

WHO

**SYSCOM:** NAVSEA  
**Sponsoring Program:** NAVSEA 073, Undersea Technology  
**Transition Target:** Naval Undersea Warfare Center (NUWC, DIVNPT)  
**TPOC:** (401) 832-6887  
**Other Transition Opportunities:**  
  
**Notes:**



<https://www.dvidshub.net/image/1186196/solid-state-laser-quick-reaction-capability-system-brief>

WHAT

**Operational Need and Improvement:** There is great demand for delivering high-energy laser from the laser source to the other subsystem with an optical fiber over long distance. However, because of the small core size (several microns to 10s microns) of a single-mode solid-core fiber, even moderate optical power can lead to high optical power intensities. As a result, nonlinear effects in a single-mode solid-core fiber often become significant and restrict the transmitting distance. Optical fibers with suppressed stimulate Brillouin scattering and other nonlinear effects are in great demand for transmitting high energy laser for a long distance for DoD’s high energy laser systems.

**Specifications Required:** The total optical power would need to be transmitted long distance capable of at least 2 to 3 kW output optical power per single-mode fiber with a goal to be able to support a future system having a threshold of 50 kW to a 100kW goal of output optical power at wavelengths 1 micron, 1.5 microns, and at 2 microns. The innovative fiber/fibers design should have a suppressed SBS and other nonlinear effects. Total optical loss of the innovative single-mode fiber/fibers/optical cables should be less than 0.5 dB of the length of 60+ feet.

**Technology Developed:** Capillary-in-tube fabrication technique was developed and hollow-core fibers with different designs have been fabricated. A hollow-core fiber with a minimum loss < 1 dB/m was fabricated and more than 150-meter fibers have been shipped to Navy’s labs and other prime contractors for high-energy laser delivery test.

**Warfighter Value:** The Navy is interested in the burgeoning technology area that supports a High-Energy Laser (HEL) system on naval platforms that can serve a vital role in naval defensive and offensive operations for ensuring Navy Battle Space Supremacy and water space management. NP Photonics anti-resonant hollow-core fiber (AR-HCF) approach is capable of SM high power( > kW) light transport with low loss, and is compatible to be integrated into HEL weapon system or subcomponents through a submarine pressure hull.

WHEN

**Contract Number:** N68335-20-C-0862      **Ending on:** Sep 28, 2021

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Develop the hollow-core fiber fabrication technology	Low	Hollow-core fiber was drawn	3	4th QTR FY20
Fabricate hollow-core fiber with loss < 0.1 dB/m	Low	Hollow-core fiber loss < 0.02 dB/m	4	4th QTR FY21
Fabricate hollow-core fiber with loss < 0.01 dB/m	Medium	Hollow-core fiber loss < 1 dB/m	5	3rd QTR FY23

HOW

**Projected Business Model:** Technical cooperation and partnership with Program Office to develop business partnership(s) with DoD Prime(s) already involved with Program Office.

Evolve to Phase III funding via DoD prime and joint product development

**Company Objectives:** Phase III funding via DoD prime and joint product development. Partnership with DoD prime for transition and commercialization.

**Potential Commercial Applications:** Innovations developed under this SBIR topic would be useful in industries such as industrial machining using high peak and high average power lasers, telecommunications and offshore oil/gas exploration.

Ultra-Short Pulse Lasers (USPL) in industrial machining require fiber coupled output for point to point transport. To date this has not been possible due to the nonlinear effects in solid core fibers.

This technology supports manned and unmanned platforms, petroleum wells, associated drilling and monitoring processes, undersea cable systems, and high-pressure pipeline monitoring.