer full training on the Resolve unit that covers all application areas. Classes can be tailored towards operators or we also offer train-the-trainer classes for larger organizations. We sometimes partner with EOD training companies such as ATOM (UK) to offer combined training to customers.

Resolve training is focused around tactics used in the field to get the best results. The through-barrier capability is genuinely new to operators.

CBNW Xplosive: Where do you see the greatest potential growth sector for your products?

RJS: The aviation security market is large, well established and can involve intermittent periods of very rapid growth that is often driven by regulation. Regulatory approvals (e.g. ECAC – European Civil Aviation Conference) are a key requirement and maintaining these is critical to achieving full potential.

Resolve has a much wider range of potential markets, where the advantages are truly game changing. We are seeing very rapid growth where the advantages of through-barrier detection, safety and improved detection performance are key.

The increasingly obvious use of sensitive homemade explosives by terrorist organizations means the demand for Resolve is increasing rapidly. Agency trials and the reports produced for cross-agency consumption replace the regulatory approvals in the aviation industry, but are easily as important. ✺