

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2018-0619

Topic # N161-025

Digital Early Warning Receiver (EWR) for the Next Generation Submarine Electronic Warfare (EW)

Sonalysts, Inc.

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** PEO Subs

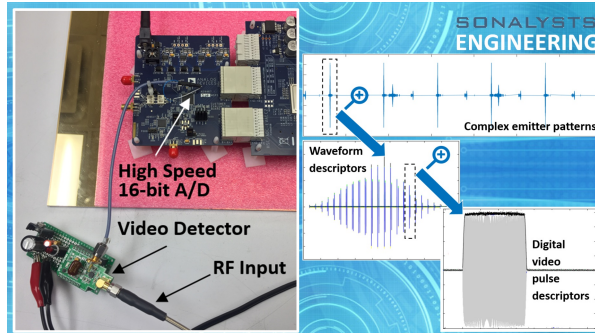
**Transition Target:** The Digital Early Warning Receiver (DEWR) is targeted for TI-20 TEMPALT integration with the AN/BLQ-10 submarine EW system. The open and modular interfaces make it suitable for fielding on all submarine classes starting in TI-22.

**TPOC:**

(401)832-4880

**Other transition opportunities:** The primary target for DEWR transition is submarine electronic warfare platforms, but the technology is also applicable to any application where real-time capture and characterization of pulsed electromagnetic energy is desired. This creates additional opportunities for transition to non-submarine Navy platforms like surface vessels (PEO Ships), aircraft (NAVAIR), and unmanned vehicles, all of which rely on spectrum situational awareness and decision making.

**Notes:** Sonalysts produced a bench-top prototype of the DEWR principles during the Phase I award. The prototype consisted of a COTS video detector, high speed analog-to-digital converter, and data extraction over Ethernet. Digital signal processing algorithms were developed to capture complex emitter patterns on macro-time scales, burst waveforms at intermediate time scales, and pulse descriptor words at micro- and nano-time scales.



Sonalysts DEWR Phase I Prototype and Digital Video Data Products

## WHAT

**Operational Need and Improvement:** Modern submarine EW systems are evolving to use digital frameworks that distribute real-time data products to reconfigurable consumers. Legacy submarine Early Warning Receivers (EWRs) are based on crystal video detector technologies, which have not followed the trend to digital architectures. Furthermore, analog EWR techniques are challenged by the intrapulse modulations and complex waveforms typical in today's transmitters. The submarine fleet is in need of a Digital EWR (DEWR) that will perform against modern emitters and provide digital data products to the control room, the Electronic Support (ES) room, and the AN/BLQ-10B (V) system.

**Specifications Required:** The DEWR is considered a "safety of ship" sensor item and must work at all cost. The receiver must exhibit tremendous sensitivity and dynamic range over all operable frequencies. The DEWR must operate dense in emitter environments, process digital data from high PRF waveforms, and be resilient to strong CW interferers. The system must interface with different mast inputs and provide Pulse Descriptor Words (PDWs) to configurable downstream data consumers.

**Technology Developed:** Sonalysts is developing a reliable, modular, and scalable Digital Early Warning Receiver (DEWR) that aligns with the digital architecture of modern submarine EW. The system leverages modern integrated circuit (IC) video detectors and high speed 16-bit A/D converters to capture real-time pulsed RF data on wide acceptance bandwidths across all frequency bands. This is achieved without compromising the dependability and familiarity of the legacy system. Digital video output is processed on reconfigurable FPGA cards to satisfy legacy safety of ship requirements, generate PDWs, perform pulse feature extraction, and distribute digital data products. The technology has been developed and matured through multiple SBIR awards.

**Warfighter Value:** The Sonalysts DEWR solution allows the submarine warfighter to fully integrate EWR functions with other digital subsystems and mission areas. The system provides increased frequency resolution, improved sensitivity across major threat bands, and a tunable notch filter to mitigate Continuous Wave (CW) interferers. With Sonalysts' modular architecture, the Navy can also realize growth capabilities such as EWR cueing of narrow band receivers, downstream threat analysis routines, and advanced third party algorithms.

## WHEN

**Contract Number:** N00178-18-C-8018 **Ending on:** February 2, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase I Base period proof of concept	N/A	Developed a workign breadboard with video detection, high speed A/D, and digital data recording	TRL 4	January 2017
Phase I Option period algorithm demonstration	N/A	Developed and exercised DSP algorithms on recorded data from real emitters	TRL 4	July 2017
Phase II Base prototype (low frequency)	Low	Development of a single low frequency receiver channel with real-time FPGA data processing	TRL 5	February 2019
Phase II Option prototype (high frequency)	Low	Incorporation of a high frequency receiver channel with real-time FPGA data processing	TRL 5	February 2020
Phase II Test Campaign	Low	Execution of factory acceptance testing (FAT) at a major prime contractor facility and/or government test site	TRL 6	February 2021
Submarine TEMPALT	Med	Fielding of a TEMPALT system on-board a US Navy submarine	TRL 7	June 2021

## HOW

**Projected Business Model:** Sonalysts has a long and successful history of transitioning innovative technology solutions to cost effective fielded programs outside of the SBIR program. Our current Commercialization Achievement Index score is 90%, and we continue to improve our SBIR technology transition to Government agencies, prime defense contractors, and industry customers. Sonalysts has a corporate business development group with more than 20 years of experience in the development and marketing of highly technical products and solutions, and has five Phase III SBIR contracts awarded since 2002. Sonalysts is committed to enhancing both our SBIR commercialization success as a technology generator by forming teams with other small businesses and defense primes to ensure we achieve the transition readiness level goal for this SBIR projects.

**Company Objectives:** Sonalysts is determined to transition the technology developed under this SBIR by incorporating it within our core business lines and by exploring its inclusion within major Government acquisition programs. Core business areas include operations research, system engineering, test and evaluation, advanced training systems development, and instructional services on major acquisition and ancillary support programs through the DoD laboratories and industry. Sonalysts' annual self-investment in technology initiatives, personnel training, direct marketing, bid and proposal, and other commercialization efforts are extraordinary for a firm of our size.

**Potential Commercial Applications:** The commercialization strategy for SBIR N161-025 Digital Early Warning Receiver (DEWR) will prioritize naval submarine applications during initial development. However, Sonalysts foresees additional naval applications with surface warfare ships, unmanned vehicles, and ELINT/SIGINT data collection mission. In addition, there may be other opportunities for insertion in electronic warfare system for non-Navy DoD service branches. Furthermore, test ranges and Hardware-In-the-Loop (HWIL) efforts may find also leverage the technology for high fidelity data capture during integration exercises and field tests that use real RF transmissions.

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