



OPTICAL SCIENCES R&D

Optical Science Division of the Naval Research Laboratory (NRL) is seeking proposals for innovative research supporting ongoing programs within the Optical Sciences Division related to a wide variety of topics in the following areas:

- 1) The development of countermeasures against laser guided or laser aided threats, such as laser beamrider missiles, laser designators, and laser rangefinders. Of these, laser beamriders are the highest priority threat. Innovative new techniques which support laser countermeasures are desired.
- 2) The development of countermeasure technology and countermeasure techniques against advanced anti-air and anti-ship imaging infrared seekers. NRL is interested in organizations with a strong knowledge of imaging tracker design and processing to conduct the countermeasure research. Offerors must also have background in the use of modeling and simulation tools for imaging seekers to conduct countermeasure research.
- 3) Fabrication of optical fibers that transmit infrared (IR) radiation, especially chalcogenide and heavy-metal oxide glass fibers; processing techniques for making IR fibers; purification of glass starting materials; novel crucible fiber drawing techniques; specialty fibers for chemical sensor applications and techniques for making chemical sensors. Development of ruggedized, vibration-resistant and athermal cables and connectors for middle wavelength IR (MWIR) fibers for use with high power mid-IR lasers. New technologies for making IR fiber switches to work with mid-IR lasers as well as technology for fabrication of IR fiber couplers, filters and splitters.
- 4) Fabrication of domes, aspherical optics and large (≥ 20 inch) diameter windows with high transmission across UV-Visible and infrared wavelengths. Technologies are sought that utilize environmentally rugged materials (glasses, ceramics or poly/single crystals) and produce defect-free optics with wide band anti-reflection coatings.

- 5) New and advanced technology for making highly-efficient, thin film photovoltaic devices. Areas of interest include new absorber materials, earth-abundant materials, and technologies enabling thin film based multi-junction devices. In addition, innovative techniques to form flexible devices by depositing these films on flexible polymer or metal substrates are required.
- 6) Fiber optic sensors for detecting acoustic, magnetic and electric fields, rotation rate, strain, temperature, pressure, chemical, and other parameters. Novel interrogation, multiplexing, demultiplexing and modulation/demodulation techniques using frequency, wavelength and time division, or other techniques to increase sensor count per fiber, decrease electronic demodulation power requirements, and provide all-optical signal processing, and lower total system cost are desired. In addition methods are sought for improving fiber sensor performance, packaging, deployment, and survivability of these systems in a variety of environments. Low phase noise laser sources that feature very good isolation from ambient effects to improve overall optical system performance are desired. Low power, high bandwidth, signal-processing components with automatic signal detection to fill current technology gaps for autonomous sensors are of interest. Robust, agile, advanced automation tools that are able to detect, classify and track selected targets of interest acoustically, using data from fixed and mobile arrays and generate automated contact reports are desired to reduce manpower requirements associated with sonar operator tasks.
- 7) High frequency data transfer networks using fiber optics; signal processing in fiber optic links; optical-microwave delay lines for gigahertz signal transmission, high frequency directly modulated diodes and external modulators, and high speed detectors (particularly any aforementioned device that reduces delay line loss). Fiber devices such as amplifiers, fiber lasers, super-luminescent fibers, and phase shifters; laser diodes that meet military specifications and can operate in the multigigabit/s range; harmonic generation and mixing using laser diodes; nonlinear effects that impact fiber optic links such as soliton propagation, Brillouin scattering, and four-wave mixing. Integrated optical devices for sensors, optical-microwave delay lines, signal processing, networks, digital or analog communication links.
- 8) Glass and processing techniques for nanochannel glass technology and holey fibers; specialty glasses and fibers for sensor applications and nuclear radiation hardness; glass and processing techniques for microwire glass technology; optical fibers with high mechanical strength, survivable coatings, and low bending loss. Novel nonlinear optical materials for optical limiters and switches to protect eyes and sensors against intense laser radiation; photonic band-gap materials; optical properties of materials and coatings; narrow band gap superlattices; quantum wells, wires and dots; bioconjugated quantum dots to probe cellular and environmental behavior; novel nanostructures; the interaction of light with single microdroplets; development of real-time in-situ optical instrumentation to detect bioaerosols, including single particles on-the-fly; development of type II "W" mid-IR lasers and quantum cascade lasers; other MWIR laser and amplifier devices that increase

brightness and power; organic light emitting sources and optoelectronics; slow light studies; nonlinear optical probes such as Fast CARS; and development of condition based sensors for oil debris monitoring.

- 9) Electro-optical, visible, infrared, multi spectral and hyperspectral technologies used in systems for reconnaissance and surveillance of air, ocean, and ground targets, from space, air, surface and subsurface platforms; high-speed digital optical/RF communications in a tactical environment, including architectural issues; algorithmic development, including digital image and signal processing algorithms for target detection and tracking; the measurement and theory of optical signatures of air and ocean targets; the acquisition, and characterization and simulation of large-area background imagery; atmospheric propagation effects relevant to missile warning, laser countermeasures, and imaging; electro-optical sensor technology including efficient high-speed photo-detectors, focal plane arrays and signal processing; electro-optical components; digital holography and electronic shutters; signal processing and data compression for multi color electro-optical and infrared sensors; multi-int sensor/data fusion and exploitation; neural network processing and electronics particularly applicable to electro-optical sensors; advanced data compression techniques and electronics for very large area visible, infrared, and multi spectral; pulsed solid state blue-green lasers.

The Optical Sciences Division is interested in receiving proposals for research related to these research interests. Address White Papers (WP) to OptSciNRL_BAA@nrl.navy.mil. Allow one month before requesting confirmation of receipt of WP, if confirmation is desired. Substantive contact should not take place prior to evaluation of a WP by NRL. If necessary, NRL will initiate substantive contact.