National and International Programs at DoD/NSF

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Office of Naval Research

SYMPOSIUM ON

The International Center for Renewable Energy & Turbulence/Aerospace

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S&T Strategy Objectives

- **Ensure alignment of Naval S&T with Naval missions and future capability needs**
- **Communicate S&T vision and approach to senior decision makers, key stakeholders, S&T partners, customers and performers**
- **Balance and manage S&T portfolio based on key tenets:**
  - **Strive to touch intellectual capital worldwide**
  - **Leverage U.S. and global technology insights**
  - **Sponsor primarily external performers**
  - **Maintain NRL in-house research capability as the Navy/Marine Corps Corporate Laboratory**
  - **Manage a balanced portfolio with technical Program Officers**

Naval Warfighting and Support Functions

Revolutionary Research . . . Relevant Results

Naval S&T Focus Area	Naval Warfighting and Support Functions
Power & Energy	• Power Generation and Storage • Assured energy sources• Man Portable & Lightweight • High-Density Power
Operational Environments	• Oceanography & Survey (Ocean/Hydro/River) • Meteorology • Space Environmental Effects
Maritime Domain Awareness	• ISR collection & integration • CBRNE (Explosives & WMD Detection) • Port/Base Security • Swimmer Detection • Wide Area & Battlespace Surveillance • Social/Cultural Understanding • MIO Sensing • HLS Ship Tracking
Asymmetric & Irregular Warfare	• Operational Adaptation • Maritime/Riverine Interception Operations • Expeditionary Security • Boat/Vehicle Disabling (Apply Non-Lethal Systems & Effects) • Forensic Site Exploration • Tactical Evidence Collection • Counter IED/Snipers • Riverine Operations • Regional Domain Awareness • Homogeneous Cultural Integration of Forces • Tactical Tagging and Tracking
Information, Analysis and Communication	• Assured and Secure Communications • Electronic Warfare • Computer Network Ops • Operations Security • Military Deception • Cross Cultural Communications • Threat Intent Determination • C4
Power Projection	• Rapid Tactical Precision Targeting • Time-sensitive strike • Neutralization (lethal/non-lethal) • Effects-scaled weapons • Integration & Control of Naval fires • Maneuver
Assure Access and Hold at Risk	• Persistent Surveillance & Monitoring • Tagging/Tracking & Locating • Shaping and Information Operations • Strategic Target ID/Tracking • Information Verification • Vessel/vehicle-stopping • MIO/Boarding • ASW & MCM • Spoof/Decoy
Distributed Operations	• Distributed Logistics • Small Unit ISR/Intel Collection/Dissemination/Fusion & Engagement • Tactical Maneuver & Mobility • Control of Integrated Fires • Training Operations in Urban/Extreme Environments • Large target lethality with reduced combat loads • Control Collateral Damage
Naval Warrior Performance and Protection	• Personal Protection • Endurance • Decision-Making Tools • Decision/Training Tools • Casualty Prevention/Care • Undersea Medicine • Enhanced Human Performance • Operating in Extreme/Austere Environments • Expeditionary Security • Training Operations in Urban Environments
Survivability and Self-Defense	• Missile Defense • Torpedo Defense • LO/CLO • Tactical EW • Damage Control/Prevention • Force Protection • Time-Critical Terminal Defense
Platform Mobility	• Platform Performance & Agility • Power-Dense Propulsion • Operational Adaptation • Tactical Maneuver Mobility
Fleet/Force Sustainment	• Seabasing • Operational Logistics • Maneuver
Affordability, Maintainability, and Reliability	• Increased warfighting capacity• Reduced logistics cost optimization reduced failure rates • Automate Naval engineering • Aircraft Propulsion Design • Reduce Manning • M&S Automation • Reduce Upgrade Costs

Enabler -- S&E Workforce/Performer Base

Enabler -- Global Technology Awareness

Naval S&T Focus Area	S&T Vision	Objective Categories
Power & Energy	Increase Naval forces freedom of action through energy assurance and power efficient systems, to provide desired power at the platform, system, and personal level	Alternative Energy Sources • Energy Storage • Efficient Energy & Power Conversion • High Energy & Pulse Power
Operational Environments	Exploit the environment to our tactical advantage by accurately predicting the ocean, air, littoral and riverine environments on tactical and strategic time scales	Mobile Autonomous Environment Sensing • Match Predictive Capabilities to Tactical Planning Requirements • Adapt Systems to the Environment
Maritime Domain Awareness	Locate and track any target of interest on, under and above the water extending to 250 nm ashore using integrated networks of persistent sensors	Sensor Integration • Pervasive and Persistent Sensors • Tactical Sensor Networks • Homeland and Port Defense Monitoring
Asymmetric & Irregular Warfare	Enable Naval forces to preempt and defeat adaptive non-conventional threats operating within complex physical and social terrain	ISR • Intelligence Analysis • Active and Passive Forensics tools • Advanced countermeasures
Information Analysis and Communication	Generate options for decision making, reduce information overload, and prevent disruption-causing degradation to enable Commander's decision making at the tactical and strategic level.	Rapid Accurate Decision Making • Decision Aids • Communications and Networks • Cyber Warfare
Power Projection	Precise extended range indirect fires, time critical power on target and control of collateral damage through electromagnetic kinetic projectiles, hypersonic missile propulsion and scalable effects weapons	Future Navy Fires • Control Collateral Damage • Time Critical Strike • Small Unit Combat Power • Combat Insensitive Munitions
Assure Access and Hold at Risk	Attain maritime, littoral, and riverine access to denied areas and hold strategic and tactical targets at risk using lethal and non lethal means	Anti–submarine and Mine Warfare • Distributed Surveillance • Battlespace Shaping
Distributed Operations	Enable dispersed small units to dominate extended battlespace through advanced warfighter training, unambiguous situational awareness, robust communications and sense and respond logistics	Training • Communications • Logistics • Fires • Survivability • Maneuver
Naval Warrior Performance and Protection	Sustained warfighter performance and enhanced decision making in all environments; through training technologies, human systems integration, and casualty management	Training and Education • Casualty Care/Prevention • Warfighter Protection • Manpower Management
Survivability and Self-Defense	Enable manned and unmanned platforms to operate in any hostile environment and avoid/survive attack through innovative materials, sensors, countermeasures and counter-weapons	Platform Stealth • Countermeasures & Counterweapons • Survivable Platforms • Force Protection
Platform Mobility	Develop agile, fuel efficient, and modular platforms capable of operating in any environment using physics based design tools	Efficient, High Endurance, High Speed Platforms • Vertical Lift Operations in Challenging Environments • Autonomous and Unmanned Vehicle Mobility
Fleet/Force Sustainment	Provide the warfighter with supplies and equipment where and when needed, for Distributed Operations, Seabasing, and Global Fleet Stations	Sea Basing • Responsive and Visible Logistics • Autonomous Re-supply
Affordability Maintainability and Reliability	Reduce acquisition and life cycle cost of Naval platforms and systems through design tools, reduced maintenance, intelligent diagnostics, and automation	Platform Affordability • Maintenance and Life Cycle Cost • Automation to Reduce Manning

Power & Energy

Revolutionary Research . . . Relevant Results

Vision: Increase Naval forces freedom of action through energy assurance and power efficient systems, to provide desired power at the platform, system, and personal level.

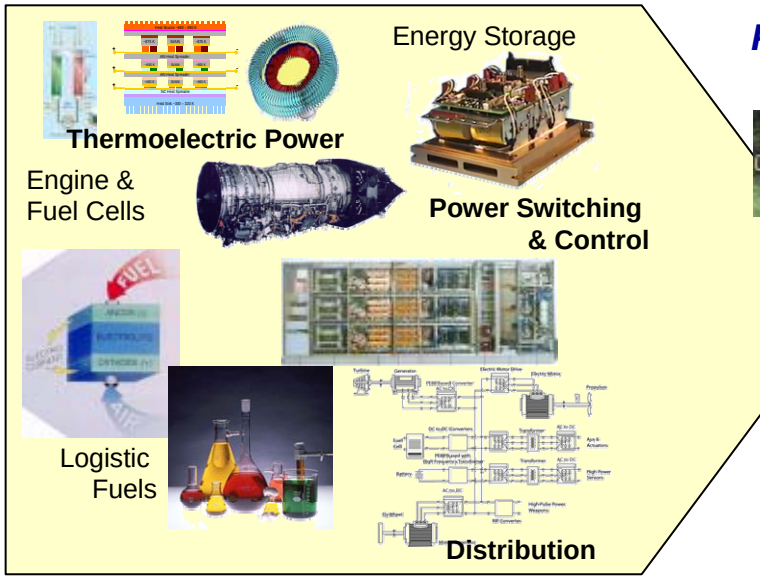
Objectives

Alternative Energy Sources
- Use of synthetic hydrocarbons & alternative fuels
- Wave Action & Bio-Energy Conversion

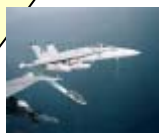
Energy Storage
- Portable, rechargeable & reserve batteries
- Personal power

Efficient Energy & Power Conversion
- Materials to increase efficiency and power density
- Power distribution architectures
- Motors and actuators
- Technologies in lubrication, friction, and wear

High Energy & Pulse Power
- Energy storage power system architectures
- Energy pulsed power switching & control systems



Platforms Warriors



Key Research Topics

Advanced Naval Power Systems
Air Platform Power
Power Electronics
Personal Power
Bio-Sensors, Materials, Processes
Manufacturing Science
Functional Materials

Platform Mobility

Revolutionary Research . . . Relevant Results

Vision: Develop agile, fuel efficient, and modular platforms capable of operating in any environment using physics-based design tools.

Objectives

Efficient, high endurance, high speed platforms

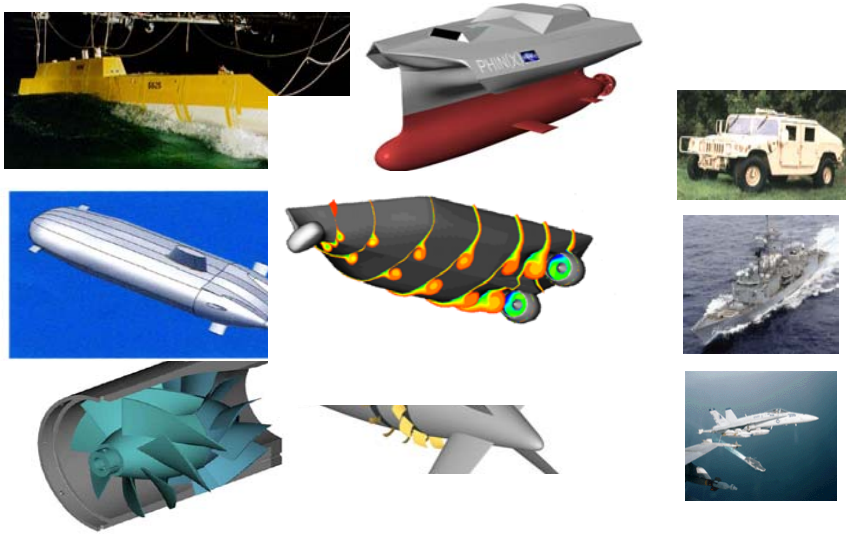
- New and novel advanced platform design supporting new directions in Naval warfare (size, agility, modularity, etc)
- Higher performance at reduced fuel consumption aerodynamic and hydrodynamic propulsion & power plants
- All terrain, lighter, more agile ground vehicle suspensions and drive trains
- Manned or unmanned surface vessel launch and recovery
- Light weight/higher strength advanced composites and structural metals (cellular, light weight alloys) building blocks

Vertical lift operations in challenging environments

- High performance VTOL/VSTOL
- High sea states launch and recovery technology to enable manned / unmanned air and surface platform operations

Autonomous and unmanned vehicle mobility

- Vehicle design technology for littoral missions and environments
- Multi-unmanned vehicles supporting simultaneous cooperative operations
- Advanced robotic systems for ground combat



Key Research Topics

Advanced Sea Platforms
Air/Ground Vehicles
Air Propulsion
Advanced Naval Power Systems
Expeditionary Maneuver
Advanced Naval Materials (Structural, Functional)
Naval Engineering/Naval Architecture
Unmanned Undersea Vehicle Technologies
Unmanned Air and Ground Vehicles

New or Increased Emphasis

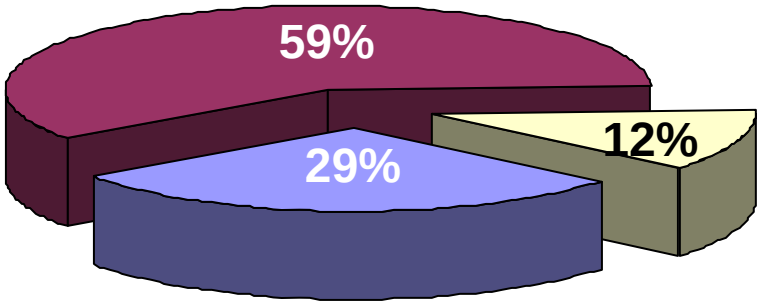
Revolutionary Research . . . Relevant Results

- **WMD Detection**
- **Large Vessel Stopping**
- **Social, Cultural & Behavioral Modeling**
- **Personal Power**
- **Unmanned Air & Ground Vehicles**
- **Complex Software Systems Tools**
- **Anti-Tamper Systems**
- **Biometrics**
- **Affordability**
- **Seabase Enablers**

ONR S&T Investments

Revolutionary Research . . . Relevant Results

6.1



Basic Research

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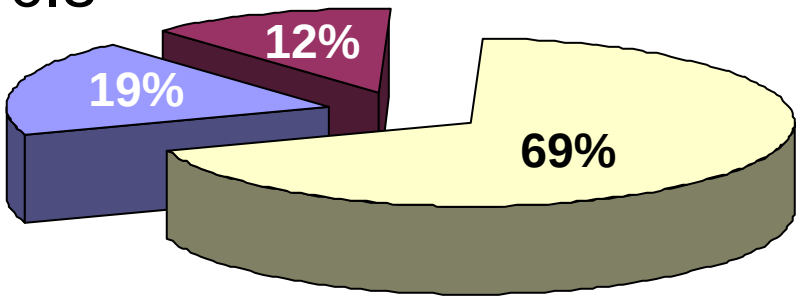

Advanced Technology Development

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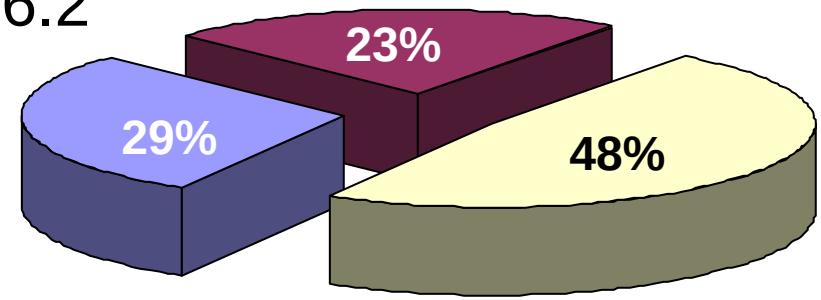
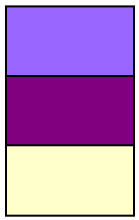


Applied Research

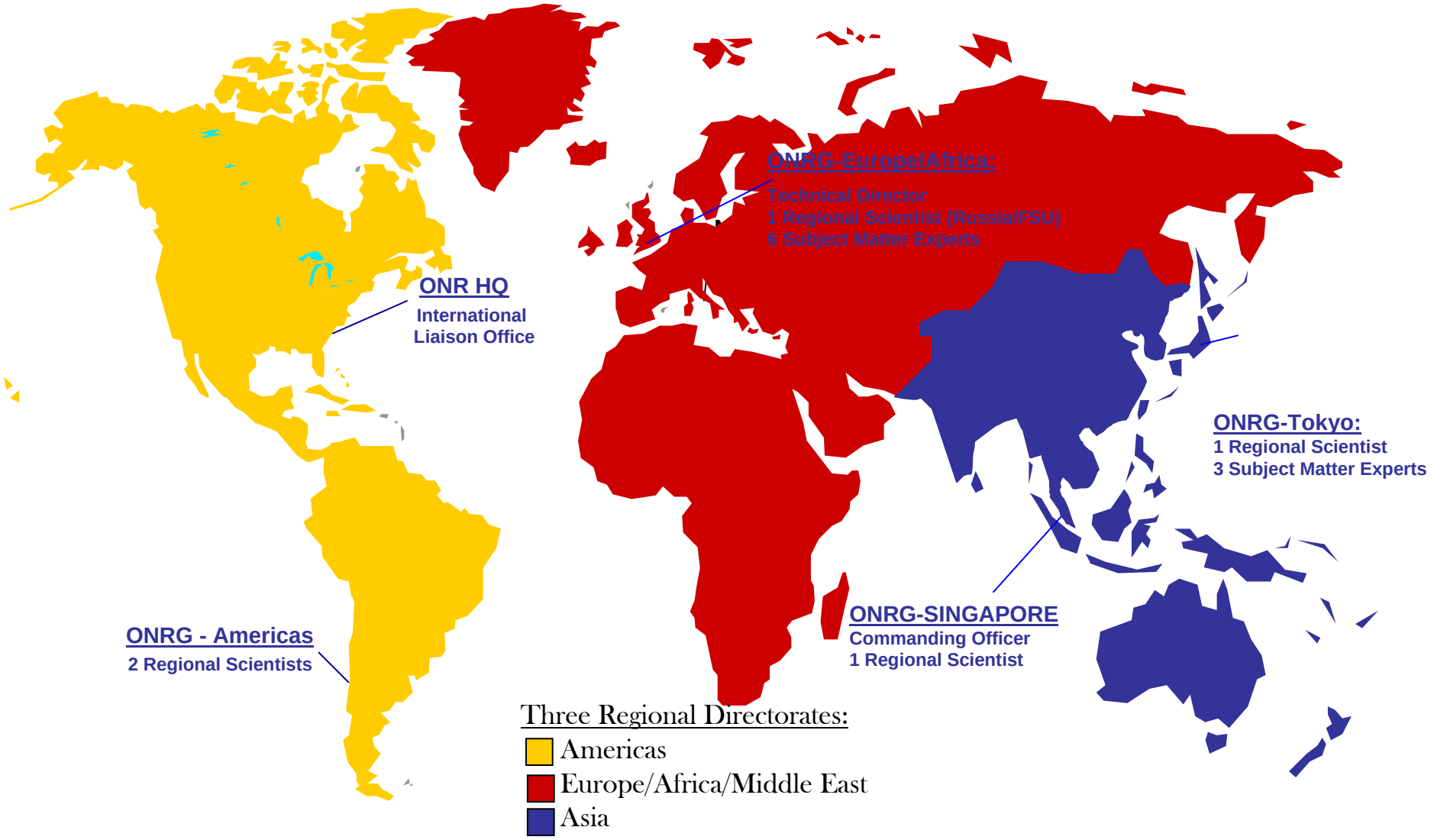


Naval Labs and Centers
University & Nonprofit
Industry

FY 2005

ONR's Global Commitment

Revolutionary Research . . . Relevant Results



Associate Director Locations

International Program Tools

Revolutionary Research . . . Relevant Results

ONR Global Programs:

- **Liaison Visits**
  - ONRG Scientists visit international institutions to develop access and discover cutting edge S&T
- **Conference Support Program (CSP)**
  - Support foreign or international conferences of Naval interest
- **Visiting Scientist Program (VSP)**
  - Support travel of foreign scientists to the US to socialize new S&T ideas or findings with the NRE
- **Naval International Cooperative Opportunities Programs (NICOP)**
  - Support the insertion of innovative, international S&T into core ONR, NRE, and Acquisition Programs

WEBSITE: www.onrglobal.navy.mil

NIPO Cooperative Programs

Revolutionary Research . . . Relevant Results

Navy International Programs Office Cooperative Programs

- **Engineer and Scientist Exchange Program (ESEP)**
  - U.S. and partner send engineers and scientists to each other for 1-2 years where they work as though part of the Host organization.
  - Done using Position Descriptions and Acceptance Letters IAW an MOU.

- **Information Exchange Program (IEP)**
  - Reciprocal exchange of R&D information between partners.
  - Done under an Annex to an MOU.

- **Project Arrangement (PA)**
  - Joint development / acquisition effort for mutual benefit with shared funding.
  - Done under an MOU.

- **Foreign Comparative Testing (FCT)**
  - We test fielded foreign systems for insertion into U.S. acquisition programs.
  - Proposals submitted by commercial companies (with Partner endorsement).

Dept of Defense National Programs

Revolutionary Research . . . Relevant Results

Faculty
- Young Investigator Program
- Summer Faculty Research Program
- Faculty Sabbatical Leave Program

Graduate and Postdoctorate
- Naval Research Enterprise Intern Program (NREIP)
- DoD National Defense Science and Engineering Graduate (NDSEG) Fellowship
- HBCU Future Engineering Faculty Fellowship Program
- Navy Postdoctoral Fellowship Program

Undergraduates
- Naval Research Enterprise Intern Program (NREIP)
- Science and Engineering Apprentice Program (SEAP)

Pre-College
- Naval High School Science Awards Program (NSAP)
- Science and Engineering Apprentice Program (SEAP)

WEBSITE: http://www.onr.navy.mil/education/

DoD National Programs cont.

Revolutionary Research . . . Relevant Results

University Research Initiative (URI)

- Multidisciplinary Research Program of the URI (MURI)
- Defense University Research Instrumentation Program (DURIP)
- DoD Experimental Program to Stimulate Competitive Research (DEPSCOR)

WEBSITE: www.onr.navy.mil/education/

Other Funding Opportunities

- Small Business Innovation Research Program (SBIR)
- Agency Announcements (BAAs) & Request for Proposals (RFPs)
- Long Range Broad Agency Announcement (BAA)
  (BAA 07-001 — Published on Sept 13, 2006)
- Historically Black Colleges and Universities and Minority Institutions
- Technology Transfer (TT)
- Commercial Technology Transition Officer (CTTO)
- Cooperative Research and Development Agreements (CRADAs)
- Patent Licensing Agreements (PLAs)
- DoD High Performance Computing Modernization Program (HPCMP)

WEBSITE: www.onr.navy.mil/doing_business/opportunity.asp

ONR Turbulence Program

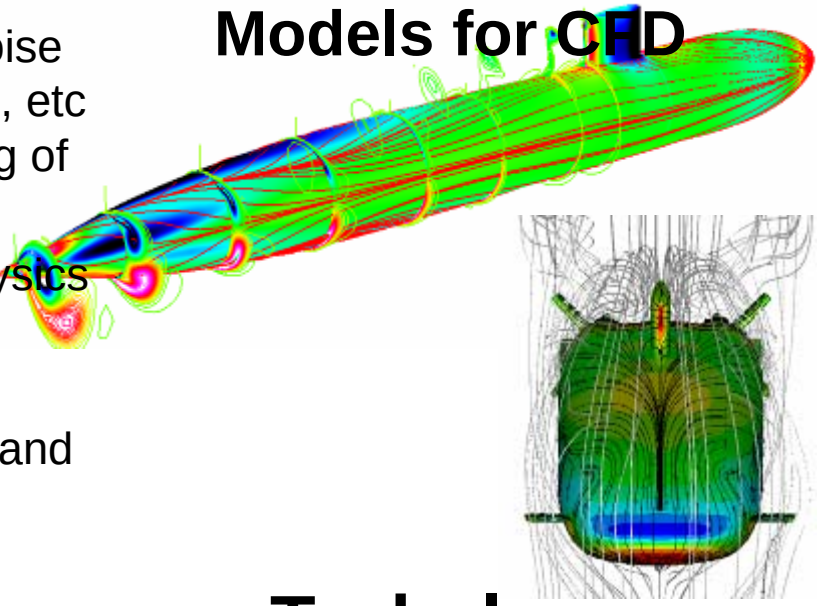
Dr. Ronald D. Joslin

Revolutionary Research . . . Relevant Results

Description:

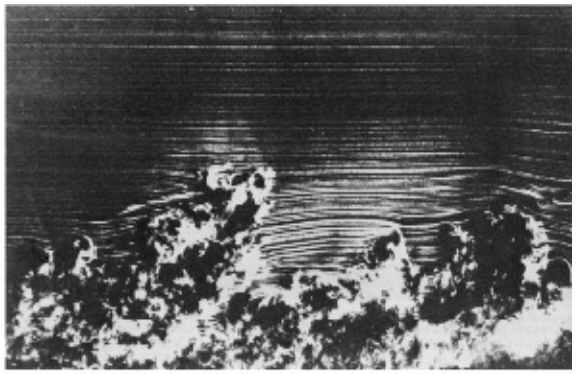
- Provide a knowledge-base of understanding on turbulent flow over platforms which have surface roughness, geometric complexities, flow-induced noise sources, regions of separated flow, unsteady forces, etc for improved design, performance, and maneuvering of Naval configurations.
- Develop computational tools that have sufficient physics to accurately predict performance and reduce "surprises".
- Develop flow control technologies which are robust and provide predictable benefits.
- Generate reliable scale-up rules from laboratory experiments to full scale

Improved Turbulence Models for CFD



Stratified Wakes Research

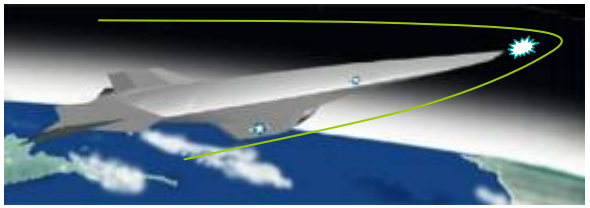
Turbulence Research



SERVICE-SPECIFIC INTERESTS AND COMMONALITY IN MECHANICS

TECHNOLOGY RELEVANCE

ONR



AFOSR

MECHANICS

- **Solid and Structural Mechanics**
- **Fluid Dynamics**
- **Propulsion and Energy Conversion**

ARO

SERVICE-SPECIFIC INTERESTS AND COMMONALITY IN MECHANICS

Subarea	Army	Navy	Air Force
Solid and Structural Mechanics Structural dynamics Composites Aeroelsticity Acoustics	Finite deformation, impact, and penetration Thin-walled composites Rotorcraft aeroelasticity Land vehicle dynamics	Structural acoustics Thick composites Mechanics of ship hulls Explosion resistant coatings	Hypersonic aeroelasticity Mechanics of high temperature materials
	Areas of common Interest: structural dynamics and control (all); damage and failure mechanics/quantitative nondestructive evaluation (all); smart structures (all)		
Fluid Dynamics Aerodynamics Hydromechanics	Rotorcraft aerodynamics Maneuvering missiles/projectiles Micro/meso-scale devices	Free surface phenomena Hydrodynamic wakes Hydroelasticity and hydro acoustics Propulsor hydrodynamics	Turbomachinery, fixed wing, and hypersonic aerothermodynamics Aero-optics Plasma and MHD flow control
	Areas of common Interest: turbulence (all); flow control (all)		
Propulsion and Energy Conversion Air-breathing Rocket Explosives	Reciprocating engines Gun propulsion Small gas turbines	Underwater propulsion Tactical missile propulsion Explosives	Large gas turbines Supersonic combustion Access to space Spacecraft propulsion
	Areas of common Interest: high energy materials, combustion & hazards (A, N); soot formation (all); turbulent flows (all); spray combustion (A, AF), pulse detonation engines (all), plasma-assisted ignition/combustion (all)		

Mechanics Research by Other Agencies

Revolutionary Research . . . Relevant Results

	Solid/Structural Mechanics	Fluid Dynamics	Energy Conversion
NASA	Airframe & Propulsion Structures	Transition, Turbulence, CFD Methods And Validation	Internal flow CFD Propulsion Control
NSF	Mechanics & Materials Civil Engineering Structures	Fluid Dynamics Multi-phase Processes	Combustion And Thermal Plasmas Transport And Thermal Processes
DOE	Fracture Mechanics ASCI – Dynamic Response	Multi-Phase Flow	Combustion ASCI – Propulsion, Rockets, And Fire/ Explosions

CONTACTS

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