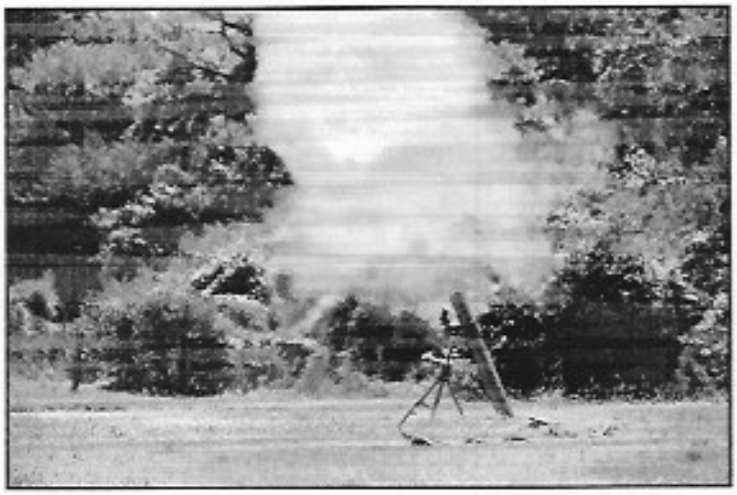
Battlefield Acoustic Sensing, Multi-modal Sensing & Networked Sensing for ISR Application [SET-189]

Acoustic sensing provides persistent, omni-directional, and low-cost surveillance to protect ground forces. Multifunctional algorithms can detect mortars, gunfire, unmanned aerial vehicles, helicopters, ground vehicles and equipment. Acoustics augments multimodal fusion and networked sensing for intelligence, surveillance and reconnaissance (ISR).



SET-189 recently collaborated during an acoustic threat detection field experiment sponsored by the Serbian Military Technical Institute (MTI) and Ministry of Defence (MOD), September 16-18, 2015. The collaboration was conducted under the auspices of the SET-189 research group. MTI and MOD provided access to Nikinci test range, Soldiers, various foreign sniper weapons and 120mm HE mortar rounds. MTI deployed several small-aperture acoustic arrays, and the multi-vehicle HEMERA acoustic detection system for long-range localization. The US Army Research Laboratory (ARL) collected acoustic signatures using various sensor systems purposely distributed at multiple ranges along the propagation channel. Sensors included high fidelity microphones, tetrahedral array configurations of two sizes, a miniature cardioid-cluster array, MicroFlown acoustic particle velocity system, and a meteorological station. The US Army Armaments, Research, Engineering and Development Center (ARDEC) also distributed many tripod-mounted Bio-Mimetic Systems (BMS) arrays to simulate networked man-wearable teaming for localization. As part of the SET-189 agreement, raw data and test documentation was immediately exchanged between all participants. The high quality waveform data will be used for signature analysis, performance assessment, and characterization of the propagation channel to accelerate transient classifier algorithm development.

This joint experiment in Serbia culminates a three-year research collaboration by conducting counter-sniper and counter-mortar field





experimentation with SET-189 members, and participants derived significant benefit from exchanging data collected by multinational systems, which will potentially lead to joint publications and sponsored special sessions at conferences. The Serbian MOD, its Soldiers, and the talented MTI team created an excellent test opportunity to advance battlefield acoustic sensing and provided tremendous hospitality to all of the scientists and engineers participating.

Since SET-189 culminated in December 2015, a follow-on was approved as SET-233 (2016-2018) "Acoustic Transient Threat Detection Sensors & Signal Processing for Battlefield Situational Awareness." Open to NATO, PfP, MD, ICI, and GP Nations, SET-233's objectives continue with improvements in acoustic transient event detection, localization, classification, propagation effects mitigation, and multimodal sensor fusion. Topical areas and applications include unattended acoustic & multimodal sensors for persistent situational awareness, small aperture acoustic sensors & array geometries tailored for Soldier-worn, ground- and air-platforms, and perimeter defense, acoustic particle velocity (vector intensity) sensing, wind, flow, and noise mitigation strategies, hardware, and processing, and advanced algorithm development for detection, tracking and classification of acoustic threats. To complement and help transition the work of SET-189, a NATO SET-218 RTG "Interoperability & Networking of Disparate Sensors and Platforms for ISR Applications" was formed in September 2014 to focus on coalition ISR sensor interoperability. SET-218 is conducting joint research, development and experimentation of interoperability technologies leveraging disparate ISR sensors, systems, platforms and architectures from different nations, with an ultimate objective to develop proposed NATO STANAGs for ease of integration and interoperability of disparate ISR assets.