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Transparent Ceramic and Fiber Amplifier Technologies

**NRL Receives 2008 Federal Laboratory Consortium Awards
for Excellence in Technology Transfer**

(Washington, DC • 8/11/08) – The Naval Research Laboratory (NRL) received two Awards for Excellence in Technology Transfer at the recent annual meeting of the Federal Laboratory Consortium (FLC) in Portland, Oregon.

Material scientists in the NRL Optical Sciences Division and licensing professionals from the NRL Technology Transfer Office (TTO) were recognized for the development and commercialization of a novel process to produce transparent spinel ceramic with superior clarity and strength compared to currently available materials. Potential applications include impact-resistant windows, protective armor, and numerous other government and private sector applications where tough yet transparent materials are required.

The NRL team overcame shortcomings in existing processing techniques to produce, for the first time, a cost-effective, high-optical quality spinel ceramic that was more rugged than glass, transparent to more infrared wavelengths than sapphire, and otherwise superior to the standard commercially available materials. Within six months, the NRL team successfully transferred its spinel ceramic technology to MER Corporation of Tucson, Arizona, by providing research-based guidance and regular technical support to company personnel during initial stages of commercial production. Concurrent patent licensing and Cooperative Research and Development Agreements (CRADAs) between NRL and MER expedited the transition of this new processing technique to the private company, now the first U.S. supplier of the breakthrough material.

The NRL-patented processing method and its spinel ceramic product together represent notable advances over traditional processing methods and transparent materials in terms of scalability, production rates, performance, durability, cost effectiveness, and range of potential applications. The transferred technology yields material of superior strength and clarity. Anticipated military applications range across the spectrum, from personnel protective items like face shields and explosive-resistant windows in aircraft, ground vehicles, and submarines, to optical components in high-energy laser systems. Commercial uses appear nearly limitless, given the ubiquity of consumer electronics using rugged transparent materials, e.g., display windows. Reduced manufacturing costs and improved performance assure that the NRL-patented spinel ceramic processes could reshape industry technologies and product standards, with the potential to capture a share of the multibillion dollar global market.

The NRL team members from Optical Sciences Division are Drs. Ish Aggarwal, Jas Sanghera, Shyam Bayya, and Guillermo Villalobos. The awardees from NRL's Technology Transfer Office are Ms. Amanda Horansky-McKinney and Dr. Rita Manak.

A second award went to a team of inventors from NRL and Sandia National Laboratories and licensing professionals from the NRL TTO for the development and commercialization of a patented laser component, a helical fiber amplifier that revolutionizes the potential applications of fiber lasers.

The NRL/Sandia team discovered that coiling laser fibers in precise dimensions would filter out undesirable modes, thereby making high-power fiber lasers with high spatial mode quality possible. Their inventive solution resolved the power limitations of fiber lasers that had stymied the industry since these lasers were first developed in 1963, while maintaining the highest quality spatial mode. The groundbreaking discovery now allows production of high-power fiber lasers that are more cost-effective, rugged, and compact than other types of lasers.

Following patent approval in 2002, the team initiated transfer of its helical fiber amplifier (also called a mode-filtering fiber amplifier) to several commercial laser manufacturers: Nufern of East Granby, Connecticut; LIEKKI Corporation of Lohja, Finland (which has since been acquired by nLight Corporation); and IMRA America, Inc., of Ann Arbor, Michigan. By granting licenses to multiple companies, the NRL technology will be available in a wide range of products at competitive prices.

By 2006, all three companies had received patent licenses allowing use of the innovative technology in their laser-based product lines. Over time, the technology transfer involved a changing list of collaborative partners and agreements as the inventors moved on to other research institutions. Despite the complexities involved, the outcome has been impressive, with new products already on the market and vast potential markets awaiting the new award-winning technology. The collaboration between Department of Defense and Department of Energy researchers to develop the NRL and Sandia-patented technology will significantly affect industries like telecommunications, materials processing, and remote sensing by enabling lasers with higher power capability, superior performance features, lower maintenance costs, and smaller size. Applications range across the private and public sectors from real-time contaminant sensing and precision circuitry manufacture to secure high-bandwidth communications. Helical fiber amplifiers are already changing the worldwide fiber laser industry, shaping multibillion dollar market shares and creating new product possibilities.

Former NRLers from the Optical Sciences Division Dr. Jeff Koplw (now with Sandia National Laboratories), Dr. Dahv Kliner (formerly also of Sandia National Laboratories), and Dr. Lew Goldberg (now with the Army Night Vision Laboratory) are members of this team of inventors. The licenses were negotiated by Ms. Jane Kuhl, formerly Head, Technology Transfer Office with the assistance of Dr. Christina Jansen, contractor to TTO, and Ms. Sally Ferrett, NRL patent attorney.

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The Naval Research Laboratory is the Department of the Navy's corporate laboratory. NRL conducts a broad program of scientific research, technology, and advanced development. The Laboratory, with a total complement of nearly 2,500 personnel, is located in southwest Washington, DC, with other major sites at the Stennis Space Center, MS; and Monterey, CA.