

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2021-0439

Topic # N18A-T012

Power and Propulsion System Optimization

Cornerstone Research Group, Inc.

## WHO

**SYSCOM:** NAVSEA

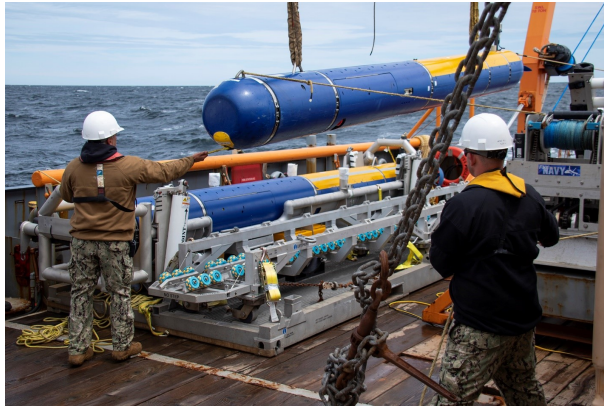
**Sponsoring Program:** PMS 406, Undersea Vehicles

**Transition Target:** Potential application is the Knifefish vehicle being used for mine detection, localization, and identification; and Large Diameter UUV, which is 48" in diameter and offers a payload capacity that lends the vehicle to multiple missions.

**TPOC:**  
(401)832-3838

**Other transition opportunities:** The new propulsion system design tool will ensure scalable performance when applied to different UUVs sizes, from micro-UUVs to Large Diameter Unmanned Underwater Vehicles (LDUUVs).

**Notes:** CRG teamed with Battle Sight Technologies to develop and mass produce a special crayon for warfighters, first responders and disaster-relief workers. Dubbed CrayTac, this device allows troops to write messages or draw complex figures on walls, sidewalks and other surfaces. The markings are invisible except to someone wearing night-vision goggles.



<https://media.defense.gov/2019/Aug/26/2002175376-1/-1/0/190513-N-YM590-1051.JPG>

## WHAT

**Operational Need and Improvement:** With the Navy's focus on the development and fielding of UUVs, there is a heightened need for efficient vehicle propulsion systems. These systems will allow the respective UUV to realize and achieve its maximum range, duration, and capability. As a result, energy management and efficient propulsion remains a fundamental limitation of UUVs. As more stress is placed on autonomy requiring more powerful sensors and computing, not having to compromise range and duration will necessitate the most efficient use of power for propulsion. What is performed currently to design a UUV propulsion system is a market survey and piecing together the adequate components. This methodology might provide a propulsion system for the UUV, but it is often far from optimized for the UUV's structure, mission, and size, weight, and power (SWaP) requirements.

**Specifications Required:** A design and analysis tool is needed that can optimize UUV power and propulsion systems for specific mission needs. This tool should be scalable across a large range of UUV size classes. It should be able to handle multiple mission objectives such as longer range or quieter systems.

**Technology Developed:** Cornerstone Research Group, Inc. (CRG) developed a software tool to analyze mission performance of existing UUVs and to design optimized power or propulsion component upgrades for UUVs. This software analyzes a number of UUV performance characteristics such as hydrodynamics, power generation and conversion, acoustics, and oceanographic effects. The software is modular to enable additional capabilities of interest to be incorporated as needed. It also uses multiple levels of fidelity to provide rapid results to the operator.

**Warfighter Value:** This technology enables improved capabilities to be provided for UUV missions. Upgraded power or propulsion systems can be retrofit to existing UUVs to increase range, to increase hotel load, or to produce quieter UUV platforms. These components can also be integrated early in the design stage for UUVs under development to further improve mission capabilities. The software can also be used to analyze existing UUVs (friendly or adversary) and predict system capabilities.

## WHEN

**Contract Number:** N68335-20-C-0043 **Ending on:** October 28, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstration of Software Capabilities	N/A	Demonstration of software analysis and optimization capabilities	3	February 2019
Baseline UUV Demonstration	N/A	Experimental validation of performance predictions of baseline UUV	5	May 2021
Optimized UUV Demonstration	Med	Experimental validation of performance predictions of optimized UUV	5	September 2021
Open Water Test	Med	If Option awarded; higher-fidelity experimental validation of performance predictions	6	September 2022

## HOW

**Projected Business Model:** Our business model is to provide upgraded power and propulsion components to system integrators or to end users for retrofit into existing systems or insertion into in-development platforms. An alternative use is to utilize the software to perform mission analysis of existing or in-development UUV platforms.

**Company Objectives:** We want to market the capabilities and uses of this technology, both on the hardware and software side, to interested parties within the Navy and primes. We want to solidify plans for transition of this technology to a Phase II Option or other follow-on opportunities to users in need of these capabilities. We anticipate that the Navy SBIR/STTR Transition Program (STP) will help facilitate connections within the Navy and prime contractors. The technology developed here is an enabler for improved UUV mission capabilities, and we see it providing value for both hardware upgrades of UUV platforms or mission analysis of UUVs.

**Potential Commercial Applications:** Commercial use could span to improving marketed UUVs used for oil and gas, and historical exploration. The expected deliverable from the subject effort will lead to efficient and low-noise UUVs regardless if the vehicle is used for military use or not. The UUV analysis and design software developed here was originally developed and used at CRG in relation to aircraft design and analysis. CRG sees further commercial applications for aircraft. This software could also be extended to other platforms of interest, such as unmanned surface vehicles (USVs).

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