

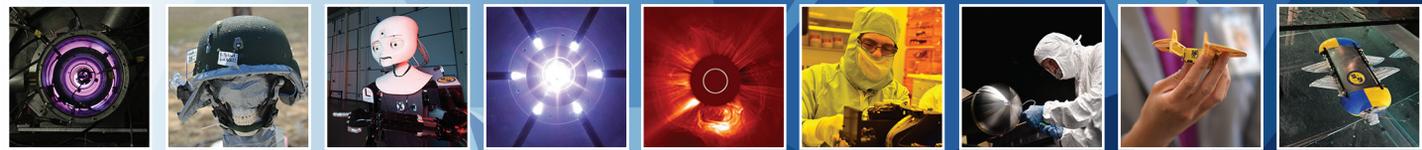
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NRL GUIDE



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Washington, DC 20375-5320

www.nrl.navy.mil



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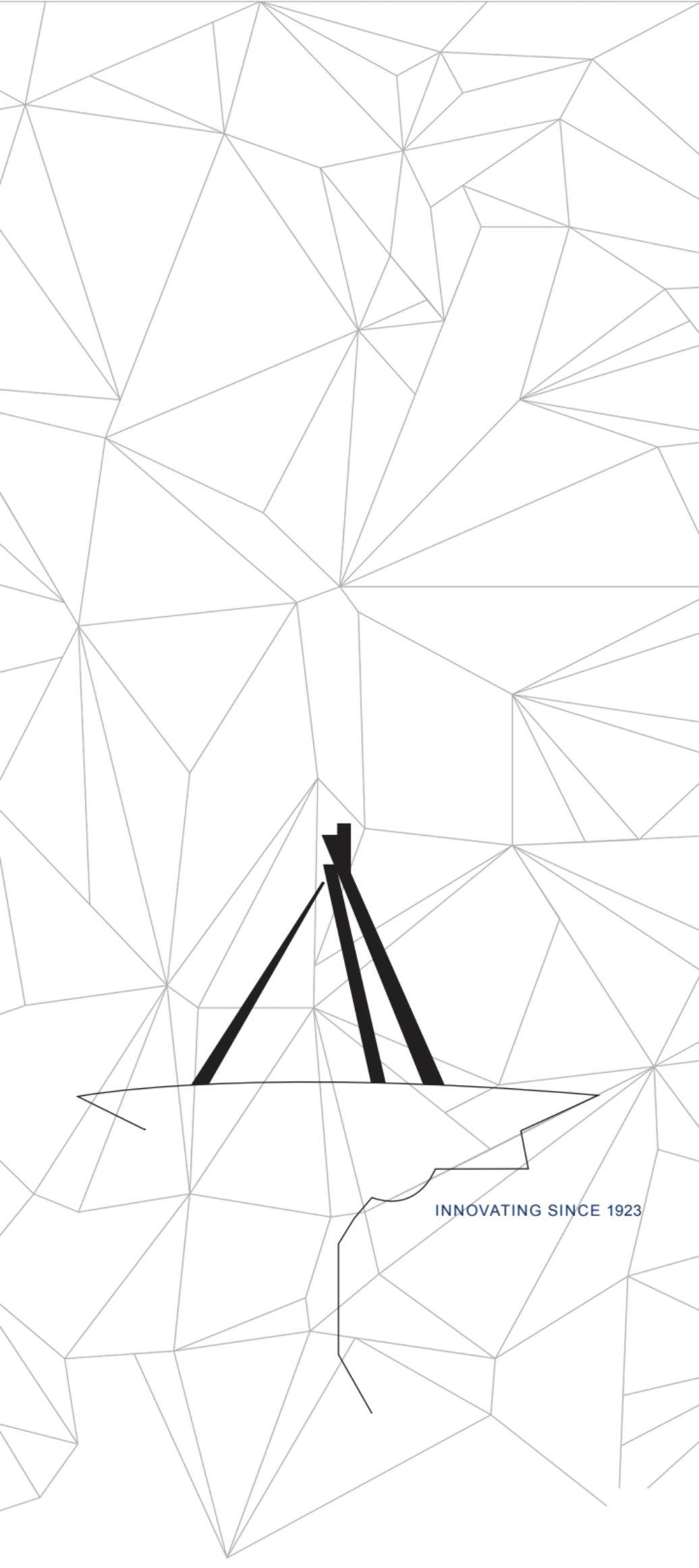
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INNOVATING SINCE 1923

Current Research and Development Efforts

Advanced Radio, Optical, and IR Sensors

Advanced optical sensors
EM/EO/meteorological/oceanographic sensors
Satellite meteorology
Precise space tracking
Radio/infrared astronomy
Infrared sensors and phenomenology
UV sensors and middle atmosphere research
VLBI/astrometry
Optical interferometry
Imaging spectrometry
Liquid crystal technology

Autonomous Systems

Algorithms for control of autonomous systems
Cognitive robotics
Human–robot interaction
Perception hardware and algorithms
High-level reasoning algorithms
Machine learning and adaptive algorithms
Sensors for autonomous systems
Power and energy for autonomous systems
Networking and communications for mobile systems
Swarm behaviors
Test and evaluation of autonomous systems

Computer Science and Artificial Intelligence

Standard computer hardware, development
environments, operating systems, and run-time support
software
Methods of specifying, developing, documenting, and
maintaining software
Human–computer interaction
Intelligent systems for resource allocation, signal
identification, operational planning, target classification,
and robotics
Parallel scientific libraries
Algorithms for massively parallel systems
Digital progressive HDTV for scientific visualization
Adaptive systems: software and devices
Advanced computer networking
Simulation management software for networked high
performance computers
Interactive 3D visualization tools and applications
Real-time parallel processing
Scalable, parallel computing
Petaflop computing, globally distributed file systems, terabit-
per-second networking

Directed Energy Technology and Railguns

- High-energy lasers
- Laser propagation
- Solid-state and fiber lasers
- High-power microwave sources
- Electromagnetic launchers (railguns)
- Pulse detonation engines
- Charged-particle devices
- Pulsed power
- DE effects
- Underwater laser acoustic sources
- Wireless recharging (power beaming)

Electronic Electro-optical Device Technology

- Integrated optics
- Radiation-hardened electronics
- Nanotechnology
- Microelectronics
- Microwave and millimeter-wave technology
- Hydrogen masers for GPS
- Aperture syntheses
- Electric field coupling
- Vacuum electronics
- Focal plane arrays
- Radiation effects and satellite survivability
- Molecular engineering

Electronic Warfare

- EW/C2W/IW systems and technology
- COMINT/SIGINT technology
- EW decision aids and planning/control systems
- Intercept receivers, signal processing, and identification systems
- Passive direction finders
- Decoys and offboard countermeasures (RF and IR)
- Expendable autonomous vehicles/UAVs
- Repeaters/jammers and EO/IR active countermeasures and techniques
- Platform signature measurement and management
- Threat and EW systems computer modeling and simulations
- Visualization
- Hardware-in-the-loop and flyable ASM simulators
- Missile warning infrared countermeasures
- RF environment simulators
- EO/IR multispectral/hyperspectral surveillance

Enhanced Maintainability, Reliability, and Survivability Technology

- Coatings
- Friction/wear reduction

- Water additives and cleaners
- Fire safety
- Laser hardening
- Satellite survivability
- Corrosion control
- Automation for reduced manning
- Radiation effects
- Mobility fuels
- Chemical and biological sensors
- Environmental compliance

Environmental Effects on Naval Systems

- Meteorological effects on communications
- Meteorological effects on weapons, sensors, and platform performance
- Air quality in confined spaces
- Electromagnetic background in space
- Solar and geomagnetic activity
- Magnetospheric and space plasma effects
- Nonlinear science
- Ionospheric behavior
- Oceanographic effects on weapons, sensors, and platforms
- EM, EO, and acoustic system performance/optimization
- Environmental hazard assessment
- Contaminant transport
- Biosensors
- Microbially induced corrosion
- Laboratory simulation of space plasmas

Imaging Research/Systems

- Remotely sensed signatures analysis
- Real-time signal and image processing algorithms/systems
- Image data compression methodology
- Image fusion
- Automatic target recognition
- Scene/sensor noise characterization
- Image enhancement/noise reduction
- Scene classification techniques
- Radar and laser imaging systems studies
- Coherent/incoherent imaging sensor exploitation
- Remote sensing simulation
- Hyperspectral imaging
- Microwave polarimetry
- Image processing

Information Technology

- High-performance, all-optical networking
- Antijam communication links
- Next-generation, signaled optical network architectures
- Integrated voice and data
- Information security (INFOSEC)
- Voice processing

High performance computing
High performance communications
Requirements specification and analysis
Real-time computing
Wireless mobile networking
Behavior detection
Machine learning
Information filtering and fusion
Integrated internet protocol (IP) and asynchronous transfer mode (ATM) multicasting
Reliable multicasting
Wireless networking with directional antennas
Sensor networking
Communication network simulation
Bandwidth management (quality of service)
High assurance software
Distributed network-based battle management
High performance computing supporting uniform and nonuniform memory access with single and multithreaded architectures
Distributed, secure, and mobile information infrastructures
Simulation-based virtual reality
High-end, progressive HDTV imagery processing and distribution
Defensive information warfare
Virtual reality/mobile augmented reality
3D multimodal interaction
Model integration (physical, environmental, biological, psychological) for simulation
Command decision support
Data fusion

Marine Geosciences

Marine seismology with both conventional and unique instrumentation, including analysis of acoustic reflections for seafloor physical and acoustic properties, and indications of fluid and gas seeps, methane gas, and methane hydrate, in support of acoustic performance prediction
Numerical simulation and prediction of seafloor sediment properties
Generation and analysis of interface (Scholte) waves in support of mine warfare and mine countermeasures
Laboratory measurements of a wide variety of sediment physical and acoustic properties.
Acoustic, electro-optic, and electromagnetic sensing for seafloor mapping and characterization
Modeling, simulation, and prediction of nearshore and riverine processes

Geospatial science and technology for enabling information dominance

Geotechnical investigations of seafloor structure and strength

Materials

Superconductivity

Magnetism

Biological materials

Materials processing

Advanced alloy systems

Solid free-form fabrication

Environmental effects

Energetic materials/explosives

Aerogels and underdense materials

Nanoscale materials

Nondestructive evaluation

Ceramics and composite materials

Thin film synthesis and processing

Electronic and piezoelectric ceramics

Thermoelectric materials

Active materials and smart structures

Computational material science

Paints and coatings

Flammability

Chemical/biological materials

Spintronic materials and half metals

Biomimetic materials

Multifunctional materials

Power and energy

Synthetic biology

Microwave and high pressure processing

Additive manufacturing

Meteorology

Global, theater, tactical-scale, and on-scene numerical weather prediction

Data assimilation and physical initialization

Atmospheric predictability and adaptive observations

Adjoint applications

Marine boundary layer characterization

Air/sea interaction; process studies

Coupled air/ocean/land model development

Tropical cyclone forecasting aids

Satellite data interpretation and application

Aerosol transport modeling

Meteorological applications of artificial intelligence and expert systems

On-scene environmental support system development/nowcasting

Tactical database development and applications

Meteorological tactical decision aids
Meteorological simulation and visualization

Ocean Acoustics

Underwater acoustics, including propagation, noise, and reverberation
Fiber-optic acoustic sensor development
Deep ocean and shallow water environmental acoustic characterization
Undersea warfare system performance modeling, unifying the environment, acoustics, and signal processing
Target reflection, diffraction, and scattering
Acoustic simulations
Tactical decision aids
Sonar transducers
Dynamic ocean acoustic modeling
Underwater acoustic communication

Oceanography

Oceanography instrumentation
Open ocean, littoral, polar, and nearshore oceanographic forecasting
Shallow water oceanographic effects on operations
Modeling, sensors, and data fusion
Ocean data assimilation
Bio-optical processes
Oceanographic processes observation: mixing, waves, circulation
Waves, tides, and surf prediction
Sea ice modeling and prediction
Coupled ocean-ice-wave-air-land modeling
Coupled data assimilation
Global, theater, and tactical scale modeling
Remote sensing of oceanographic parameters
Satellite image analysis
In-water sensing of ocean optics and biology
Turbulence effects on ocean optics

Space Systems and Technology

Two-phase heat transfer systems
Space systems architectures and requirements
Advanced payloads and optical communications
Controllers, processors, signal processing, and VLSI
Precision orbit estimation
Onboard autonomous navigation
Satellite ground station engineering and implementation
Tactical communication systems
Spacecraft antenna systems
Launch and on-orbit support
Precise Time and Time Interval (PTTI) technology
Atomic time/frequency standards/instrumentation
Passive and active ranging techniques

Design, fabrication, and testing of spacecraft and hardware

Structural and thermal analysis

Attitude determination and control systems

Reaction control

Propulsion systems

Navigation, tracking, and orbit dynamics

Spaceborne robotics applications

Surveillance and Sensor Technology

Point defense technology

Imaging radars

Surveillance radars

Multifunction RF systems

High-power millimeter-wave radar

Target classification/identification

Airborne geophysical studies

Fiber-optic sensor technology

Undersea target detection/classification

EO/IR multispectral/hyperspectral detection and classification

Sonar transducers

Electromagnetic sensors, gamma ray to RF wavelengths

SQUID for magnetic field detection

Low observables technology

Ultrawideband technology

Interferometric imagery

Microsensor systems

Digital framing reconnaissance canvas

Biologically based sensors

Digital radars and processors

Undersea Technology

Autonomous vehicles

Bathymetric technology

Anechoic coatings

Acoustic holography

Unmanned undersea vehicle dynamics

Weapons launch



Research in NRL's
DIVISIONS/DEPARTMENTS

EXECUTIVE DIRECTORATE

INSTITUTE FOR NANOSCIENCE, CODE 1100

NANOINFO@NRL.NAVY.MIL

NANOSCIENCE AND NANOTECHNOLOGY

Low-power, high-speed electronics
Lightweight, high-strength materials
Molecular sensors
Efficient energy generation and storage
Quantum information technology
Bio/inorganic hybrids
Neuroelectronics

LABORATORY FOR AUTONOMOUS SYSTEMS RESEARCH, CODE 1700

LASRINFO@NRL.NAVY.MIL

AUTONOMOUS SYSTEMS RESEARCH

Multidisciplinary research, development, and integration
in autonomous systems
Software for intelligent autonomy
Novel human–systems interaction technology
Mobility and platforms
Sensor systems
Power and energy systems
Networking and communications
Trust and assurance

SYSTEMS DIRECTORATE

RADAR DIVISION, CODE 5300

RADARINFO@NRL.NAVY.MIL

RADAR ANALYSIS

Target signature prediction and measurement
Electromagnetics and antennas
Airborne early-warning radar (AEW)
Inverse synthetic aperture radar (ISAR)
Sea clutter modeling
Periscope detection
Wideband array simulation and fabrication

ADVANCED RADAR SYSTEMS

High-frequency over-the-horizon radar systems
HF radar technology
Signal analysis

Real-time signal processing and equipment
Computer-aided engineering (CAE)
Multifunction systems

ADVANCED CONCEPTS GROUP

Millimeter-wave radar
Radar systems engineering
Commercial technology exploitation

SURVEILLANCE TECHNOLOGY

Optimization techniques
FPGA-based digital processing
Shipboard surveillance radar
Ship self-defense
Electronic counter-countermeasures and
 electronic protection (EP)
Target signature and information extraction
Asymmetric and expeditionary warfare
Spectrum management
Ultrawideband technology
Dynamic waveform diversity
Multistatic radar network information
Ballistic missile defense
Mine detection

**INFORMATION TECHNOLOGY DIVISION,
CODE 5500**

ITDINFO@NRL.NAVY.MIL

ADVERSARIAL MODELING AND EXPLOITATION OFFICE

Behavioral indicators of hostile intent
Suspicious behavior detection research
Behavioral modeling, analysis, and metrics
Deception detection research
Geospatial modeling and simulation
Spatially integrated social science
Automated video analysis and retrieval

**NAVY CENTER FOR APPLIED RESEARCH IN ARTIFICIAL
INTELLIGENCE**

Autonomous and intelligent systems
Cognitive science
Cognitive architectures and models
Machine learning and deep learning
Adaptive systems
Intelligent decision aids
Natural language and multimodal interfaces
Human-robot interaction and teaming
Human/autonomous system interaction and
 collaboration

Robotics software
Perception and computer vision

TRANSMISSION TECHNOLOGY

Communication system architecture
Communication antenna/propagation technology
Communications intercept systems
Secure voice technology
Satellite and tactical networking
Satellite communications research
Satellite architecture analysis
RF systems analysis
Extended spectrum communications
Atmospheric channel effects on photonic transfer
Studies in marine miraging
Modulating retroreflector based communications
Signature studies for ISR
Adaptive optics for freespace optical communications
Signal processing
Software defined radio

CENTER FOR HIGH ASSURANCE COMPUTER SYSTEMS

Hypervisor technology for computational platforms
Formal specification/verification of system security
COMSEC application technology
Technology and solutions to secure networks and databases
Software engineering for secure systems
Key management and distribution solutions
Information systems security (INFOSEC) engineering
Formal methods for requirements specification and verification
Security product development
Secure wireless network and wireless sensor technology
Network security protocol modeling, simulation, and verification
Security for systems-on-a-chip (SoC)
Cross-domain solution technology development
Computer Network Defense (CND) technology
Hardware/software co-design
Malicious code analysis
Anonymizing systems
Quantum information science

NETWORKS AND COMMUNICATION SYSTEMS

Communication system engineering
Mobile, wireless networking technology
Bandwidth management (quality of service)

Joint service tactical-edge networking
Automated testing of highly mobile tactical networks
Reliable multicast protocols and applications
Communication network simulation and emulation
Networking protocols for directional antennas
Policy-based network management
Tactical voice over IP
Distributed sensor networks
Advanced tactical data links
Cognitive radio and networking technology
Communications channel optimization and agility
Spectrum sharing and sensing

INFORMATION MANAGEMENT AND DECISION ARCHITECTURES

Virtual reality/mobile augmented reality
Visual analytics
Scientific visualization
Computer graphics
Human-computer interaction
Service oriented architecture
Service orchestration
Data and information management
Human-centered design
Parallel and distributed computation
Distributed modeling and simulation
Natural environments for distributed simulation
Intelligent decision support
Information sharing
Semantic web technology
Data mining
Software agents for data fusion

CENTER FOR COMPUTATIONAL SCIENCE

Transparent optical network research and design
Parallel computing
Scalable high performance computing and networking
for Navy and DoD
Large data in distributed computing
Scientific visualization
High-performance file systems
High-definition video technology
NRL labwide computer network and related services
Labwide support for web, email, and other
information services
ATDnet and leading-edge WAN research networks

RUTH H. HOOKER RESEARCH LIBRARY

Desktop/workbench access to relevant scientific resources

NRL scientific digital archive (TORPEDO)

Authoritative database of NRL-produced publications
(NRL Online Bibliography)

Comprehensive literature/citation/classified searches

Extensive collection of print and digital books, journals,
and technical reports

OPTICAL SCIENCES DIVISION, CODE 5600

OPTINFO@NRL.NAVY.MIL

OPTICAL MATERIALS AND DEVICES

Advanced infrared optical materials

IR fiber-optic materials and devices

IR fiber chemical and environmental sensors

IR transmitting windows and domes

Transparent ceramic armor materials

Planar waveguide devices

IR nonlinear materials and devices

Ceramic laser gain materials

Advanced solar cell materials

Fiber lasers/sources and amplifiers

Radiation effects

OPTICAL PHYSICS

Laser materials diagnostics

Nonlinear frequency conversion

Optical instrumentation and probes

Optical interactions in semiconductor superlattices
and organic solids

Laser-induced reactions

Organic light-emitting devices

Nanoscale electro-optical research

Aerosol optics

APPLIED OPTICS

UV, optical, and IR countermeasures

Ultraviolet component development

Missile warning sensor technology

UV, visible, and IR imager development

Multispectral/hyperspectral sensors

Multispectral/hyperspectral/detection algorithms

Framing reconnaissance sensors

Novel optical components

Sensor control and exploitation system development

IR low observables

EO/IR systems analysis
Atmospheric IR measurements
Airborne IR search and track technology

PHOTONICS TECHNOLOGY

Fiber and solid-state laser/sources
High-speed (<100 fs) optical probing
High-power fiber amplifiers
High-speed fiber-optic communications
Antenna remoting
Free space communication
Photonic control of phased arrays
Micro-electro-optical-mechanical systems
Optical clocks
Microwave photonics

OPTICAL TECHNIQUES

Fiber-optic materials and fabrication
Fiber Bragg grating sensors/systems
Fiber-optic sensors/systems (acoustic, magnetic, gyroscopes)
Integrated optics

TACTICAL ELECTRONIC WARFARE DIVISION, CODE 5700

EWINFO@NRL.NAVY.MIL

OFFBOARD COUNTERMEASURES

Decoys and offboard payloads
Expendable technology and devices
Unmanned air vehicles

EW SUPPORT MEASURES

Radar signal intercept
Signal demodulation/feature extraction
Multiplatform geolocation
Advanced real-time digital signal processing

AEROSPACE EW SYSTEMS

Airborne radar CM systems
Communications CM technique development
RF-enabled cyber
Cognitive EW

SURFACE EW SYSTEMS

Shipboard EA systems
High-power EA transmitters
EA techniques and vulnerabilities
Signal processing for EA

ADVANCED TECHNIQUES

High-fidelity physics-based ASM modeling
New EW techniques
EO/IR EW modeling and flyable simulators
Experimental systems

INTEGRATED EW SIMULATION

Hardware-in-the-loop simulation
Flyable ASM seeker simulators
Central Target Simulator
Foreign Military Equipment exploitation

EFFECTIVENESS OF NAVAL EW SYSTEMS

SIMDIS
Scenario Builder
High-level analysis and modeling simulation

SIGNATURE TECHNOLOGY OFFICE

Electromagnetic scattering fundamentals
Low observable materials

MATERIALS SCIENCE AND COMPONENT TECHNOLOGY DIRECTORATE

LABORATORIES FOR COMPUTATIONAL PHYSICS AND FLUID DYNAMICS, CODE 6040

COMPHYSINFO@NRL.NAVY.MIL

REACTIVE FLOWS

Fluid dynamics in combustion
Turbulence in compressible flows
Multiphase flows
Turbulent jets and wakes
Jet noise
Detonation engines
Propulsion systems analysis
Contaminant transport modeling
Fuel cells
Fire and explosion mitigation

COMPUTATIONAL PHYSICS DEVELOPMENTS

Laser-plasma interactions
Inertial confinement fusion
Space debris elimination
Solar physics modeling
Many-core computing

Advanced graphical and parallel processing systems
Solar and heliospheric modeling
Microfluidics
Fluid structure interaction
Shock and blast containment
Bio-inspired propulsion for micro air vehicles and
unmanned underwater vehicles

CHEMISTRY DIVISION, CODE 6100

CHEMINFO@NRL.NAVY.MIL

CHEMICAL DIAGNOSTICS

Alternative energy sources
Battery safety
Biological laser printing
Environmental chemistry/microbiology
Ion/molecule processes
Kinetics of gas phase reactions
Laboratory-on-a-chip/microfluidics
Optical diagnostics of chemical reactions
Plasmonic systems
Trace analysis

MATERIALS CHEMISTRY

Bio-inspired materials
Degradation and stabilization mechanisms
Functional organic coatings
High-temperature resins
Magnetic resonance
Novel nanotubes and nanofibers
Polymer characterization
Reactive nanometals
Synthesis and evaluation of innovative polymers and
composites

CENTER FOR CORROSION SCIENCE AND ENGINEERING

Aquatic invasive organism control
Biofouling control
Cathodic protection
Corrosion control engineering
Corrosion science
Environmental fracture and fatigue
Marine coatings
Materials failure analysis

SURFACE/INTERFACE CHEMISTRY

Adhesion
Bio/organic interfaces
Chemical/biological sensors

Diamond films
Electrochemistry
Plasmonics
Energy storage materials
Nanostructured materials and interfaces
Surface/interface analysis
Surface properties of materials
Surface reaction dynamics
Synchrotron radiation applications
Tribology

SAFETY AND SURVIVABILITY

Chemometrics/data fusion
Combustion dynamics
Fire protection and suppression
Mobility fuels
Modeling and scaling of combustion systems
Personnel protection
Firefighting doctrine development
Explosives vapor generation and detection
Canine training aid development
Modeling and simulation of nanoscale systems
Trace analysis

**MATERIALS SCIENCE AND TECHNOLOGY
DIVISION, CODE 6300**

MATERIALINFO@NRL.NAVY.MIL

MULTIFUNCTIONAL MATERIALS

Integrated computational materials engineering (ICME)
Nanoscale, microscale, mesoscale material
characterization and manufacturing
Phase transformation and microstructural evolution in
material systems
Microstructure and process control in additive
manufacturing
Multiple principal element alloys
Atom probe tomography
Computational simulations of materials in extreme
environments (e.g., electromagnetic launch, blast,
ballistic events)
Computational simulations of manufacturing processes
Multifunctional composite material systems
Magneto-electric sensors
Energy harvesting materials and devices
Nonlinear multiferroic materials
Corrosion, fatigue, and fracture of naval materials

High pressure synthesis
High energy density dielectrics
Bulk nanostructured ceramics
Ceramic thermal and environmental barrier coatings
Biomechanical simulation and response of live cell cultures
Surrogate model development for the warfighter
Personal protection equipment

MATERIALS AND SYSTEMS

Laser direct write
Terahertz sources, devices, and sensors
Graphene heterostructures and devices
Magnetic materials
Superconducting materials
Optoelectronic materials
Electroceramic materials
Multiferroic materials
Radar absorbing materials
Analysis of extrasolar materials
Chemical sensors
Additive manufacturing and flexible electronics
Thin film deposition for devices
Secondary ion mass spectrometry (SIMS)
Glass fiber processing and characterization
Polymer synthesis and characterization
Personal protective equipment
Remote explosives detection
Accelerator mass spectrometry (AMS) for ultra-trace elemental and isotope analysis
Materials and systems for carbon capture and fuel synthesis
Aberration-corrected STEM for single-atom spectroscopy and tomography

MATERIALS PHYSICS AND TECHNOLOGY

Condensed matter theory
Electronic structure of solids and clusters
Molecular dynamics
Quantum many-body theory
Theory of magnetism, magnetic materials and alloys
Materials for power and energy
Semiconductor and surface physics
Theoretical studies of phase transitions
Atomic physics theory
Quantum dots
Computational biophysics and protein modeling
Continuum multiphysics modeling

Reduced order modeling
Multiphysics simulation of materials behavior
Development of high-performance computational methods
Spintronic/magneto-electronic materials and devices
Nonlinear dynamics and chaos theory
Nanoplasmonic biosensors
Automated learning
Quantum information
Radiation in matter

PLASMA PHYSICS DIVISION, CODE 6700

PLASMAINFO@NRL.NAVY.MIL

RADIATION HYDRODYNAMICS

Radiation hydrodynamics of Z-pinch and laser-produced plasmas
X-ray source development
Cluster dynamics in intense laser fields
Plasma kinetics for directed energy and fusion
Plasma discharge physics
Dense plasma atomic physics, equation of state
Numerical simulation of high-density plasma
Laser driven ion/neutron sources

LASER PLASMA

Nuclear weapons stockpile stewardship
Laser fusion, inertial confinement
Megabar high-pressure physics
Rep-rate KrF laser development
High power electron beam applications
Laser fusion technology
Laser fusion energy
Detection of chemical/biological/nuclear materials

CHARGED PARTICLE PHYSICS

Applications of modulated electron beams
Rocket, satellite, and International Space Station natural and active experiments
Laboratory simulation of space plasmas
Large-area plasma processing sources
Surface modification of energy sensitive materials
Atmospheric and ionospheric GPS sensing
Ionospheric effects on communications
Electromagnetic launchers
Radiation belt remediation

PULSED POWER PHYSICS

Production, focusing, and propagation of intense electron and ion beams

High-power, pulsed radiography

Plasma and bremsstrahlung radiation sources

Capacitive, inductive, and battery energy storage

Nuclear weapons effects simulation

Electromagnetic launchers

Detection of Special Nuclear Materials

Advanced energetics via stimulated nuclear decay

BEAM PHYSICS

Directed energy and laser propagation in the atmosphere

Advanced accelerators and radiation sources

Microwave, plasma, and laser processing of materials

Microwave sources: magnicons and gyrotrons

Nonlinear stochastic dynamical systems

Ultrahigh-intensity laser-matter interactions

Free electron lasers and laser synchrotrons

Theory and simulation of space and solar plasmas

Global ionospheric and space weather modeling

Underwater laser interactions

ELECTRONICS SCIENCE AND TECHNOLOGY DIVISION, CODE 6800

ELECINFO@NRL.NAVY.MIL

QUANTUM INFORMATION TECHNOLOGY

Quantum materials

Quantum photonics

Quantum sensing

NANOSCIENCE AND NANOTECHNOLOGY

Nanoelectronics

Neuroelectronics

Plasmonics

Energy harvesting

Sensing

SURFACE AND INTERFACE SCIENCES

Two-dimensional materials

Phase change materials

Polaritonic materials and metamaterials

ELECTRONIC MATERIALS GROWTH AND CHARACTERIZATION

Advanced elemental and compound semiconductors,
high- κ dielectrics, and second-order materials

Unique materials characterization
Fabrication of electronic devices with high degree of
complexity and precision

THEORY AND COMPUTATIONAL MODELING

Microscopic calculations
Macroscopic modeling
First principles atomistic calculations
Physics-based solid-state and vacuum device modeling
3D GPU-based modeling coherent interaction of
electromagnetic fields with electron beams

POWER ELECTRONICS

SiC and GaN epitaxial growth research
Characterization of defects in SiC and GaN
Development of advanced SiC and GaN power device
processes
Reliability of SiC and GaN power devices

MICROWAVE, MILLIMETER, AND SUB-MILLIMETER TECHNOLOGY

Mesoscale fabrication techniques for vacuum electronic
devices
Physics-based design tools for vacuum electronic devices
RF solid-state electronics
Filters and control components

OPTOELECTRONICS

Design and synthesis of new materials in the IR spectrum
region

PHOTOVOLTAICS

High-efficiency technologies for portable photovoltaic
power systems

RADIATION EFFECTS

Particle irradiation
Photon irradiation
Displacement damage dose effects in materials and
devices

CENTER FOR BIO/MOLECULAR SCIENCE AND ENGINEERING, CODE 6900

BIOMOLINFO@NRL.NAVY.MIL

BIOLOGICALLY DERIVED STRUCTURES

Self-assembly
Molecular engineering
Synthetic membranes
Nanocomposites

Tailored electronic and optical materials
Molecular imprinting
Viral scaffolds
Multifunctional materials

CHEM/BIOSENSORS

Distributed and autonomous sensing
Biosensors for underwater chemical sensing
DNA biosensors
Array-based sensors
Optical biosensors
Microfluidics and microarrays

NOVEL MATERIALS

Soil/groundwater explosives detection
Single chain and single domain antibodies
Nanoparticles and quantum dots
Energetic materials
Nanoporous and mesoporous materials
Quantum dot and protein conjugates
Biomimetic materials
Multifunctional decontamination coatings

MOLECULAR BIOLOGY

Genomics, transcriptomics, proteomics and
metabolomics of microbial consortia
Systems and synthetic biology
Biomarker discovery
Molecular epidemiology of pathogenic
microorganisms
Antimicrobial resistance
Tissue engineering

ENERGY HARVESTING

Biomaterials for charge storage
Ocean floor biofuel cell
Photo-induced electron transfer
Novel photo-active polymers

OCEAN AND ATMOSPHERIC SCIENCE AND TECHNOLOGY DIRECTORATE

ACOUSTICS DIVISION, CODE 7100

ACOUSINFO@NRL.NAVY.MIL

PHYSICAL ACOUSTICS

Structural acoustics
Quantum effects in phononic crystals

Nanomechanical devices
Fiber-optic acoustic sensors
Acoustic transduction
Inverse scattering
Target strength/radiation modeling
Flow-induced noise and vibration
Active sonar classification
Underwater distributed, networked sensing
AUV-based sensing

ACOUSTIC SIGNAL PROCESSING AND SYSTEMS

Underwater acoustic communications and networking
Limits of array performance
Waveguide invariant processing
Acoustic field uncertainty
Acoustic interactions with transonic/supersonic flows
Acoustic noise forecasting
Long-range underwater communications
Underwater distributed sensing networks
Ocean boundary scattering
Acoustic propagation
Acoustic inversion
Characterization of reverberation
Acoustic metamaterials
Acoustics of microfluidic bubbly emulsions
Active sonar performance modeling
Compressive sensing
Acoustic classification
Nonlinear propagation
Underwater acoustic network warfare

ACOUSTIC SIMULATION, MEASUREMENTS, AND TACTICS

Ocean acoustic propagation and scattering models
Fleet application acoustic models
High-frequency seafloor and ocean acoustic
measurements
Riverine acoustics
Distributed sensing networks
Incorporating uncertainty in predictive models
Tactical acoustic simulations and databases
Warfare effectiveness studies and optimization
Environmental assessment and planning tools

REMOTE SENSING DIVISION, CODE 7200

REMSENINFO@NRL.NAVY.MIL

REMOTE SENSING

Sensors

- SAR
- Passive microwave imagers
- CCDs and focal plane arrays
- Thermal IR cameras
- Hyperspectral imaging systems
- Radio interferometers
- Optical interferometers
- Adaptive optics
- Lidar
- Spaceborne and airborne systems

Research areas

- Radiative transfer modeling
- Coastal oceans
- Marine ocean boundary layer
- Polar ice
- Snow depth
- Middle atmosphere
- Global ocean phenomenology
- Environmental change
- Ocean surface wind vector
- Soil moisture
- Ionosphere
- Data assimilation

ASTROPHYSICS

- Optical interferometry
- Radio interferometry
- Fundamental astrometry and reference frames
- Fundamental astrophysics
- Star formation
- Stellar atmospheres and envelopes
- Interstellar medium, interstellar scattering pulsars
- Low-frequency astronomy

PHYSICS OF ATMOSPHERIC/OCEAN INTERACTION

- Mesoscale, fine-structure, and microstructure
- Aerosol and cloud physics
- Marine aerosol production
- Mixed layer and thermocline applications
- Sea-truth towed instrumentation techniques
- Turbulent jets and wakes
- Nonlinear and breaking ocean waves
- Stratified and rotating flows
- Turbulence modeling

Boundary layer hydrodynamics

Marine hydrodynamics

Computational hydrodynamics

IMAGING RESEARCH/SYSTEMS

Remotely sensed signatures analysis/simulation

Real-time signal and image processing algorithms/
systems

Image data compression methodology

Image fusion

Automatic target recognition

Scene/sensor noise characterization

Image enhancement/noise reduction

Scene classification techniques

Radar and laser imaging systems studies

Coherent/incoherent imaging sensor exploitation

Numerical modeling simulation

Environmental imagery analysis

OCEANOGRAPHY DIVISION, CODE 7300

NRL/STENNIS SPACE CENTER, MISSISSIPPI

OCEANINFO@NRL.NAVY.MIL

OCEAN DYNAMICS AND PREDICTION

Coupled systems

Air-ice-ocean-wave coupling

Ocean-acoustic coupling

Circulation

Global resolution of circulation and mesoscale fields

Littoral circulation at the coast, bays, and estuaries

Satellite observation processing and assimilation

UUV adaptive sampling

Observation system simulation experiments

Ice volume and ice drift

Tidal currents and heights

Ocean data assimilation

Surface effects

Surface wave effects globally and into bays

Wave breaking

Mixed layer dynamics

Swell propagation and dynamics

Phase averaged wave evolution

Phase resolved wave dynamics

Nearshore

Wave breaking at the shore

Rip currents at the shore

Tidal currents and heights into rivers

Nonlinear wave interaction

Sensor deployment optimization

Acoustic effects

Sound speed variation for acoustic propagation

Internal waves, solitons, and bores for beam focusing

Wave bubble entrainment and noise generation

OCEAN SCIENCES

Dynamical processes

Optical turbulence

Biological sensing and modeling

Optical thin layers

Ocean current systems

Waves and bubbles

Ocean turbulence and mixing

Air–sea interaction

Coupled systems

Coupled bio/optical/physical processes

Coupled physical/sediment processes

Remote sensing applications

3D optical profiling

Color/hyperspectral signatures

Ocean optics

Sea surface salinity

Microbiologically influenced corrosion

Metal–microbe interaction

MARINE GEOSCIENCES DIVISION, CODE 7400

NRL/STENNIS SPACE CENTER, MISSISSIPPI

GEOSCIINFO@NRL.NAVY.MIL

MARINE GEOLOGY

Sedimentary processes

Sediment microstructure

Pore fluid flow

Diapirism, volcanism, faulting, mass movement

Biogenic and thermogenic methane

Hydrate distribution, formation, and dissociation

Small-scale granular/fluid dynamics

Modeling of littoral morphodynamics

MARINE GEOPHYSICS

Seismic wave propagation

Physics of low-frequency acoustic propagation

Acoustic energy interaction with topography and inhomogeneities

Geodesy

Geomagnetic modeling

Nearshore dynamics

Riverine processes

MARINE GEOTECHNIQUE

Seafloor characterization

Unmanned systems

Bathymetry estimation techniques from remote and acoustic imagery

Geoacoustic modeling

Measurement and modeling of high-frequency acoustic propagation and scattering

Mine burial processes

Marine biogeochemistry

Animal–microbe–sediment interactions

Early sediment diagenesis

Biomineralization of palladium species

Physics-based modeling of sediment strength

AIRBORNE GEOPHYSICS

Gravity, magnetic, scanning lidar, photogrammetry, synthetic aperture radar, snow radar

Integrated aerogeophysical studies

Foliage penetration

Soil moisture

Snow and ice thickness

Periscope and wake detection

GEOTECHNICAL STUDIES

Geotechnical properties and behavior of sediments

Trafficability

Ground truth for remote sensing

Snow-ice properties

GEOSPATIAL SCIENCES AND TECHNOLOGY

Digital database design

Digital product analysis and standardization

Data compression techniques and exploitation

Hydrographic survey techniques

Incorporating uncertainty and human factors in decision making

Geospatial portal design with 2D and 3D interfaces

IN SITU AND LABORATORY SENSORS

High-resolution subseafloor 2D and 3D seismic imaging

Laser/hyperspectral bathymetry/topography

Swath acoustic backscatter imaging

Sediment pore water pressure, permeability, and undrained shear strength

Compressional and shear wave velocity and attenuation
Seafloor magnetic fluctuation
Sediment microfabric change with pore fluid and/or gas
change
Instrumented mine shapes
Bottom currents and pressure fluctuations

MARINE METEOROLOGY DIVISION, CODE 7500

NRL/MONTEREY, CALIFORNIA
METEORINFO@NRL.NAVY.MIL

ATMOSPHERIC DYNAMICS AND PREDICTION

Global to tactical scale
Deterministic and probabilistic forecasting
Large eddy simulation
Boundary layer processes
Land surface processes and modeling
Coastal processes and modeling
Arctic processes and modeling
Coupled ocean and atmosphere phenomena
Madden Julian oscillation
Atmospheric waves and scale interactions
Hydrology and hydrological cycle
Tropical cyclones
Aerosol particles
Gravity waves
Predictability
Advanced numerical methods

DATA ASSIMILATION

Hybrid ensemble-variational techniques
3D and 4D variational analysis
Ensemble Kalman Filter (EnKF)
Quality control and bias correction
Tropical cyclone initialization
Remotely sensed data assimilation
Radar data assimilation
Targeted observing strategies
Data selection techniques
Aerosol and trace gas assimilation

TACTICAL ENVIRONMENTAL SUPPORT

Rapid environmental assessment
Atmospheric impact on weapons systems
Data fusion
Nowcasting
Visualization

Verification and validation
Information assurance
Expert systems
Aviation risk assessment

ATMOSPHERIC PHYSICS

Air-sea interaction
Cloud and aerosol microphysics
Fire weather, smoke emission, and pyroCb's
Radiative transfer
Cloud and aerosol radiative properties
Aerosol analysis and prediction
Gravity wave drag
Aerosol and radiation instrumentation
Instrumentation calibration facilities

SATELLITE DATA AND IMAGERY

Automated cloud properties
Sensor calibration and validation
Nighttime environmental analysis
Tropical cyclone characterization
Dust, smoke, and aerosols monitoring
Satellite imagery analysis and enhancement
Rain rate and snow cover
Precipitation and cloud climatology
Future satellite and constellation assessment
Tactical meteorology
Training and public outreach

DECISION AIDS

Probabilistic decision aids
Refractivity and ducting
Ceiling and visibility
Fog, turbulence, and icing
Atmospheric acoustics
EM and EO propagation
Tropical cyclone forecasts
Port studies
Typhoon havens
Forecaster handbooks
Quantification of uncertainty
Counter-piracy guidance
Tropical cyclone sortie guidance
Ship wind and wave limits
Optimal ship routing and fuel savings

SPACE SCIENCE DIVISION, CODE 7600

SPASCIINFO@NRL.NAVY.MIL

Development and test facilities for satellite, sounding rocket, and balloon instruments
Solar Coronagraph Optical Test Chamber (SCOTCH)
Solar Irradiance Calibration Facility
Neutron Characterization Laboratory
SuperMISTI reconfigurable and adaptable stand-off gamma ray and neutron radiation detection systems
Suborbital Instrument Assembly and Test Facility
Helium Resonance Scattering in the Corona and Heliospheric (HERSCHEL) sounding rocket instrument
Large Angle Spectrometric Coronagraph (LASCO) satellite instrument
Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) satellite instrument suite
Special Sensor Ultraviolet Limb Imager (SSULI) satellite instrument
Michelson Interferometer for Global High-resolution Thermospheric Imaging (MIGHTI) satellite instrument
Solar Orbiter Heliospheric Imager (SoloHI) satellite instrument
Wide-field Imager (WISPR) satellite instrument
SoftWare for Optimization of Radiation Detectors (SWORD)

NAVAL CENTER FOR SPACE TECHNOLOGY

SPACE SYSTEMS DEVELOPMENT DEPARTMENT, CODE 8100

SPASYSINFO@NRL.NAVY.MIL

ADVANCED SPACE/AIRBORNE/GROUND SYSTEMS TECHNOLOGIES

Space systems architectures and requirements
Advanced payloads and optical communications
Controllers, processors, signal processing, and VLSI data management systems and equipment
Embedded algorithms and software
Satellite laser ranging

ASTRODYNAMICS

Precision orbit estimation
Onboard autonomous navigation
Onboard orbit propagation

GPS space navigation
Satellite coverage and mission analysis
Geolocation systems
Orbit dynamics
Interplanetary navigation

**COMMAND, CONTROL, COMMUNICATIONS,
COMPUTERS, INTELLIGENCE, SURVEILLANCE,
AND RECONNAISSANCE**

Communications theory and systems
Satellite ground station engineering and
implementation
Transportable and fixed ground antenna systems
High-speed fixed and mobile ground data collection,
processing, and dissemination systems
Tactical communication systems
Multi-INT/multi-domain data fusion
Maritime domain awareness
Near-real-time data analytics
Signal/waveform generation and collection

SPACE AND AIRBORNE PAYLOAD DEVELOPMENT

Space and airborne system payload concept definition,
design, and implementation; hardware and software
Detailed electrical/electronic design of electronic and
electromechanical payload and systems and
components
Design and verification of real-time embedded multi-
processor software
Payload antenna systems
Space and airborne payload fabrication, test, and
integration
Launch and on-orbit payload support

LASER COMMUNICATIONS RESEARCH

Ship-to-ship laser communications
Space-to-ground laser communications
Satellite laser ranging for precise orbit determination

SPACE AND AIRBORNE MISSION DEVELOPMENT

Mission development and requirements definition
Systems engineering and analysis
Concepts of operations and mission simulations
Mission evaluation and performance assessments

POSITIONING, NAVIGATION, AND TIME

Advanced navigation satellite technology
Alternative Positioning, Navigation, and Timing (APNT)
Geospatial information systems
Precise Time and Time Interval (PTTI) technology

Atomic time/frequency standards/instrumentation
Passive and active ranging techniques
Precision tracking of orbiting objects from space/ground
National and international standards for timekeeping/
Universal Coordinated Time/UTC (NRL)

SPACECRAFT ENGINEERING DEPARTMENT, CODE 8200

SPAENGINFO@NRL.NAVY.MIL

DESIGN, TEST, AND PROCESSING

Preliminary and detailed design of spacecraft mechanical components, structures, and mechanisms
Fabrication, assembly, integration, and testing of spacecraft and payloads
Vibration, shock, acoustic, and thermal vacuum testing of components, systems, payloads, and spacecraft
Integration of spacecraft onto launch vehicles
Systems engineering for new spacecraft proposals

SPACE MECHANICAL SYSTEMS DEVELOPMENT

Prototype spacecraft systems and experimental payloads development, integration, and transition
Design and analysis of large and precision morphing space structures
Spacecraft thermal architecture concepts
Thermal systems design, analysis, fabrication, integration, test, and flight operations
Integrated structural/thermal/optical or RF design and analysis
Pumped and advanced multiphase heat transfer systems and devices
Fiber-reinforced polymers and vascular composites design, analysis, fabrication, and test
Computational fluid dynamics (CFD) techniques for space systems
Hypersonic, hypervelocity, and re-entry systems design and analysis
All aspect program/mission concept development, integration and execution including systems engineering management; quality, configuration, safety and cyber assurance; financial, schedule, mission resource development, tracking and analysis

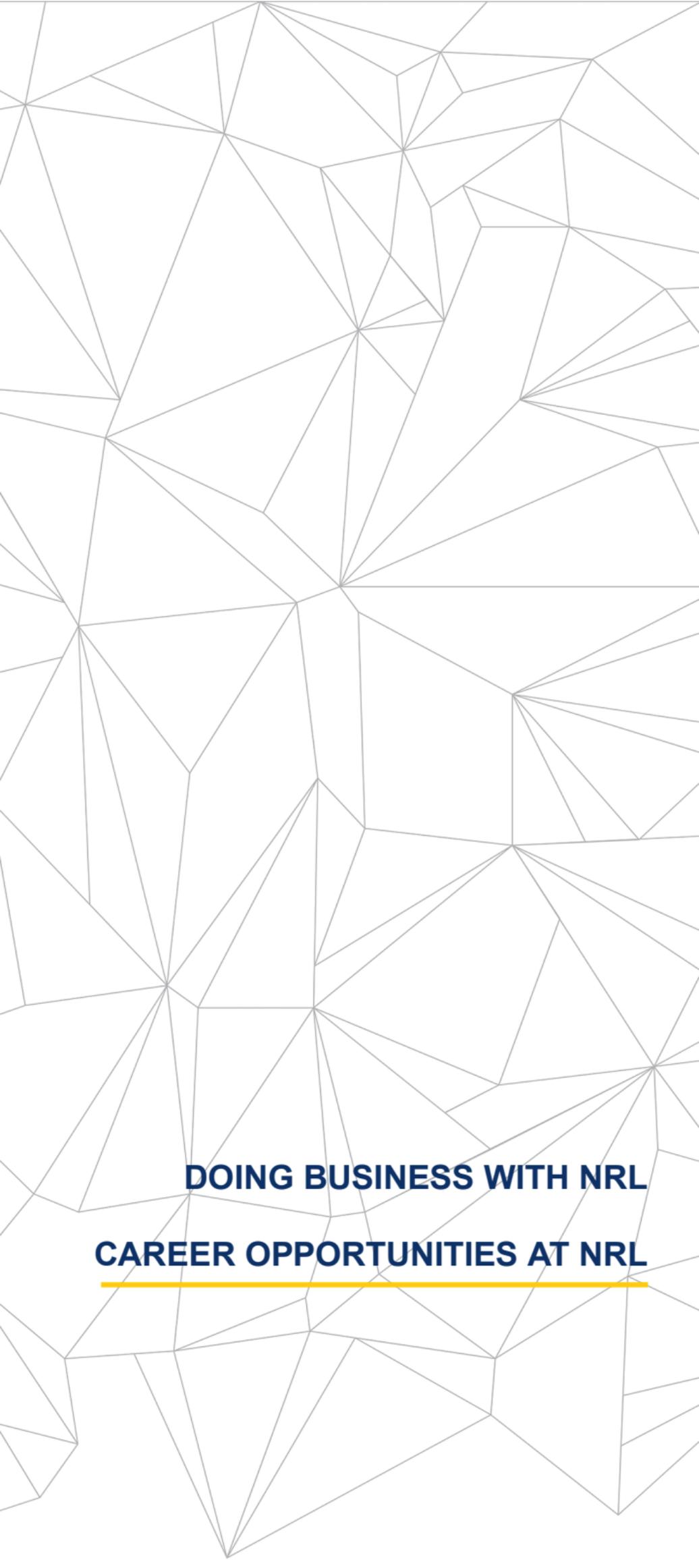
CONTROL SYSTEMS

Attitude determination and control systems
Precision pointing
Optical line-of-sight stabilization

Propulsion systems
Precision cleaning and component testing
Propellant and pressurization systems
Hydraulic and pneumatics control
Test systems and services
Analytical design and mission planning
Navigation, tracking, and orbit dynamics
Expert systems
Flight operations support
Computer simulation and animation
Robotics systems engineering
Proximity operations
Autonomous servicing and inspection
End effector design
Compliance control
Trajectory planning
Machine vision
Fault detection, isolation, and recovery
Electrodynamic tethers
Robotic control algorithms and software
Robotic actuation and sensing
Space situational awareness

SPACE ELECTRONIC SYSTEMS DEVELOPMENT

Space system concept definition, design, and implementation including hardware and software
Detailed electrical design of electronic and electromechanical systems and components
Implementation of real-time flight software and embedded command, control, and telemetry software
Implementation of spacecraft ground system software, including integration and test and operations (Neptune/CGA)
Mission tasking software (VMOC)
Spacecraft antenna systems, receivers, transmitters, and radiometers
Space hardware design, fabrication, test, and integration
Launch and on-orbit support
Space test systems and electronic launch support equipment
Spacecraft power systems: collection, storage, conversion, and distribution
Spacecraft TT&C and control systems
Space communications



DOING BUSINESS WITH NRL
CAREER OPPORTUNITIES AT NRL

Doing Business with NRL

Technology Transfer Office

NRL has a long history of working with industry and academia to assist in the transfer of its inventions for nonmilitary applications. Many of NRL's research efforts result in materials, techniques, and other products that have additional applications in the commercial or civilian sectors. NRL developments in areas such as radar, radio, satellite navigation, fire fighting, and a wide variety of materials and coatings have made significant contributions to the safety and welfare of the civilian sector. Technology transfer ensures full use of the results of the nation's federal investment in research and development by transferring federally owned or originated technology to the private sector for the public good.

The Technology Transfer Office markets NRL's technologies in various ways, including distributing and posting fact sheets describing available technologies, participating in NRL exhibits at scientific and Navy conferences, working with local economic development groups, and through NRL's social media program.

Mechanisms for technology transfer include Cooperative Research and Development Agreements (CRADAs) and licensing of inventions.

E-MAIL: TECHTRAN@RESEARCH.NRL.NAVY.MIL

URL: [HTTP://WWW.NRL.NAVY.MIL/TECHTRANSFER](http://WWW.NRL.NAVY.MIL/TECHTRANSFER)

Cooperative Research and Development Agreements (CRADAs)

To promote the timely transfer of technology from government laboratories to the private sector and to improve the competitiveness of U.S. industry, Congress passed the Federal Technology Transfer Act (FTTA) of 1986. With this legislation, Congress authorized federal organizations to enter into CRADAs with nonfederal parties. The objective of a Navy CRADA is cooperative research that will enhance the mission of the Navy and benefit the non-Navy party. The CRADA defines the individual responsibilities of the Navy and non-Navy parties toward achieving the objective, as well as rights to intellectual property developed under the CRADA. The Navy party in a CRADA may provide personnel, facilities, and equipment to perform the cooperative research. The non-Navy party may provide personnel, facilities, equipment, and funding. CRADAs can be established

with industrial organizations, industrial development organizations, nonprofit organizations, universities, state and local governments, and licensees of inventions owned by federal agencies.

NRL signed the Navy's first CRADA in 1989. Since that time, the Laboratory has continued to pursue and promote this program actively. Recently, NRL has entered into CRADAs directed at solar array concentrators, photovoltaic modules for laser power conversion, solar-powered unmanned aerial vehicles (UAVs), fast and accurate prediction of airborne contaminant movement in urban environments, developing multiaxial material testing systems for the characterization of additively manufactured materials, and other technological advances that have impacted the military and the civilian sectors. Information on our CRADA process, including the CRADA boilerplate and questionnaire can be found at <http://www.nrl.navy.mil/techtransfer/cradas.php>.

E-MAIL: TECHTRAN@RESEARCH.NRL.NAVY.MIL

URL: [HTTP://WWW.NRL.NAVY.MIL/TECHTRANSFER](http://www.nrl.navy.mil/techtransfer)

Licensing of Navy Inventions

Since the enactment of FTTA, the effort to encourage commercial use of government-funded technology has expanded in the federal laboratories. Title 35, Section 209, of the United States Code authorizes federal agencies to license their patentable inventions. A license grants the licensee the right to make, use, import, and sell a product based on the licensed technology in exchange for royalty payments that are shared by the Laboratory and the inventors. NRL supports an active licensing program and has over 900 patents and patent applications available for licensing in fields as diverse as advanced materials, chemistry, biotechnology, optics, ocean and atmospheric sciences, electronics, radar, and satellite technology. NRL has licenses with small and large U.S. businesses, and foreign and multinational businesses.

To begin the process of acquiring a license, the potential licensee is required to fill out the Application to Practice a Navy Invention (found at <http://www.nrl.navy.mil/techtransfer/licenses.php>). This application must include a detailed business/commercialization plan that covers the important aspects of product development, marketing, and sales, including a development plan with milestones, timelines, and relevant expertise; the source of funding for development of the invention; the risks associated with the technology and the market; and a

projected sales forecast with the underlying assumptions used to generate the forecast.

Key items in the application are: the field of use and the type of license (non-exclusive, partially exclusive, or exclusive). Partially exclusive means exclusive in a field of use. For partially exclusive or exclusive licenses, the licensee's plan submitted with the application must meet certain determinations from the federal regulations showing that exclusive licensing is a reasonable and necessary incentive to attract the investment of risk capital necessary to bring the invention to practical application. The proposed scope of exclusivity must not be greater than the licensee capabilities for developing and commercializing the technology, and granting the license must not substantially lessen competition.

For partially exclusive or exclusive licenses, if the application is acceptable and reasonable terms and conditions can be negotiated successfully, an "Intent to Grant" notice is published in the Federal Register for a minimum of 15 calendar days before a license can be executed. The Intent to Grant notice lists the company name and the field of use for the license.

Typical financial components to each license are: (1) a lump-sum upfront fee paid on execution of the license, (2) milestone fees, (3) a running royalty for sales other than to the federal government, and (4) a minimum annual royalty.

E-MAIL: TECHTRAN@RESEARCH.NRL.NAVY.MIL

URL: [HTTP://WWW.NRL.NAVY.MIL/TECHTRANSFER](http://WWW.NRL.NAVY.MIL/TECHTRANSFER)

Work for Nonfederal Parties

NRL has many unique capabilities that may enhance the R&D efforts of organizations external to NRL. NRL may sell testing and other services, articles, models, and software if: NRL's capabilities are unique; the sale would not constitute undue competition with industry; making them available for sale is in the interest of national defense; the sale requires no more than incidental subcontracting; and the nonfederal party agrees to hold harmless and indemnify the United States. The Navy requires advance payment, but incremental funding by task is often acceptable. The procedures for the approval of sales to nonfederal entities are covered in NRL Instructions.

Call (202) 767-2244 if you have any questions regarding work for nonfederal parties.

Letters of Intent

With increasing frequency, funding agencies are sponsoring R&D programs that are performed by “teams” consisting of industry, national laboratory, and/or university members. NRL participates actively in such programs that are funded by ONR, DARPA, and other public and private funding agencies. At the proposal phase of such programs, NRL may submit a letter of intent to the team lead that describes the work NRL will perform on a best efforts basis if the proposal is funded. Whenever possible, NRL arranges for direct funding of its efforts by a sponsoring U.S. government agency via the Economy Act. In the event that NRL cannot be directly funded by a federal sponsor, NRL will use its best efforts to negotiate an authorized agreement under applicable law and regulation with the team lead under which NRL will perform and be compensated for its assigned tasks under the proposal.

Call (202) 767-2244 if you have any questions regarding Letters of Intent.

Memoranda of Understanding

NRL scientists participate actively with scientists from other federal laboratories and organizations on projects of national interest. Such collaborations among federal organizations may be formalized with a Memorandum of Understanding or a Memorandum of Agreement that defines the scope of the work and the responsibilities of each federal party toward achieving the objectives. NRL has entered into Memoranda of Understanding or Agreement with the Army, Navy, Air Force, Marine Corps, Department of Energy, and other U.S. government activities.

Call (202) 767-2244 if you have any questions regarding establishing MOUs and MOAs with NRL.

Funding External Activities

NRL is the Navy’s corporate laboratory, conducting basic, applied, and advanced research for the Navy in a variety of scientific and technical disciplines. The basic research program is driven by perceptions about future requirements of the Navy. In addition to actively performing research, NRL supports various R&D projects that directly relate to its ongoing work. This support is provided through contracts and grants with industrial firms, colleges and universities, and nonprofit organizations.

Performers are competitively selected after review of proposals submitted in response to Broad Agency Announcements (BAAs) or Requests for Proposals (RFPs).

Proposals may be submitted by any nongovernmental entity, including commercial firms, institutions of higher education with degree-granting programs in science or engineering (universities), or by consortia led by such concerns. NRL encourages small businesses, veteran-owned small businesses, service-disabled veteran-owned small businesses, small disadvantaged businesses, HUBZone small businesses, woman-owned small businesses, and historically black colleges and universities and minority institutions to submit proposals in response to its business opportunities.

Broad Agency Announcements

BAAs are issued under the provisions of paragraphs 35.016 and 6.102(d)(2) of the Federal Acquisition Regulation. Proposals may range from theoretical studies to proof-of-concept to include fabrication and delivery of a prototype. BAA topics include all NRL sites located in the Washington, DC area, the Stennis Space Center, MS, and Monterey, CA. Proposals submitted in response to a BAA announcement that are selected for award are considered to be the result of full and open competition and are in full compliance with the provisions of Public Law 98-369, "The Competition in Contracting Act of 1984." The North American Industry Classification System (NAICS) Code is 541712 — Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology).

The selection of proposals for contract award will be based on a scientific peer review of proposals submitted in response to each BAA. The major purpose of the evaluation will be to determine the relative merit of the technical approach of each proposal. Business and contractual aspects, including cost realism, will also be considered as part of the evaluation. Selection of proposals for award will be based on the potential benefits to the government weighed against the cost of the proposals, in view of the availability of funds.

Current BAA information, including award considerations and instructions for submitting proposals, can be obtained via the NRL website at <http://heron.nrl.navy.mil/contracts/>.

Commercial Contracts/Procurements

NRL also contracts with commercial firms, nonprofit organizations, and academic institutions to obtain specific products and services. These contracts and purchases are for equipment (either complete systems or components), professional and technical services supporting the

Laboratory's ongoing R&D programs, and special projects. NRL contract opportunities are announced via Federal Business Opportunities (FedBizOpps) website under the Department of the Navy (USN) Office of Naval Research (ONR). ONR is NRL's parent organization. A link to FedBizOpps is available on the NRL Contracting Division website.

Purchases at or below the simplified acquisition threshold and purchases for standardized material items of supply, regardless of dollar amount, assigned a National Stock Number (NSN), are processed by the Purchasing Branch (Code 3410) in the NRL Supply and Information Services Division (Code 3400).

More information on "Doing Business" with the Naval Research Laboratory is available at <http://heron.nrl.navy.mil/contracts/>.

Grants

A grant is another mechanism used by NRL to fund outside activities. Grants are made primarily to educational and nonprofit organizations for proposals submitted under BAAs. NRL occasionally enters into cooperative agreements for research traineeships or fellowships and awards small grants for S&T conferences and symposia. For grants, contact the Contracting Division at (202) 767-5227.

Career Opportunities at NRL

[HTTP://WWW.NRL.NAVY.MIL/CAREERS](http://www.nrl.navy.mil/careers)

The U.S. Naval Research Laboratory is always looking to recruit talented individuals in many fields of science. Civilian vacancies and programs for postdocs, faculty, and students are announced at www.nrl.navy.mil/careers.

Research Associateships

Every year, NRL hosts several postdoctoral research associateship and fellowship programs through the National Research Council (NRC) and the American Society for Engineering Education (ASEE). These competitive positions provide postdoctoral scientists and engineers an opportunity to pursue research at NRL in collaboration with NRL scientists and engineers. Research associates are guest investigators, not employees of the U.S. Naval Research Laboratory.

NRL/NRC COOPERATIVE RESEARCH ASSOCIATESHIP

PROGRAM: The NRC conducts a national competition to recommend and make awards to outstanding scientists and engineers at recent postdoctoral levels for tenure as guest researchers at participating laboratories.

The objectives of the NRC program are (1) to provide postdoctoral scientists and engineers of unusual promise and ability opportunities for research on problems, largely of their own choice, that are compatible with the interests of the sponsoring laboratories and (2) to contribute thereby to the overall efforts of the federal laboratories. The program provides an opportunity for concentrated research in association with selected members of the permanent professional laboratory staff, often as a climax to formal career preparation.

NRL/NRC Postdoctoral Associateships are awarded to persons who have held a doctorate less than five years at the time of application and are made initially for one year, renewable for a second and possible third year. Information and applications may be found at <http://www.national-academies.org/rap>. Contact NRL's program coordinator at (202) 767-8323 or nrc@hro.nrl.navy.mil.

NRL/ASEE POSTDOCTORAL FELLOWSHIP PROGRAM:

The ASEE program is designed to significantly increase the involvement of creative and highly trained scientists and engineers from academia and industry in scientific and technical areas of interest and relevance to the Navy. Fellowship awards are based upon the technical quality

and relevance of the proposed research, recommendations by the Navy laboratory, academic qualifications, reference reports, and availability of funds.

NRL/ASEE Fellowship awards are made to persons who have held a doctorate for less than seven years at the time of application and are made for one year, renewable for a second and possible third year. Information and applications may be found at <http://www.asee.org/nrl/>. Contact NRL's program coordinator at (202) 767-8323 or asee@hro.nrl.navy.mil.

Office of Naval Research Summer Faculty Research and Sabbatical Leave Program

This program provides for university faculty members to work for ten weeks (or longer, for those eligible for sabbatical leave) with professional peers in participating Navy laboratories on research of mutual interest. Applicants must hold a teaching or research position at a U.S. college or university. Contact NRL's program coordinator at sfrp@hro.nrl.navy.mil.

NRL/United States Naval Academy Cooperative Program for Scientific Interchange

This program allows faculty members of the U.S. Naval Academy to participate in NRL research. This collaboration benefits the Academy by providing the opportunity for USNA faculty members to work on research of a more practical or applied nature. In turn, NRL's research program is strengthened by the available scientific and engineering expertise of the USNA faculty. Contact NRL's program coordinator at usna@hro.nrl.navy.mil.

Student Programs

The **NAVAL RESEARCH ENTERPRISE INTERNSHIP PROGRAM (NREIP)** offers summer appointments at Navy laboratories to current college sophomores, juniors, seniors, and graduate students from participating schools. Application is online at www.asee.org/nreip through the American Society for Engineering Education. Electronic applications are sent for evaluation to the point of contact at the Navy laboratory identified by the applicant. Contact NRL's program coordinator at nreip@nrl.navy.mil.

The **NATIONAL DEFENSE SCIENCE AND ENGINEERING GRADUATE FELLOWSHIP PROGRAM** helps U.S. citizens obtain advanced training in disciplines of science and engineering critical to the Navy. The three-year program awards fellowships to recent outstanding graduates to support their study and research leading to doctoral degrees in specified disciplines such as electrical engineering, computer sciences, material sciences,

applied physics, and ocean engineering. Award recipients are encouraged to continue their study and research in a Navy laboratory during the summer. Contact NRL's program coordinator at (202) 767-8323 or ndseg@hro.nrl.navy.mil.

The **PATHWAYS INTERN PROGRAM** (formerly STEP and SCEP) is designed to provide students enrolled in a wide variety of educational institutions, from high school to graduate level, with opportunities to work at NRL and explore Federal careers while still in school and while getting paid for the work performed. Students can work full-time or part-time on a temporary or non-temporary appointment. Students must be continuously enrolled on at least a half-time basis at a qualifying educational institution and be at least 16 years of age. The primary focus of our **Non-temporary** intern appointment is to attract students enrolled in undergraduate and graduate programs in engineering, computer science, or the physical sciences. Students on non-temporary appointments are eligible to remain on their appointment until graduation and may be noncompetitively converted to a permanent appointment within 120 days after completion of degree requirements. Conversion is not guaranteed. Conversion is dependent on work performance, completion of at least 640 hours of work under the intern appointment before completion of degree requirements, and meeting the qualifications for the position. The **Temporary** intern appointment is initially a one year appointment. This program enables students to earn a salary while continuing their studies and offers them valuable work experience. Our Intern Program opportunities are announced on USAJOBS. For additional information on our Intern Program, contact (202) 767-8313.

The **STUDENT VOLUNTEER PROGRAM** helps students gain valuable experience by allowing them to voluntarily perform educationally related work at NRL. It provides exposure to the work environment and also provides an opportunity for students to make realistic decisions regarding their future careers. Applications are accepted year-round. For additional information, contact (202) 767-8313.

The **DoD SCIENCE AND ENGINEERING APPRENTICESHIP PROGRAM (SEAP)** provides an opportunity for high school students who have completed at least Grade 9 and are at least 15 years of age to serve as junior research associates. Under the direction of a mentor, for eight weeks in the summer, students gain a better understanding of research, its challenges, and its opportunities

through participation in scientific, engineering, and mathematics programs. Criteria evaluated for acceptance are science and mathematics courses completed and grades achieved; scientific motivation, curiosity, and the capacity for sustained hard work; a desire for a technical career; teacher recommendations; and exceptional test scores. The NRL program is one of the largest in DoD. For detailed information visit <http://seap.asee.org/> or contact NRL's program coordinator at (202) 767-8324 or seap@hro.nrl.navy.mil.

The **SUMMER RESEARCH PROGRAM FOR HISTORICALLY BLACK COLLEGE OR UNIVERSITY (HBCU) OR MINORITY INSTITUTION (MI) STUDENTS** is a ten-week summer internship program that provides opportunities for undergraduate and graduate students to participate in research under the guidance of a mentor at the Naval Research Laboratory. Preference is given to students planning careers in science, technology, engineering, and mathematics (STEM) disciplines. Applicants must be U.S. citizens or have permanent residency and be enrolled at an HBCU, MI, or Tribal College or University. Participating students receive a stipend. Information and application materials are available at: [TWCIAS-NRL HBCU Information Page](#). Online applications can be found at <http://nrl.e.twc.edu/>.

CAREERS AT NRL

- Aerospace Engineer
- Astrophysicist
- Chemical Engineer
- Computational Research Linguist
- Computer Engineer
- Computer Scientist
- Electrical Engineer
- Electronics Engineer
- Engineering Research Psychologist
- Geologist
- Geophysicist
- Materials Research Engineer
- Mathematician
- Mechanical Engineer
- Metallurgist
- Meteorologist
- Oceanographer
- Physical Scientist
- Research Physicist
- Research Biologist
- Research Chemist
- Social Scientist

Please use the Division or Department email addresses in this guide to submit a resumé.

Current job vacancies can be found at:
<http://www.nrl.navy.mil/careers>.

REVIEWED AND APPROVED
NRL/PU/3430--16-622
Release Number: 16-1231-3666
October 2016

CAPT Mark C. Bruington, USN
Commanding Officer

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