Topic: N151-057

Colorado Engineering, Inc.

Direct Radio Frequency Sampling (DRFS) (SPS-49)
Colorado Engineering Inc (CEI) is a woman owned small business enterprise which specializes in extremely complex mixed signal system design related to high frequency RF and digital system processing. CEI developed an industry leading architecture Radar Advanced Receiver/Exciter (RARE), through SBIR funding, Topic Code MDA05-034, Contract Number HQ0006-08-C-7908, that has been incorporated into several programs of record. RARE is a modular and scalable architecture which can be used far beyond Radar. RARE, now known as 3DR is being adopted for High Performance Computing and missiles. Colorado Engineering's strategic semiconductor partnerships and its access to their technology roadmap will enable CEI to advance this modular architecture for future product generations, which can be utilized in sea, land, air and space applications where SWaP-C is critical.

Technology Category Alignment:

RF Components for sensing, transmission and communication
Information Collection/Management
Preemptive/Proactive Effects
Radio Frequency (RF) (non-EW)
Sensors, Electronics and Photonics

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SYSCOM: NAVSEA
Contract: N00178-17-C-2007
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N00178-17-C-2007

Department of the Navy SBIR/STTR Transition Program

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Direct Radio Frequency Sampling (DRFS) (SPS-49)
Colorado Engineering, Inc.

WHO

SYSCOM: NAVSEA

Sponsoring Program: NSWC - Crane

Transition Target: SPS-49

TPOC:
(812)854-3981

Other transition opportunities: AN/TPS-59 (USMC) and AN/FPS-124 (AF) and other older radars as sustainment may become increasingly difficult due to age and the inability to acquire replacement parts. CEI's technology significantly reduces SWaP-C and sustainment while upgrading capabilities.

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 enable Digital to Analog Conversion as well as Digital Signal Processing in identical form factors which are also interconnecting.

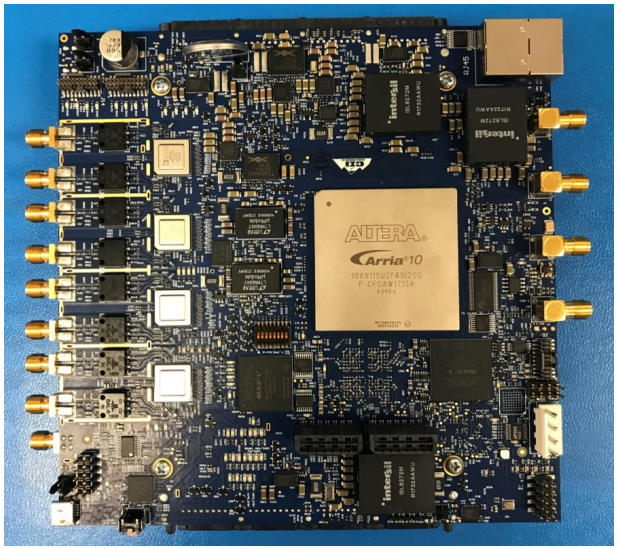


Image courtesy of Colorado Engineering Inc, Copyright 2018 (Analog to Digital Converter Module for Topic# N151-057)

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 an Analog to Digital Conversion module, with two additional options
Option 1: complete testing and integrate ADC 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# N151-057, which replaces existing legacy 3-step intermediate frequency analog conversion with advanced direct-to-digital architecture, potentially possible through the Reconfigurable Advanced Rapid-prototype Environment (RARE) hardware and software defined radio capabilities, enabled through the 3DR board family. CEI's digital receiver 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: Analog to Digital Conversion Module based on former SBIR, RARE, which has since been commercialized and adopted for multiple programs of record. RARE has since received the marketing name of 3DR, which is 3D-RARE. This product family is referred to as "3D" because of its unique architecture enabling its scalability in 3 Dimensions, which allows for a simple 6.25" x 6.25" Card to interconnect with very fast communication in six direction (2 in the X, 2 in the Y and 2 in the Z) simultaneously, rather than the older method of technology which enabled boards to interconnect through one single point on a back plane.

Warfighter Value: Compact Design to reduce footprint below deck - size and weight ; modular form factor to reduce costs related to sustainment and upgrade; high density design to improve cost per watt performance; increased digital signal process is a smaller size to boost computational capabilities.

WHEN

Contract Number: N00178-17-C-2007 **Ending on:** March 16, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
First Article Test	Low	Lab Testing for Receiver Hardware	5	August 2018
Map SPS-49 control and signal processing (SigPro) to hardware	Med	Existing SPS-49 Control &SigPro fully mapped	5+	October 2018
SPS-49 specific functionality (FW/SW)	Med	Firmware and Software functionality designed	5+	February 2019
Integrate Platform Specific Firmware & Software	Med	Receiver Module functions correctly	6	March 2019
Integrate 3DR modules for ADC and DSP functionality	Med	SWaP-C friendly, scalable receiver system become operational	6	June 2019
Package, Ruggedize & Integrate in System with Digital Exciter	Med	Combined Digital Receive & Digital Excite correctly function	6+	March 2020

HOW

Projected Business Model: Topic N151-057 Phase 2 funding with options already received. Topic N151-051, Phase 2 award and funding to be received shortly. BAA HQ0034-17-BAA-RIF-0001B, funding already awarded. These two Phase 2 SBIR awards and RIF are being used to combine the primary back end functions for the SPS-49, Digital Receive and Digital Excite, into a single box, referred to as DREX+. Over the next 24 to 36 months, CEI will be designing, integrating and testing each of the individual sub-systems into a complete replacement system for the SPS-49.

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

Potential Commercial Applications: SPS 49 is the primary end application for Topic N151-057. The underlying 3DR architecture is being used in other applications from government primes. Additionally, it is being used in alternate applications by other DoD agencies like AFRL in a Missile Seeker.

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