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Signal Systems Corporation
sound science, real world solutions

...specializing in signal processing and active noise control

- SSC is a leader in multi-static active sonar signal processing.

- SSC uses electronic noise reduction technology to design solutions in active noise control, acoustic surveillance, speech enhancement and interference rejection.

- SSC has developed state-of-the-art signal processing solutions for more than two dozen government and commercial customers.

- Our technical staff has written over 50,000 source lines of code for real-time applications.

About Signal Systems Corporation

Established in 1995, Signal Systems Corporation (SSC) is a small business with a strong capability in signal processing and active noise control. We specialize in distributed acoustic sensors for surveillance and reconnaissance.

Our customers value SSC's rigorous engineering approach coupled with the best real-time software design talent available. Ninety-five per cent (95%) of our technical staff hold advanced engineering degrees and more than 50% have been developing signal processing systems for at least ten years.

At SSC, we combine a deep understanding of advanced technology with exceptional skill in bringing our customer's perspective to new projects. We bring these strengths, together with our proven practices of software development, to create solutions that are changing the state-of-the-art.

Technical Specialties and Services

Products and Other Services

❑ **Ground Vehicle Sensors**

❑ **Unattended Ground Sensors**

❑ **Active Noise Programmable Controllers**

Signal Processing Algorithms

❑ **Multi-static Active Sonar Signal Processing**
❑ **Active Noise Cancellation**
❑ **Adaptive Noise and Interference Reduction**
❑ **Source, Receiver and Target Localization**
❑ **Bayesian track before detection and data fusion**

System Development

❑ **Acoustic System Engineering**
❑ **Control System Design**
❑ **Architecture Analysis and System Design**

Engineering Capabilities

❑ **Acoustic surveys**
❑ **System design**
❑ **Real-time embedded controller development**
❑ **System integration and test installation at customer facility**

Applications for any setting

❑ **Industrial**
❑ **Military**
❑ **Land**
❑ **Air**
❑ **Underwater**

Acoustic Signal Processing for Air ASW

SSC has also performed significant innovative work in the field of Acoustic Signal Processing for the U.S. Navy and is a recognized expert in distributed acoustic signal processing for Air Anti-Submarine Warfare (ASW).

Our work includes the Likelihood Ratio Tracker (LRT) multiple hypothesis localization and track-before-detect processing with automated multi-static contact follower that significantly enhances active/passive fusion and improves multiple submarine search capability. We have also developed space-time adaptive processing, algorithm multi-static signal processing.

We have developed a Signal Systems Corporation is developing a new and innovative acoustic approach of buoy and target localization to provide absolute target geo-location without visual, RF or GPS inputs. We have developed unique and highly innovative algorithms for adaptive beamforming and adaptive noise reduction for sonobuoys.

Our software is being used by the U.S. Army and Navy to detect, classify and localize sources of acoustic noise.

Acoustic Surveillance Systems Development

We develop algorithms and software for underwater and battlefield acoustic surveillance. SSC offers state-of-the-art technology in adaptive filtering to reduce noise and interference, high resolution time frequency analysis for signal classification, and multiple hypothesis tracking to localize sources when receiver locations are not known.
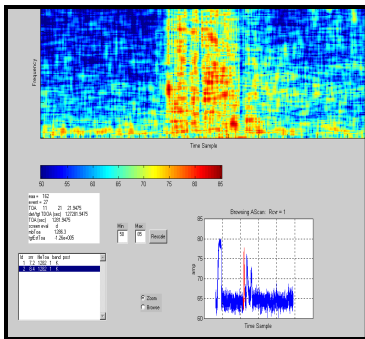
High Resolution Time Frequency Analysis provides improved classification ability.

Surveillance Function	SSC Technology Features	Benefit
Detection	Space-time adaptive processing and adaptive noise reduction technology that eliminates noise and interference	Detection rate improvements of at least 300% demonstrated on numerous surveillance systems. Improved multi-static, multi-look detector in high false alarm environments.
Classification	High resolution time frequency analysis	Proven ability to extract physics based features useful for classification.
Localization	Multiple hypothesis tracking for sensors and sources with uncertain locations. Track-before-detect processing	Improved localization accuracy without power consuming sensor positioning communication.

Active Noise Control

For the past several years, SSC has been developing active noise cancellation systems for acoustic composite tiles. We also developed a real-time 48 channel controller using programmable DSP's. This system was integrated into a smart skin that was demonstrated underwater. Our control system designs are based on hierarchical approaches. We are currently investigating on-line evolutionary techniques for fully adaptive control systems that change sensor and actuator configurations as well as filter coefficients. These systems promise to define the state-of-the-art in affordable and effective controllers for intelligent materials.
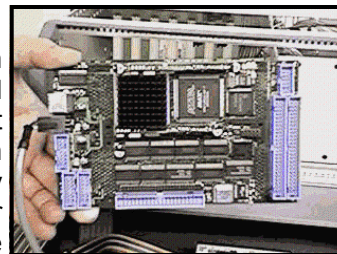
SSC uses state-of-the-art DSP for active control .

We are currently developing a 72 channel active noise control system using programmable DSP's networked together to control a smart materials-based sleeve. The control electronics are integrated with the rest of the smart material, including sensors, signal conditioners, processors, power amplifiers and solid state actuators. The active noise control system contains processing resources with over 16 Billion Operations Per Second capability.

Ground Vehicle Acoustic Sensors

SSC is a pioneer in Platform Noise Reduction (PNR) technology. We have developed fully automated acoustic sensor systems that incorporate noise cancellation technology to reduce platform noise, while providing detection, localization and classification of acoustic targets. Our Vehicle Acoustic Warning and Surveillance (VAWS) system performs all acoustic sensor functions and incorporates innovative noise reduction technology to improve sensor ranges by up to 300%. Our second generation real-time VAWS subsystem has been integrated on four different ground vehicles and tested with real targets. Recently demonstrated capabilities include multi-vehicle networked detection and tracking, while on the move.

Unattended Acoustic Ground Sensors

SSC has developed for DHS an ultra-low power acoustic detection and localization sensor node prototypes using a low power SHARC processor, innovative signal processing algorithms and acoustic enclosure. As a result, the Three Dimensional Acoustic Sensing Unit (3DASU) can successfully detect ground and airborne targets in a small form factor that can last up to 2 years in the field.

The 3DASU was based upon previous work for our vehicle base acoustic sensing unit (ASU). The ASU had the capability to cancel platform generated noise, track vehicles and impulsive events as well as streaming noise cancelled audio back to the operator. The ASU has been installed on both robotic ground vehicle as well as unmanned surface vessels.

3DASU

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Visit SSC on the Web

Our website provides more information about SSC including publications authored by our technical staff, resumes of key personnel and our latest products and research results. We also maintain links to interesting reading and current research in active noise control.

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Testing Facilities

SSC has a comprehensive inventory of equipment to support all aspects of acoustic projects from simulations that demonstrate a proof of concept to the TRL-7 demonstration of acoustic systems onboard military platforms. SSC has in-air and underwater test equipment including a 16-channel acoustic array suitable for in-air testing, an ADAR array, and a set of hydrophones used for underwater experiments in lakes and the ocean.

We have a high-performance computing cluster with capabilities to run up to 48 individual or parallel processes. Combined with a central storage capacity of over 2.3 TB, SSC has ample resources to support extensive and large scale simulation studies using our in-house ASW and ANC simulations or any other software package.

Research and Development

Some projects currently in progress:

❑ Multi-static Signal Processing Sonobuoys as Opportunistic Receivers

❑ Autonomous Environmental Sensor Performance Prediction Tool for Multi-Static Active and Passive Anti-Submarine Warfare (ASW) Systems

❑ Spread Spectrum Techniques for Sonar Ping Technology

❑ Three Dimensional Acoustic Sensing Unit

❑ Multi-Sensor Fusion for Littoral Undersea Warfare

❑ Composite Continuous Active Sonar

❑ Multi-static Active Coherent (MAC) software development

SSC applies its expertise to other control applications including:

♦ Robotic Manipulators

♦ High Speed Machine Tools

♦ Fiber Optic Communications Optimization