Department of the Navy SBIR/STTR Transition Program

Topic # NSF11-561
Software-Defined Noise Cancellation for Wireless Pulse Based Communications
Dirac Solutions Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: NAVAIR

Transition Target: PMA-209 / PMA 202

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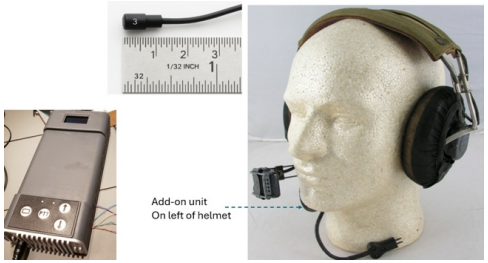
Other Transition Opportunities: Army Air Warrior Integration, Navy nuclear submarines, DHS



DiracSolutions.com, BellAviations.com

Notes: Adaptive noise cancellation on Software Designed Radio (SDR) integrated with reliable Ultra-wideband communications for V-22 aircraft.

The noise cancellation capability in software-defined radio (SDR) leverages adaptive signal processing algorithms to continuously analyze the acoustic and vibration profiles characteristic of aircraft operations. By dynamically adjusting filtering parameters in real time, the system mitigates a broad spectrum of interference, including engine harmonics, aerodynamic flow noise, and transient impulsive sounds from onboard systems. When combined with reliable wireless communications using ultra-wideband (UWB) signaling, this capability ensures robust, low-latency data transmission and high immunity to multipath effects, enabling consistent communications and sensor data integrity across varying operational conditions.

WHAT

Operational Need and Improvement: In DoD helicopter operations, effective wireless voice communication is vital for safety and coordination, yet current systems struggle in extreme acoustic environments—rotor noise often exceeds 100 dB SPL and vibration adds further interference. These conditions, amplified by helmet and hearing protection use, significantly impair speech intelligibility and lead to miscommunications. To solve this, DSI has developed and field-tested advanced signal processing techniques for active noise and echo cancellation within a pulse-based wireless audio system. Running on a software-defined platform, the solution concurrently targets multiple noise sources—from low-frequency rotor and gear noise to high-frequency engine noise—ensuring clear and reliable voice communication in high-noise flight operations, thereby boosting mission effectiveness and operational safety.

Specifications Required: (1) Reliable wireless transmissions between cabin crew members (in the air) and cabin crew members and external crew members (on the ground). (2) High speech intelligibility in presence of various sources of acoustic noise (3) Minimum communications range of 300 feet (T), as measured from a crew member inside the V-22 Osprey cabin to a crew member external to the V-22 aircraft (eliminating the existing long cord for maintenance crew communications.

Technology Developed: DSI's software-defined wireless communication system incorporates cutting-edge signal processing for active noise and echo cancellation, designed specifically for high-noise environments like DoD helicopter operations where rotor, engine, and transmission noise overwhelm traditional audio systems. By targeting multiple noise sources simultaneously, it ensures clear, reliable speech even when users wear helmets and hearing protection. Built natively on DSI's pulse-based wireless platform, this solution delivers robust, real-time voice communication in mission-critical settings. Additionally, DSI has adapted similar wireless systems for DOE applications, enabling the secure transmission of sensor data and image/video through 5-foot-thick nuclear concrete.

Warfighter Value: DSI's advanced wireless communication system delivers critical value to the warfighter by enabling clear, dependable voice communication in high-noise helicopter environments. By actively suppressing rotor, engine, and vibration-induced noise, the system ensures that essential commands are clearly transmitted and understood, minimizing the risk of miscommunication during mission-critical operations. This improves situational awareness, coordination, and safety for pilots, crew, and ground personnel. Its battery-free design and extended range further enhance mission flexibility while reducing equipment load—meeting the warfighter's need for lightweight, reliable communication tools in dynamic operational settings.

WHEN

Contract Number: N68335-24-C-0258 **Ending on:** Jun 03, 2026

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Implementation of adaptive noise cancellation algorithms for various noise sources	Low	Successful firmware evaluations	6	4th QTR FY25
Testing the dynamic and Adaptive Algorithm Selection Module	Low	Laboratory testing	6	4th QTR FY25
Full integration with UWB radios	Low	Hardware/software co-verification	6	1st QTR FY26
Field testing with V-22	Low	Performance evaluation at the intended environment	6	2nd QTR FY26

HOW

Projected Business Model: DSI's business model is to transition innovative research to high TRL through SBIR phase I, II, and III projects and target various applications based on the similar technologies. DSI's current strategy includes working with prime defense contractors for mainframe integration and welcomes the opportunity to test and sell directly to other government agencies if there are sufficient interests.

Company Objectives: DSI aims to design next-gen wireless systems that prioritize reliability, security, low cost, and low power. Its initial focus is on DoD applications, including aircraft, submarine, tunnel, and skyscraper communications, supporting voice, sensor data, and image/video. DSI also targets DOE and nuclear environments, deploying wireless sensor and video systems capable of penetrating thick concrete walls—such as those in nuclear reactors and submarines. Additionally, the technology supports first responder networks in harsh conditions, including firefighters operating in nuclear emergency scenarios.

Potential Commercial Applications: This military-grade voice system employs software-defined radio with adaptive noise and echo cancellation to maintain clear, reliable communication in the loudest environments—such as combat helicopters with intense rotor, engine, and transmission noise. It enhances speech clarity even when users wear helmets and hearing protection and seamlessly integrates with DSI's pulse-based wireless platform for mission-critical use. The same technology has been adapted for DOE applications, enabling wireless sensor, data, and video transmission through 5-foot-thick nuclear concrete.

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