



Real-time Biodetection



Enhanced Generic Discrimination

- *Size*
- *Shape*
- *Fluorescence*

Biral specialises in the design, manufacture and supply of particle analysis and biodetection instruments.

Biral's family of devices, based on our unique ASAS (Aerosol Size and Shape) Technology, characterise particle populations according to size, shape, concentration and fluorescence in real-time.

Biral's ASAS Technology is currently deployed by the British Armed Forces for battlefield detection of biological warfare agents. This brochure explains the fundamental principles underpinning the devices and how ASAS Technology meets the biodetection challenge.



*Spatial Scattering Profiles
for a Sphere Particle Shape
(image kindly provided by
The University of Hertfordshire)*

The Biodetection Challenge

There is a great need for technology that is capable of detecting biological warfare agents but biodetection is challenging for a number of reasons:

Biological warfare agents are only micron-sized and are a great threat even in very small quantities. Consequently, there is a requirement for extremely sensitive detectors.

● These agents are difficult to discriminate from naturally occurring background material. Not only can background aerosol concentrations be high (typically $10^7 / m^3$), but also the particles are extremely diverse in nature.

Additionally, the agents have a complex nature themselves, with characteristics very similar to other bioaerosols particularly non-pathogenic bacteria.

Ideally, a detection system against biological threats would have a number of key features:

- Real-time detection
- Specific identification
- Low cost of ownership
(notably, no requirement for expensive consumables)
- Networkable
- Robust and reliable
- Compact and portable
- Unmanned

Unfortunately, there is no such system to date although the technology is developing fast. Whilst there are existing technologies with the capability of specific agent identification, they tend to generate results far too slowly (tens of minutes to hours), be labour intensive and require expensive chemical reagents as consumables. Consequently, the solution has been to integrate different but complementary technologies into a single point detection system.

Real-time Generic Detection

Currently, there is a drive towards improved technology that generically identifies biological particles, in real-time and without expensive consumables; the principle of "detect-to-warn" requires sensors with fast response. Indeed, this is the technical area on which Biral is focussing its development efforts. Such a device could act as a trigger to initiate the specific tests that have the disadvantage of high running costs and delayed response. Information from the trigger could also be used to give immediate warning that a significant aerosol event has occurred. Another concept of deployment for real-time sensors is within an intelligent network for perimeter or area protection of strategic assets. Finally, generic bioaerosol detectors would be an important defence against genetically

engineered agents that would otherwise escape detection by specific identification devices

Biral's ASAS Technology

Aerosol Size And Shape Technology is an optoelectronic technique of real-time biodetection that is unique to Biral and was originally demonstrated by the University of Hertfordshire and Dstl Porton Down (UK Ministry of Defence). The ASAS product family characterises aerosols by analysing elastically scattered laser light from individual particles. Not only can information be derived about particle size, but the spatial distribution of scattered light conveys detail about the particle shape too.

ASAS Technology has been used for many years in the British Armed Forces' Prototype Biological Detection System (PBDS) and has also been selected for the new Integrated Biological Detection System (IBDS). Additionally, Biral's real-time sensors are used in Smiths Detection's integrated systems such as NBCerberus.

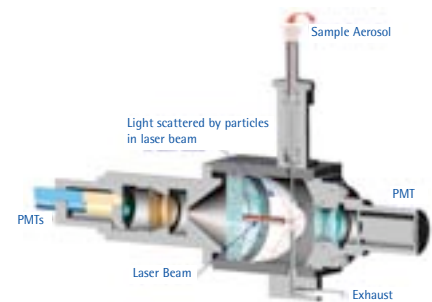
The fundamental principle of ASAS biodetection is to physically characterise the ambient aerosol in real-time. The background "signature" is analysed in terms of particle concentration as a function of size and shape, and when algorithms

identify systematic changes in this signature, alarms and trigger signals can be activated. The power of the technique rests in the sensors' ability to spot small but significant changes in a complex background. Furthermore many benign aerosol sources have clearly different size and shape distributions from the threat and so can be rejected.

VeroTect - Next Generation Sensors with Fluorescence

Biral is further enhancing ASAS Technology for the next generation of sensors with greater generic discrimination. The innovative VeroTect will combine a set of particle fluorescence measurements together with ASAS characterisation. Spectral analysis of fluorescence has long been known to be a very powerful tool when distinguishing biological aerosols, which contain fluorescent molecules such as tryptophan, and non-biological aerosols which do not.

Biral's new technology bridges the US sensor philosophy (fluorescence) and the UK philosophy (shape) that have been deployed in systems up until now. By measuring a greater number of independent particle parameters than alternative sensors, the level of discrimination between the threat and other biological particles or interferents is greatly enhanced.



Schematic of ASAS Technology's Optical Architecture



ASAS Technology – the Biral Aspect Particle Size and Shape Sensor



Summary of Biral Sensors Capability

Capability	Aspect ASAS Technology	VeroTect ASAS Technology with Fluorescence
Real-time	✓✓✓	✓✓✓
Specific	✓ 'non specific'	✓✓ 'generic'
Unmanned	✓✓✓	✓✓✓
Networkable	✓✓✓	✓✓✓
Compact and Portable	✓✓✓	✓✓✓
Robust and Reliable	✓✓✓	✓✓✓
Low Cost of Ownership	✓✓✓	✓✓✓

✓✓✓ Excellent ✓✓ Strong ✓ Limited



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