Topic: N141-065

EpiSys Science, Inc.

High-Speed Reconfigurable SIGINT (HiReS) System for Large Time Bandwidth Product
HiReS (High-speed, Reconfigurable SIGINT) system offers a novel capability to detect, isolate, and classify hard-to-find signals over 500+MHz bandwidth without a priori knowledge such as center frequency, signal bandwidth, signal duration, and modulation features. HiReS is being developed under the initiative of OpenVPX-based Multi-Function RF systems where electronic attack, communication, and SIGINT functions can be instantiated using the common, interchangeable hardware platforms. Sustained competitive advantage is provided as HiReS allows warfighters to achieve and maintain a significantly higher level of RF situational awareness thanks to its "constant-stare", low-power signal detection, and radar detection. HiReS has been verified for its functionality and innovation of the technology. EpiSys Science specializes in artificial intelligence, RF communication and signal processing technologies. The ultimate goal is to integrate and transition HiReS into government and prime contractor's multi-function RF systems for significantly enhancing its SIGINT function.

Technology Category Alignment:
Advanced Electronics
Command, Control, Communications, Computers, & Intelligence (C4I)
Electronic Warfare (EW)
Radio Frequency (RF) (non-EW)

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SYSCOM: ONR
Contract: N00014-15-C-5173

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00014-15-C-5173

Department of the Navy SBIR/STTR Transition Program

STATEMENT A. Approved for public release; distribution is unlimited.

ONR Approval # 43-2262-16

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EpiSys Science, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: Office of Naval Research (ONR) Division 312, RF Surveillance and Signal Processing Program
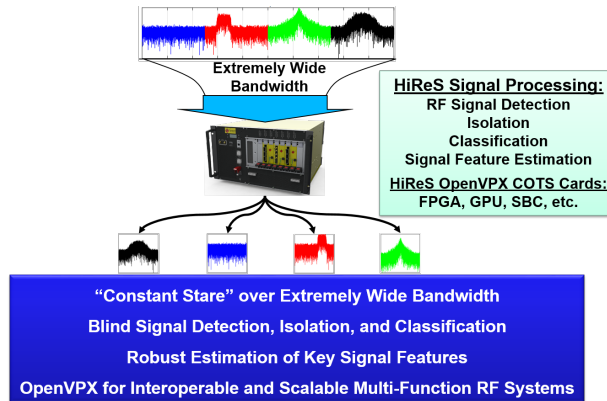
Transition Target: Ship's Signal Exploitation Equipment (SSEE) Increment F, Surface Electronic Warfare Improvement Program (SEWIP), AN/BLQ-10 Submarine Electronic Warfare System, AN/BLQ-10 Virginia Class Electronic Support Measures (ESM) System

TPOC:
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Other transition opportunities:
National Security Agency (NSA)
Electronic Surveillance
Central Intelligence Agency (In-Q-Tel)

Extremely Wide Bandwidth

HiReS Signal Processing:
RF Signal Detection
Isolation
Classification
Signal Feature Estimation

HiReS OpenVPX COTS Cards:
FPGA, GPU, SBC, etc.

"Constant Stare" over Extremely Wide Bandwidth

Blind Signal Detection, Isolation, and Classification

Robust Estimation of Key Signal Features

OpenVPX for Interoperable and Scalable Multi-Function RF Systems

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WHAT

Operational Need and Improvement: New solutions are needed to provide warfighters with significantly higher levels of Radio Frequency (RF) situational awareness while meeting size, weight, and power (SWaP), and cost requirements imposed by emerging multi-function RF systems.

Specifications Required: 1. To continuously process extremely wide bandwidth (e.g., several hundreds of MHz) and detect/classify a large number of signals simultaneously that exhibit a wide variety of behaviors and patterns.
2. To accurately estimate and visualize key features of the detected signals, including hard-to-find radar pulses.
3. To implement and operate using commercial-off-the-shelf (COTS) hardware components.
4. To meet the interoperability requirements with the Department of Defense (DoD) standards such as OpenVPX multi-function RF system specifications.

Technology Developed: 1. Novel signal processing techniques to detect and classify a wide range of RF signals with low signal-to-noise ratios, large bandwidth, and extremely short duration.
2. Robust estimation techniques for capturing key features of detected RF signals without a priori knowledge.
3. Optimal distribution of complex computations across heterogeneous COTS Digital Signal Processing (DSP) devices (FPGA, GPU, CPU, etc.), significantly reducing hardware cost and SWaP.

Warfighter Value: "Never miss a signal!" HiReS enables warfighters to maintain significantly improved RF situational awareness because it: (i) eliminates "scanning"; (ii) estimates signal types and parameters with much higher accuracy; (iii) detects hard-to-find signals such as radar pulses and weak signals; (iv) visualizes both instantaneous and temporal signal behaviors; (v) significantly reduces costs by utilizing COTS products; and (vi) complies with OpenVPX standard for seamless interoperability with emerging multi-function RF systems.

WHEN

Contract Number: N00014-15-C-5173 **Ending on:** March 31, 2018

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Algorithm Development	High	Successful signal classification ratio	3	June 2016
Prototype Implementation	Med	Real-time operation of individual components in target hardware environment	4	September 2016
Integrated system based on target hardware	Med	Real-time operation of integrated system in target hardware environment	5	March 2017
Integration with customer hardware platform	Med	Real-time operation with desired performance	6-7	September 2017
Testing and demonstration of fielded system	Low	Real-time operation with desired performance	8-9	March 2018

HOW

Projected Business Model: Model 1: Make and sell HiReS subsystems based on OpenVPX hardware modules to the prime contractor providing full SIGINT and Multi-Function RF System solutions to the government. The prime contractor may require us to customize the HiReS system to meet particular requirements of the government customers.
Model 2: Sell a complete stand-alone HiReS system directly to the government. EpiSys Science can produce and deliver a complete system within 6 months upon receiving the order.

Company Objectives: The short-term objective of EpiSys Science is to further advance the signal sensing and classification technologies over extremely wideband spectrum, while building the sustainable business for selling both stand-alone HiReS solutions (to the government) as well we subsystems (to the prime contractors). Its long-term goal is to become the industry leader in SIGINT, RF Sensor, Software Defined Radios, and Multi-Function RF systems. In addition, EpiSys Science is expanding its R&D and business areas to include AI-based autonomous systems such as drone swarms with self-piloting technologies.

Potential Commercial Applications: The demand for spectrum by commercial wireless services is increasing dramatically. Meeting this explosive demand growth is a daunting challenging since spectrum is a finite resource. One area of breakthrough to meet such demands is to "dynamically" grant access to those who are willing to participate in the dynamic spectrum access (DSA) paradigm. Core enablers for this DSA include such technologies as robust RF sensing, signal detection, and classification, all of which must be present in the form of low-cost, low-power cognitive radios. The innovations being brought by HiReS technologies are natural foundations for commercially viable cognitive radios. EpiSys Science is advancing the state-of-the-art HiReS technologies to bring them to mobile devices.

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