

# Department of the Navy SBIR/STTR Transition Program

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Topic # N182-102  
Multicore Fiber Optic Connector for Wideband Digital and Analog Photonic Links  
Chiral Photonics, Inc.

## WHO

**SYSCOM:** NAVAIR

**Sponsoring Program:** Seeking Navy or DoD program

**Transition Target:** RF-over-fiber communications or towed array applications

**TPOC:** (301) 342-4122

**Other Transition Opportunities:** High bandwidth density fiber optic links and cables



Image courtesy of Chiral Photonics, Inc. 2022

**Notes:** Chiral Photonics (CPI) has been working with multicore fiber (MCF) for over a decade and providing MCF fanouts and other related components worldwide for a variety of applications ranging from 3D shape sensing for equipment enabling minimally invasive surgery to submarine cables. Fanouts, having been Telcordia, submarine and biomedical qualified, are in volume production. CPI was also integral to the first terrestrial deployment of a high bandwidth density MCF cable in 2022.

The present award for NAVAIR Topic Number N182-102, together with a few sister topics, is aimed at developing mil-spec ready technology for RF-over-fiber that utilizes multicore fiber. In RF-over-fiber, balanced detection provides improved noise and gain performance but requires a pair of channels as identical as possible in terms of path length and environmental conditions for making phase measurements. A multicore optical fiber, contains multiple optical cores and assures those channels are nearly identical in length and the environmental conditions they encounter. Chiral is tasked with making a mil-spec ready connector for multicore fiber, shown in the center of the fiber optic assembly shown here. NRL's informal test report stated, "as expected with 38999 style military connectors, the unit is robust, easy to use, and intuitive. The connector is keyed and the threading mechanism engages easily, making it foolproof."

## WHAT

**Operational Need and Improvement:** Military grade connectors that can enable RF-over-fiber balanced detection with improved noise and gain.

**Specifications Required:** Sub-0.5 dB insertion loss military grade connectors that enable adoption of high bandwidth density MCF across platforms and operate at the 1000 nm and 1550 nm RFoF wavelength bands.

**Technology Developed:** The military-grade MCF connector has been delivered in physical connection (PC) and angled physical connection (APC) versions and an expanded beam (EB) version is under development.

**Warfighter Value:** Higher quality communications links provide higher bandwidth density, are lighter weight and have tighter bend radius than comparable electronic or conventional fiber optic links.

## WHEN

**Contract Number:** N68335-21-C-0186

**Ending on:** Dec 29, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
MCF PC connector	High	Prototype passes testing and delivered to NRL for additional testing	4	4th QTR FY22
MCF APC connector	High	Prototype passes testing and delivered to NRL for additional testing	4	4th QTR FY23
MCF EB connector	High	Prototype passes testing and delivered to NRL for additional testing	4	3rd QTR FY24

## HOW

**Projected Business Model:** CPI is a primary supplier of MCF fanouts and related components worldwide. Oftentimes CPI's customers require MCF connectorization, which is addressed currently with available fiber connectors that are optimized and installed by CPI. CPI is well positioned to carry forward mil-spec testing once the testing required is defined with customers. CPI envisions manufacturing the connectors and providing them to defense contractors and other customers as part of MCF assemblies. Licensing of the designs are also possible.

**Company Objectives:** CPI is expanding and scaling its MCF component and assembly offerings worldwide for communications, sensing and defense applications.

**Potential Commercial Applications:** The market for MCF components is rapidly expanding with biomedical equipment utilizing 3D shape sensing in production for a few years. The first terrestrial high bandwidth density link was installed in 2022 and the first submarine cable announced in 2023. New markets that can take advantage of the promise shown in R&D, in areas such as RF (Radio Frequency) over Fiber (RFoF) and free-space and quantum communications, promise to continue to expand the demand for MCF-related components and devices.

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