



# Developing Future Naval Technology

## Moving From Knowledge to Applications

### *US-Japan Defense Industry Conference*



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**Office of Naval Research Global**  
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O F F I C E   O F   N A V A L   R E S E A R C H

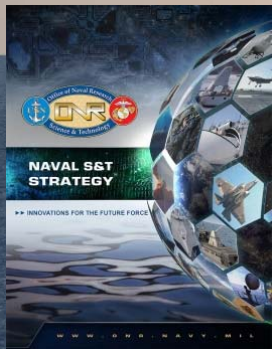


# The Office of Naval Research

The S&T Provider for the Navy and Marine Corps



- 4,000+ People
- 23 Locations
- \$2.1B / year
- >1,000 Partners



*Discover*



*Develop*



*Deliver*



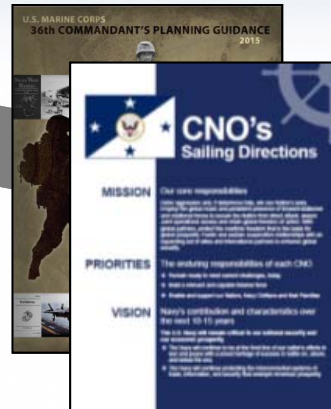
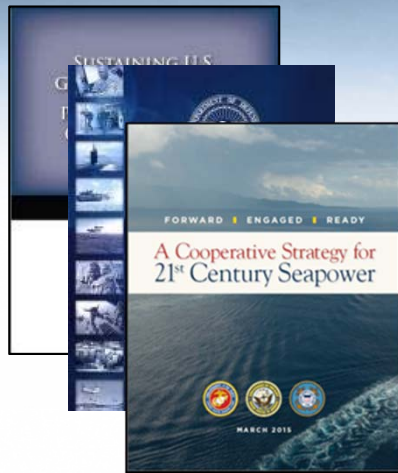
*Technological  
Advantage*





# Strategic Guidance is the Foundation for our Naval S&T

## National & Naval Strategy/Direction



## Warfare and Acquisition Enterprise's S&T Objectives

Naval S&T Strategic Plan [DOWNLOAD LINK > http://www.onr.navy.mil/en/About-ONR/science-technology-strategic-plan.aspx](http://www.onr.navy.mil/en/About-ONR/science-technology-strategic-plan.aspx)



# Naval S&T Focus Areas



## Assure Access to the Maritime Battlespace

- Ocean/Atmospheric Sciences
- Underwater Acoustics
- Ocean Sensing



## Autonomy and Unmanned Systems

- Robotics
- Machine Learning
- Perception
- Human Machine Interface



## Expeditionary and Irregular Warfare

- Situational Awareness
- Decision Making
- Mobility / Logistics
- Soldier Protection



## Information Dominance / Cyber

- Communications / Information Technology
- Computer Science
- Mathematics /Data Analytics



## Power Projection and Integrated Defense

- Directed Energy
- Energetic Materials



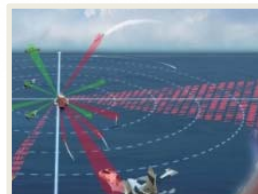
## Platform Design and Survivability

- Air/Surface/Subsurface Vehicles
- Materials
- Corrosion /Biofouling
- Manufacturing Technologies



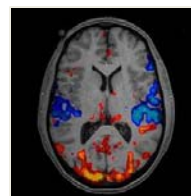
## Power and Energy

- Renewable Energy
- Propulsion
- Power Control
- Thermal Management



## Electromagnetic Maneuver Warfare

- EM Propagation & Waveforms
- Sensors and Electronics
- Optical Systems



## Warfighter Performance

- Biomedical / Bioengineering
- Cognitive / Neural Sciences
- Training Technologies
- Health Protection

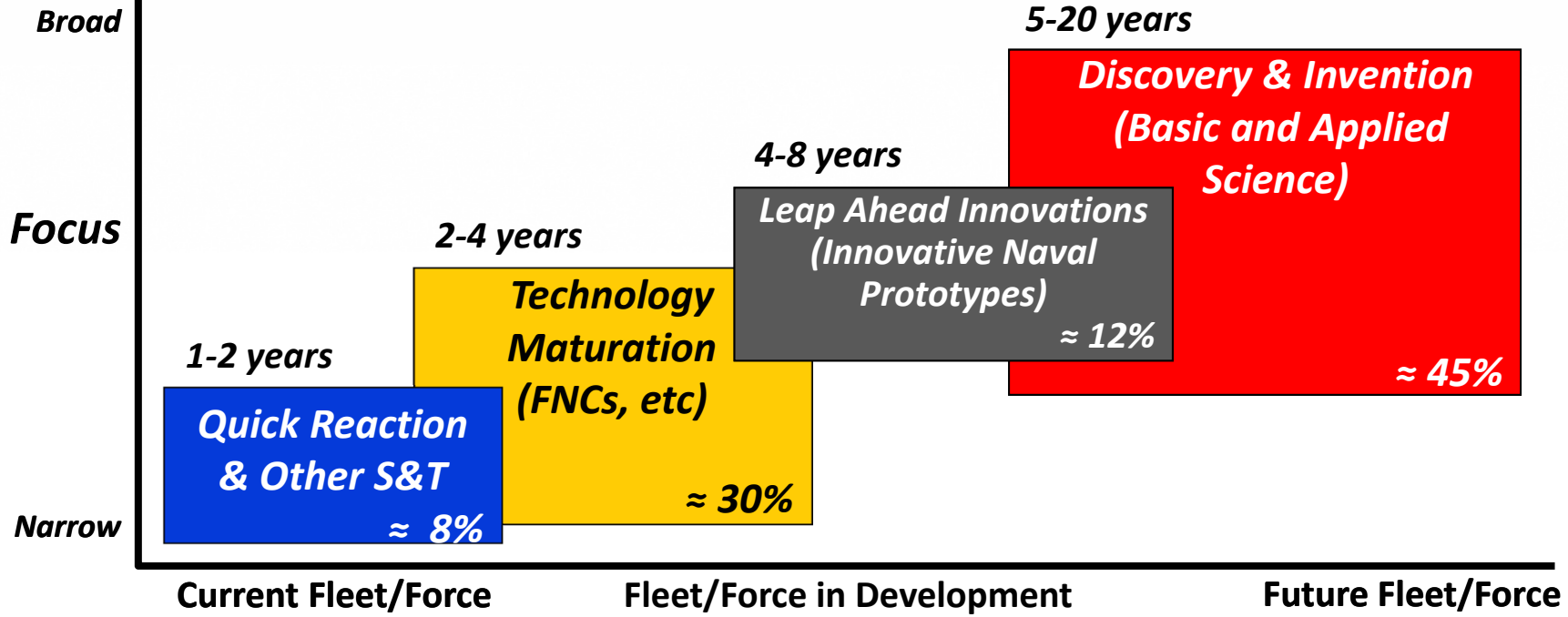
**Naval S&T Strategic Plan [DOWNLOAD LINK >](http://www.onr.navy.mil/en/About-ONR/science-technology-strategic-plan.aspx)**  
**<http://www.onr.navy.mil/en/About-ONR/science-technology-strategic-plan.aspx>**



# Naval S&T Investment Strategy



- *Assure Access to Maritime Battlespace*
- *Autonomy & Unmanned Systems*
- *Electromagnetic Maneuver Warfare*
- *Expeditionary & Irregular Warfare*
- *Information Dominance/Cyber*
- *Platform Design & Survivability*
- *Power & Energy*
- *Strike & Integrated Defense*
- *Warfighter Performance*

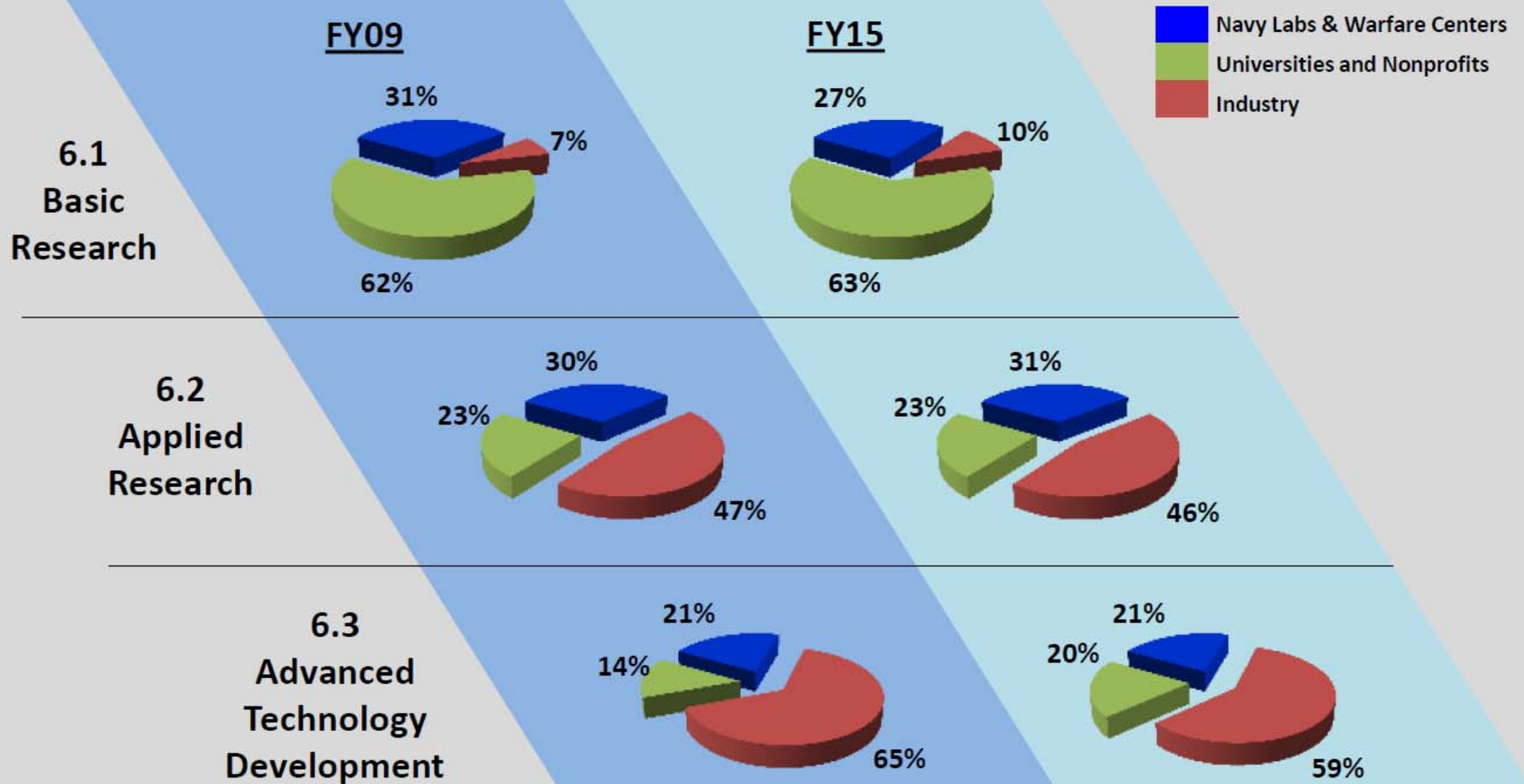


**Portfolio is balanced across near, mid, and long term S&T investments**



# Naval S&T Investment Trend

(Funds obligated in each FY)



**Relatively Constant Investment Balance; Small Shifts in 6.1 & 6.3 Allocations**



# ONR is part of the NR&DE, Providing Full-Spectrum RDT&E

## RDT&E Budget (6.1-6.7)

### S&T Budget (6.1-6.3)

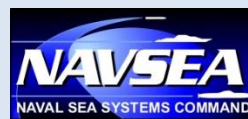
6.1 Basic Research	6.2 Applied Research	6.3 Advanced Technology Development	6.4 Adv. Comp. Development & Prototypes	6.5 System Development & Demonstration	6.6 RDT&E Management Support	6.7 Operational System Development
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## Naval R&D Establishment

(ONR, SYSCOMs and their Warfare Centers, PEOs)

### Office of Naval Research





# US-Japan Cooperation: How Industry Can Partner

- The US Department of the Navy (DON) is looking for
  - Ways to reduce cost while developing and incorporating mature technologies requiring minimal engineering changes to meet the military requirements
  - Developing knowledge and technologies for new or improved capabilities
- More information and cooperation from industry can improve chance to be considered for future projects, including through
  - Government to Government agreements
  - Foreign Comparative Testing (FCT) program
  - Technology development efforts (ONR Global programs)
  - Technical Assessment via 2<sup>nd</sup> Party Purchases – allows a US contractor to purchase directly from ally vendor, analyze, test and report to US DOD while protecting vender IP
- Government to Government dialog provides the primary pathway for the USN to be briefed on Industry technology development
  - Japanese dual-use industry gains an understanding on how US defense process works
  - The DON will protect industrial IP that is brought forward especially for assessment and testing

*“We need to encourage international competition”  
HON Frank Kendall, USD Acquisition, Technology and Logistics*





# What is the Foreign Comparative Testing (FCT) Program

## ***The U.S. doesn't have a monopoly on good ideas:***

- The mission of the Foreign Comparative Testing Program is to test items and technologies of our foreign allies and friends that have a high Technology Readiness Level (TRL) in order to satisfy valid defense requirements more quickly and economically
- FCT is a unique acquisition tool from a U.S. Government-to-Foreign Industry standpoint
- The FCT Program has served as a catalyst for industry teaming arrangements, which have been productive for both U.S. and foreign industries
- For more information: <http://www.acq.osd.mil/rfd/index.html>
- Proposal Submission – Please contact METI
  - <https://cto.acqcenter.com/osd/portal.nsf/>
  - Additional background information on FCT and thrust area topics



# ONR Global Program Tools

- VSP
  - Visiting Scientists Program
  - 旅費の支援
- CSP
  - Collaborative Science Program
  - カンフェレンス・ワークショップの支援
- NICOP
  - Naval International Cooperative Opportunities in Science & Technology Program
  - 研究プロジェクトへの助成金



# Recent ONR Global Funded Research & Collaboration in Japan

- Material Science (材料科学)
  - Photovoltaic materials (太陽電池の材料)
  - Piezoelectric crystals (圧電単結晶)
  - Vibration based energy harvester using magnetostrictive material
  - Carbon-fiber-reinforced polymer, CFRP (炭素繊維ポリマー)
- Maritime Safety (船舶安全工学)
  - Ship stability (船舶の安全工学的デザイン)
  - Computational fluid dynamics (船舶のデザインと波の数値モデル)
- Robotics (ロボット工学)
  - Manipulator mechanics (ロボットハンド・マニピュレーター)
- Medicine (医学)
  - Mental health after a natural disaster (自然災害後のメンタルヘルス)
- Limnology & Oceanography (海洋学・湖沼学)
  - Acoustic tomography of Lombok Straits (インドネシア近海の物理海洋学)
  - Biwa Lake physical limnology (琵琶湖の物理湖沼学)
  - Maritime domain awareness through remote sensing (漁船リモートセンシング)
- Mathematics
  - Innovative, origami-based deployable structures

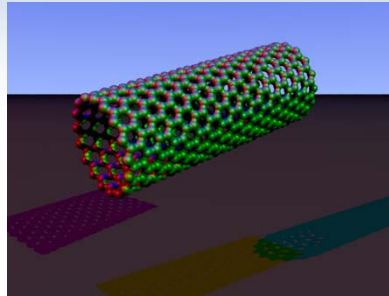




# ONR and GoJ Working Together to Identify Opportunities and Develop Capabilities



Power and Energy



Advanced Materials



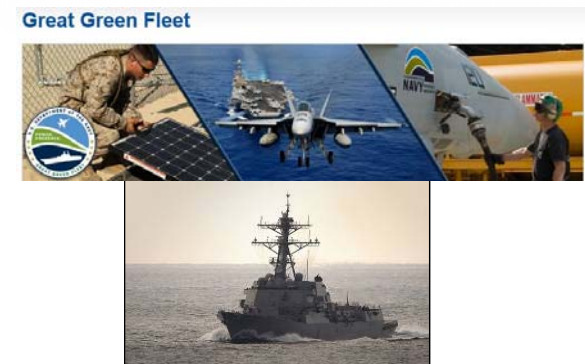
Space Technologies



Ground Vehicles



Solider Technologies



Power and Energy



# ご質問は？





# Back-Up Slides



# Naval S&T Knowledge, Technology, Capability

1-2 years  
Quick Reaction  
& Other S&T ≈ 8%

2-4 years  
Technology Maturation  
(FNCs, etc.) ≈ 30%

4-8 years  
Leap Ahead Innovations  
(Innovative Naval Prototypes) ≈ 12%

5-20 years  
Discovery & Invention  
(Basic & Applied Science) ≈ 45%



SSL-QRC



Transportable  
Electronic Warfare  
Module (TEWM)  
Upgrade



USSV Autonomous  
Operations



XFC UAV



Advance Aircraft  
Topcoats



GBAD OTM



Data Triage



SLQ-32



Mk18 Family  
of UUVs



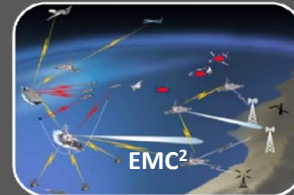
Next Generation  
Countermeasures  
Technologies for  
Ship Missile Defense



Integrated Topside  
(InTop)



FEDECO



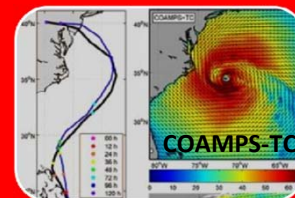
EMC<sup>2</sup>



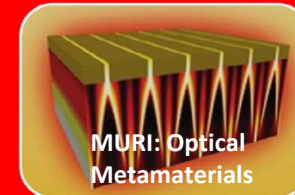
LDUUV INP



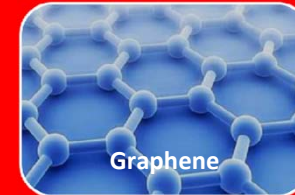
Electromagnetic  
Railgun (EMRG)



COAMPS-TC



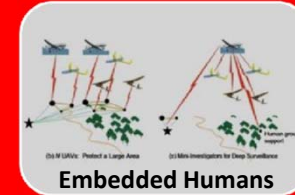
MURI: Optical  
Metamaterials



Graphene



ZRay Glider



Embedded Humans



# FCT Program- How to Get More Info

- OSD Website -- <http://www.acq.osd.mil/rfd/index.html>
  - Access the Rapid Fielding website for briefing on Comparative Technology Office Foreign Comparative Testing Program (under “Resource” tab)
- Proposal Submission --  
<https://cto.acqcenter.com/osd/portal.nsf/>
  - Registration required for submission
  - Additional background information on FCT and thrust area topics
- Contact your Embassy in DC – Defense Attaché or the trade or science and technology organization
- Contact the Office of Defense Cooperation / Attachés in the US Embassy in your country
- Contact the OSD FCT Office directly