Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2019-0567

Topic # N171-051

Advanced Direct Digital Exciter for Radar (ADDER)

Colorado Engineering Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: NSWC - Crane

Transition Target: SPS-49

TPOC:
(812)854-3981

Other transition opportunities: This technology is ideal for aging radar systems (from UHF to Ku-band) nearing end-of-life, which is a large portion of radar systems currently in use. It offers improved performance and service life extension with reduced SWaP-C.

Notes: Image references the CEI proprietary 3DR architecture, a scalable, small form factor, 6.25" x 6.25", Reconfigurable Advanced Rapid-prototype Environment (RARE) that provides a hardware and software-defined solution applicable for Analog to Digital Conversion. The 3DR product family also enables Digital to Analog Conversion as well as Digital Signal Processing in identical form factors which are stackable in three dimensions.

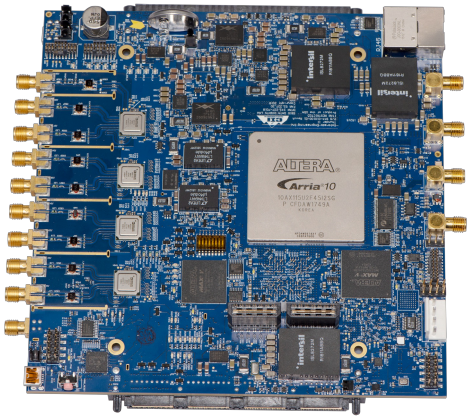

Image courtesy of Colorado Engineering, Inc., Copyright 2019 (Digital to Analog Converter Module for Topic N171-051)

WHAT

Operational Need and Improvement: According to the Office of Naval Research, "...band-pass sampling is a powerful tool that allows a relatively high frequency signal to be sampled by a relatively low-performance digitizer, which can result in considerable cost savings."
The operational needs are to design, build, and provide initial test of a Digital to Analog Conversion module with two additional options:
Option 1: complete testing and integrate DAC with processor and code
Option 2: package, ruggedize, and test at system level
Success for this program will be determined with the end of Phase 2 that includes a system ready to transition to SPS-49 Technology Refresh Program (March 2020).

Specifications Required: Colorado Engineering's 3DR technology provides the functionality required in Topic # N171-051, which replaces existing legacy 3-step intermediate frequency analog conversion with advanced direct-to-digital architecture, potentially possible through the RARE hardware and software-defined radio capabilities, enabled through the 3DR board family. CEI's digital exciter will eliminate the legacy analog approach, which has become difficult and costly to maintain ($10k/system/year with 45 A(V)1s in service). This design will reduce TOC and improve performance, while reducing parts count, noise, and instability. (Note: Cost savings figure provided by US DoN, NSWC - Crane)

Technology Developed: Digital to Analog Conversion module based on former SBIT, RARE, which has since been commercialized and adopted for multiple programs of record. RARE has since received the marketing name of 3DR, which is also known as 3D-RARE. This product family is referred to as "3D" because of its unique architecture enabling its scalability in three dimensions, which allows for a simple 6.25" x 6.25" card to interconnect with very fast communication in six directions (2 in X, 2 in Y, and 2 in Z) simultaneously, rather than the older method of technology which enabled boards to interconnect through only one single point on a backplane.

Warfighter Value: The compact design reduces the footprint below deck, which results in size and weight savings. The modular form factor reduces costs related to sustainment and upgrade. The high density design improves cost-per-Watt performance. The increased digital signal processing offers a smaller size to boost computational capabilities.

WHEN

Contract Number: N68335-19-C-0160 **Ending on:** January 1, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Integrate 3DR modules for DAC and DSP functionality	Low	Lab Testing for Exciter Hardware	6	August 2019
Package, Ruggedize & Integrate in System with Digital Exciter	Med	Combined Digital Receiver & Digital Exciter correctly function	6+	March 2020
System Integration Lab Testing	Med	Receiver and Exciter Modules function correctly when integrated with the SPS-49 system	6+	May 2020
Certification and Field Testing on Navy Test Platform	Med	Integration and Testing on Navy Platform	7	April 2021

HOW

Projected Business Model: SBIR Phase II awards feeding the technology: Topic N151-057 (Receiver) PoP ending 3/16/2020; Topic N171-051 (Exciter) PoP ending 1/1/2020 (two Option years pending for 2020 and 2021). A PEO IWS RIF (contract N00024-18-C-4009) is funding the integration of the Receiver and Exciter into a product referred to as the Digital Receiver/Exciter Plus (DREX+) - the "Plus" includes digital waveform generation and digital signal processing. This RIF extends through June 2020. CEI is in the midst of designing, integrating, and testing the individual subsystems which will serve as a complete replacement for the SPS-49.

Company Objectives: The primary objective of Colorado Engineering, Inc. (CEI) is to become the primary solution provider for the NAVSEA Prime Contractor who will integrate the technical refresh on various classes of surface ships. CEI's secondary objective is to become recognized as a leader in modular, low-cost, high-performance radar and computing solutions for sea, air, land, and space platforms.

Potential Commercial Applications: The SPS-49 is the primary end application for Topic N171-051. The modular architecture of the DREX+ will have applications across a large segment of surface ships' radar systems. The RIF funding by the Office of the Secretary of Defense was provided to ensure that the DREX+ will reach the necessary maturity level to serve as the foundation for radar system technical refreshes across al service branches.

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