Expeditionary Warfare Conference 2011

Dr. Walter Jones

Executive Director

Revolutionary Research . . . Relevant Results

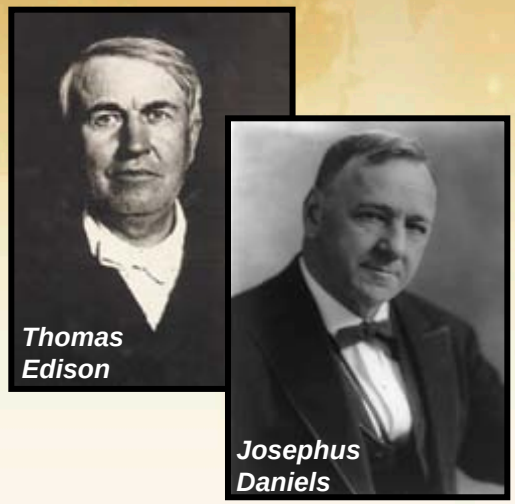
OFFICE OF NAVAL RESEARCH

The Office of Naval Research

Revolutionary Research . . . Relevant Results

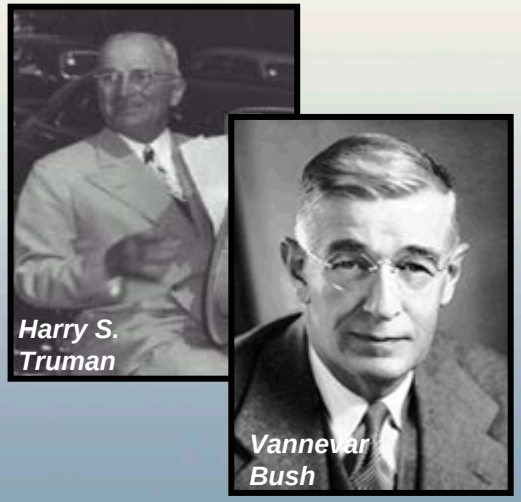
Naval Research Laboratory *(Appropriations Act, 1916)*

"[Conduct] exploratory and research work…necessary …for the benefit of Government service, including the construction, equipment, and operation of a laboratory…."



Office of Naval Research *(Public Law 588, 1946)*

"…plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future of naval power, and the preservation of national security…"



Office of Naval Research - London Office *(1946)*

"…reporting on the latest developments and to assist visiting American scientists to make contact with their colleagues in Europe…"

Transitioning S&T *(Defense Authorization Act, 2001)*

"…manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

88 Years of Naval Research

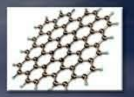
Revolutionary Research . . . Relevant Results

Naval S&T Milestones

ACCOMPLISHMENTS ACROSS ALL DOMAINS

Powered by Naval Research TM/SM


Virtual At-Sea Training (Live-Fire Combat Skills)


Nobel Prize to ONR Researchers for Graphene


NTS-2 Satellite in NAVSTAR GPS


Nobel Prize to Dr. Jerome Karle, NRL


Navy Aerosol Analysis and Prediction System


High Temperature Superconductive Degaussing


Free Electron Laser


Timation and NAVSTAR GPS


Coronal Mass Ejection


High-Energy Magnets


Clementine Spacecraft


Hyperspectral Imager for Coastal Oceans


Tactical Microsatellite


First Detection of X Rays from the Sun


First Unmanned Helicopter


Owens Valley 40M Radio Telescope


Mobile Robots


ONR-funded Tech finds RMS *Titanic*

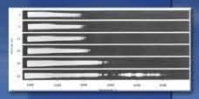

Interactive Multisensor Analysis Training (IMAT)


SHARP Reconaissance


Large Displacement Unmanned Underwater Vehicle


Multistatic Radar Tested at NRL


Plan-Position Indicator


First Far-Ultraviolet Spectrum of the Sun


Vanguard I Launched


Aqueous Film Forming Foams (AFFF)

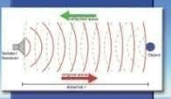

Excimer Laser Technology


Global Atmospheric Prediction System


High-Strength Low-Alloy Steels


Dragon Eye UAV


Integrated Topside (INTOP)


Sound Navigation and Ranging (SONAR)


Uranium 235 Production


Principles of Modern Fracture Mechanics

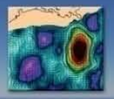

Project Whirlwind Digital Computer


First U.S. Intelligence Satellite

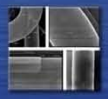

Far Ultraviolet Lunar Camera


Sidewinder Air-to-Air Missile


Neural Networking Computer Chips


First Operational Global Ocean Model


CBR Sensors for Fleet Security


Gamma-Ray Radiography


First Concept for a Nuclear Submarine


Synthetic Lubricants


Particle Accelerators

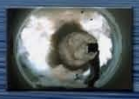

SEALAB I and II


Lithium Batteries


Contributed to Aegis Combat System


Ultra-High Strength Steel


QuikClot® Combat Gauze


World-Record Setting 33 MJ EMRG Shot


NRL Commissioned

1920s


First U.S. Radar Patents

1930s


ONR Founded 1946

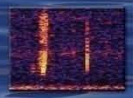
1940s


Vertical Take-Off and Landing

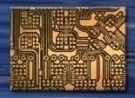
1950s


Bathyscaphe *Trieste* reaches 35,800 ft.

1960s


SOund SUrveillance System (SOSUS)

1970s


Acoustic Microscopy

1980s


Hull Anti-Fouling Coatings

1990s


Remote Environment Monitoring Units

2000s

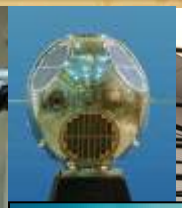

Anti-Torpedo Torpedo

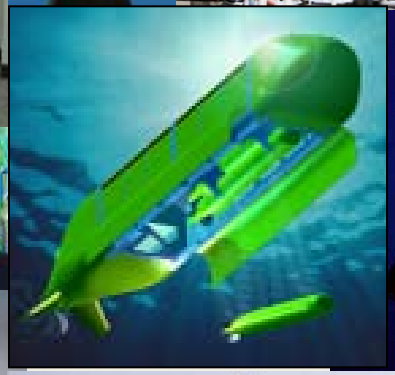
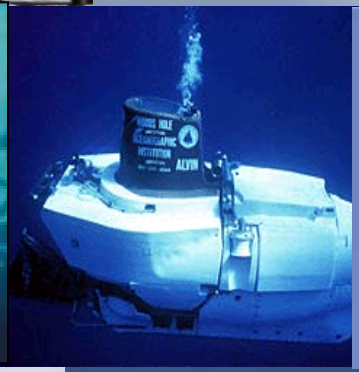
2010 & BEYOND

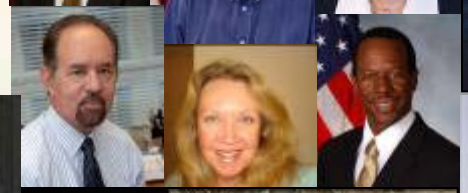
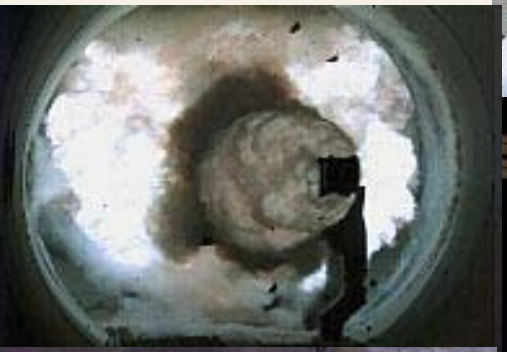
Who We Are

Revolutionary Research . . . Relevant Results

ONR/NRL	
People:	3,900
Govn't:	3,360
Contractor:	540
PhDs:	842
SES:	45
USNR:	212

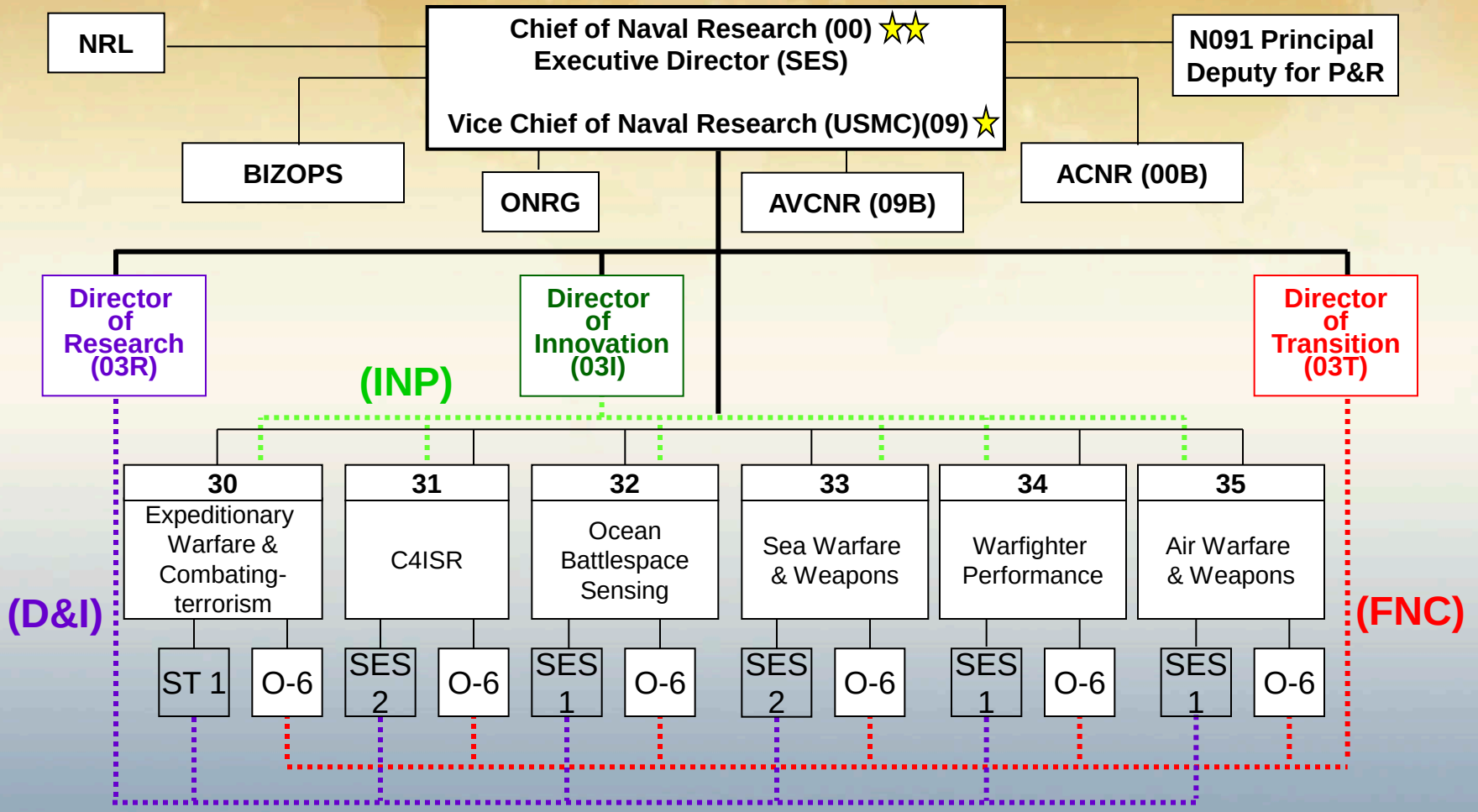








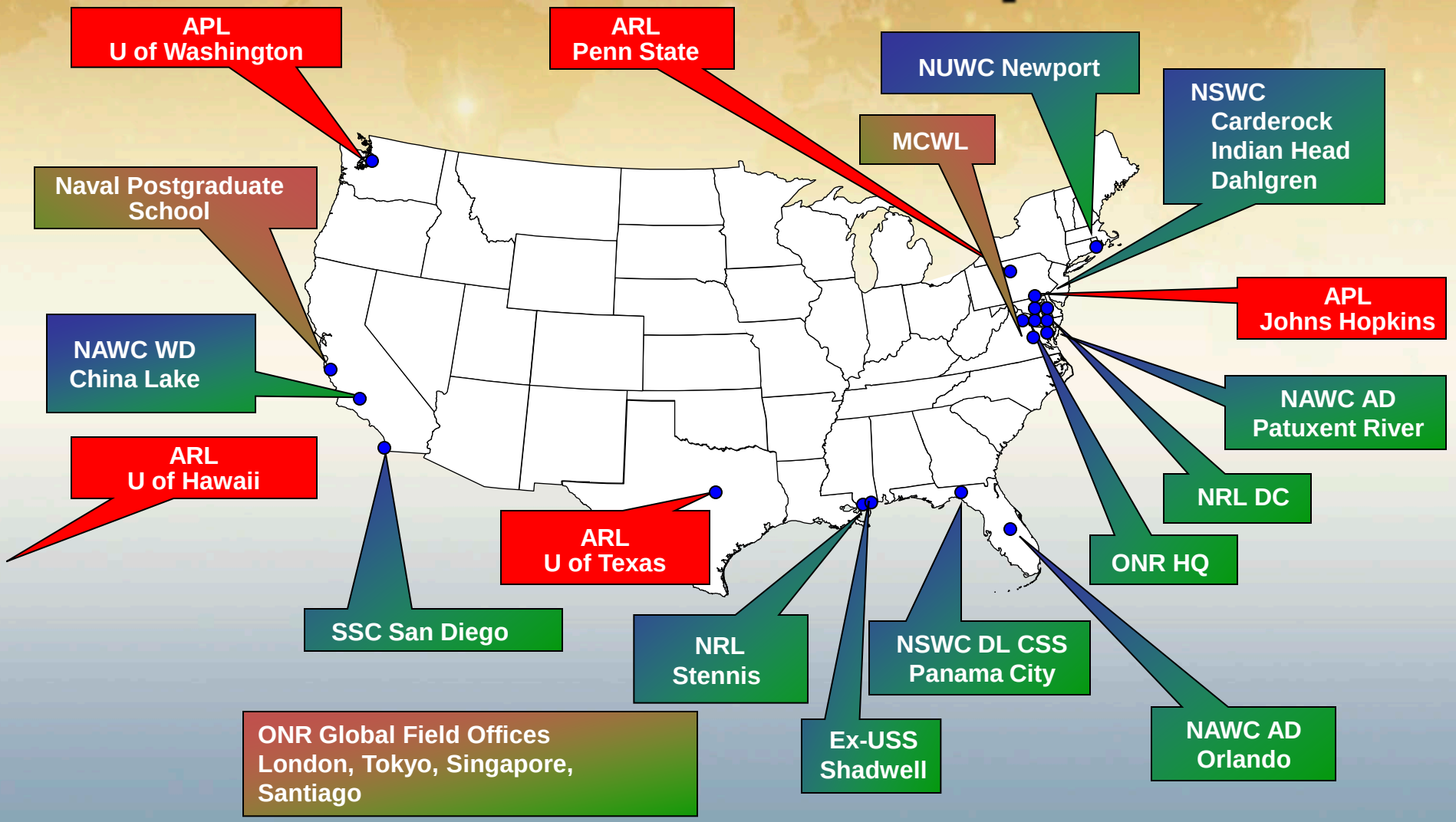


ONR Organization



Department of the Navy Research Enterprise

ONR
Revolutionary Research . . . Relevant Results



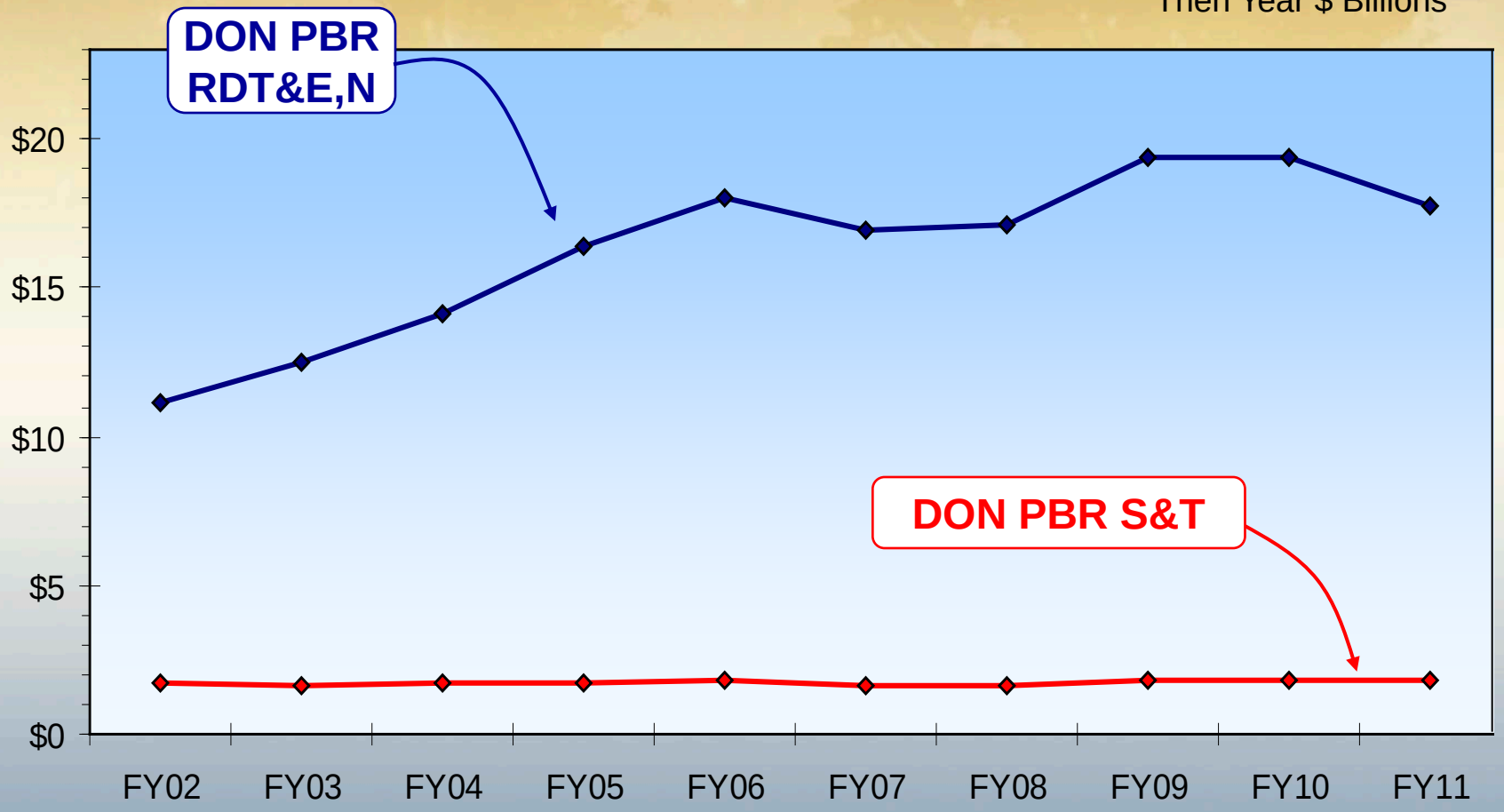
ONR-Global

Revolutionary Research . . . Relevant Results

- **Develop Partnerships**
- **Leverage Global S&T Advances**
- **Avoid Technology Surprise**

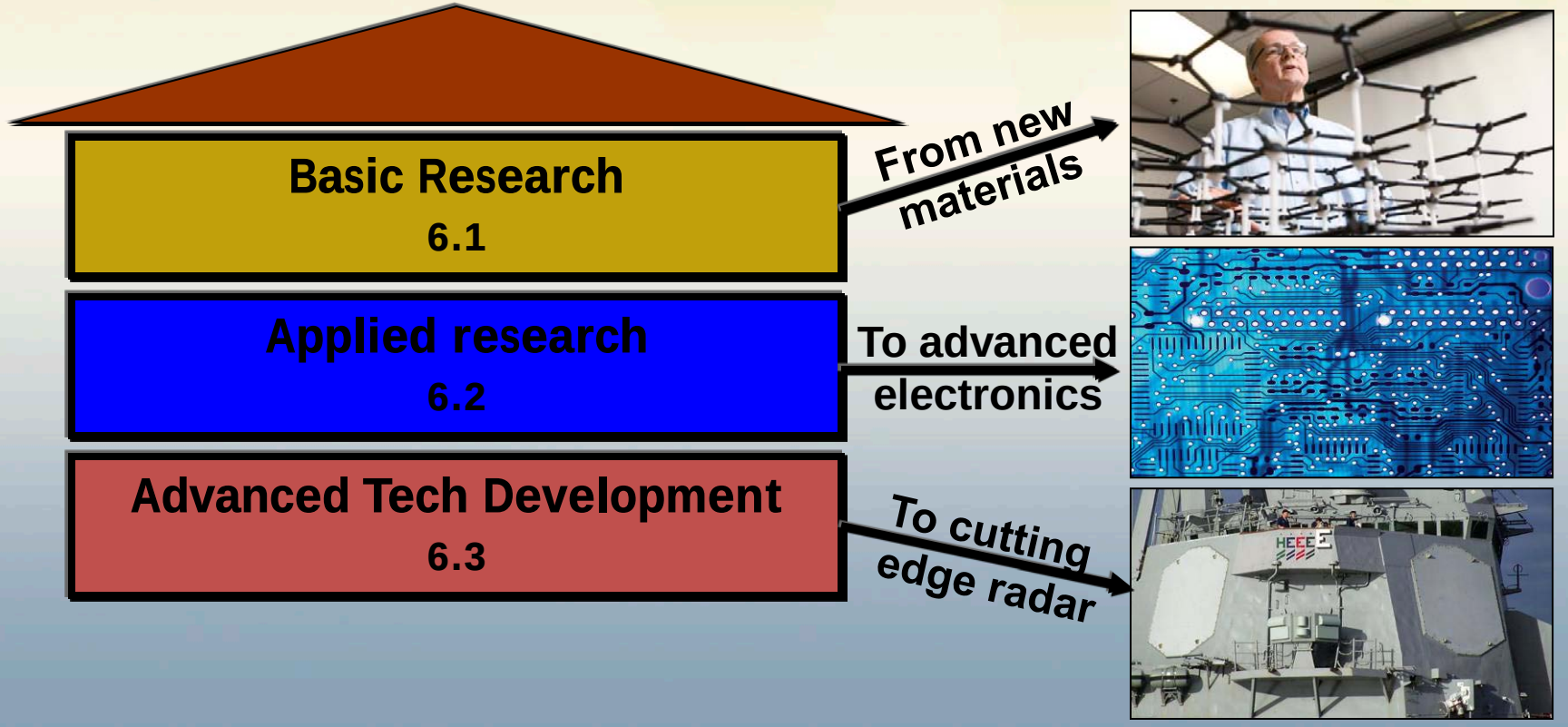
RDT&E 6.1 – 6.7

Then Year $ Billions



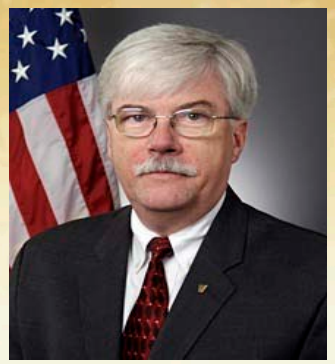
Unique Structure

- All three S&T funding lines under one roof
- Program Officer can see a program through D&I → Applied Science → Transition



Leadership for S&T

RADM Nevin Carr Jr.
Chief of Naval Research



Dr. Walter Jones
Executive Director

BGen Mark R. Wise
Vice CNR

Guidance Comes From…

Assistant Secretary of the Navy (Research, Development and Acquisition)

Vice Chief of Naval Operations

Assistant Commandant for the Marine Corps

Assistant Secretary of Defense for Research & Engineering

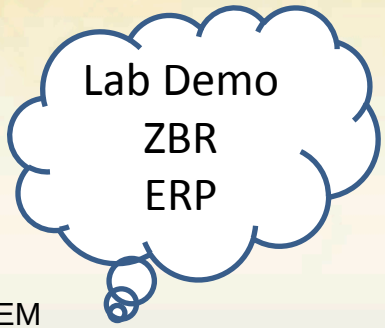
CNR 2011 Priorities

Revolutionary Research . . . Relevant Results

CNR 2011 Priorities

1. **Focus on S&T areas that provide the biggest payoff for our future**
2. **Be innovative in our thinking and business processes**
3. **Improve transition of S&T products into acquisition programs and the Fleet**
4. **Expand strategic communication and engagement with stakeholders**

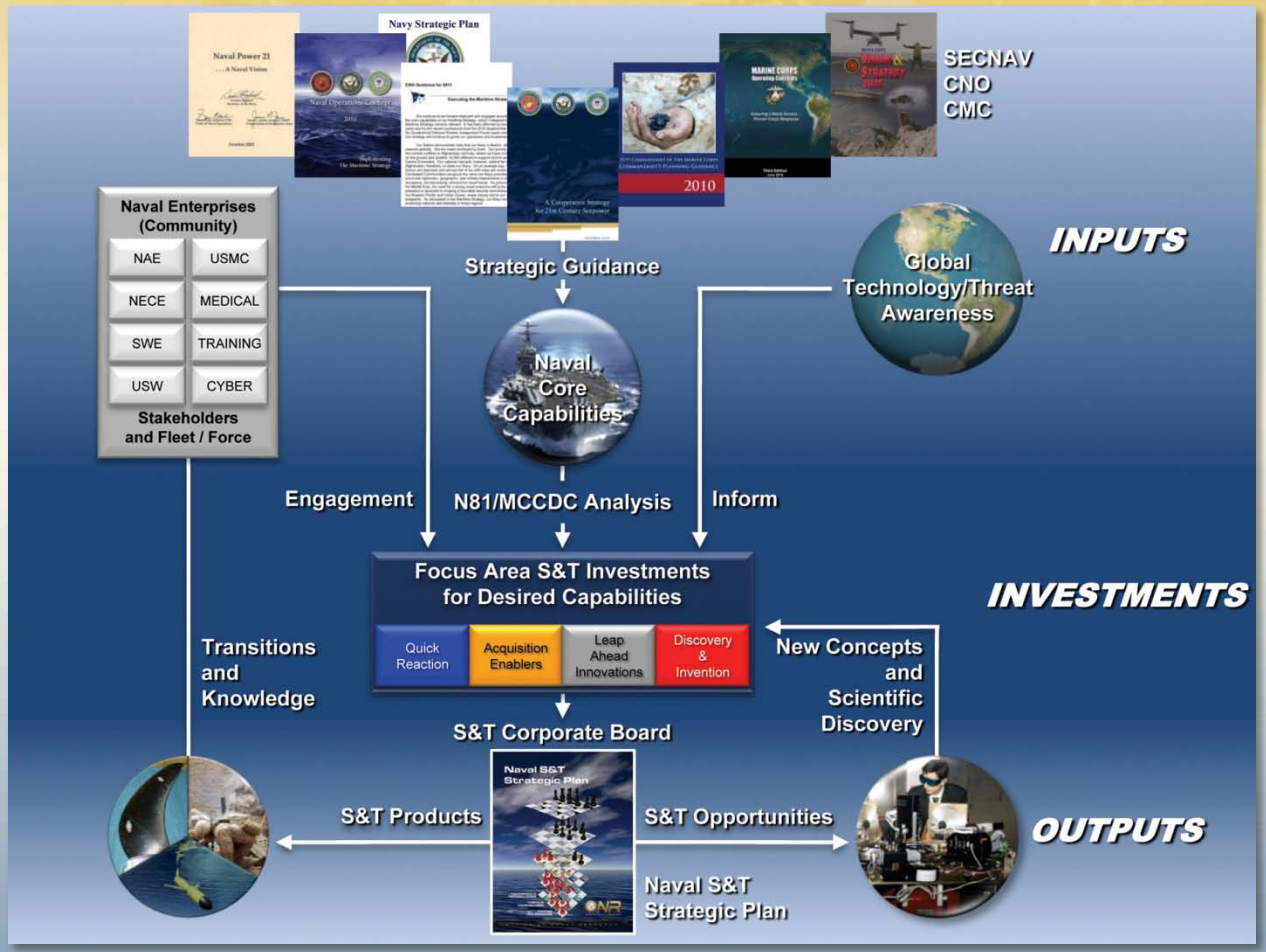
- High-Payoff S&T Areas:
  - Power & Energy
  - Directed Energy & Hypersonics
  - Information Dominance
  - Autonomous Systems
  - Total Ownership Cost Reduction
  - Expeditionary & Irregular Warfare
  - Naval Warfighter Performance
- Support the ONR Business Plan
  - Implement Lab Demo
  - Achieve and declare audit readiness
  - Prepare to double our support for STEM
  - Implement a peer review process for Basic Research
  - Prepare to transition to ERP, and incorporate KM
  - Expand career development to include Executive Education
- Improve alignment with requirements
  - Support “Speed to Fleet” initiatives
  - Address “Valley of Death” challenges
  - Expand ONRG and Science Advisor program
- Ensure we understand customer needs and they understand how we’re working to meet those needs
  - Tell the ONR story, “Leading the Vision, Delivering Results”
  - Communication is a leadership responsibility



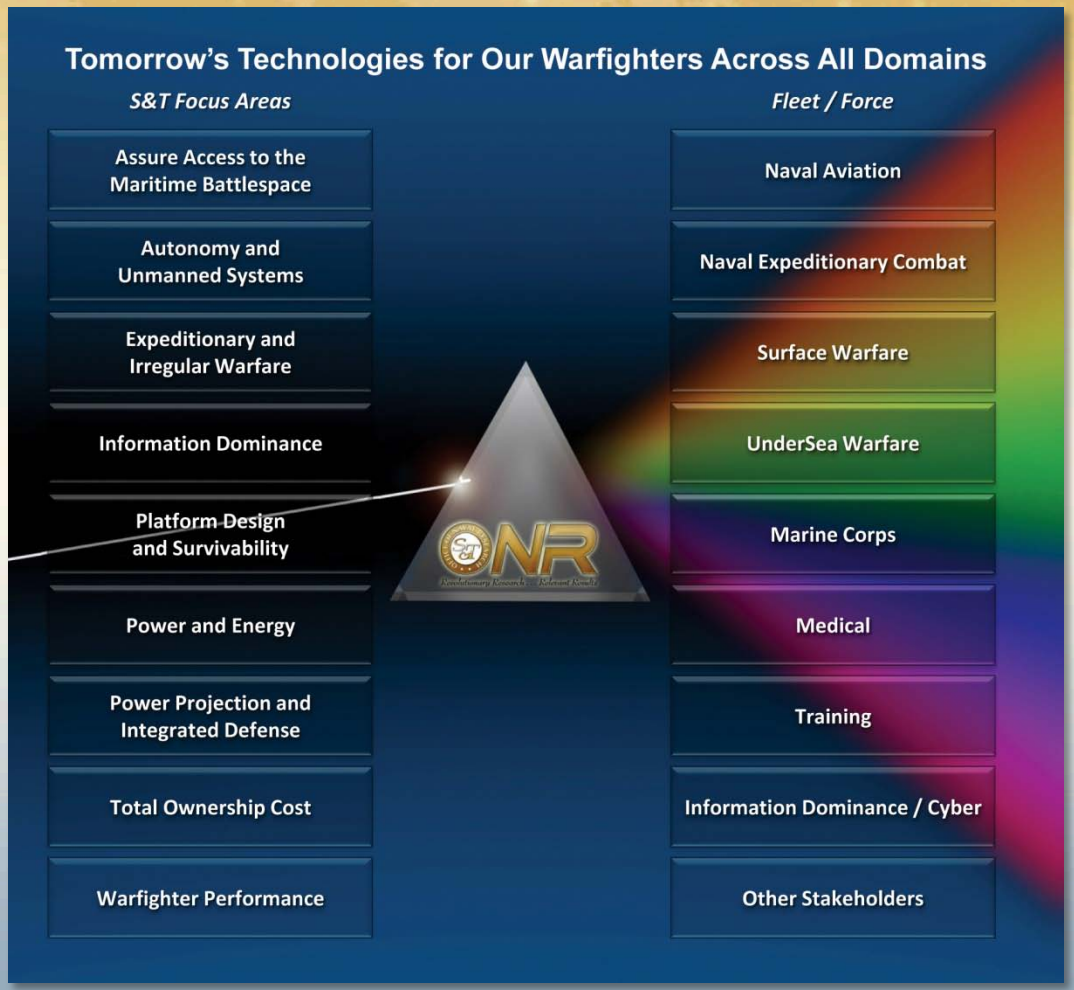
Naval S&T Strategic Plan

- Second update of the original Naval S&T Strategic Plan
- Focused on top-down guidance, informed by fiscal realities of POM13
- Strategic Context – development guided by CS-21, SECNAV Guidance, NSP, and Vision and Strategy 2025
- Focus Areas consolidated from 13 to 9; includes addition of one new area on Autonomy and Unmanned Systems

Naval S&T Strategic Process



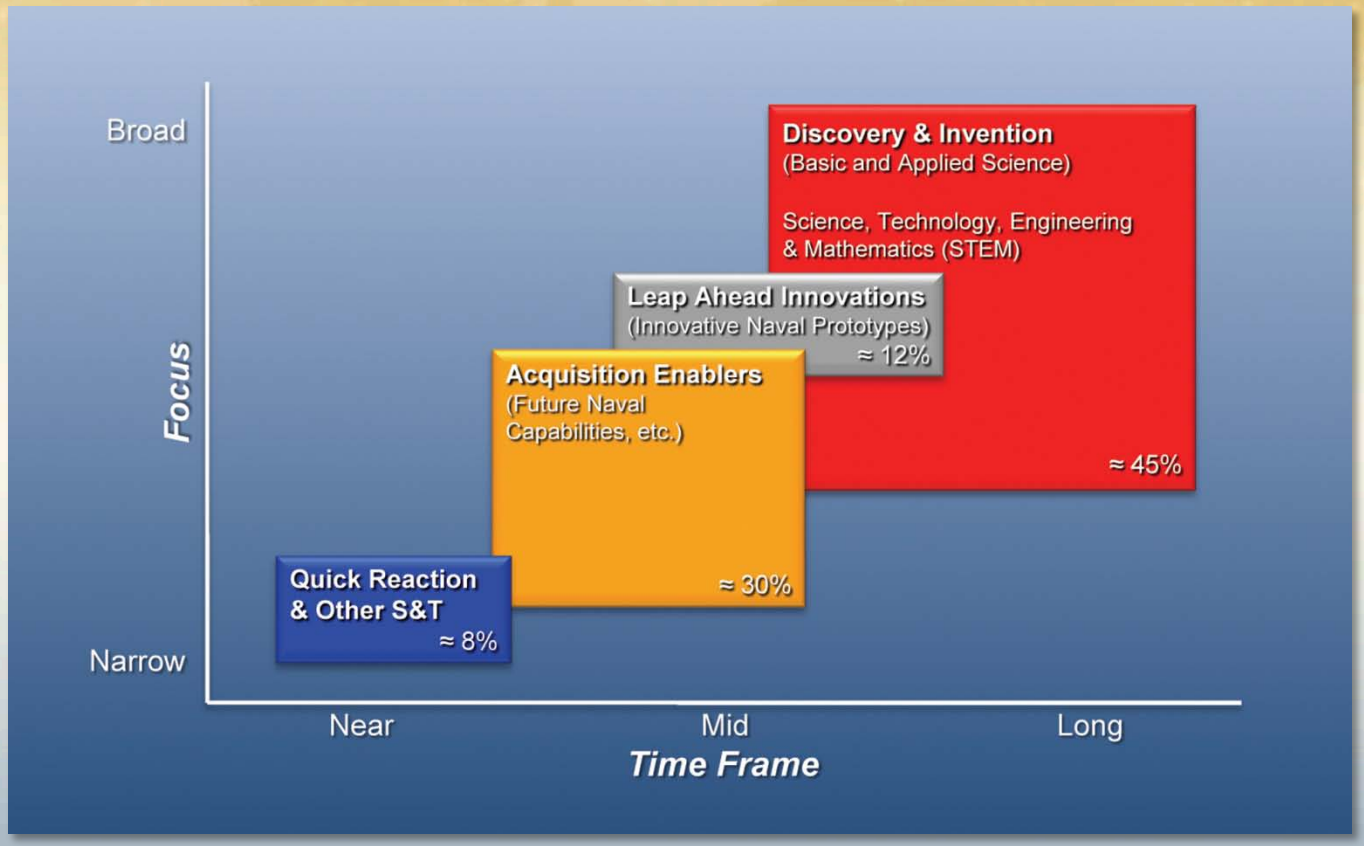
Naval S&T Focus Areas



STEM is a critical enabler across all Focus Areas

ONR S&T Investment Portfolio

Revolutionary Research . . . Relevant Results



Quick Reaction S&T
- Tech Solutions
- Experimentation
- All MCWL, %JNLW 6.3
- % Code 30 6.3
- RTT, UUNS Response

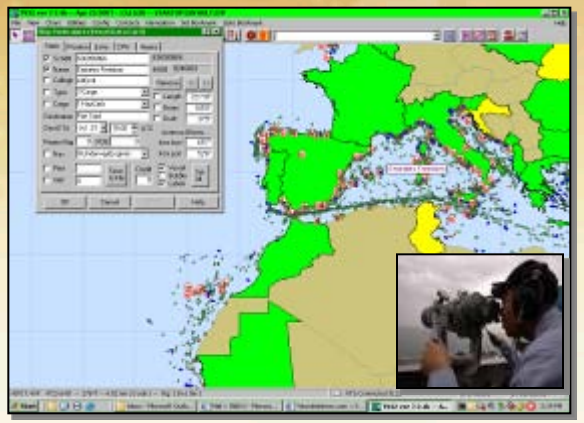
Acquisition Enablers
- Future Naval Capabilities
- Warfighter Protection
- Capable Manpower
- % LO/CLO
- % Code 30 6.3 /JNLW 6.3

Leap-ahead Innovations
- Innovative Naval Prototypes
- % SwampWorks

Discovery & Invention
- Basic & Early Applied Research
- National Naval Responsibilities
- Education Outreach HBCU/MI

Quick Reaction S&T

- Ship Identification
- Solid State Lighting
- HCO Trainer
- Food Service Software
- Automated Weather Prediction system

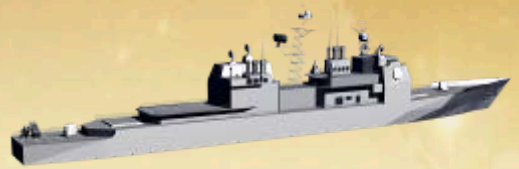


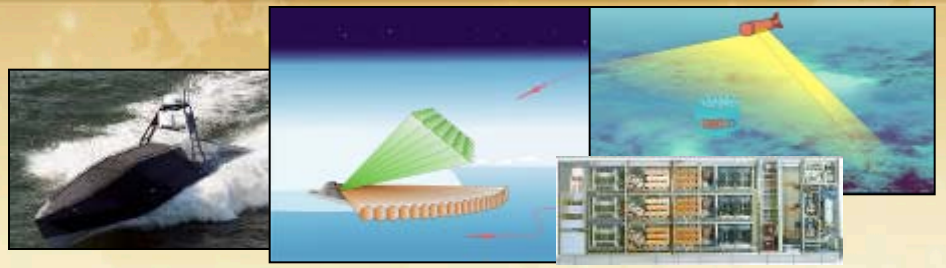
- **Rapid solutions to problems identified by deckplate Sailors and Marines**
- **1 year turnaround time**
- **Video: www.youtube.com/usnavyresearch**
- **Requests submitted online www.onr.navy.mil/techsolutions**

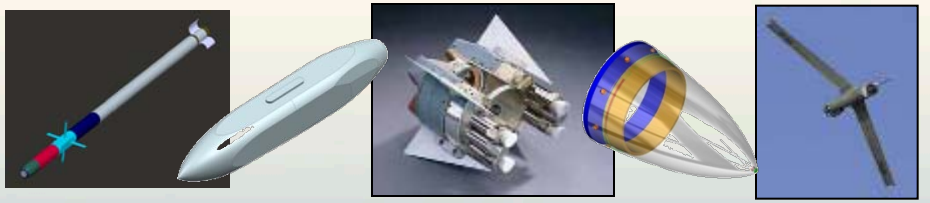
Future Naval Capabilities

(3-5 Year) Component Technologies

Revolutionary Research . . . Relevant Results







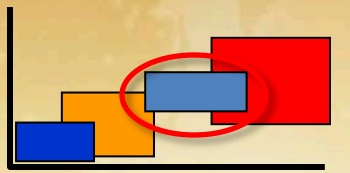
Secure Networks

Innovative Naval Prototypes

(5-10 Year) Disruptive Technologies

Revolutionary Research . . . Relevant Results

- **High Risk / High Payoff**
- **Innovative and game-changing**
- **Approved by Corporate Board**
- **Delivers prototype**

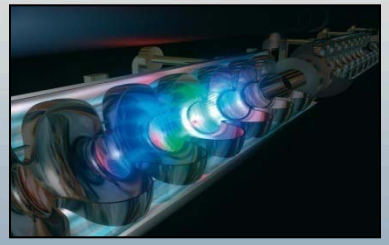


Tactical Satellite

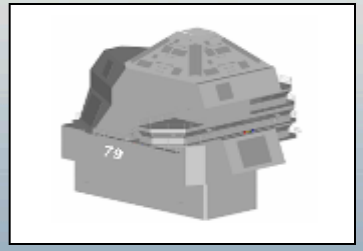
EM Railgun

Persistent Littoral Undersea Surveillance

Sea Base Enablers



Free Electron Laser



Integrated Topside

Large Displacement UUV

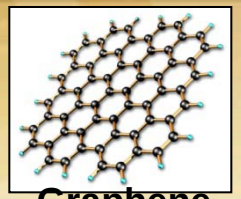
AACUS

Basic Research

Seed corn for disruptive technologies

Revolutionary Research . . . Relevant Results

- Diverse portfolio
- Fosters innovation
- Long-term
- Investment in people
  *60+ Nobel laureates



Graphene

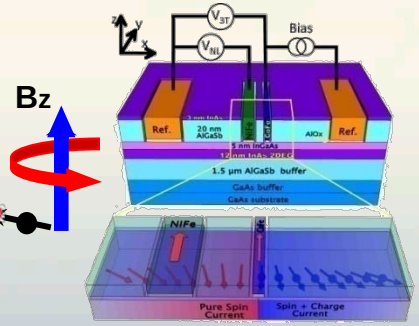
1st U.S. Intel satellite

Semiconductors
GaAs, GaN, SiC

EW

GRAB

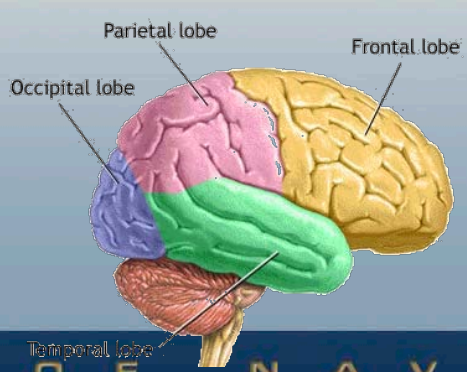
Spintronics



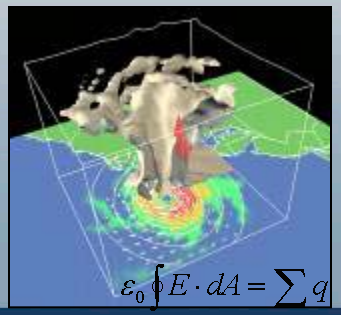
Bz

Arctic Research

GPS



Weather Modeling



Laser Cooling

How We Execute

Revolutionary Research . . . Relevant Results

ONR Global

FFRDCs

UARCs/Academia

Industry

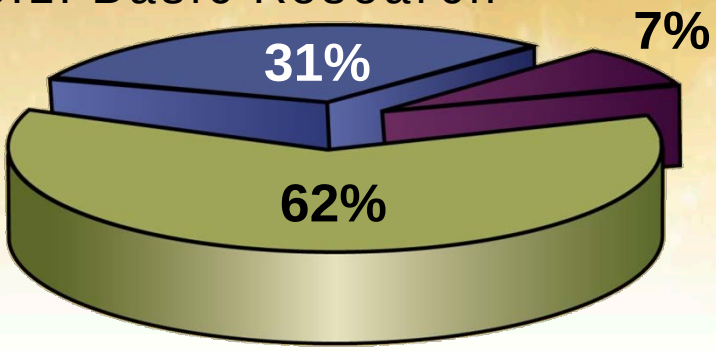
NRL/Warfare Centers

- 70 Countries
- 50 States
- 1,078 Companies
  - 859 small businesses
- 1,035 Universities & Nonprofit Entities
  - 3,340 principal investigators
  - 3,000 grad students

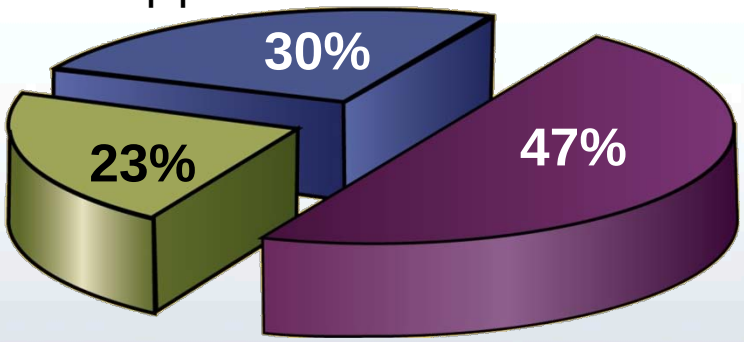
Investment Balance

Revolutionary Research . . . Relevant Results

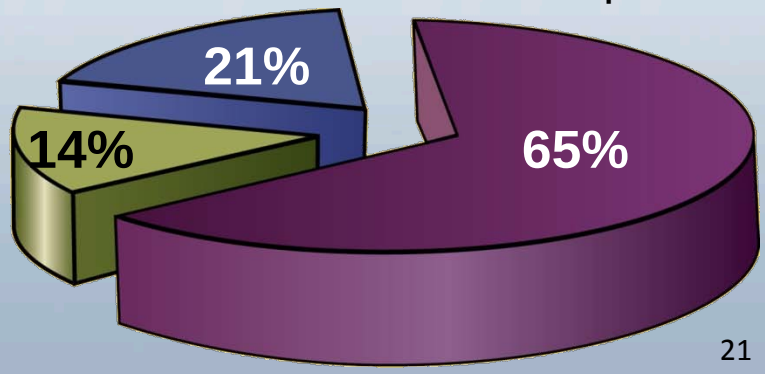
6.1: Basic Research



6.2: Applied Research



6.3: Advanced Tech Development



Naval Labs and Centers

University & Nonprofit

Industry

Requirements Driven Process

Innovation Driven Process

Revolutionary Research . . . Relevant Results

Communicating Success

Revolutionary Research . . . Relevant Results

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Navy Crowdsources Pirate Fight To Online Gamers » MMOWGLI Gameplay

engadget

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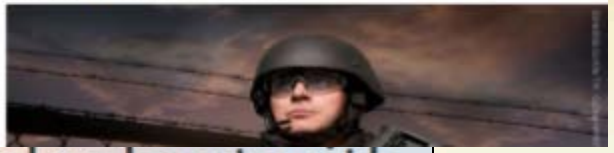
NAVY SEALs getting fancy LCD sunglasses, will surely show up as DLC in next SOCOM game



Innovation on msnbc.com

Navy raygun disables boat with new high energy laser

Maritime Laser Demonstrator could one day protect military vessels

FOX NEWS .com Fair & Balanced

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The Washington Post

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Marines Going Green to Save Lives on Battlefield

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The Navy's Free Electron Laser System Will be More Than Just a Death Ray

IEEE

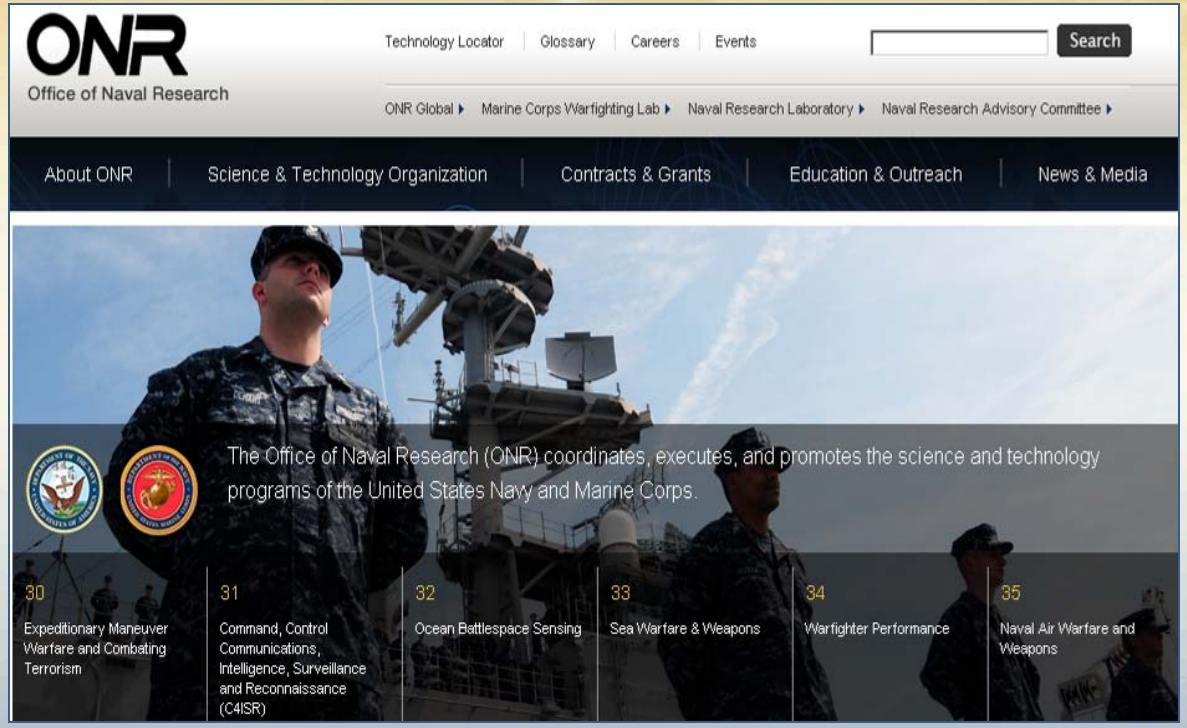
Advancing Technology for Humanity

DANGER ROOM

70 Days at Sea For New Robot Sub

Navy's Patent Portfolio #1 in World Among Government Organizations

Where to Find Us Online



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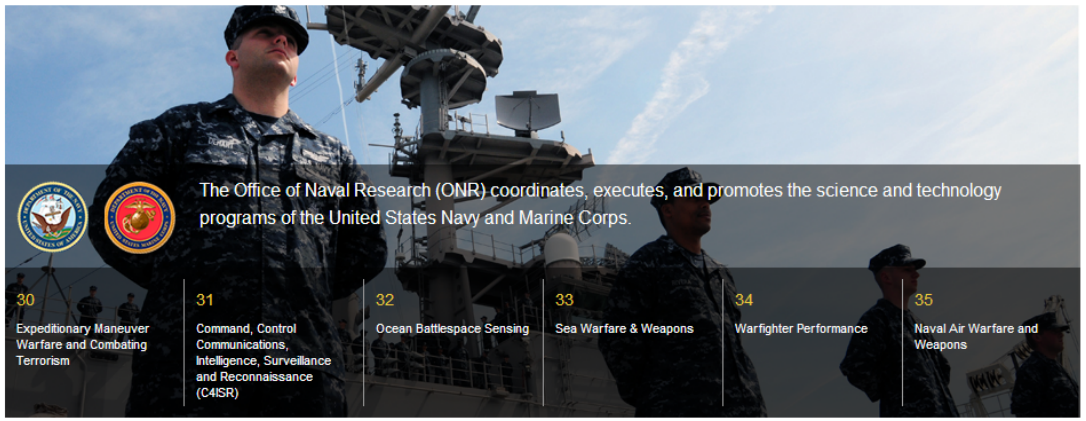


Directorates

ONR's directorates balance a robust science and technology (S&T) portfolio, allocating funds to meet the warfighter's requirements.

- 03I Innovation
- 03R Research (Discovery & Invention)
- 03T Transition

Chief of Naval Research Spotlight

Challenge Winners Named
On Feb. 28, the Office of Naval Research announced 10 finalists for its Chief of Naval Research (CNR) Challenge. Winners, like Professor Moeness Amin of Villanova University (left), will receive a $100,000 research grant for basic research which could significantly contribute to building future naval forces.

"ONR program officers reviewed the entries and selected 10 very promising ideas from nearly 100 white papers," said Rear Adm. Nevin Carr, chief of naval research. "As always, final selection was tough, but the winners were ultimately chosen based on potential and how well the idea supports the needs of the Navy."

Quick Links

Get shortcuts to commonly requested topics below:

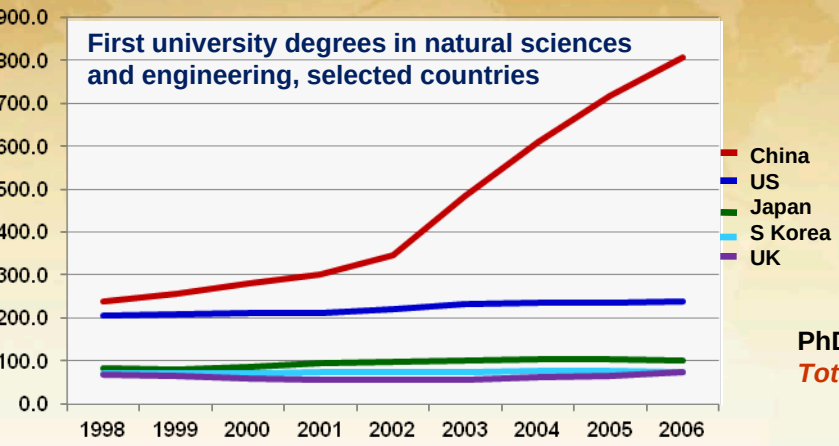
- ONR Wins Website of the Year
- Explore research funding opportunities
- Learn how to submit a proposal
- Follow ONR on Facebook

Done | Local intranet | 100%

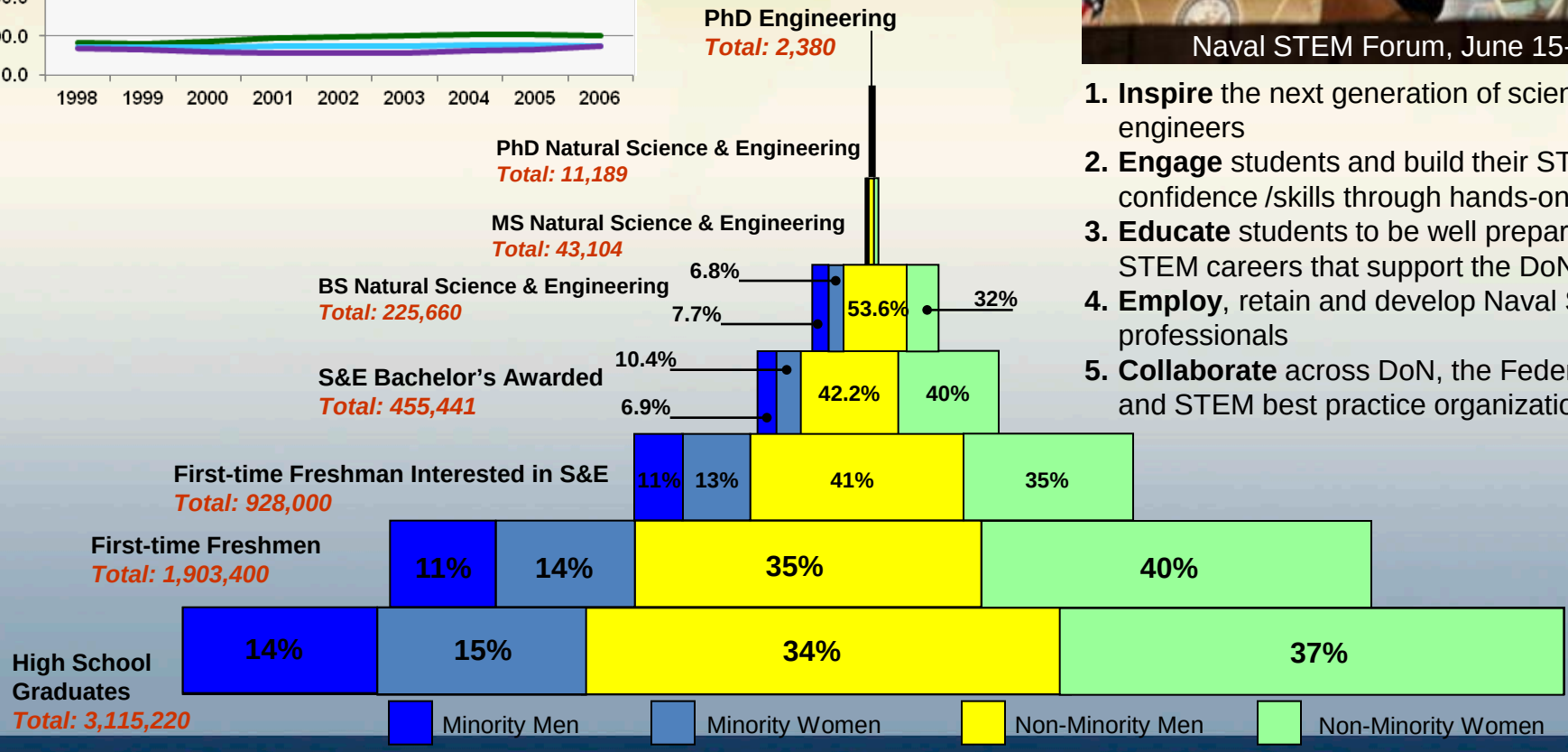
BACK UP

STEM

Revolutionary Research . . . Relevant Results

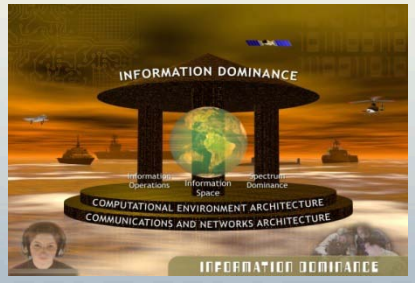


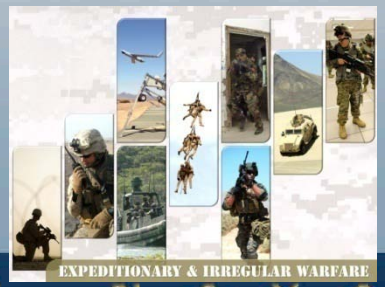
1. **Inspire** the next generation of scientists and engineers
2. **Engage** students and build their STEM confidence /skills through hands-on learning
3. **Educate** students to be well prepared for STEM careers that support the DoN
4. **Employ**, retain and develop Naval STEM professionals
5. **Collaborate** across DoN, the Federal govn't and STEM best practice organizations.



Technology Themes

- Power & Energy
- Directed Energy & Hypersonics
- Information Dominance
- Autonomous Systems
- Total Ownership Cost Reduction
- Expeditionary & Irregular Warfare
- Naval Warfighter Performance





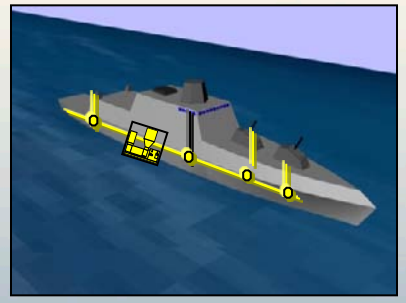
Power & Energy

Revolutionary Research . . . Relevant Results

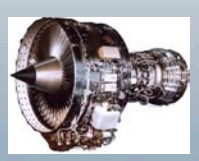
SECNAV Energy Goals:

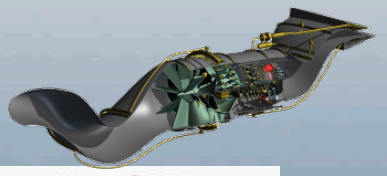
1. **Sail a "Green Strike Group" by 2016**
2. **50% of Navy energy from alternative sources by 2020**
3. **Demonstrate a Green Strike Group in by 2012 and sail it by 2016**
4. **reduce petroleum use in the commercial fleet 50% by 2015**
5. **Evaluation of energy factors will be mandatory when awarding contracts**

ONR Naval Energy Forum
14-15 October 2009



- Fuels
- Power Generation
- Energy Storage
- Efficient Distribution
- Energy Usage





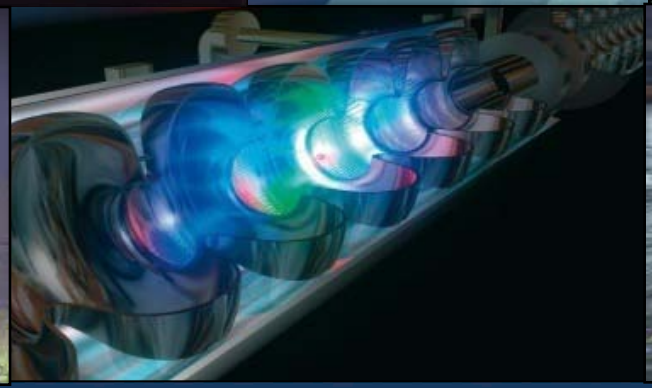
Directed Energy & Hypersonics

- **Fight at Hypervelocity & Speed of Light**
- **Deepen the Magazines**
- **Increase Depth of Fire**
- **Broad Range of Missions**










Directed Energy

Blur The Lines Between Sensors & Weapons

Revolutionary Research . . . Relevant Results

Maritime Laser Demonstration (MLD)

Laser Weapon System (LAWS)

Technology Development Programs

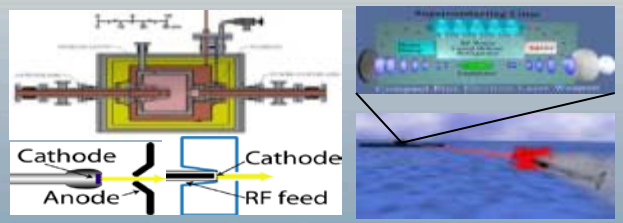
Free Electron Laser (FEL)

Officer Involvement and Training

US Naval Academy

Platform vibration and jitter control

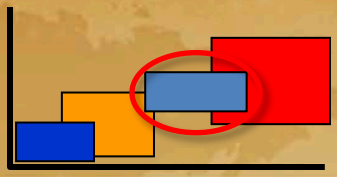
Naval Postgraduate School

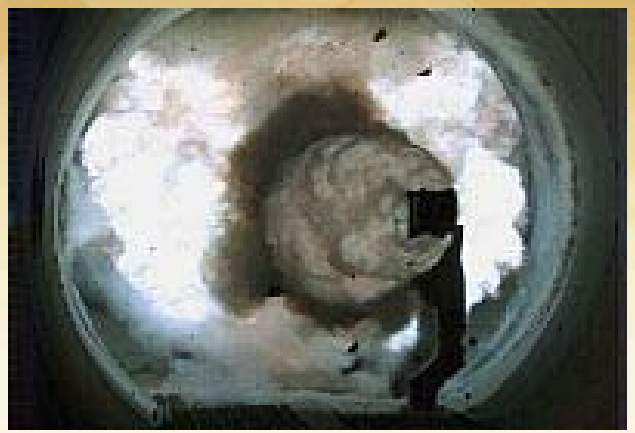


FEL Modeling and Simulation, Quarter Wave–Superconducting RF Injector, Beam Control and Shipboard Integration Concepts

EM Railgun

Blur The Lines Between Missiles & Bullets





32MJ Shot from the Lab Launcher

General Atomics Blitzer

Rapid Pulsed Power Module

BAE Composite Prototype

Projectile Dispense Test

Muzzle energy:

- From 6MJ to 32MJ
- 50-100nm range capability

Pulsed Power:

- 2.5X increase in energy density
- Multi-shot capable design

Bore Life:

- From 10s to 100s
- Multiple configurations & materials

Industry Launcher Prototypes:

- From concept to hardware

Projectile:

- From slugs & sand catch
- To instrumented and dispensing flight bodies on open range

Mission:

- From Land Attack
- To Multi-Mission Initiative

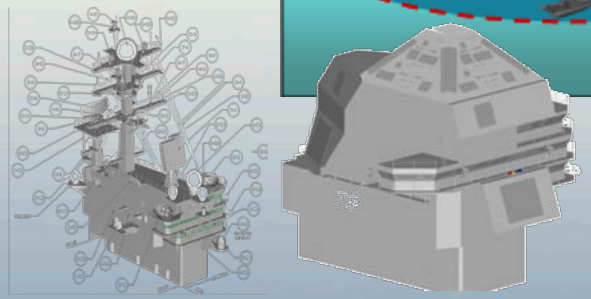
Information Dominance

Revolutionary Research . . . Relevant Results

- Extend the frequency range and effectiveness of Nulka and SEWIP transmitter

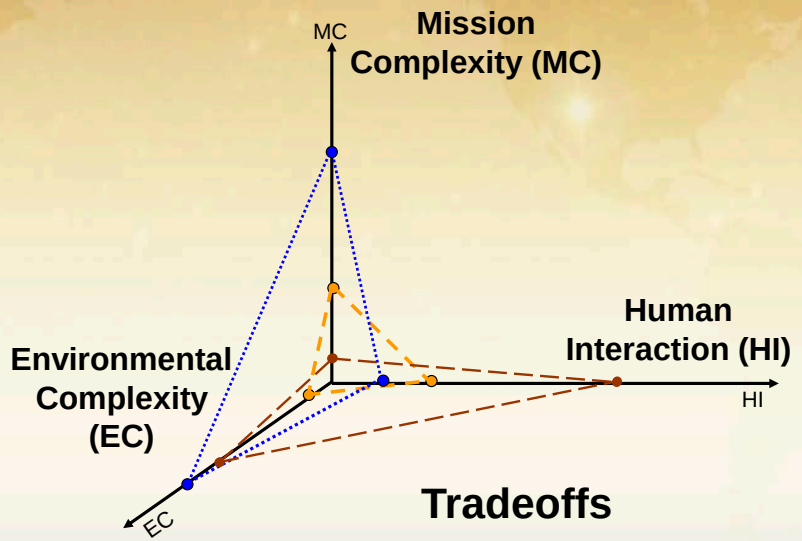
- Achieve synchronized wide area EM spectrum control across multiple mission areas using multiple assets

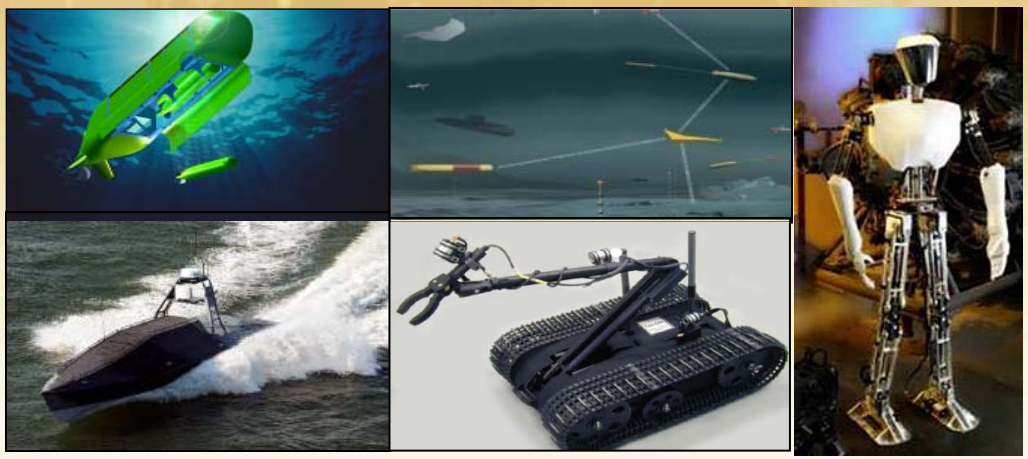
- Simultaneously share RF functions, apertures and signal processing
- Continually optimized to meet Commander's highest priority need

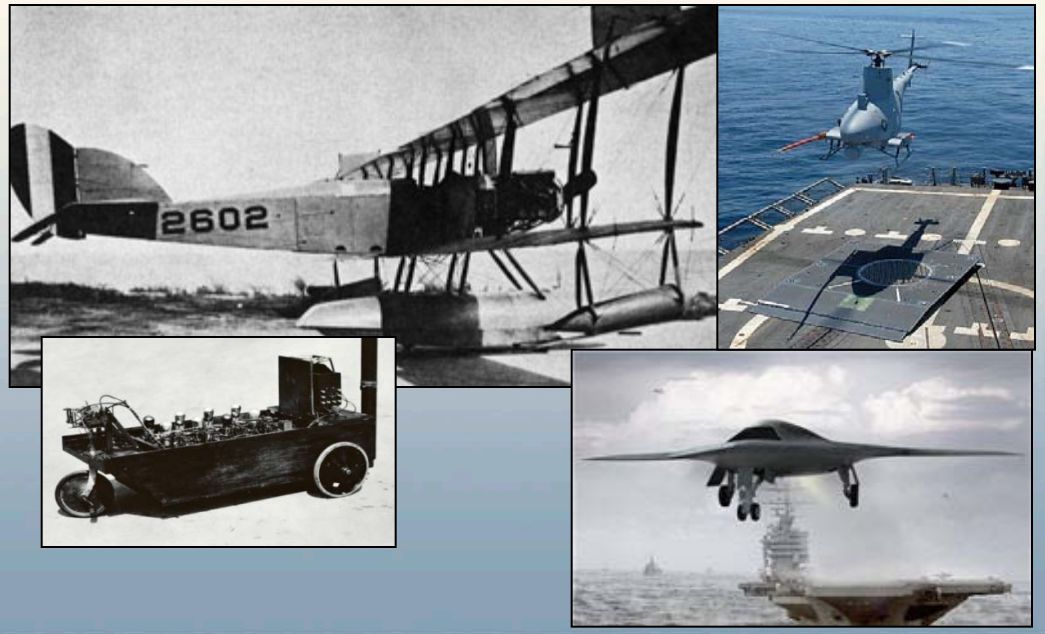


Integrated Topside

Autonomy





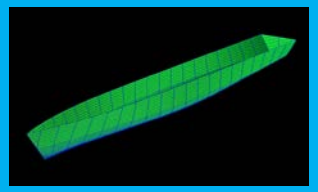


- Changes everything
  - Tactics to strategy
- Hybrid force with manned systems
- Power & Energy implications
- Mission CONOPS development
- Nanoscale Computing

Total Ownership Cost

Revolutionary Research . . . Relevant Results

Design



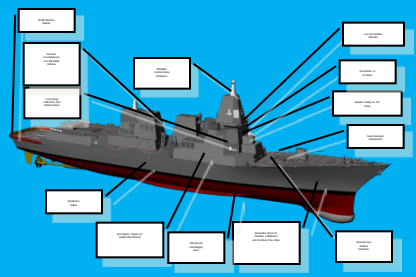
10%

Acquisition

20-30%

Operations & Support

Modernization

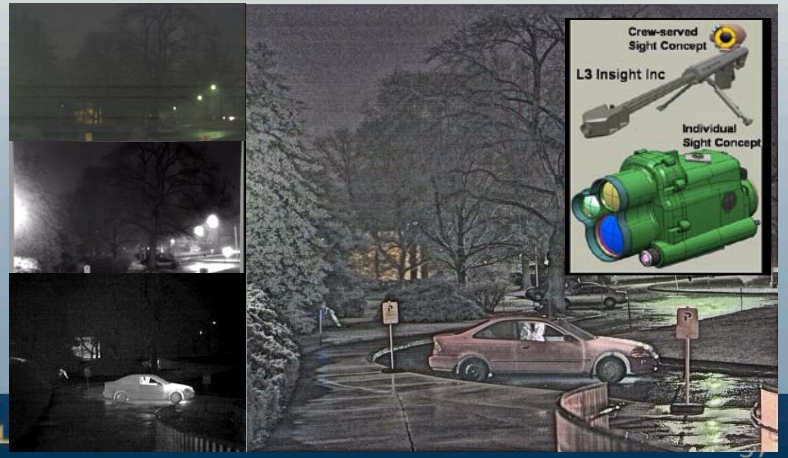


Disposal

60-70%

Expeditionary & Irregular Warfare

- Operational Adaptation
- Physical & Mental Resilience
- Mobile Communications
- Social Cultural Sciences
- Warfighter Protection



Naval Warfighter Performance

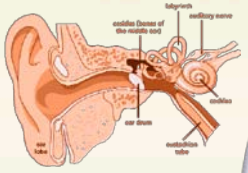
Revolutionary Research . . . Relevant Results

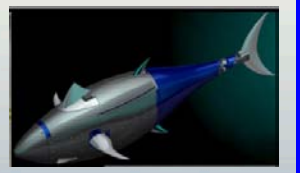
Human Systems Integration

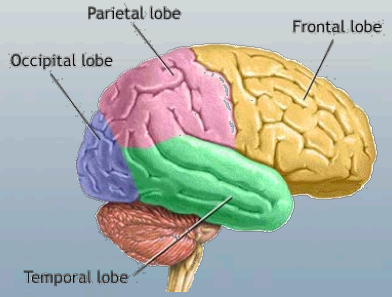
- Manpower & Personnel Management
- Training
- User-Centered Design
- C2 Decision Support
- Human, Social, Cultural Sciences
- Safety / Hearing

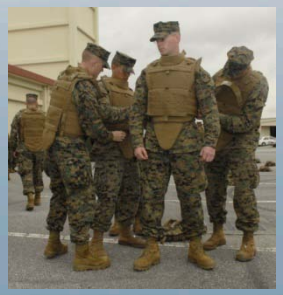
Bio-Engineered Systems

- Marine Mammal Health
- Bio-Sensors / Materials
- Microbial Fuel Cells
- Bio Robotics
- Human-Autonomy Systems









Undersea & Expeditionary Medicine

- Undersea Medicine (NNR)
- Point of Injury Care
  - "Lighten the Load"
  - Treat hemorrhagic shock
- Automated Medical Care
  - CASEVAC / Patient Movement

3x Code Division Missions

Revolutionary Research . . . Relevant Results

Code 30

Expeditionary Warfare & Combating Terrorism

Division 301: *Research* Mission: Basic, applied research in CIED, C4, ISR, Logistics, Human Performance, mobility, lethality, survivability, and ground based Autonomy.

Division 302: *Applications* Mission: Develop technology related to Research Thrust Areas and transition to R&D addressing warfighting capability gaps and opportunities.

Division 303: *Combating Terrorism & Enterprise Integration* Mission: Analysis, concept definition, and integrated tech demonstration in expeditionary and hybrid irregular warfare, confronting irregular challenges, combating terrorism, the middle-weight force, mission command.

Code 31

C4ISR

Division 311: *Mathematical, Computer, and Information Sciences,* Mission: new research in computation, information processing and assurance, cyber security, command and control and accurate decision making in a network centric environment.

Division 312: *Electronic Sensors and Networks,* Mission: address needs in surface and aerospace surveillance, communications, electronic warfare and navigation.

Division 313: *C4ISR*, Mission: advanced research in surface and aerospace surveillance, communications, precision timekeeping and electronic combat.

Code 32

Ocean Battlespace Sensing

Division 321: *Ocean Sensing and Applications*, Mission: Applied research and systems demonstrations for MCM, ASW and space technology. Programs include maritime sensing, ocean engineering and marine systems, and undersea signal processing.

Division 322: *Ocean Atmosphere and Space,* Mission: Basic and applied research to characterize and predict the ocean/atmosphere/ice environment for naval warfare. Programs improve understanding of the environment, the assimilation of data, and the limits of predictability.

Code 33

Sea Warfare & Weapons

Division 331: *Ship Systems and Engineering*, Mission: research and technology development in the areas of energy, advanced sea platforms, survivability and surface ship hydrodynamics

Division 332: *Naval Materials,* Mission: research in physical sciences and engineering, materials and processing, and environmental quality

Division 333: *Sea Platforms and Weapons*, Mission: enhance afloat warfighting capabilities, reduce ship total ownership costs, and improve undersea weapons

Code 34

Warfighter Performance

Division 341: *Life Sciences* Mission: research in cognitive science, computational neuroscience, bioscience and bio-mimetic technology, physiology and social/organizational science, training and human factors

Division 342: *Biological and Biomedical,* Mission: research in the survival, health and performance of Navy and Marine Corps personnel during training, and operations

Division 343: *Research Protection* Mission: ensure compliance with Human Research Protection Program (HRPP).

Code 35

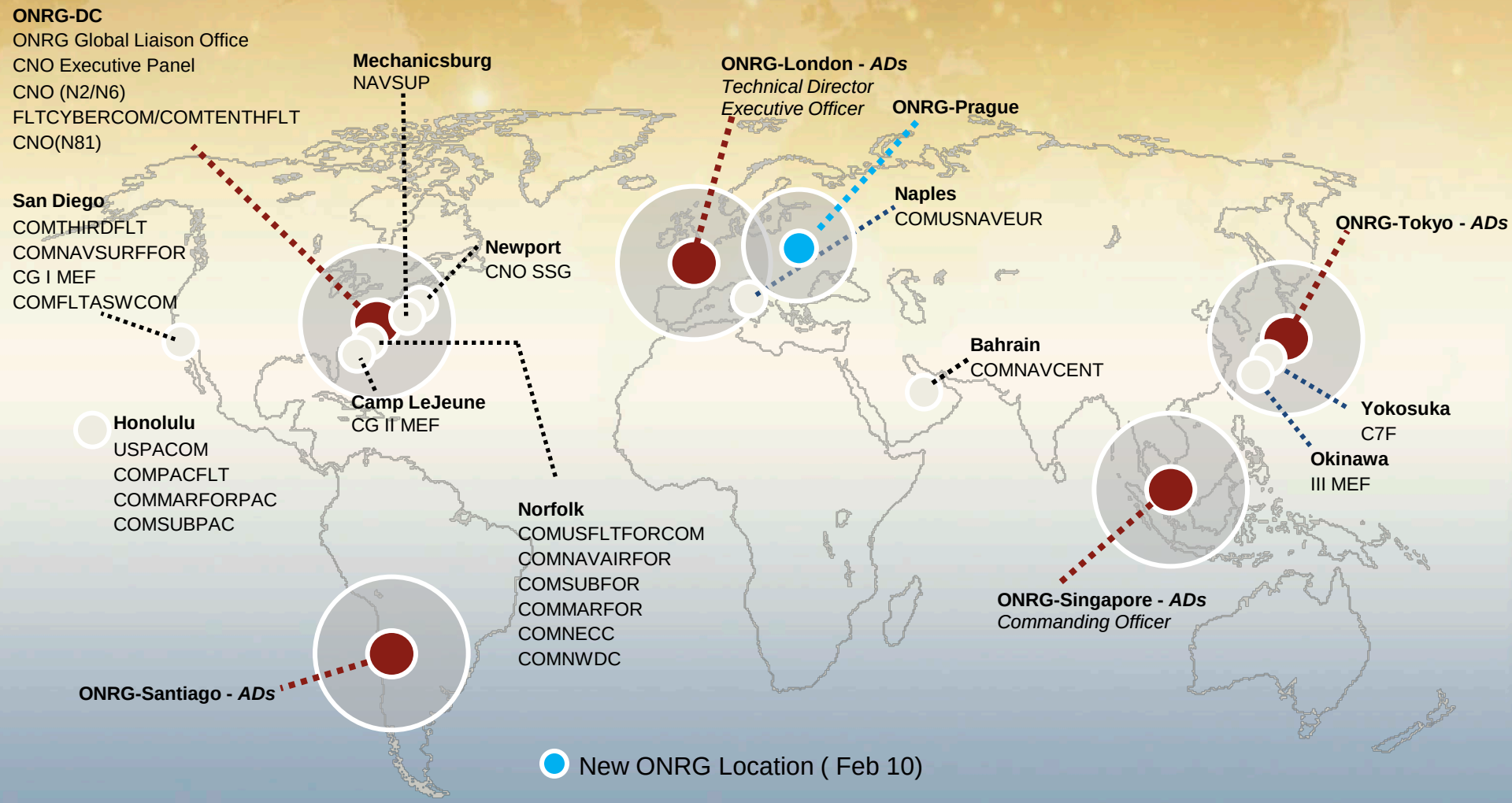
Air Warfare & Weapons

Division 351: *Aerospace Science and Research* Mission: develop strike technology to include high-energy lasers, hypersonics, rotorcraft technology, advanced propulsion naval air and surface weaponry, and naval aircraft.

Division 352: *Air Warfare and Naval Weapons Application* Mission: oversee unique or essential applied research projects and advanced technology aligned with current and future naval aviation capability gaps and innovative naval prototypes.

ONR Global Presence Today

Revolutionary Research . . . Relevant Results



Develop Partnerships

Leverage Global S&T Advances

Avoid Technology Surprise

OFFICE OF NAVAL RESEARCH