GOOD FIBER

A mid-infrared fiber technology, licensed from DoD, neutralizes threats from heat-seaking missiles

IRFlex's Fiber Combiner

According to the U.S. Air Force, nearly 80 percent of their aircraft losses during Operation Desert Storm in Iraq in 1991 resulted from ground-based defensive systems with infrared (IR) homing capabilities. IR homing allows weapons systems to track the IR light, or heat signature, emitted from hot objects, such as vehicles and aircraft. Using IR homing, heat-seeking missiles can be launched from the ground or another aircraft and detect the hot engine plumes of their targets. Infrared countermeasure (IRCM) systems protect tactical aircraft and their crew against heat-seeking missile threats by using lasers to blind and disable the missile's guidance system.

IRflex, a small company based in Herndon, Virginia, is dedicated to the development and production of fiber optic devices for mid-infrared applications. IRflex president Francois Chenard, Ph.D., a fiber-optics expert, started the company in 2006 because he saw a significant gap in the industry's capabilities for the mid-infrared spectrum. At an industry conference, he met several researchers from the Navy Research Lab (NRL) and discussed with them the Navy's interest in commercializing results of the cutting-edge research they had performed in fiber optics, specifically the mid-infrared spectrum.

According to Chenard, silica fibers for telecommunications and industrial applications were already a mature market, but transmission stopped at two microns wavelength. IRflex instead focused on the mid-infrared spectrum from 2 to 10 microns.

After founding IRflex in 2006, Chenard licensed the patented technology through the technology transfer office at NRL. The partially-exclusive agreement allowed IRflex to commercialize NRL's intellectual property for fabricating and using low-loss mid-infrared glass fibers, fiber amplifiers, and fiber couplers. IRflex started manufacturing products in 2009 and taking them to market in 2012. With a small team of ten dedicated employees—experts in materials sciences, engineers, and technicians—IRflex has continued to improve their fiber technology and commercialize new products based on their successful license agreement with NRL.

Chenard credits NRL staff and technology transfer officers for providing a smooth transition and comprehensive support during the licensing process. All of IRflex's current products—the mid-IR fibers, connectors, and fiber combiners—are based on the one Navy patent licensed during the company's founding stages.

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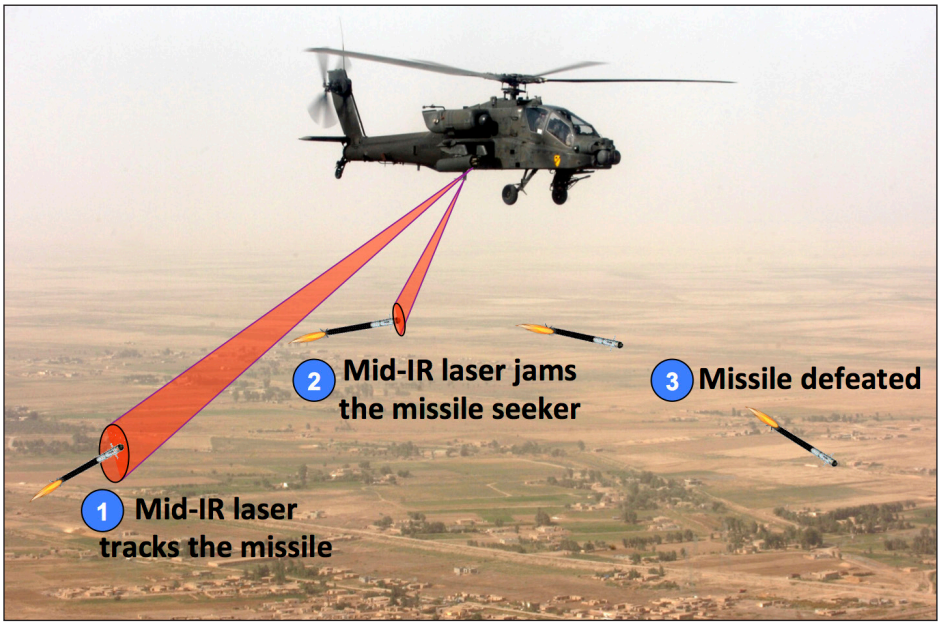
Christopher L. Strand, Ph.D., a research engineer at Stanford University, utilized IRflex's expertise for a project regarding rotation detonation engines with the Naval Postgraduate School in Monterey, California. Strand praised IRflex's willingness to rapidly address technological hurdles and develop pioneering technologies that were desperately needed: "IRflex's novel fiber combiner enabled us to get light in and out of a sensor system we developed for this engine. IRflex was the first company to make this type of combiner in the mid-infrared, which allowed us to take more accurate measurements and achieve better performance than near-infrared fibers would have."

The sensor and measurements using IRflex's fiber combiner were presented in 2018 at the 37th International Symposium on Combustion, and received a silver medal nomination in the diagnostics category.

Dr. Christopher L. Strand
Stanford University

Dr. Francois Chenard
President, IRFlex

Dr. Augie Ifarraguerri
Leidos



Photos courtesy IRFlex

A demonstration of IRFlex's Laser-Based Infrared Countermeasures (IRCM) technology, developed with help from a Navy patent license.

One of the main issues addressed by IRflex was the need for bringing mid-infrared technology up to par with near-infrared capabilities. The mid-infrared range called for different materials than near-infrared, and the big challenge has been to figure out which materials to use, how to manipulate them, and how to replicate the qualities of the near infrared devices.

Augie Ifarraguerri, Ph.D., program manager at Leidos, a Virginia-based defense and aviation company, appreciated IRflex's commitment to meeting their needs for developing a new mid-infrared supercontinuum source: "I found Dr. Chenard to be very knowledgeable in his field and an eager collaborator," Ifarraguerri said, "As with much high-risk research, there are failures and setbacks, which we experienced together with IRflex as they pushed the frontier in terms of fiber performance. IRflex made a significant investment in process improvement to satisfy our requirements. Our collaboration has led to the publication of several research papers as well as the development of a prototype mid-infrared supercontinuum source."

IRflex is now working to develop the next-generation IRCM to defend aircraft from heat-seeking missiles. Current systems use multiple lasers but are combined with mirrors and lenses into the pointer tracker, causing the separate parts to be subjected to vibration and temperature changes which in turn can negatively affect alignment and transmission. The new IRflex system will combine lasers and pointer trackers into one system. The modular structure will have no moving parts, allowing for easier maintenance and replacement of components, while decreasing complexity and increasing overall reliability.

Chenard continues to advance the boundaries of what is possible in mid-infrared technology. "Currently, fiber performance in our products is good," he said, "but we are striving to make it even better in terms of transmission, to lower the loss and improve the performance. We're grateful for the support from the military and government initiatives to grow our company, develop advanced technologies, and create products that benefit the warfighter and commercial industries."

IRFlex Corp. • Danville, VA

Agency: Navy • Lab: NRL • License Type: Partially-Exclusive • Technology Description: Methods for fabricating and using low-loss mid-infrared glass fibers, fiber amplifiers, and fiber couplers.