Naval S&T Overview

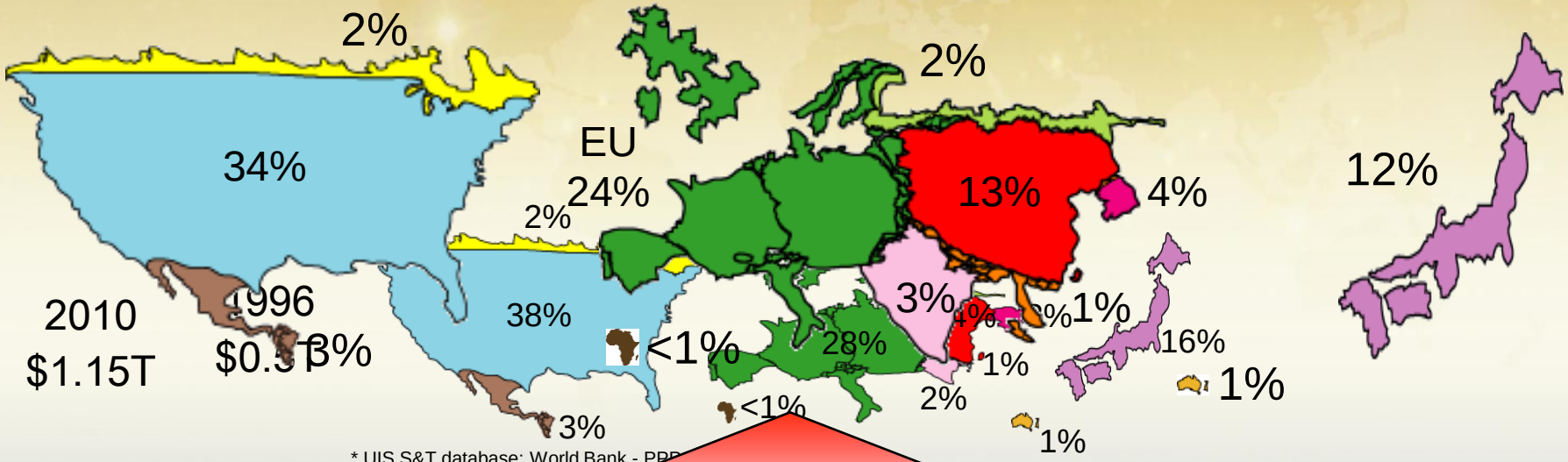
Dr. Joseph Lawrence
Director of Transition
Office of Naval Research
June 22, 2011

ONR
Revolutionary Research . . . Relevant Results

OFFICE OF NAVAL RESEARCH

Global R&D Trends

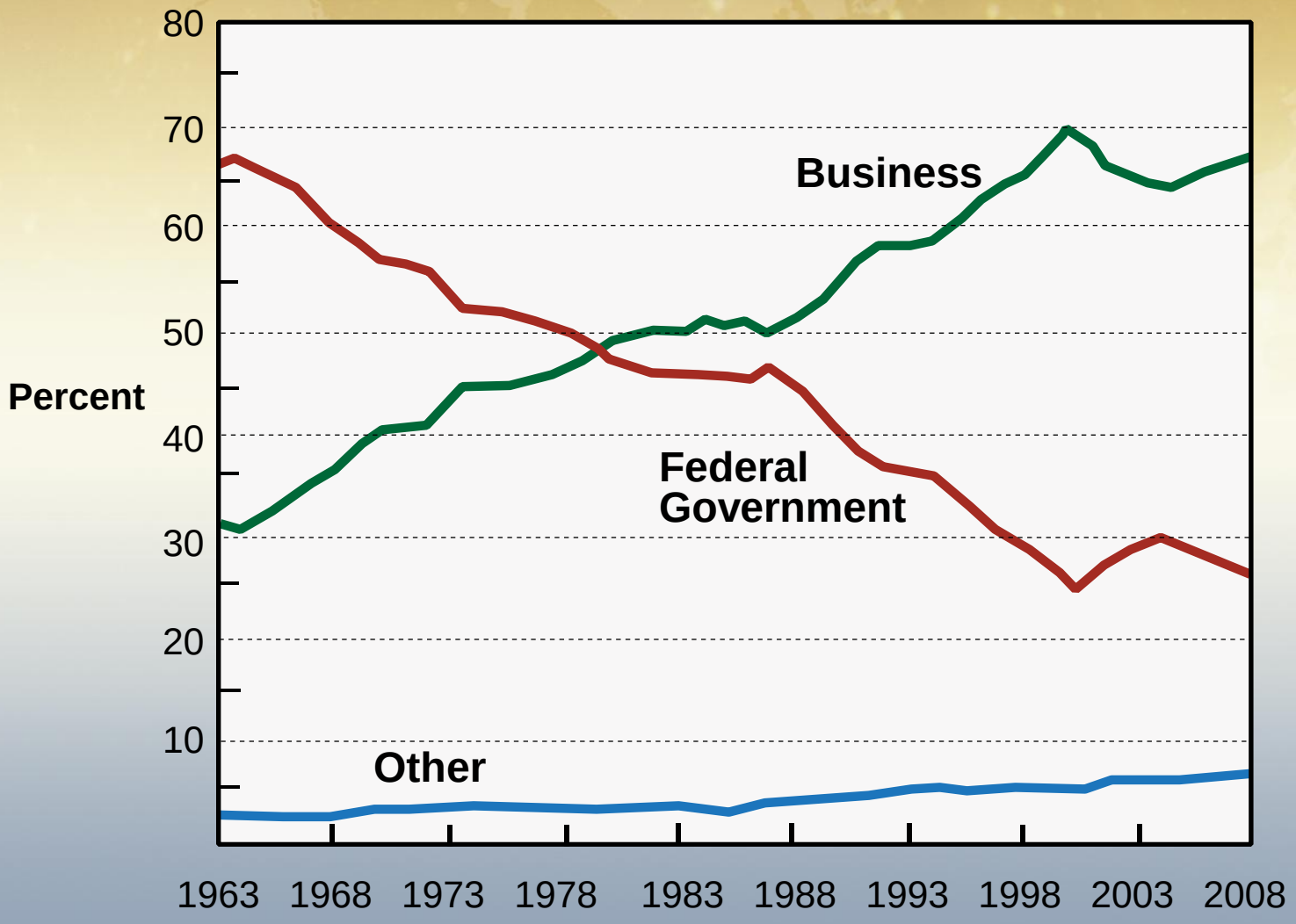
Revolutionary Research . . . Relevant Results



* UIS S&T database; World Bank - PPP

** OECD 2010 PPP; 2010 Global R&D Report (Battelle)

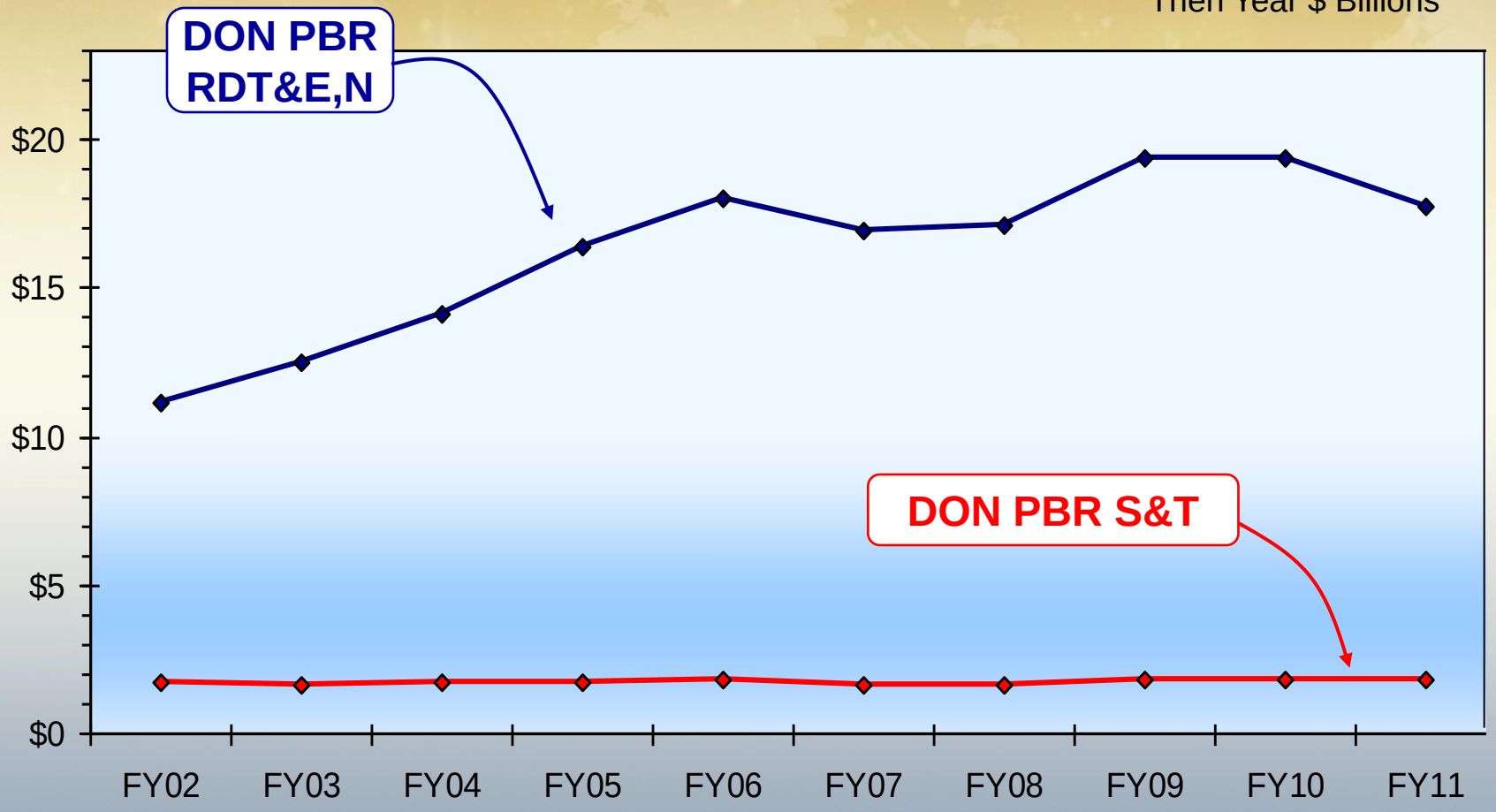
R&D Investment Trends



Source: National Science Foundation, Division of Science Resource Statistics, *Science and Engineering Indicators 2010*

RDT&E 6.1 – 6.7

Then Year $ Billions



88 Years of Naval Research

Looking Back .....

ONR — Revolutionary Research . . . Relevant Results

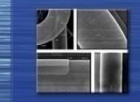
Naval S&T Milestones

ACCOMPLISHMENTS ACROSS ALL DOMAINS

Powered by Naval Research TM/SM


Multistatic Radar Tested at NRL


Sound Navigation and Ranging (SONAR)


Gamma Ray Radiography


NRL Commissioned

1920s

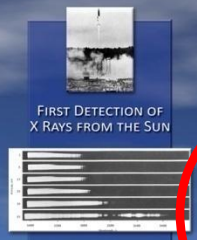

Plan-Position Indicator


Uranium 235 Production


First Concept for a Nuclear Submarine


First U.S. Radar Patents

1930s


First Far-Ultraviolet Spectrum of the Sun


Principles of Modern Fracture Mechanics


Synthetic Lubricants


ONR Founded 1946

1940s

First Detection of X Rays from the Sun


First Unmanned Helicopter


Vanguard I Launched


Project Whirlwind Digital Computer


Particle Accelerators


Vertical Take-Off and Landing

1950s


Timation and NAVSTAR GPS


Owens Valley 40m Radio Telescope


Aqueous Film Forming Foams (AFFF)


First U.S. Intelligence Satellite


Sealab I and II


Bathyscaphe *Trieste* reaches 35,800 ft.

1960s


NTS-2 Satellite in NAVSTAR GPS

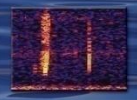

Coronal Mass Ejection


Mobile Robots


Excimer Laser Technology


Far Ultraviolet Lunar Camera


Lithium Batteries


Sound SUrveillance System (SOSUS)

1970s


Nobel Prize to Dr. Jerome Karle, NRL

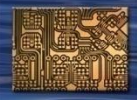

High-Energy Magnets


ONR-funded Tech finds RMS *Titanic*


Global Atmospheric Prediction System


Sidewinder Air-to-Air Missile


Contributed to Aegis Combat System


Acoustic Microscopy

1980s


Navy Aerosol Analysis and Prediction System


Clementine Spacecraft


Interactive Multisensor Analysis Training (IMAT)


High-Strength Low-Alloy Steels


Neural Networking Computer Chips


Ultra-High Strength Steel


Hull Anti-Fouling Coatings

1990s

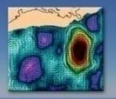

Virtual At-Sea Training (Live-Fire Combat Skills)


High Temperature Superconductive Degaussing


Hyperspectral Imager for Coastal Oceans


SHARP Reconaissance


Dragon Eye UAV


First Operational Global Ocean Model


QuikClot Combat Gauze


Remote Environment Monitoring Units

2000s


Nobel Prize to ONR Researchers for Graphene

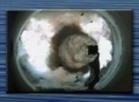

Free Electron Laser


Tactical Microsatellite


Large Displacement Unmanned Underwater Vehicle


Integrated Topside (INTOP)


CBR Sensors for Fleet Security

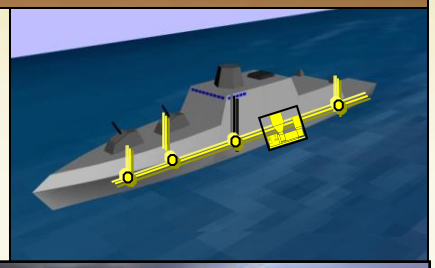

World-Record Setting 33 MJ EMRG Shot


Anti-Torpedo Torpedo

2010 & BEYOND

OFFICE OF NAVAL RESEARCH OFFICE OF NAVAL RESEARCH

..... And Looking Ahead

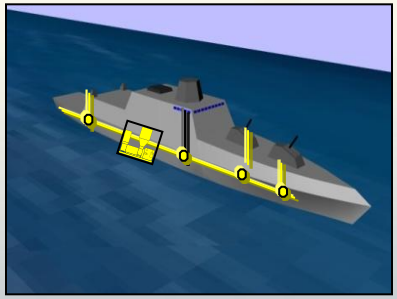


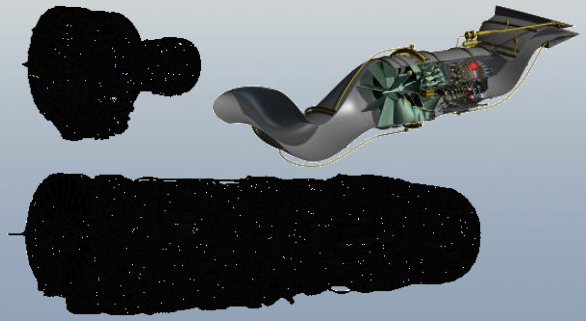
- Power & Energy
- Directed Energy & Hypersonics
- Information Dominance
- Autonomous Systems
- Total Ownership Cost Reduction
- Naval Warfighter Performance

Power & Energy

1. **Sail a "Green Strike Group" by 2016**
2. **50% of Navy energy from alternative sources by 2020,**

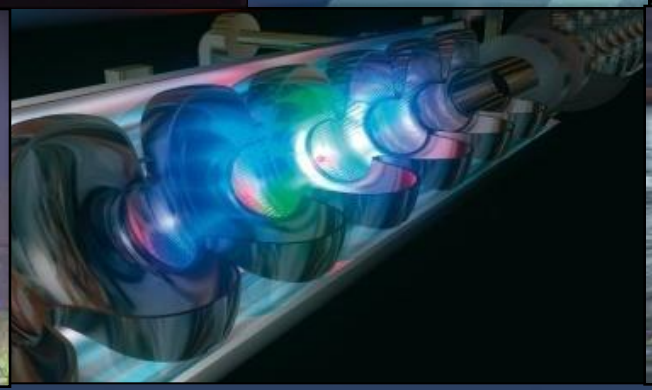
- Fuels
- Power Generation
- Energy Storage
- Efficient Distribution
- Energy Usage





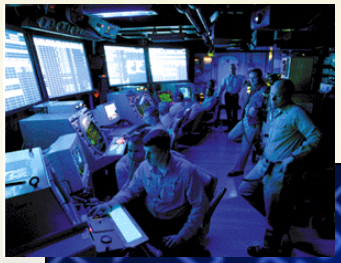
Directed Energy & Hypersonics

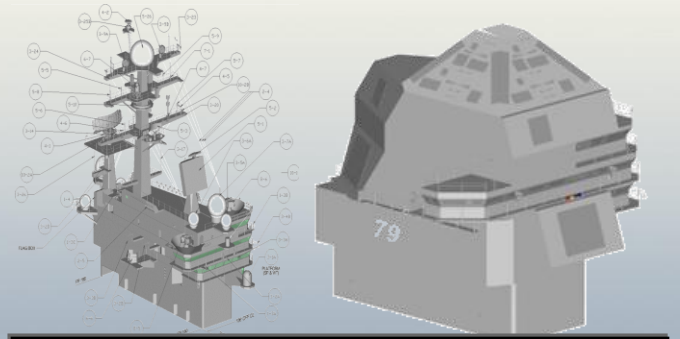
- Fight at Hypervelocity & Speed of Light
- Deepen the Magazines
- Increase Depth of Fire
- Broad Range of Missions



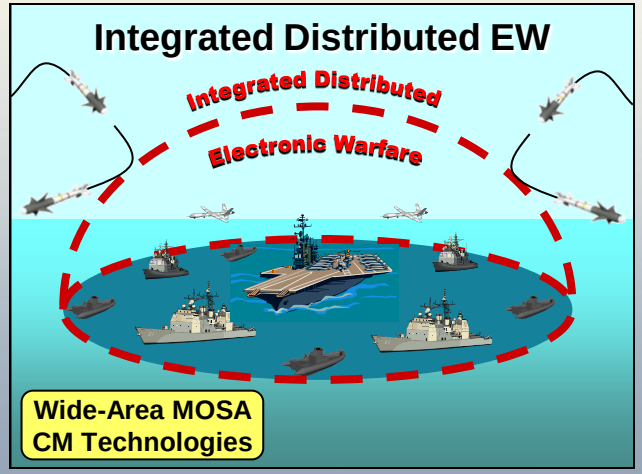
Dominating the Electromagnetic Spectrum

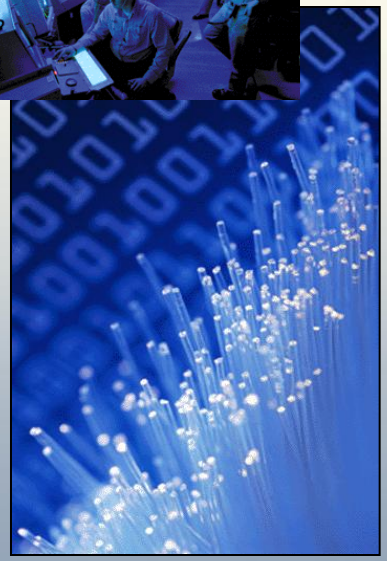
Revolutionary Research . . . Relevant Results



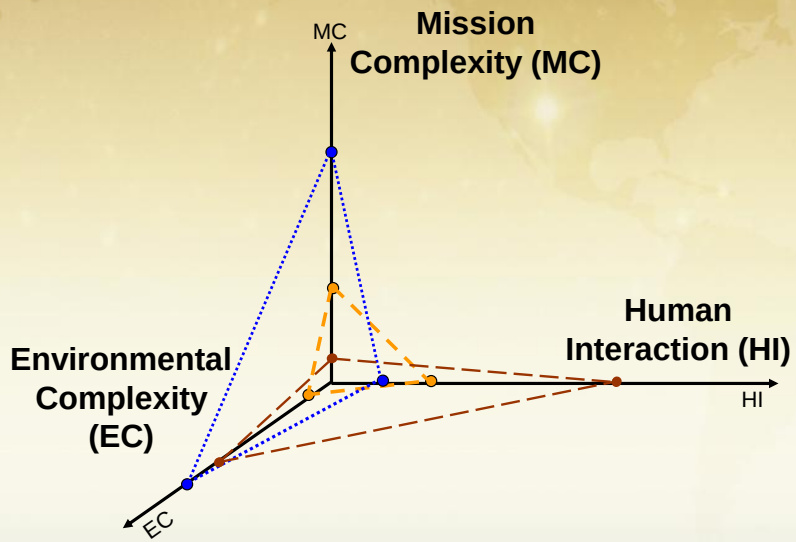


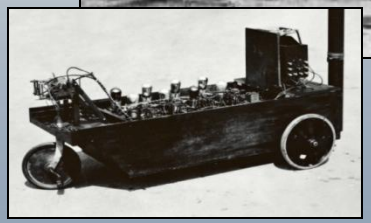
Integrated Topside Innovative Naval Prototype Program (INTOP)





Autonomy



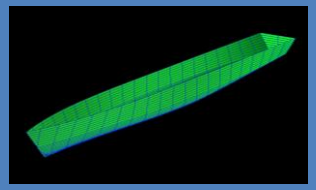


- **Changes everything**
  - Tactics to strategy
- **Hybrid force with manned systems**
- **Power & Energy implications**
- **Mission CONOPS development**

Total Ownership Cost

Revolutionary Research . . . Relevant Results

Design



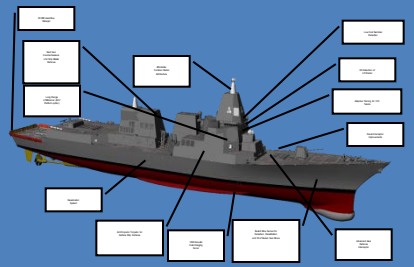
10%

Acquisition

20-30%

Operations & Support

Modernization



Disposal

60-70%

Naval Warfighter Performance

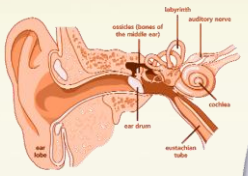
Revolutionary Research . . . Relevant Results

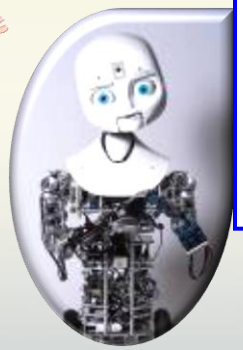
Human Systems Integration

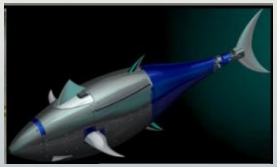
- Manpower & Personnel Management
- Training & Digital Tutors
- User-Centered Design
- C2 Decision Support
- Human, Social, Cultural Sciences
- Safety / Hearing

Bio-Engineered Systems

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

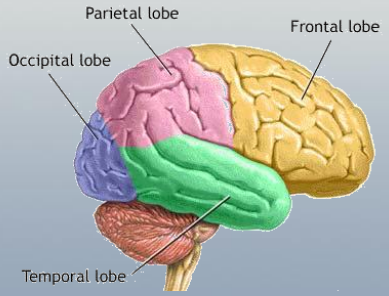






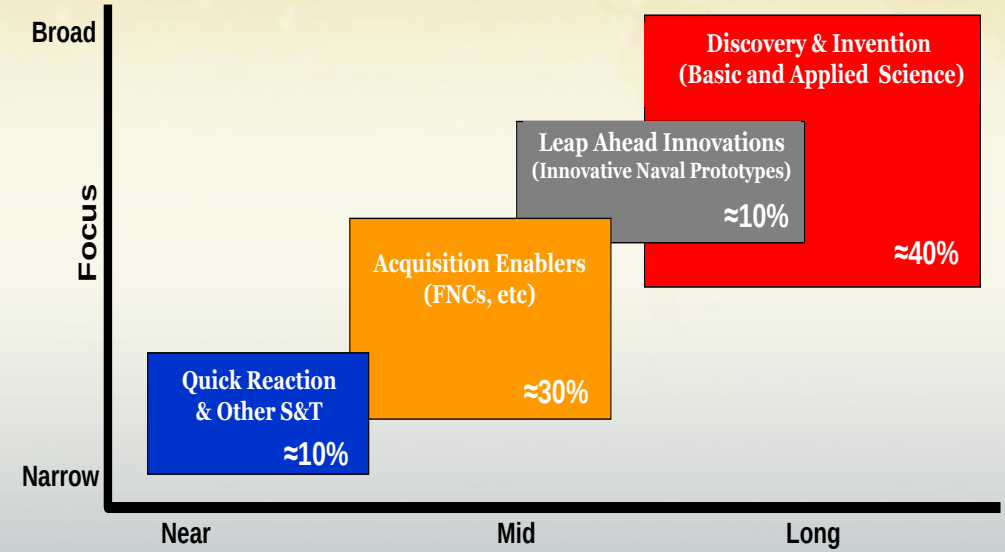
Undersea & Expeditionary Medicine

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



Naval S&T Strategic Plan

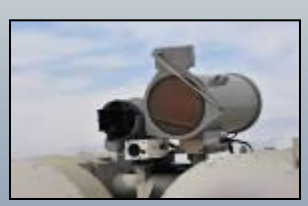
Revolutionary Research . . . Relevant Results



Focus Areas

- Power and Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric & Irregular Warfare
- Information Superiority and Communication
- Power Projection
- Assure Access and Hold at Risk
- Distributed Operations
- Naval Warfighter Performance
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Total Ownership Cost

Tech Solutions



FNCs

INPs

D&I

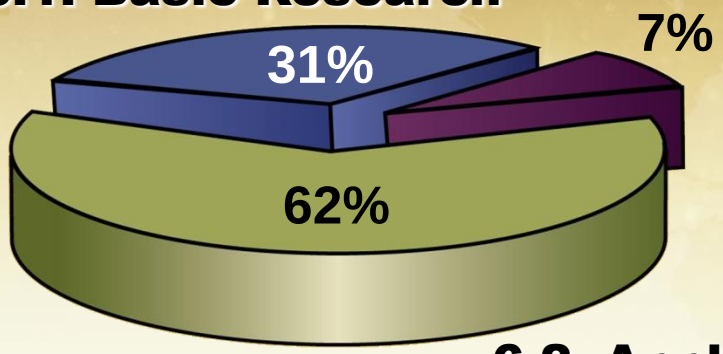
How We Execute

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

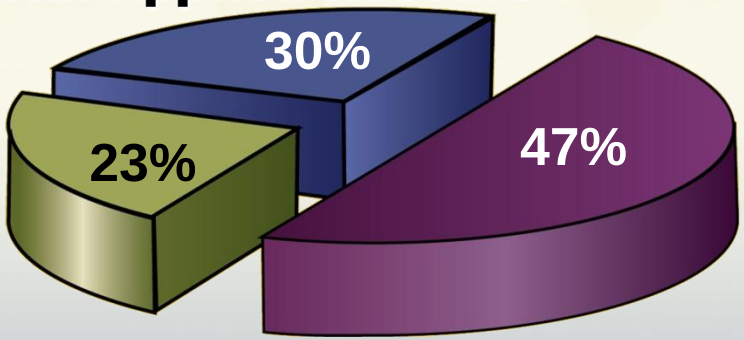
Investment Balance

Revolutionary Research . . . Relevant Results

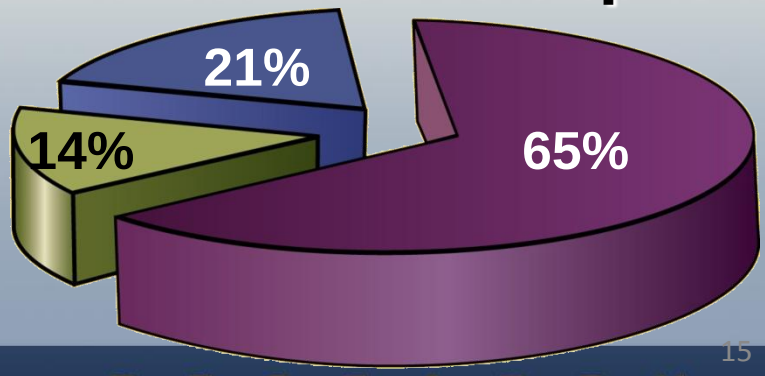
6.1: Basic Research



6.2: Applied Research



6.3: Advanced Tech Development

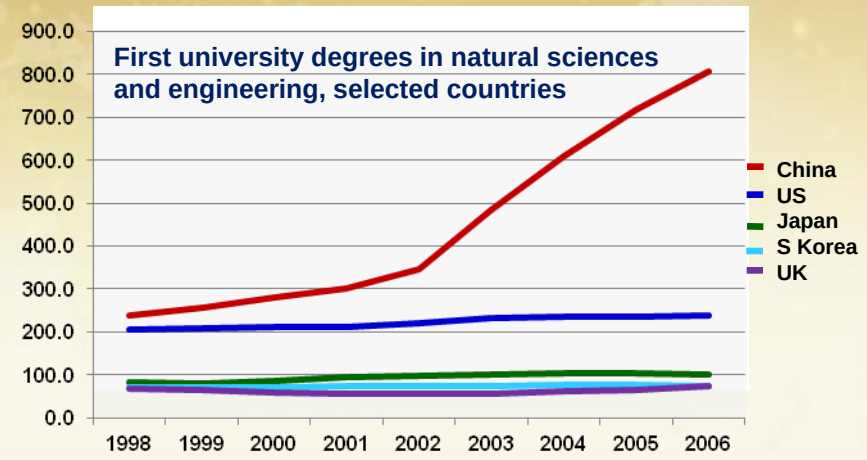


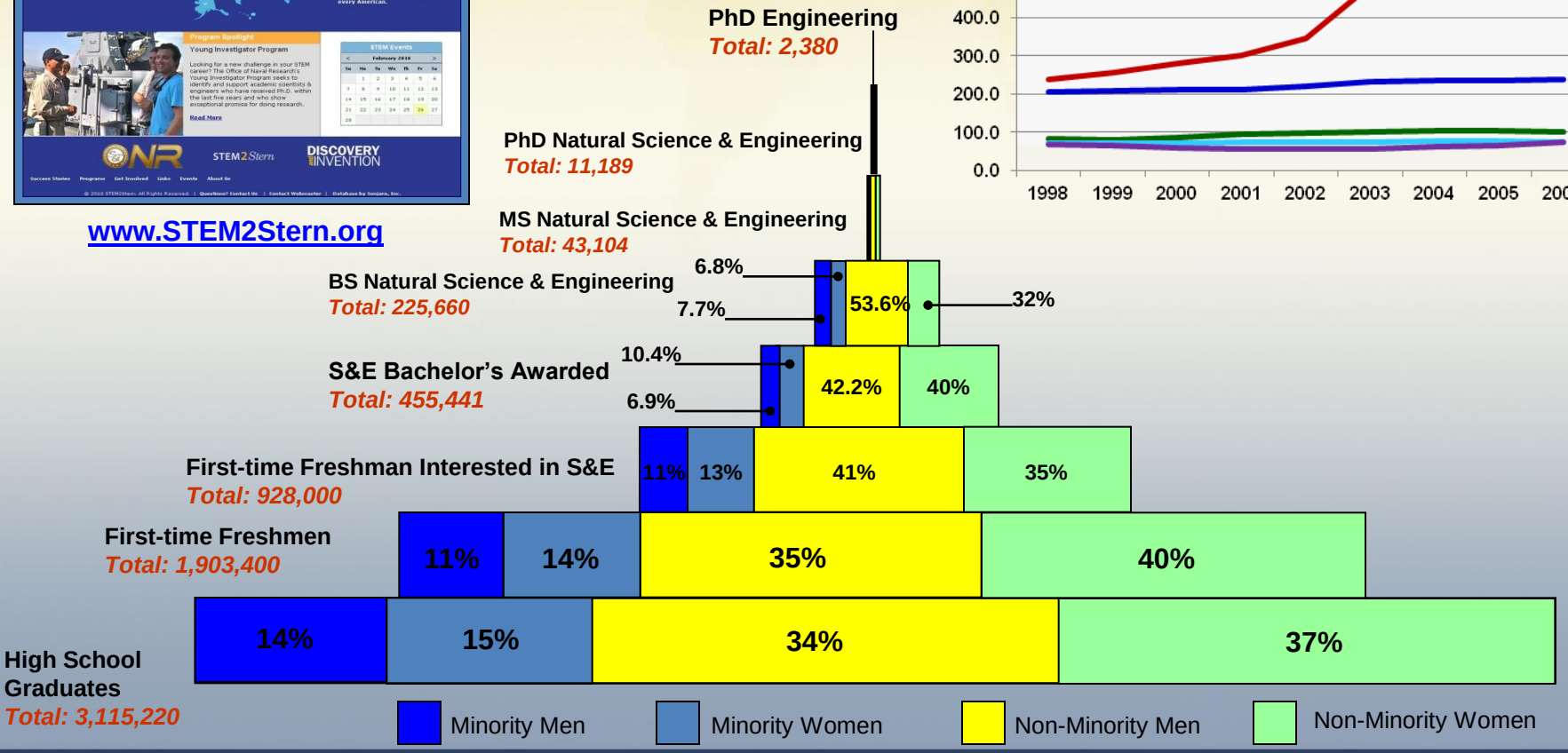
- Naval Labs and Centers
- University & Nonprofit
- Industry

STEM

Revolutionary Research . . . Relevant Results

www.STEM2Stern.org

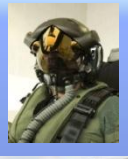
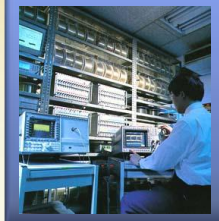




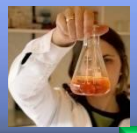
Speed to Fleet

Revolutionary Research . . . Relevant Results

Industry

Academia




R&D

6.4-6.8

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S&T

6.1-6.3

$$

Acquisition

P.O.R.

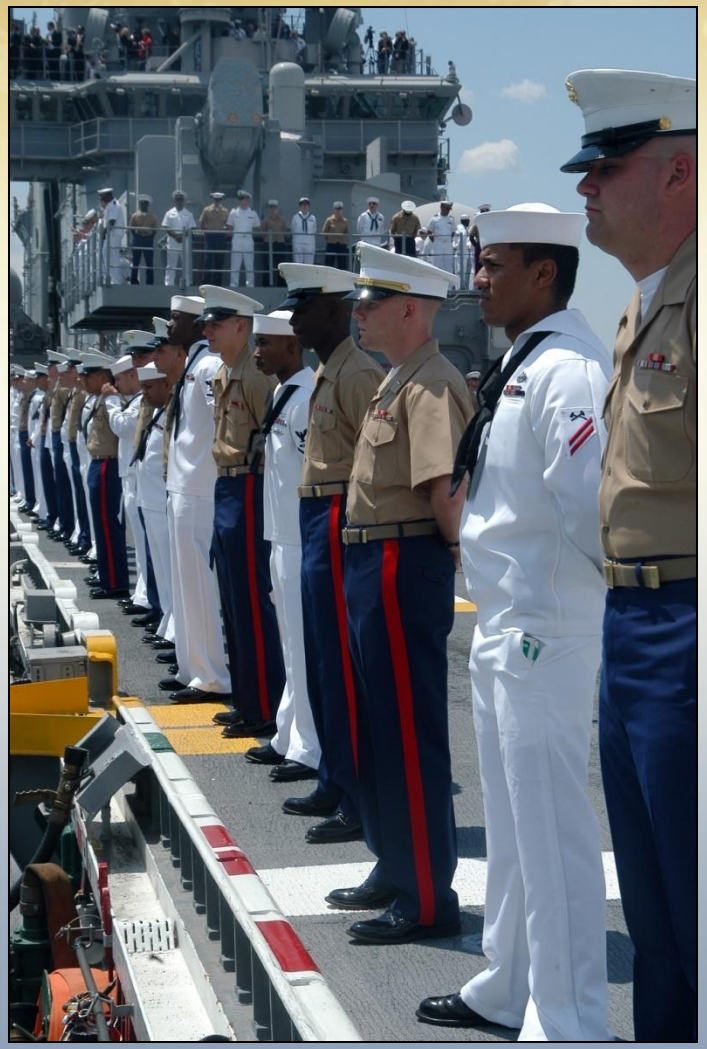
6.4

$$






Why it Matters



"I never, ever, want to see a Sailor or a Marine in a fair fight!

-Adm. Gary Roughead
Chief of Naval Operations

We Want To Hear From You!

- *ONR Website:*
  www.onr.navy.mil

- *ONR Central Phone Number:*
  703-696-5031

Back-up

Transitions

Revolutionary Research . . . Relevant Results

Successfully delivered 83% of the FNCs to Acquisition

FNC Delivery Year	Products Planned to Deliver	Products Delivered to Acquisition	Deployed	On-Track for Deployment	Still With Acquisition Program	Did Not Transition
FY10	19	15	1	7	5	2 (13%)
FY09	35	32	2	12	11	7 (22%)
FY08	47	35	8	12	3	12 (34%)
FY07	32	26	7	8	1	10 (38%)
FY06	34	30	7	4	2	17 (57%)
Total	167	138	25	43	22	48 (35%)

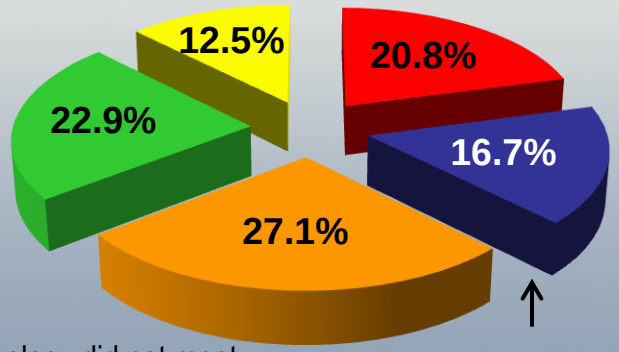
Forensics

- Did Not Transition
- Still With Acquisition Program
- Deployed or On-Track for Deployment

Technology Lost in Acquisition Competition

PMO Lost Interest

Acquisition Strategy Significantly Modified

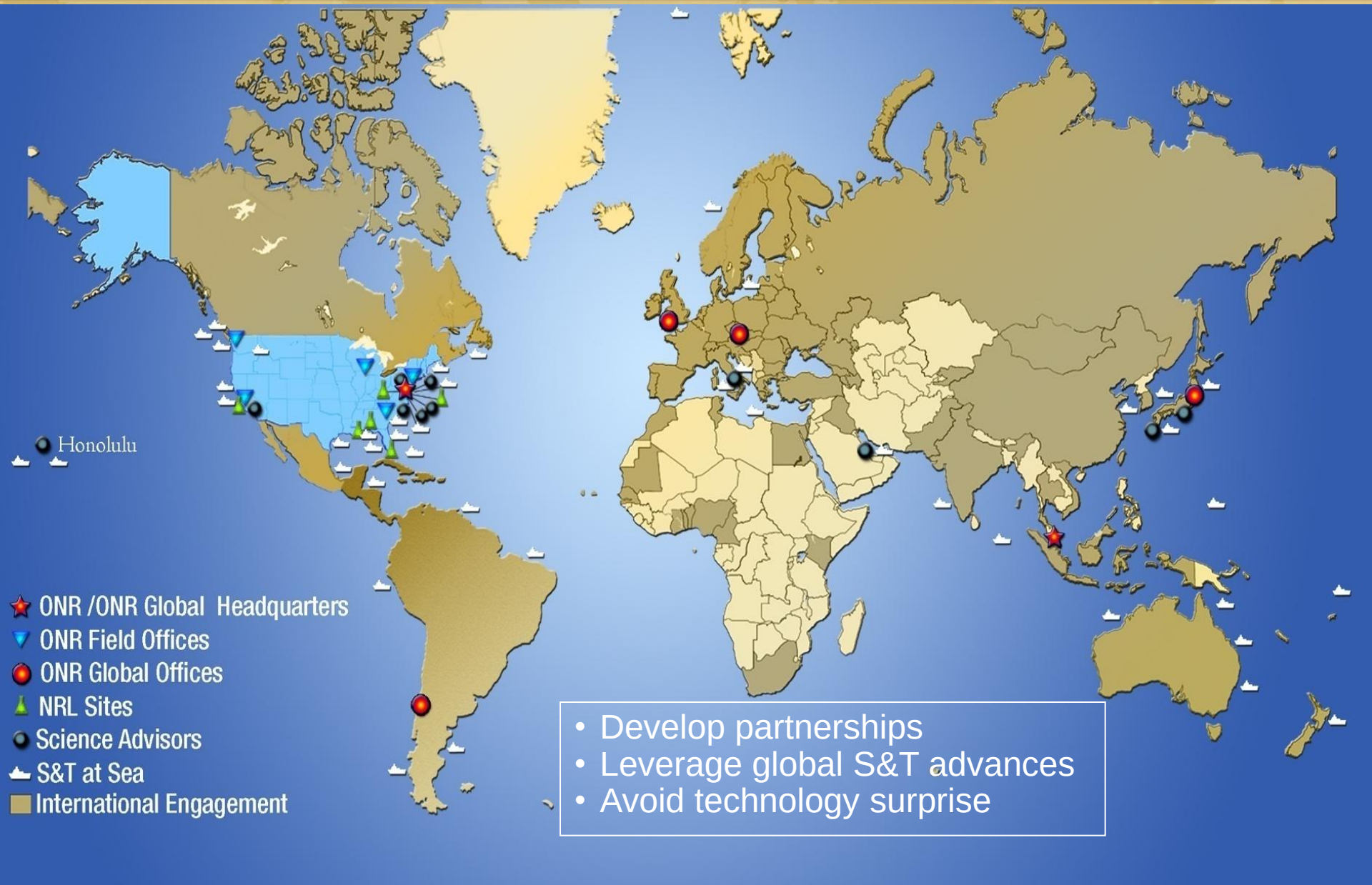


Technology did not meet TTA Requirements

Requirements Changed or not Adequately Specified

ONR Global

Revolutionary Research . . . Relevant Results



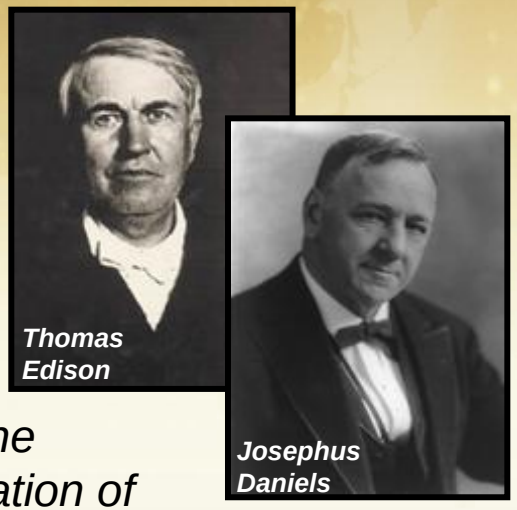
- Develop partnerships
- Leverage global S&T advances
- Avoid technology surprise

A Great Place to Work

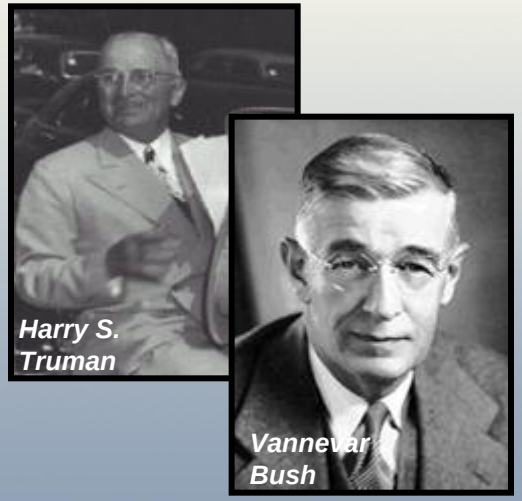
- *#1 "Best Place to Work"* in the Navy
  - *Partnership for Public Service*
- *"Most Admired Employer"*
  - *Black Engineer* magazine
  - *Hispanic Engineer* magazine
  - *Women of Color* magazine
- *#1 Patent Portfolio worldwide among government agencies from IEEE Patent Power Scorecard*
  - *232 patents in 2009*
- *Popular Science Magazine's 2010 Best of What's New Winner*
  - *NEAH Power Systems' Infinity Fuel Cells*
- *TIME Magazine's "Best Inventions of the Year"*
  - *2009: Microbial Fuel Cell*
  - *2008: NEXI, MEMRISTOR*

The Office of Naval Research

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…."

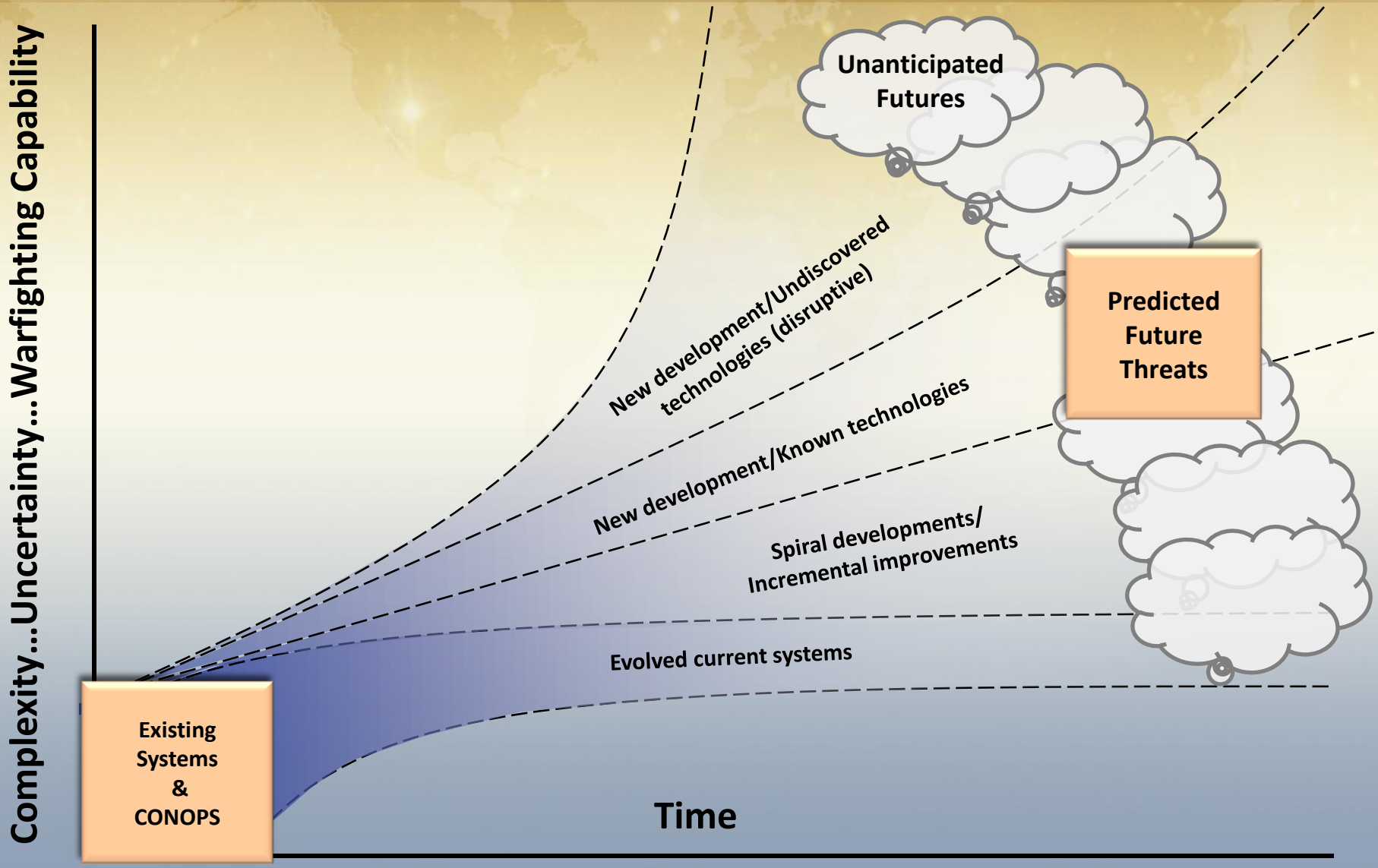


Office of Naval Research *(Public Law 588, 1946)*
"…plan, foster, and encourage scientific research in recognition of its paramount importance as related to the maintenance of future of naval power, and the preservation of national security…"

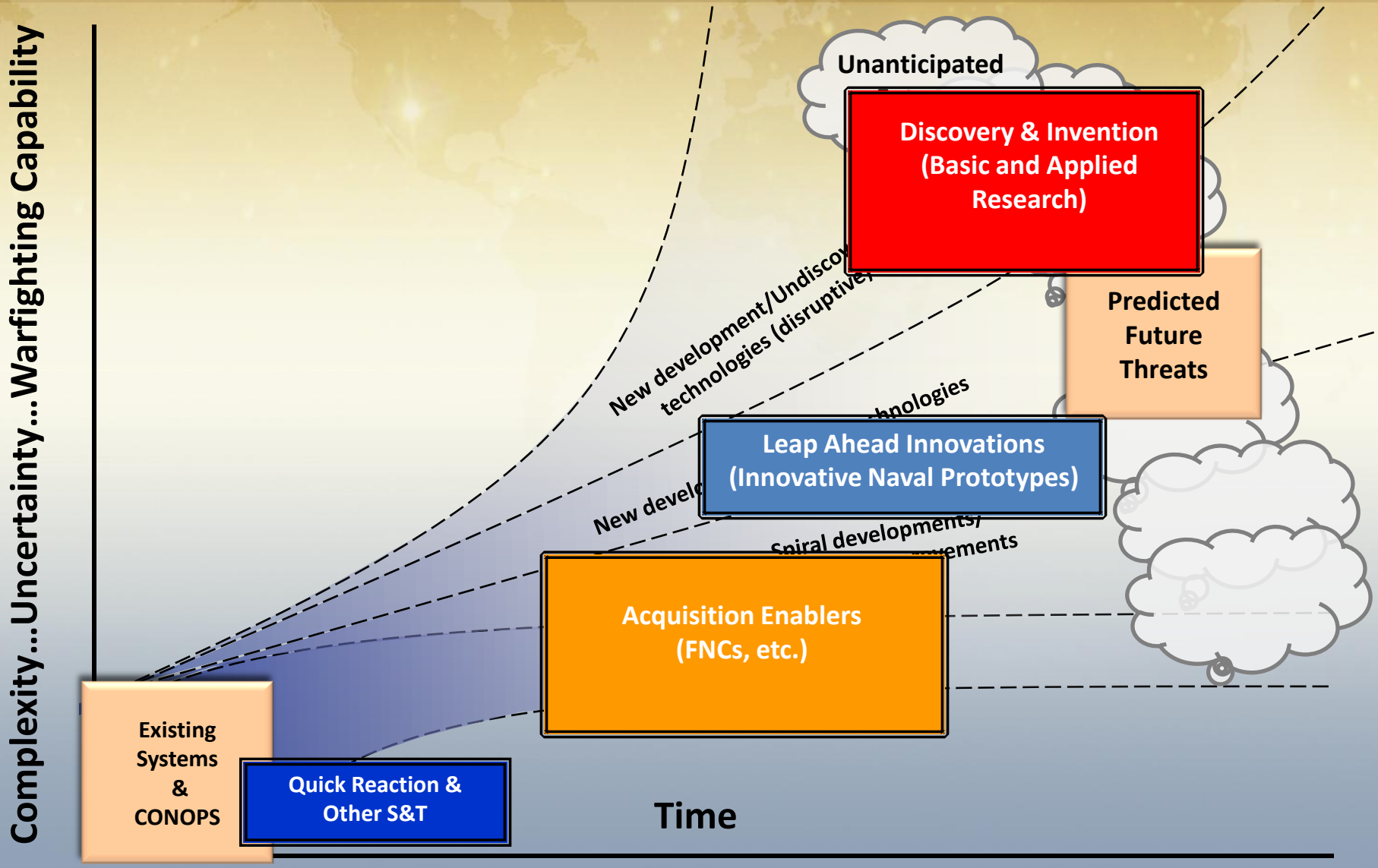


Transitioning S&T *(Defense Authorization Act, 2001)*
"…manage the Navy's basic, applied, and advanced research to foster transition from science and technology to higher levels of research, development, test, and evaluation."

Uncertain Future



Uncertain Future



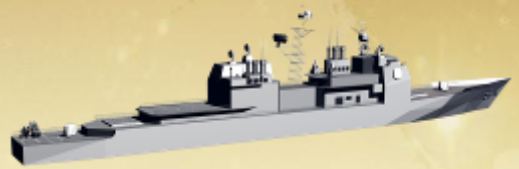
Quick Reaction S&T
(1-2 Year) Off-The-Shelf Technologies

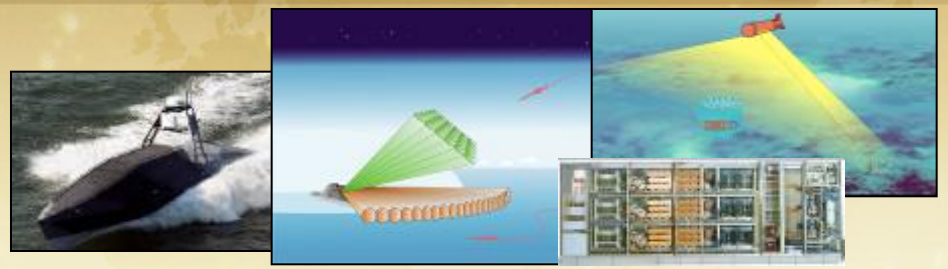
- **Rapid solutions to problems identified by deckplate Sailors and Marines**
- **1 year turnaround time**
- **Video: www.youtube.com/usnavyresearch**
- **Requests submitted online**
  www.onr.navy.mil/techsolutions

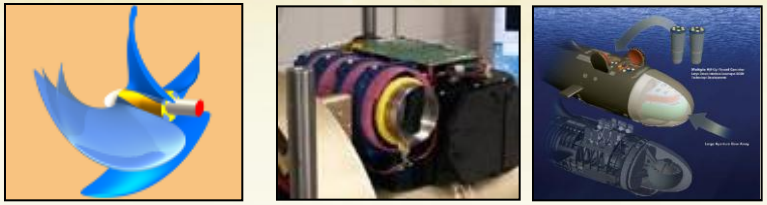
Future Naval Capabilities

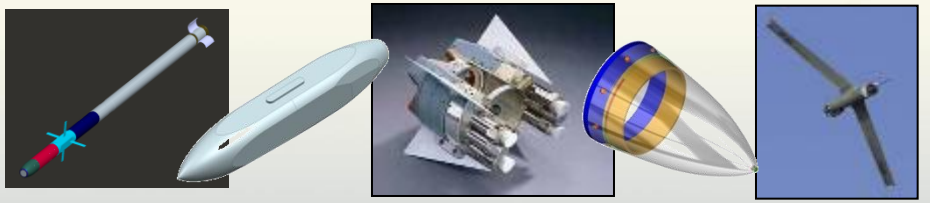
(3-5 Year) Component Technologies

Revolutionary Research . . . Relevant Results









Secure Networks

Technology Oversight Group

Revolutionary Research . . . Relevant Results

S&T Corporate Board

★★★★

VCNO ASN (RDA) ACMC

CNR-Executive Secretary

N8/N2/N6

TOG Working Group

0-6/GS-15 reps

Sea Shield

★★

N86
MCCDC
USFF N803
PEO LMW
ONR 32

Sea Basing

★★

N85B
Dep. CG MCCDC
USFF N804
PEO Ships
ONR 33

Sea Strike

★★

N87
HQMC Aviation
USFF N8
PEO U&W
ONR 35

Naval Expeditionary Maneuver Warfare

★★

N85B
HQMC PP&O
USFF N8
MCSC
ONR 30

FORCENet

★★

N6F
Dir HQMC C4
NETWARCOM
SPAWAR 05
ONR 31

Power & Energy

★★

N45
USMC HQ
USFF N8
NAVSEA 05
ONR 03T

Enterprise & Platform Enablers

★★

N8F
HQMC I&L
USFF N433
NAVSEA 05
ONR 03T

Force Health Protection

★★

N0931
TMO, USMC
FFC N02H
NMSC
ONR 34

Capable Manpower

★★

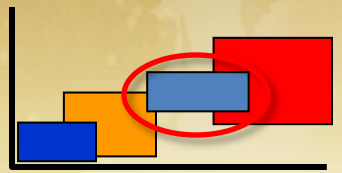
N15
USMC Training/Ed
USFF N1D
NAVAIR TSD
ONR 34

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

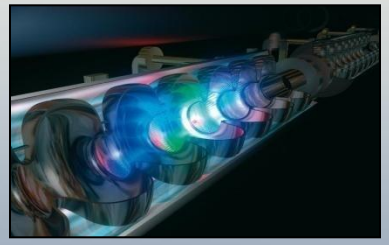


Tactical Satellite

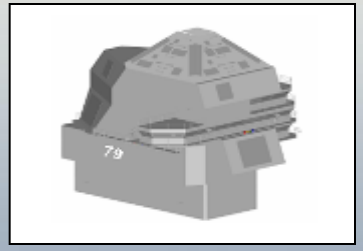
EM Railgun

Persistent Littoral Undersea Surveillance

Sea Base Enablers



Free Electron Laser



Integrated Topside

Large Displacement UUV

AACUS

Basic Research

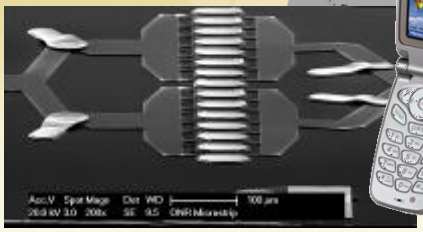
(1-25 Year) Undiscovered & Emerging Technologies

Revolutionary Research . . . Relevant Results

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

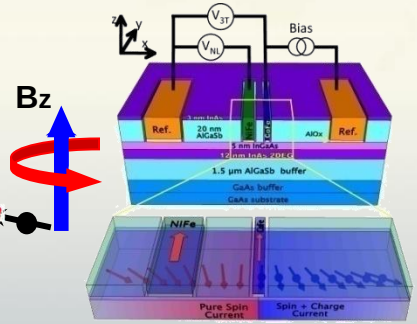
1st U.S. Intel satellite GRAB

Semiconductors
GaAs, GaN, SiC



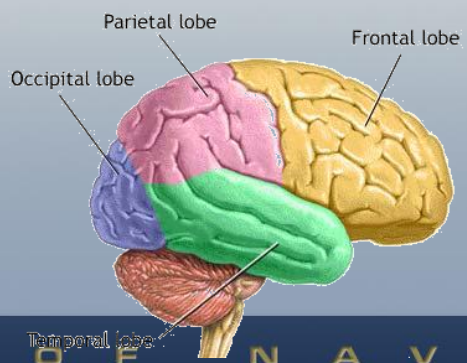
EW

Spintronics

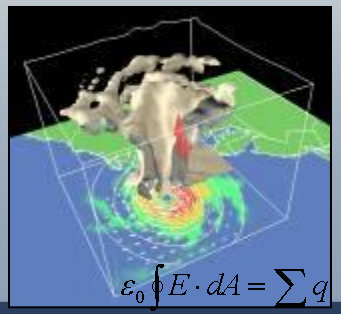


Arctic Research

GPS



Weather Modeling



Laser Cooling

The Challenge: "Speed to Fleet"

"I never, ever, want to see a Sailor or a Marine in a fair fight! … We have to get technology to the Fleet faster."

- Adm. Gary Roughead, Chief of Naval Operations