

Topic: AF083-193

Vulcan Wireless, Inc.

Bandwidth Efficient SATCOM Waveform Techniques

The technology developed was a compact multifunctional software defined radio hosting both MUOS and Legacy UHF waveforms on a Low Earth Orbit (LEO) satellite platform. The communications link provides low latency, anywhere on orbit data control and connectivity from the user to the space vehicle, which is not currently available to the satellite user. Vulcan Wireless is currently focusing on Machine to Machine (M2M) communications, whereas most Mobile User Objective System (MUOS) terminals are designed for voice and data and are much larger. We see multiple paths to transition to M2M applications, first is into LEO space vehicles, second unmanned aerial vehicles, and unmanned underwater vehicles. This system has been prototyped and its functionally verifiable. We transition products from conception to production for military and commercial customers.

**Technology Category Alignment:**

EO/IR Components for sensing, transmission and communication

RF Components for sensing, transmission and communication

High-Speed/Hypersonics

Fixed Wing Vehicles (includes UAS)

Synthesis/Analytics/Decision Tools

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**SYSCOM:** SPAWAR

**Contract:** FA9453-16-C-0423

 Corporate Brochure: [https://navystp.com/vtm/open\\_file?type=brochure&id=FA9453-16-C-0423](https://navystp.com/vtm/open_file?type=brochure&id=FA9453-16-C-0423)

**WHO**

**SYSCOM:** SPAWAR

**Sponsoring Program:** Navy PEO Space

**Transition Target:** Mobile User Objective System (MUOS)

**TPOC:**  
619-553-1675

**Other transition opportunities:** We see multiple paths to transition to machine to machine (M2M) applications, first into Low Earth Orbit (LEO) space vehicle and then into unmanned aerial vehicles and unmanned underwater vehicles. We also have a transitioning path directly with a Vulcan Wireless produced cryptographic solution.

**Notes:** The figure shows Vulcan Wireless's compact multi-functional software defined radio (SDR). The dimensions are 82 x 92 x 48.8 mm.



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**WHAT**

**Operational Need and Improvement:** There is a need to develop next generation of bandwidth efficient waveform(s) and/or hardware leading to increased radio frequency (RF) capacity in military Satellite Communications (SATCOM) applications. Driven by user demand for fixed and mobile satellite communications, satellite capacity requirements have grown by a factor of ten over a period of approximately twelve years. In order to continue this explosive growth in the face of limited RF spectrum, new innovations in advanced waveform processing will be required to leverage existing RF spectrum for increased SATCOM capacity.

**Specifications Required:** Tactical communications in polar regions and communications in denied regions is required. The goal of this project is to demonstrate a highly flexible space based CubeSat communications payload that can communicate with ground based tactical ultra high frequency (UHF) SATCOM radios, as well as crosslink to the MUOS satellite network. The ability to communicate over two radio systems requires the SDR to switch waveforms, as well as RF configurations. This capability will be built into the NSR-SDR-MUOS radio. The resulting CubeSat radio will provide dual mode communications for the CubeSat. The MUOS system will provide control of the CubeSat and data bridging and the second mode provides data bridging in the polar region for tactical UHF SATCOM users.

**Technology Developed:** Vulcan Wireless developed a compact multi-functional SDR hosting both MUOS and Legacy Ultra high frequency (UHF) waveforms on a LEO satellite platform. The radio has been prototyped and its functionally verifiable. This radio will be launched on a satellite and testing will be done in the pole and denied areas. Vulcan's radio provides:

- Global coverage, spread spectrum and anti-jam capability.
- Next generation UHF network that is connected to the Global Information Grid (GIG) for real time data.
- Connectivity to thousands of Legacy UHF radios deployed in the field today.
- Ability to reuse existing ground infrastructure without modification.
- Ability to be hosted on many small vehicles such as unmanned and space vehicles.
- Beyond the Line of Site (BLOS) capability.

**Warfighter Value:** The system provides a cost effective and enhanced global military communications links hosted on a low cost space vehicle that works in the poles and denied areas.

**WHEN**

**Contract Number:** FA9453-16-C-0423 **Ending on:** April 24, 2018

| Milestone                          | Risk Level | Measure of Success  | Ending TRL | Date          |
|------------------------------------|------------|---|------------|---------------|
| Environmental testing NSR-SDR-MUOS | Low        | Radio passed qualification testing  | TRL-6      | May 2016      |
| Design dual radio hardware upgrade | Med        | Radio fully assembled and presented in Critical Design Review (CDR) to SPAWAR | TRL-6      | February 2018 |
| Fabricate dual Radio NSR-SDR-MUOS  | Med        | Integrated, passed verification and operational testing                       | TR-6       | April 2018    |

**HOW**

**Projected Business Model:** Vulcan Wireless's radio is scheduled to go up into a satellite, where it will be tested in the polar and denied area regions. However, to get permission to operate on the MUOS network we will need to get National Security Agency (NSA) Communications Security (COMSEC) certification. Vulcan Wireless intends to manufacturer the radio hardware, but needs a partner to provide Type 1 cryptographic subsystem and Vulcan completes the system certification / qualification.

**Company Objectives:** Vulcan Wireless is looking to expand this technology in the area of cryptographic subsystem. The value chain would be Vulcan provides the radio hardware, partner provides the Type-1 cryptographic solution to complete this project with Vulcan Wireless completing the system certification/qualifications.

**Potential Commercial Applications:** With the radios flexible architecture multiple commercial applications can be for small satellites, unmanned aerial vehicles (UAVs), unmanned underwater vehicles (UUVs) and aircraft applications.