

WHO

SYSCOM: NAVWAR

Sponsoring Program: PEO C4I

Transition Target: MUUV (Medium Unmanned Underwater Vehicle) - Razorback TTL&R (Torpedo Tube Launch and Recovery)

TPOC: (619) 306-7378

Other Transition Opportunities: Medusa, Snakehead, other medium-to-large UUVs (Unmanned Underwater Vehicles) as well as USVs (Unmanned Surface Vehicles)

Notes: During the Base Phase II Program, PSI demonstrated the DUCS system mounted on a 12" UUV, achieving TRL 5 - testing in a relevant environment. The testing showed that PSI's antennas and mast can improve Beyond Line-of-Sight (BLoS) communications and GPS signal compared to the existing antennas. DUCS also stows into a compact form for Torpedo Tube Launch and Recovery (TTL&R).

- Activities during the Phase II Base program included:
- Development of a robust, pressure-compensated drivetrain and housing
 - Design and testing of novel, electrically-small antennas for satcom
 - Integration and demonstration of the completed system onboard a UUV

- Planned activities during future work include:
- Building and testing a reduced-Size, Weight and Power (SWaP) deployment mechanism
 - Implementing features that allow submersion of the antennas
 - Integration and testing on a UUV in an operational environment

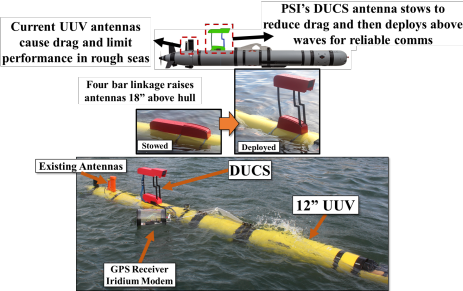


Photo courtesy Physical Sciences, Inc.

WHAT

Operational Need and Improvement: The US Navy seeks improved communications and GPS antennas for the Razorback UUV (Unmanned Underwater Vehicle) with multi-band operation. Torpedo-tube-launched UUVs have limited protrusion height above the hull, which reduces antenna performance in elevated sea states.

Physical Sciences, Inc. (PSI) is developing the Deployable UUV Communications System (DUCS) that raises multiple communications antennas off the hull of a UUV. Increased height above the ocean provides improved line-of-sight and beyond-line-of-sight communications. This integrated antenna solution ensures reliable communication links from the UUV to LEO and GEO satellites, and surface ships up to 12 nmi in conditions up to Sea State 2.

Specifications Required:

- Raising and Lowering Mechanism:
- Size: 24 in (L) X 2.9 in (H) X 3 in(W); system should match curvature of UUV hull
 - Cubical Content: 251 cu. Inches
 - Weight: neutrally buoyant including antennas
 - Power: Integrate with Razorback TTLR PoR requirements and constraints
- Antenna(s):
- Frequency coverage: Multi-band
 - Included in volume and weight specified above

Technology Developed: The Base Phase II program involved iterative design spirals to develop the deployer mechanism and novel antennas. The deployer mechanism is designed to survive up to Sea State 4 conditions when surfaced and is capable of submersion up to 600m. The antennas are designed to communicate with up to geostationary satellites to provide location and command-and-control data from over-the-horizon.

Warfighter Value: Enables launch and recovery from ships and boats, improving standoff and crew safety. Increased operational windows in heavier seas means more uptime, faster mission completion. Operational resiliency in areas with weak GPS/comms signals.

WHEN

Contract Number: N68335-21-C-0255

Ending on: Mar 25, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Tested Phase I Deployer in ocean	Low	Deployer operated in Sea State 2 waves	3	1st QTR FY21
Tested combined antennas	Medium	Testing in anechoic chamber showed antennas could function in close proximity without compromising performance	4	4th QTR FY21
Demonstrated integrated DUCS onboard UUV	Medium	System attached to UUV, with external data/power/RF connections achieved BLoS communications and pitch/roll stable operation	5	2nd QTR FY22
Future work: Demonstrate capability to submerge to 600m	Low	Successfully complete 10 cycles to 1000 psig, showing retention of functionality for all subsystems	6	2nd QTR FY23
Future work: Demonstrate system functionality integrated with UUV	Medium	System operates under control of UUV and performs BLoS comms	7	3rd QTR FY23

HOW

Projected Business Model: Engage with Primes and Program Offices to address current and future UUV development. Demonstrate DUCS meeting SWaP (Size, Weight, and Power) for TTL&R. We plan to partner with the Prime Contractor for MUUV, in support of the operational goals of PMS 406. We will continue to work closely with the Program Office and Prime to understand ConOps and mission requirements. PSI plans to manufacture DUCS in-house and sell to UUV Primes as either an integrated system sensor or optional system payload.

Company Objectives: We are looking to engage with the Prime for MUUV and other medium-to-large UUVs. Our goal is to become a provider for antenna masts and antennas onboard UUVs and Unmanned Surface Vehicles (USVs).

Potential Commercial Applications: Organizations with technology need include Navy Program Offices, Original Equipment Manufacturers (OEMs), and existing/future platforms.

- The main Program Office with UUV operations is PEO USC, including PMS 406 and PMS 408.
- UUV platforms include the REMUS 100/600/6000 and Mk 18 Mod2, MUUV, Knifefish, Riptide.
- Future platforms for the technology include Medusa, Snakehead LDUUV, and Orca XLUUV.
- Commercial applications include Oceanography, Resource extraction, and Search-and-rescue at sea.
- Many Navy UUVs are derived from commercial versions produced by the same Prime contractors, making it easy to transition DUCS to the commercial market.

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