Experience the revolutionary Acoustic Vector Sensor technology and its capabilities for detection, classification and localisation of sound sources for training and mission use.

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www.microflown-avisa.com
Microflown AVISA develops acoustic systems to detect, classify and localise sound sources from various platforms. Two new systems will be launched shortly: a scoring system for training ranges (RAM-SCORE) and a wide area surveillance system for mission use (RAM-LOC). These systems make use of the Microflown Acoustic Vector Sensor (AVS), the world's only 3D particle velocity sensor, which makes it possible to determine the direction of an acoustic source using a single ½ inch (12mm) probe.

RAM-SCORE is a new acoustic scoring system for rocket, artillery and mortar (RAM) training ranges, proving ranges and air-to-ground bombing ranges, providing fast and accurate location reports of points of origin (POO) and points of impact (POI) on the range. The system has been developed in cooperation with the Dutch and British Armies.

NEW INNOVATIVE SENSOR
With RAM-SCORE and RAM-LOC, many of these drawbacks to the old systems have been removed. Each AVS contains a single pressure microphone as well as three acoustic particle velocity sensors, sensitive in x, y and z directions, respectively. The three particle velocity channels form the particle velocity vector.

During an acoustic event such as a rocket launch, the particle velocity vector points towards the source. The pressure microphone is used to correct the phase of the particle velocity channels, ensuring an accurate vector.

There is no need to space the sensors apart, as the direction finding does not rely on time differences, resulting in a sensor size not much larger than a match head (around 7mm).

As there is no array required at each sensor station, the system can be light and small with no cables between sensors, making it fast to deploy. RAM-SCORE and RAM-LOC do not rely on time differences for pointing at sound sources. Therefore, if the detected sound is a rumble or a bang or anything else it makes no difference to the localisation capability unlike with the traditional systems.

In addition to the above, using AVS for localisation of RAM has the following advantages over existing acoustic detection equipment:

- smaller system size;
- fewer sensors (each sensor replaces an array of microphones);
- reduced power consumption (maximum 2W) with either mains power or battery options;
- faster deployment capability and interchangeability between RAM-SCORE (training) and RAM-LOC (mission use);
- AVS can localise additional sound sources such as gunshots, airplanes, helicopters and ground vehicles for mission use.

AVS Capabilities

Sound Sources Localised

Acoustic Vector Sensor measures full acoustic spectrum, allowing localisation of multiple sound signatures:

- Gunshots
- Rockets
- Artillery
- Mortars
- Helicopters
- Airplanes
- UAVs
- Ground Vehicles

Localisation of mortar impacts on a training range

RAM-LOC is designed to be used as part of a C-RAM (Counter Rocket, Artillery and Mortar) system, locating enemy firing positions over a wide area.

TRADITIONAL SYSTEMS
Traditionally, acoustic detection has been based on arrays of microphones spaced apart (typically 0.5m to 20m) measuring sound pressure. The direction of sound sources is calculated by means of measuring sound wave time of arrival differences between various microphones. However, there are several disadvantages to this method:

- the spacing of the microphones is highly dependent on the type of sound source to be localised, which means each system is generally capable of localising only one source type, i.e. either gunshots, or artillery, or helicopters;
- array sizes for artillery localisation can be rather large (around 20m) with each microphone needing to be accurately surveyed, meaning traditional systems can be time consuming to deploy;
- at a distance, the sound of a gun is not a sharp crack but a rumble, which makes it difficult for microphone systems to locate the firing position;
- artillery is often fired in large numbers, which makes it especially difficult to determine which wave front is associated with which artillery piece.
As the Microflown Sensor is broad banded, i.e. measuring and localising at all frequencies, it is capable of being used to detect and locate all kinds of sound sources simultaneously. It can also filter certain sources in or out and can even filter by direction of the source. This is vital in battlefield situations where there are multiple noise sources all around.

**RAM-SCORE**

The main features of RAM-SCORE are:

- localisation with high accuracy, points of impact (POI) of artillery shells and bombs;
- localisation with high accuracy, points of origin (POO) of artillery shells and bombs;
- immediate reporting of detonation type (Complete/Partial/Blind);
- immediate alarm of ordnance exploding outside the designated target area;
- complete overview of the weapons being fired on the range.

Each RAM-SCORE system typically comprises multiple remote operated ground sensors, a wireless communication system, and a command centre processor.

Tests have shown the localisation accuracy to be typically within 1% of the range between the event and the sensor, so 50m at 5km for example. The final detection ranges are still to be released but it is thought to be at least 15km.

As an option, it is possible to add real-time monitoring of the training range activity to any remote location or control system; so for example, it would be possible for air controllers to have a real-time overview of a bombing mission, even though the practice range may be thousands of kilometres away.

**RAM-LOC**

RAM-LOC is designed to be used as part of a C-RAM (Counter Rocket, Artillery and Mortar) system, locating enemy firing positions over a wide area. The hardware is similar to that used for RAM-SCORE. The main difference is that the RAM-LOC ground sensors include more sophisticated magnetic compass and inertial sensors. The sensors are mobile, fast deployable, and modular, and therefore can be configured to work in all areas and environments. Typical use would be for the protection of fixed perimeters such as border lines and forward operating bases (FOBs), or for temporary locations such as rest over nights (RONs).

RAM-LOC is also suitable for supporting weapon locating radar (WLR), reconfirming targets (as per rules of engagement) and reducing false alarms which can bring base operations to a halt for unnecessary periods of time. As RAM-LOC works best at close range and radar is more suited for long range detection, the systems complement each other well. It also acts as an unjammable close range backup during radar affecting weather, for where line of sight is obscured by terrain dips or hills, and for low trajectory weapons where projectiles stay close to the ground and out of sight of radar. Crucially, RAM-LOC is a passive system, so it cannot be located and jammed like radar.

Each ground sensor contains an Acoustic Vector Sensor (AVS), windshield, weatherproof housing and wireless communication. Also contained within the weatherproof housing are the embedded digital signal processor (DSP), GPS, wireless communication module and battery. The battery life is up to 30 days using the standard battery.

Detection of an event by one of the ground sensors results in information being sent to the command centre, typically time stamp, classification of sound, and bearing and elevation to the source. The bulk of the processing is done at each ground sensor individually, so there are only very small packets of text data to transmit to the command centre. This data, from multiple sensors, is then collated and processed centrally, and the calculated locations are presented both in tabular form as well as in a graphical format, e.g. on a map of the training range. The points of impacts (POI) and points of origin (POO) are presented as grid coordinates. All information can be exported or printed out in hard copy for further reporting and de-briefing.

With the command centre software, the ground sensors can be remotely accessed, allowing for easy and convenient configuration.

For more information on RAM-SCORE or RAM-LOC please email:

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