



NR

Revolutionary Research . . . Relevant Results

Pacific Operational Science and Technology Conference

RADM Bill Landay
Chief of Naval Research

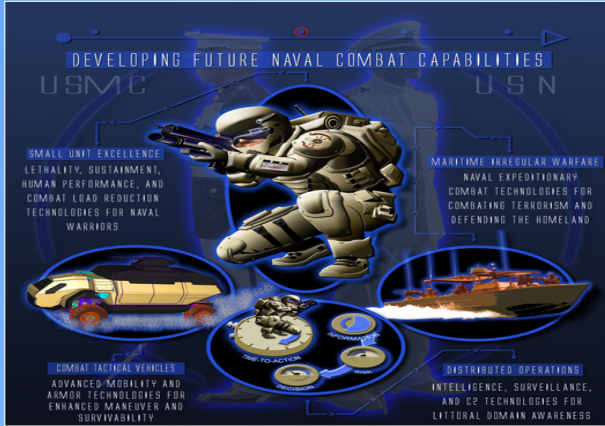




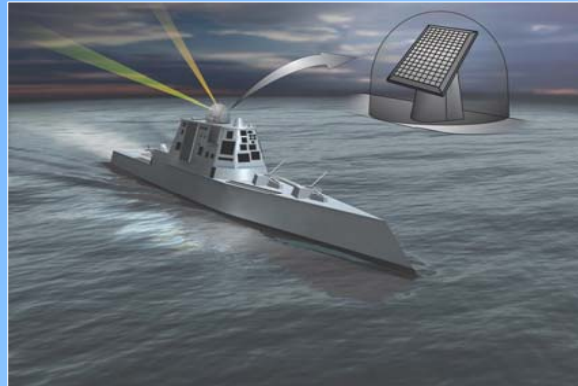
ONR S&T Departments



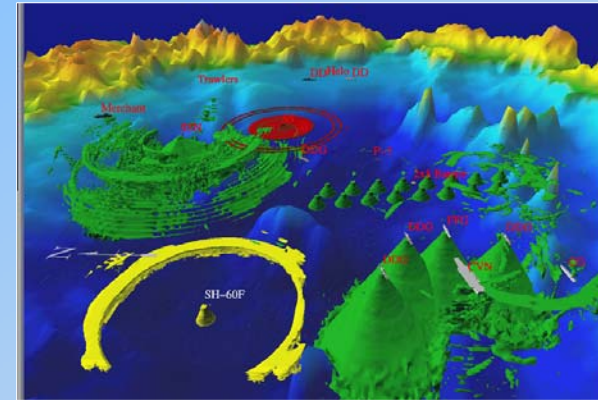
Code 30 Expeditionary Warfare and Combating Terrorism



Code 31 Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR)



Code 32 Ocean Battlespace Sensing



Code 34 Warfighter Performance



Code 33 Sea Warfare and Weapons

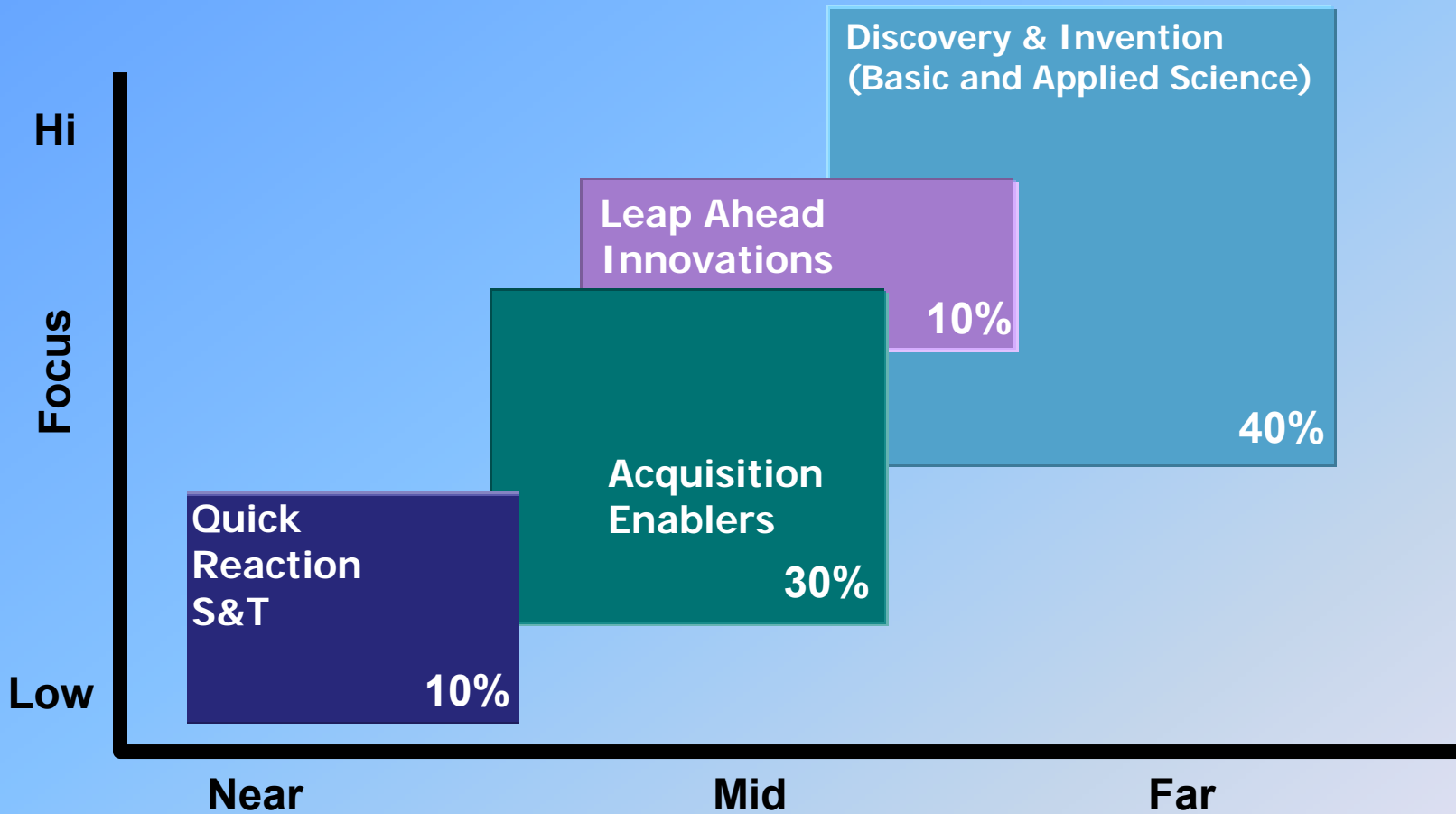


Code 35 Air Warfare and Weapons





ONR's Balanced S&T Portfolio

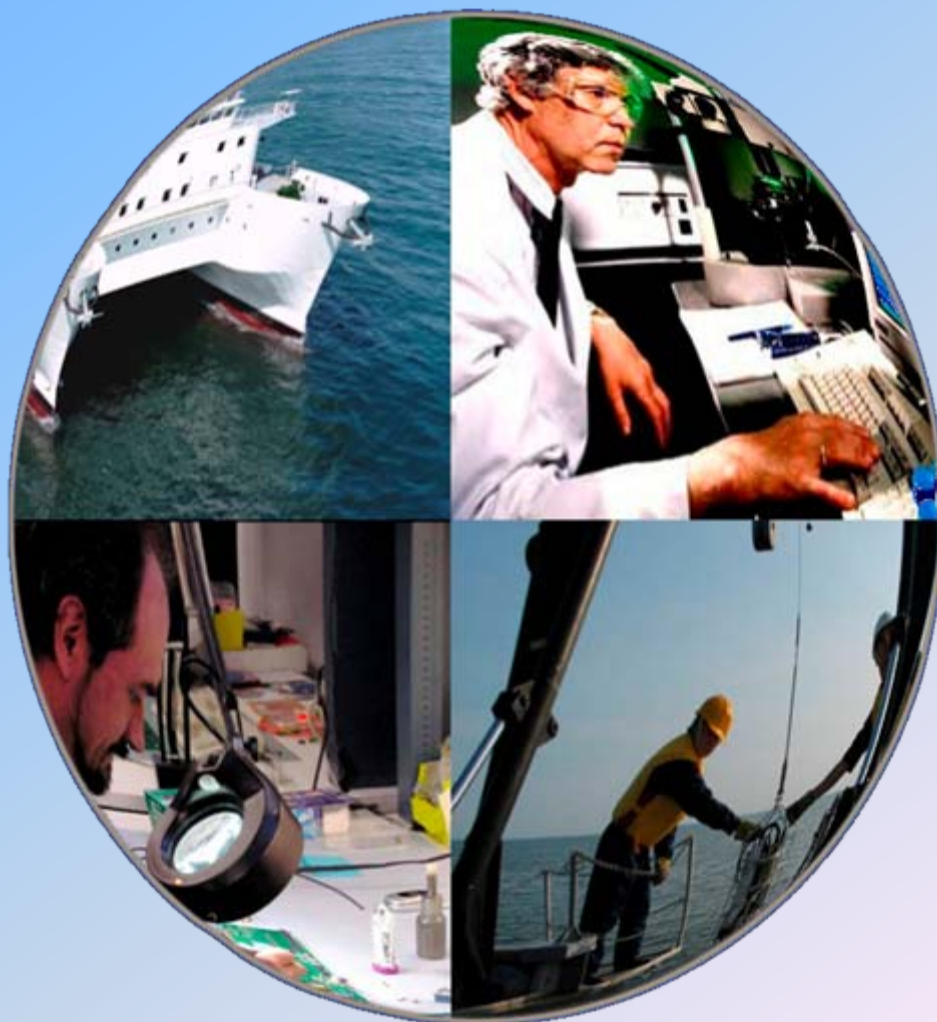


S&T has a long-term focus but is responsive to near-term Naval needs



S&T Enterprise Span

- **50 States**
- **70 Countries**
- **1,035 Universities and Non-Profit Entities**
- **914 Companies**
- **3,340 Principal Investigators**
- **3,000 Grad Students**





Revolutionary Research . . . Relevant Results

Naval Science and Technology Worldwide Engagement

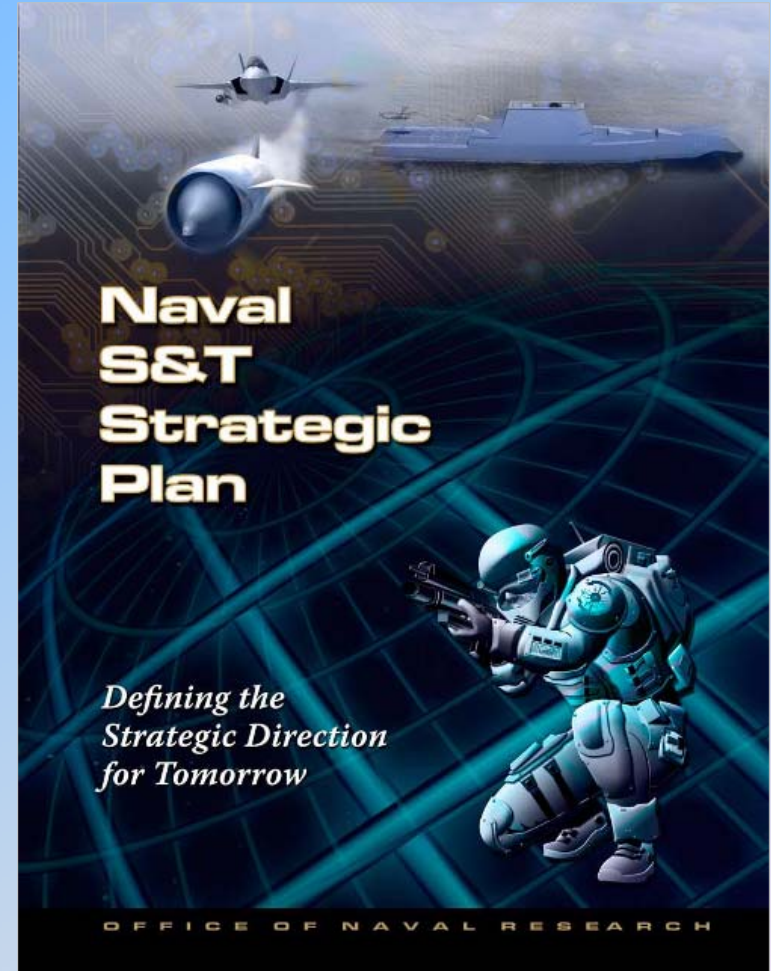




Naval S&T Focus Areas



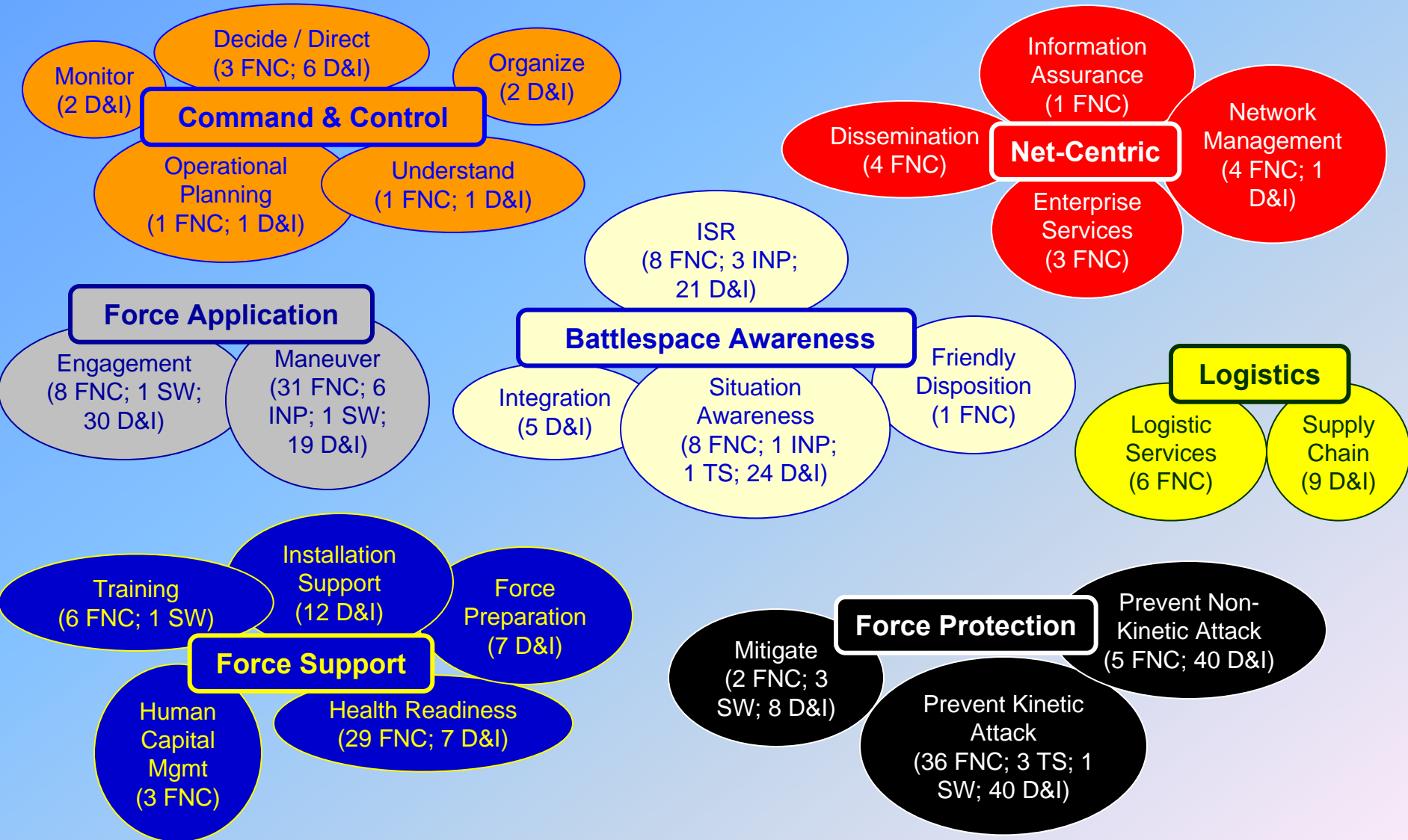
- Power and Energy
- Operational Environments
- Maritime Domain Awareness
- Asymmetric and Irregular Warfare
- Information, Analysis, and Communication
- Power Projection
- Assure Access and Hold at Risk
- Distributed Operations
- Naval Warrior Performance and Protection
- Survivability and Self-Defense
- Platform Mobility
- Fleet/Force Sustainment
- Affordability, Maintainability, and Reliability



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S&T Transitions





Traumatic Brain Injury Mechanisms



Product Description:

Knowledge Products.

Products that will provide greater understanding of causes of traumatic brain injury related to exposure to blast energy.

TRL at Start: 2

TRL at Transition: 4



Planned Demos/ Deliverables/Transitions:

- FY09: Technical report on risk of exposure to blast energy during dynamic entry training.
- FY10: Report on ability of IED-associated EMP to cause TBI.
- FY11: Report on thresholds for mild-TBI for primary blast exposure, repetitive exposure to free-field blasts, and exposure to complex blast waves.

Warfighting Payoff:

These research efforts will fill important gaps in knowledge regarding the effects of exposure to blast overpressure on the brain. Once mechanisms are known then appropriate interventions can be identified. Development of a new therapeutic option for management of traumatic brain injury which reduces cerebral perfusion pressure, maintains oxygenation and reduces cerebral edema.

FY08 FY09 FY10 FY11 FY12 FY13

Demos - ◆
Transitions - ▲





Integrated IMAT Training & Performance Support for Theater-Level ASW Operations



Product Description

CNO ASW Task Force Team Bravo recommended the development of a high fidelity physics-based training and mission support environment to properly prepare commanders and senior staff for the incredibly complex tasks involved in the conduct of ASW operations using modern C4ISR systems.

TRL at Start: 4, TRL at Transition: 7



Planned Demos/ Deliverables/Transitions

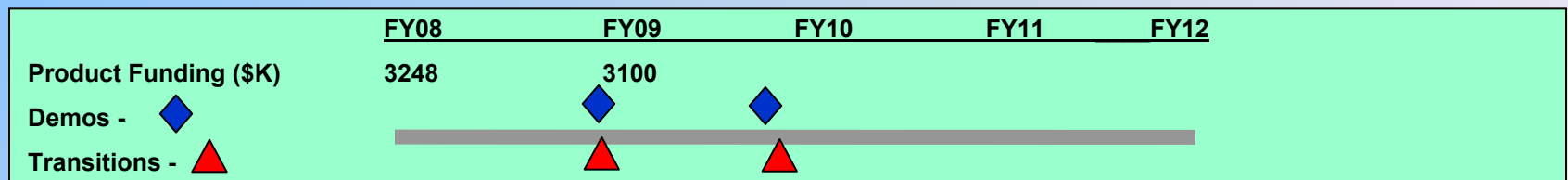
Demos in PAC Theater-level exercises.

- Theater Course of Action Analysis Training
- Theater Model Implementation Optimization
- Integrated ASW Curriculum and Simulation-Based Training

Transition to: Naval Mine and ASW Command (NMAWC); C7F/CTF74

Warfighting Payoff

- Provides critical training for highest priority PACFLEET warfighting requirement
- Metrics are NMAWC certification criteria for theater staffs
- Payoffs = greater detection rates and ranges, lower false alarm rates, increased contact time





Revolutionary Approach to Time-Critical Long Range Strike – RATTLRS



Flight Demonstration Program Objectives

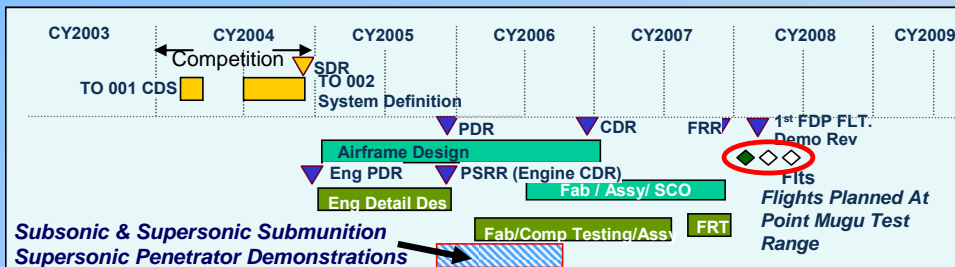
- Develop and flight demonstrate (TRL 6+), payload flexible, multi-mission high speed system with a cost goal of under \$600K AUPC/ 2500 missiles

Minimum Objectives

- At least one Mach 3 Flight Demonstration in FY2008
- Subsonic Air Launch, No Booster
- Transonic Acceleration: 0.25 g or Greater in Level Flight
- Mach 3.0+ Cruise
- Cruise Time: 5-minutes or Greater
- Joint Tactical Weapon System Traceability
- Demonstrate Sub/Supersonic Submunition and Penetrator

Warfighter Capability Need / Objective

- Flexible, Multi-Mission Weapons With Ability to Engage Time-Critical and Hard/Buried Targets
- Joint Warfighter Platform Compatibility (Strategic and Tactical Aircraft, Ship & Submarine)
- Able to Trade Speed for Range Increase w/ Potential Loiter Capabilities
- Highest Range & Weapons Payload For High-Speed Solution – from 500 - 1000lb payload up to 1000nm, depending on the variant



Enabling Technologies/Challenges

- Non-afterburning Mach 3+ Turbine Engine
- High Temperature Nozzle and Airframe Materials
- High Speed Inlet with Payload Integration
- High Lift/Drag Configurations
- Aero-propulsion Integration

RATTLRS FDV



Notional Tactical Weapon System





High Rate Vertical / Horizontal Material Movement

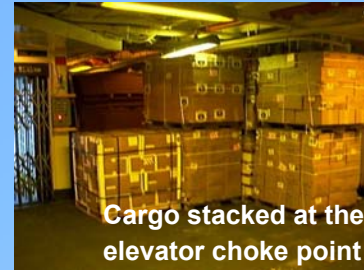


Product Description:

- Seamless horizontal to vertical to horizontal material movement
- Enabling technology for strike-down to occur at the rate of receipt (UNREP), achieve required sortie generation rate, and reduce workload (i.e. manning) overall.

TRL at Start: 2

TRL at Transition: 6



Cargo stacked at the elevator choke point



HRVHMM
High Rate Vertical-to-Horizontal Material Movement System

PHASE I FINAL REVIEW
October 25, 2008

FEDERAL EQUIPMENT COMPANY
David M. Brown, President
Rene G. Gable, General Program Manager
James S. Linnell, Mechanical Engineer
Paul J. Lutz, Systems Architect
Paul M. McHugh, Program Manager
David S. Smith, Land Electrical & Controls Engineer
Scott Thompson, Mechanical Engineer

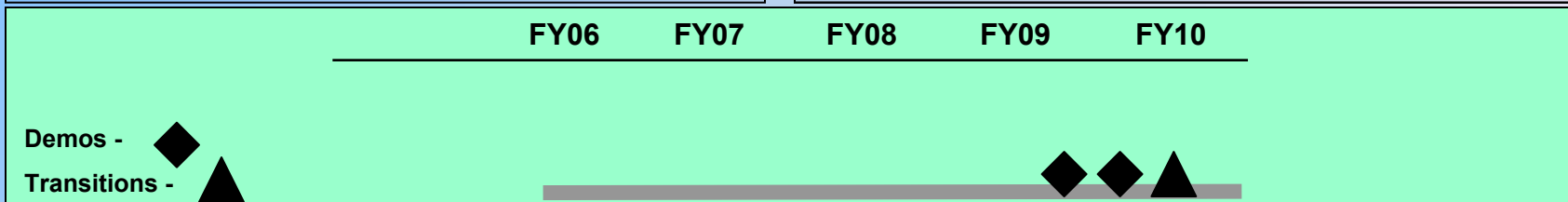
AGILE SYSTEMS INC.
Robert J. Smith, Vice President
Erik Kahan, Program Designer, Mobility & Automation
Tim Lutz, Senior Mechanical Engineer
Eric Schaefer, Mechanical Designer

Planned Demos/Deliverables/Transitions

- Three projects in Phase I Q3 FY06
- Down-select to one Phase II project Q2 FY08
 - Federal Equipment Company Selected
- Full-Scale Proof of Principle Land Based Demonstration Q2 FY09
- Relevant Environment Full-Scale Proof of Principle Demonstration Q3 FY10
- Transition to MPF(F)/PMS-385 Q3 FY10

Warfighting Payoff:

- Supports Sea Base Pillar - Sea Based Mobility and Interfaces
- Enables at-sea arrival and assembly
- Selective offload / total asset visibility
- Greater cargo transfer throughput
- Workload reducer





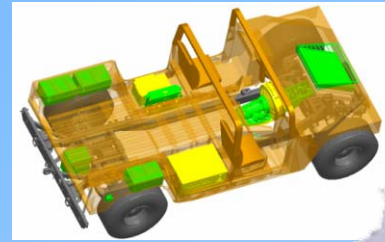
Battlefield Power Generation



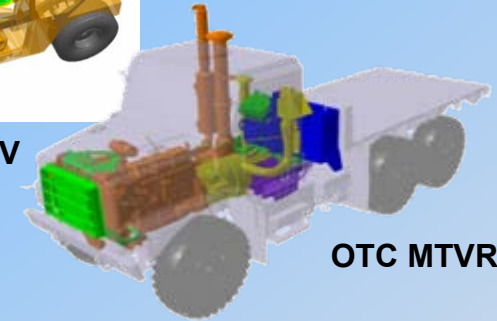
Product Description:

On-board Vehicle Power (OBVP): Provide vehicle-integrated exportable utility quality 60 Hz electric power for mounted and stationary applications that have high electrical power needs

- TRL at Start: 4
- TRL at Transition: 7



DRS HMMWV



OTC MTRV

Planned Demos/Deliverables/Transitions:

- FY-07 MTRV w/120kW stationary, 20kW mobile export power capability
- FY-08 HMMWV w/30kW export power capability
- Full Government MTRV/HMMWV testing during FY08 @ ATC
- Transition to MCSC – FY09

Warfighting Payoff:

- Support missions with dedicated vehicles that currently use APUs, non-standard generators, or towed generators
- Applications include Mobile C2, Radar, Air Defense Sensors, NBC, and Ops Centers
- Replacing towed systems reduces logistical footprint, improves power mobility, and saves fuel
- **Gap addressed:** PR09-31 Advanced Electrical Power Systems
- **Metrics:** 6X (HMMWV) & 20X (MTRV) on-board, electrical power generation; parallelable with another vehicle or TQG; minimum +/- 5% THD power quality

FY05 FY06 FY07 FY08 FY09

Demos -
 Transitions -



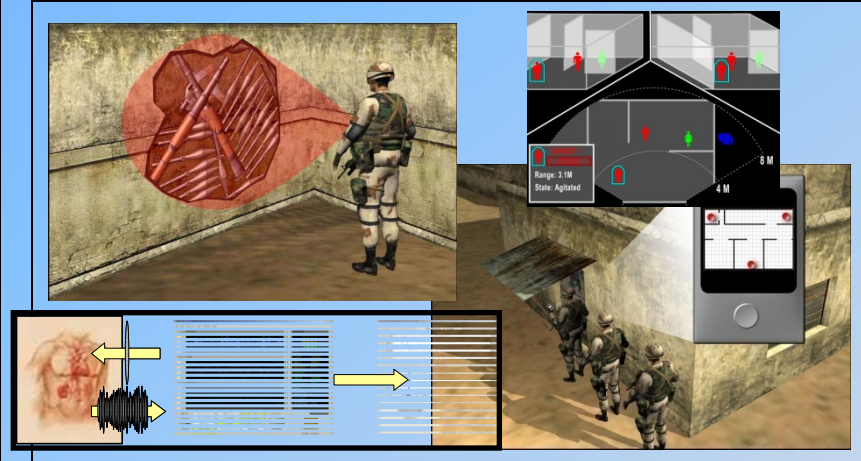


Sensing Through Walls



Product Description: Hand-held or small-UGV mounted wall-penetrating sensors capable of detecting and classifying personnel (moving and stationary), detecting firearms and identifying construction features (walls, windows, stairwells) from standoff range. Develop multi-band, multi-mode systems using UWB pulsed radar, acoustics, Doppler and biometric techniques. Sensors will be networked to enhance resolution and situational awareness

TRL at Start: 4 (Average)
 TRL at Transition: 6

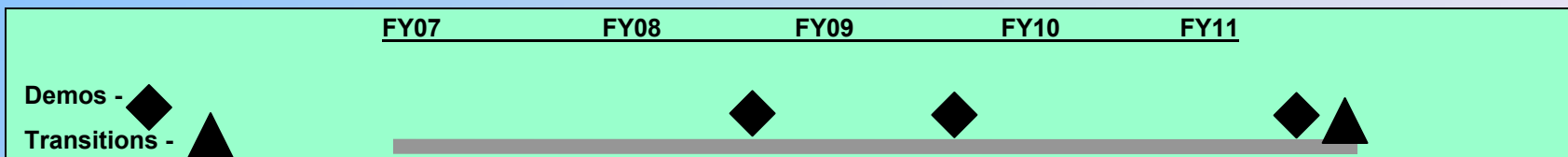


Planned Demos/Deliverables/Transitions

- Demos
 - 4QFY08 - acoustic stimulation RF and UHF/VHF resonance signatures
 - 4QFY09 - multipath mitigation and high resolution at low frequency RF
 - 2QFY11 - biometric, multiband impulse soldier-borne radar
- Transition
 - Marine Expeditionary Rifle Squad (PM MERS)

Warfighting Payoff:

- Develop capability to detect, classify, and discriminate between friendly and enemy personnel in urban structures. Determine if buildings are occupied without entering. Detect and classify without physical confrontation. Show enemy orientation and intent before engaging. Detect and classify weapons.
- **Gap addressed:** PR09-1 Urban/Littoral Operations
- **Metrics:** SWAP suitable for individuals/UGVs; 100m standoff; Multi-wall layers; Moving & stationary personnel, weapons, explosives





Naval Expeditionary Overwatch System



LAND NAVAL SURFACE WARFARE CENTER AIR SEA

NEO

NAVY EXPEDITIONARY OVERWATCH SYSTEM

- Multi-Spectral ISR
- Detection and Location Sensors
- Lethal and Non-Lethal Engagement
- Distributed Operations
- Ground and Littoral Environments

UNITED STATES FLEET FORCES COMMAND

NAVY EXPEDITIONARY COMBAT COMMAND

OFFICE OF NAVAL RESEARCH **ONR**
Revolutionary Research... Relevant Results

U.S. NAVAL RESEARCH LABORATORY WASHINGTON, D.C.

WARLOCKS VXG-1

NORTHROP GRUMMAN

NAV AIR

NAVSEA WARFARE CENTERS

INSITU

DAHLGREN • DAMNECK • PANAMA CITY • CARDEROCK • PORT HUENEME



Fighting at Hypervelocity & Light Speed



Shipboard Defense at Speed of Light:
Free Electron Laser

Time-Critical Long-Range Strike:
Supersonic and Hypersonic Missiles



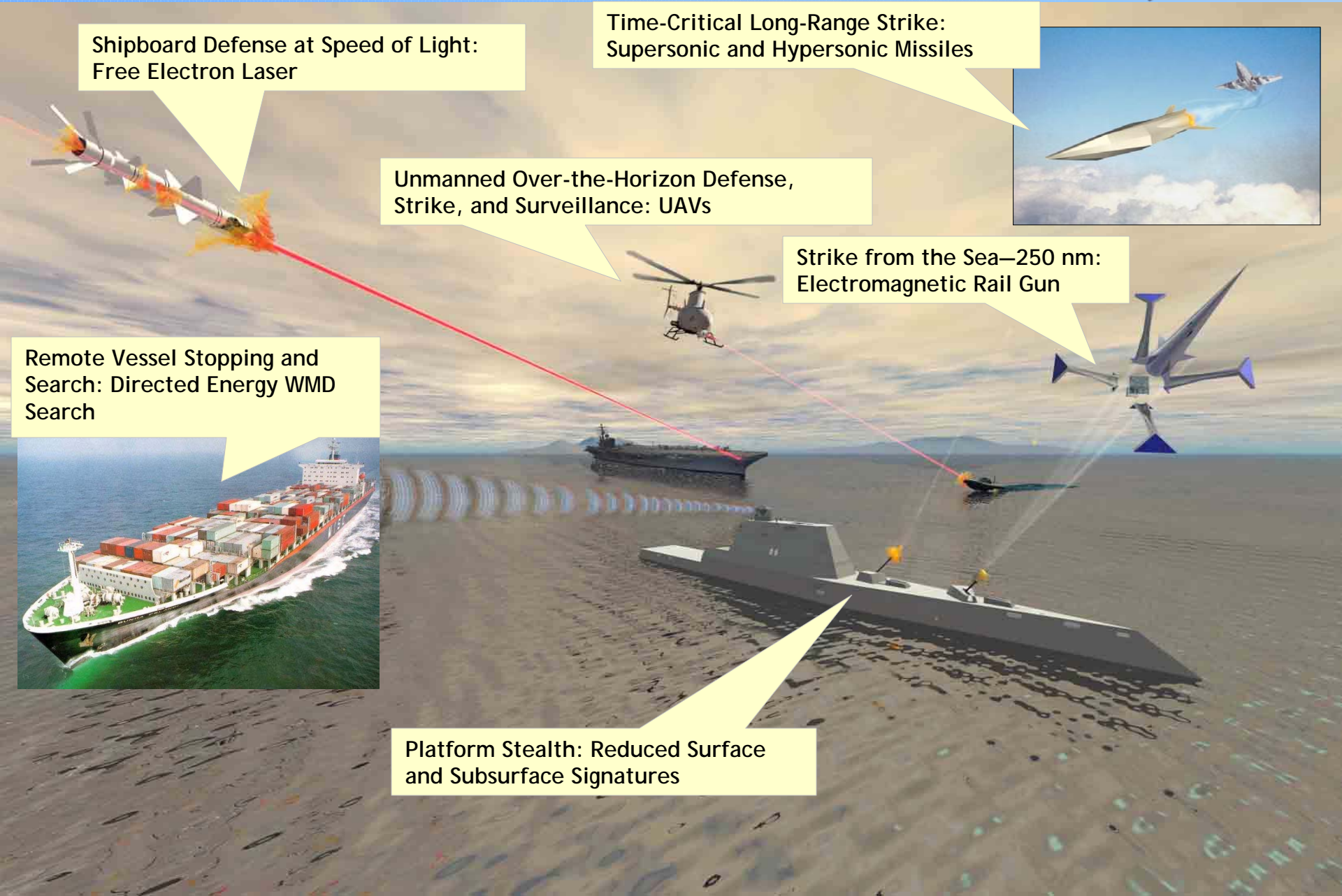
Unmanned Over-the-Horizon Defense,
Strike, and Surveillance: UAVs

Strike from the Sea—250 nm:
Electromagnetic Rail Gun

Remote Vessel Stopping and
Search: Directed Energy WMD
Search



Platform Stealth: Reduced Surface
and Subsurface Signatures

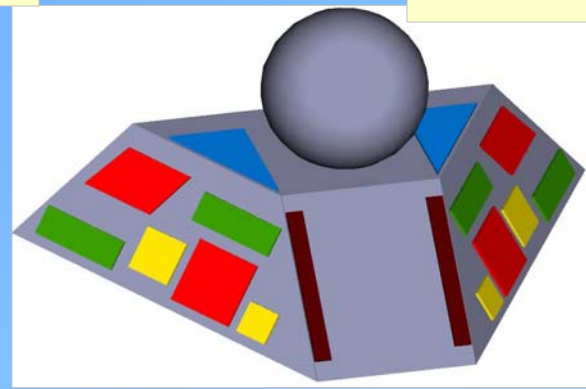
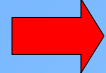
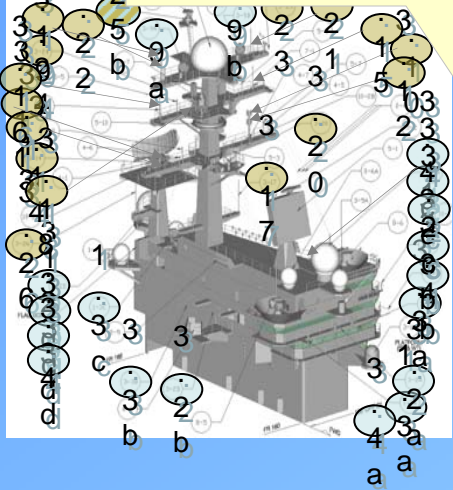




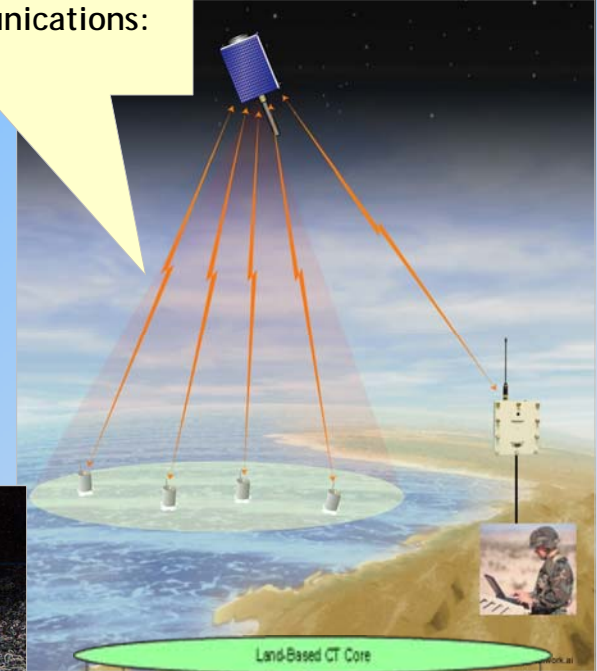
Dominating the Electromagnetic Spectrum



Reduced Antennae Clutter:
Integrated Aperture Array



Adaptable, Quickly
Deployable Communications:
ODTML and TacSat

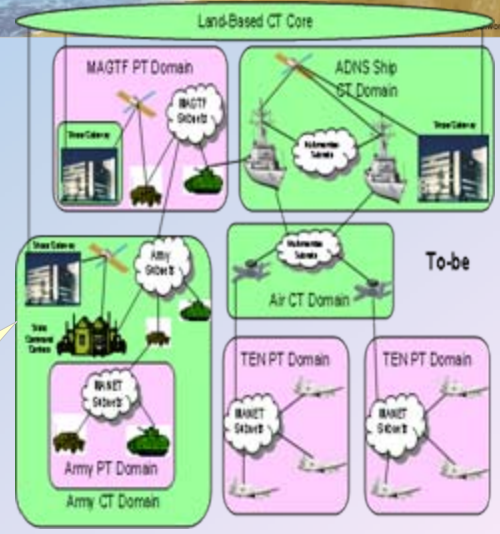


Electronic Suppression:
Counter-IED Systems



EM and Electro-Optical
Camouflage

Self-Organizing, Dynamic
Tactical Communications
Networks





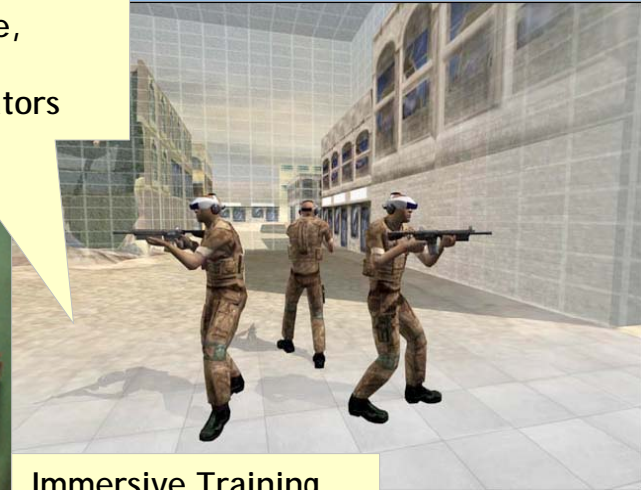
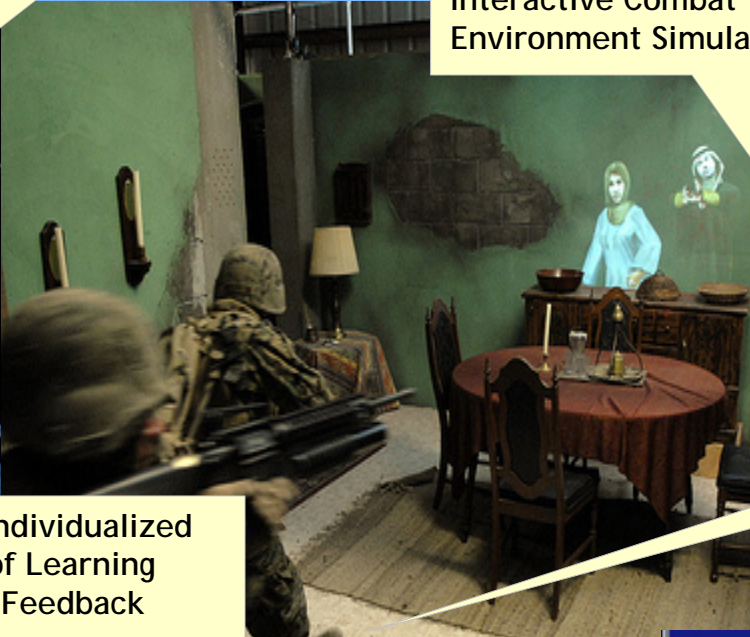
Outthinking & Out-Adapting the Enemy



Virtual Reality Training Systems



Scalable, Deployable, Interactive Combat Environment Simulators

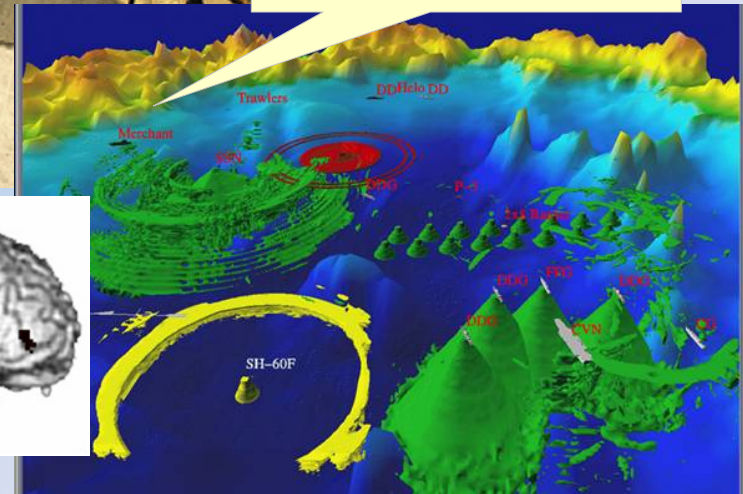


Immersive Training Environments



Real-time, Individualized Monitoring of Learning with Neural Feedback

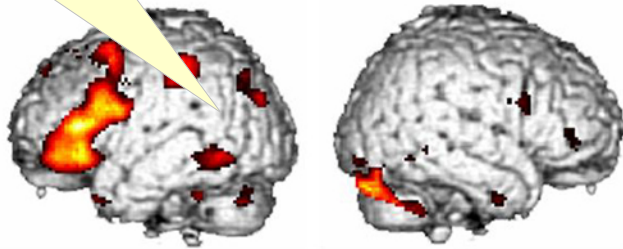
Advanced Environments



Second Language Learning



Virtual Reality Treatment and Medical Systems





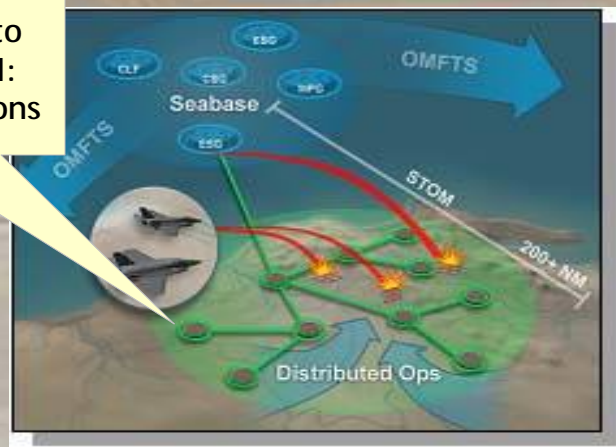
Dominating the Battle in the Littorals



Unmanned Land Transport, Sensor, and Combat Systems



Maneuver and Connectivity Down to Platoon/Squad Level: Distributed Operations



Non-Lethal Weapons



Seabased Logistics and Communications: Intraship Cargo Systems



Personal Exoskeleton: Integrated Power, Armor, Comms, and Combat Systems



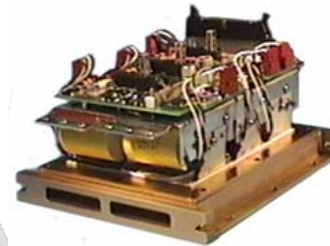
Unmanned Irregular and Riverine Warfare Systems



Next-Generation Power, Propulsion, and Hull Forms



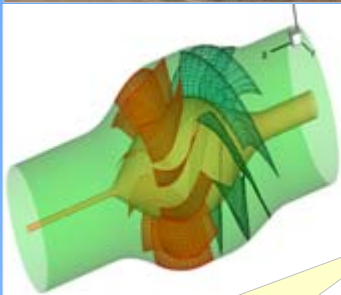
Superconducting Motors



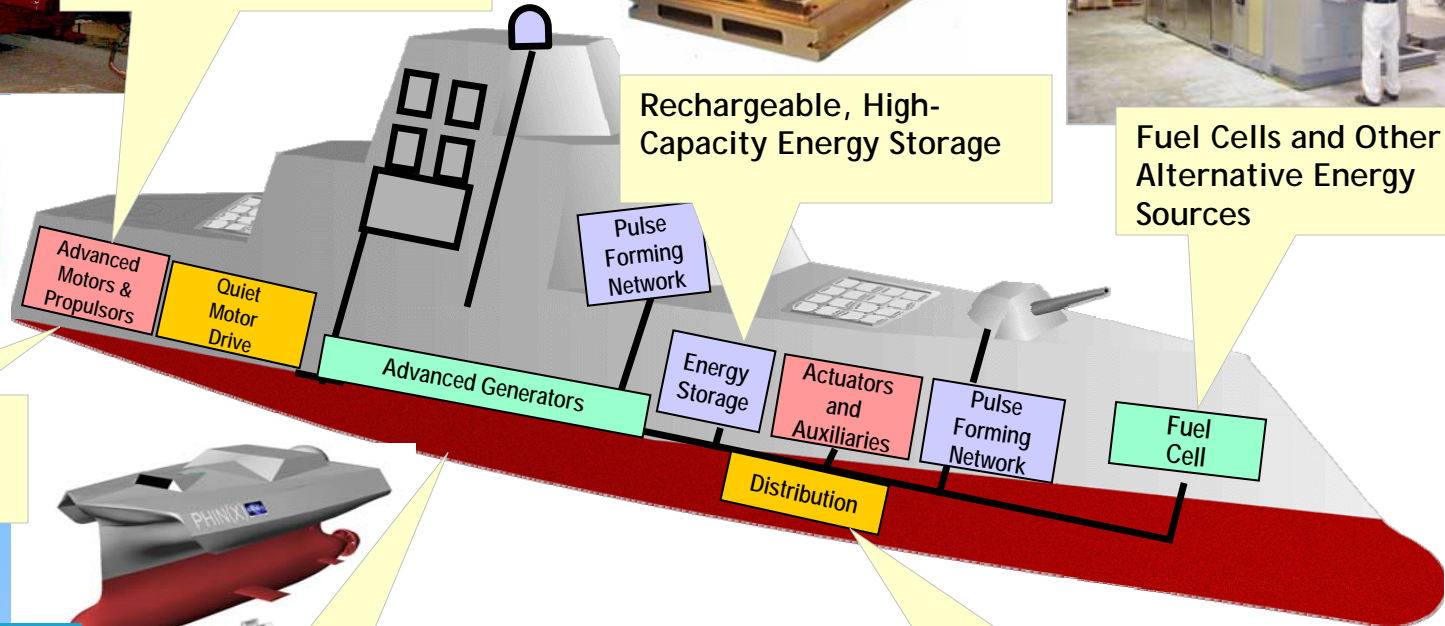
Rechargeable, High-Capacity Energy Storage



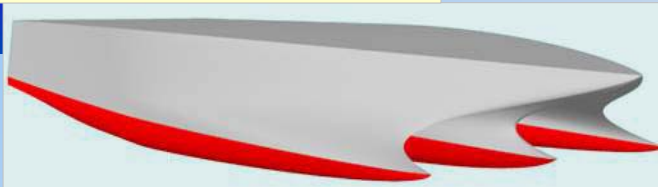
Fuel Cells and Other Alternative Energy Sources



Hydrodynamic Podded Propulsion



Efficient, High-Speed, High-Endurance Hull Forms



All-Electric Ship Power Control and Distribution

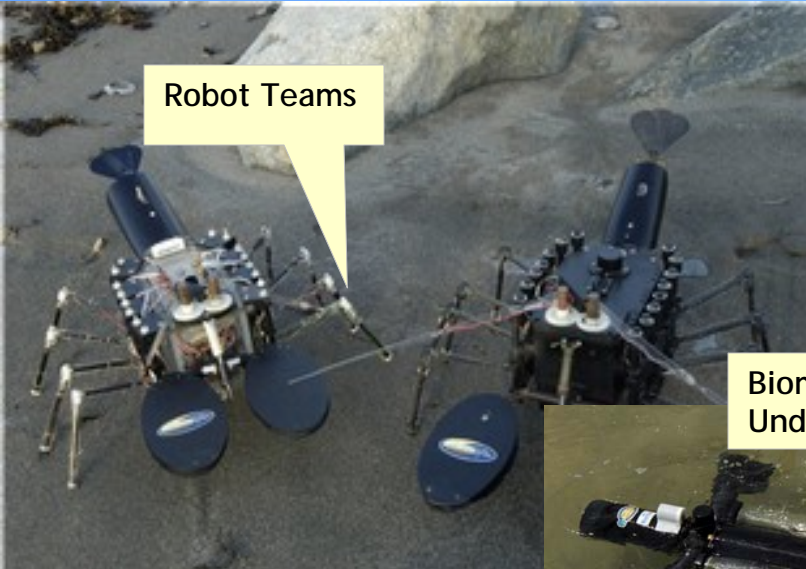




Adaptable Autonomous Systems

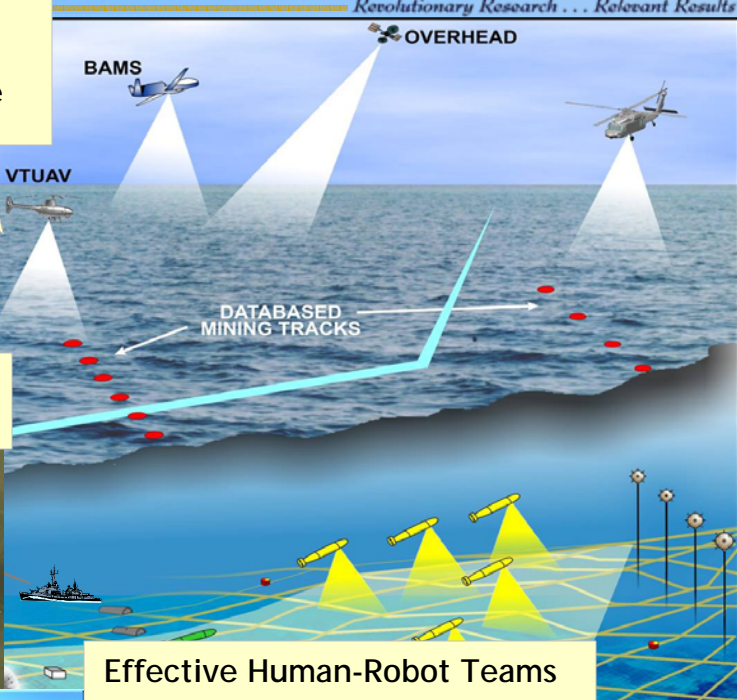


Revolutionary Research . . . Relevant Results



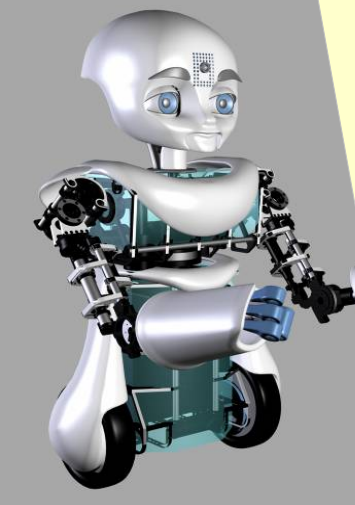
Robot Teams

Autonomous Network-Centric Mine and Antisubmarine Warfare and Countermeasures

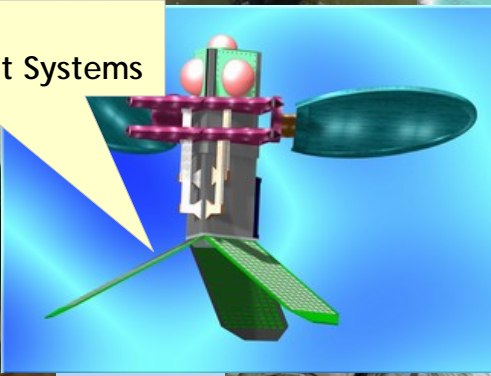


Biomimetic Autonomous Undersea Systems

Remote Physiological Sensing and Human-Robot Interaction



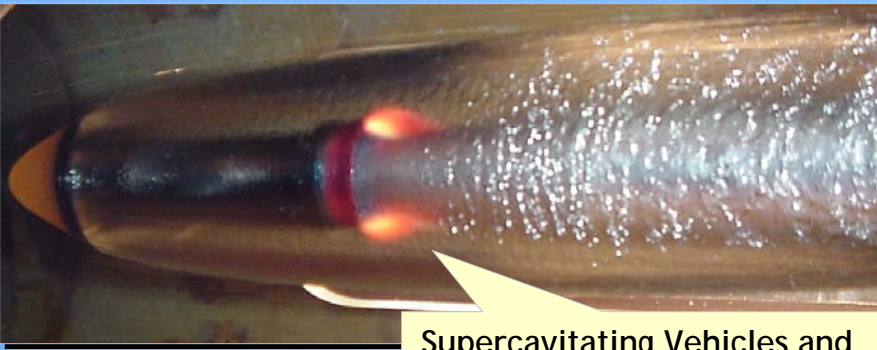
Unmanned Aerial Surveillance/Combat Systems



Effective Human-Robot Teams

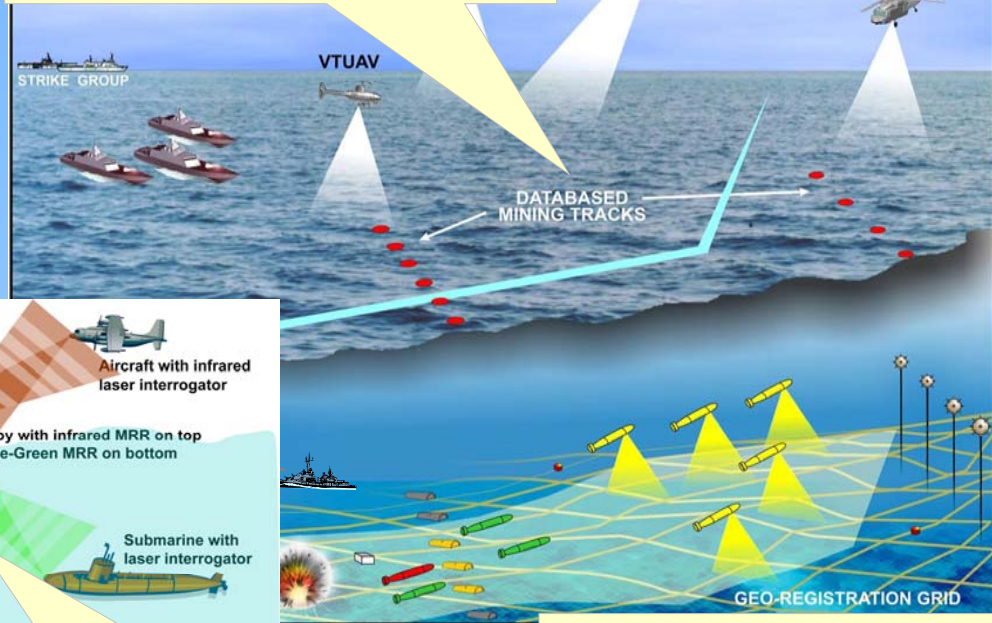


Dominating the Undersea Battlespace

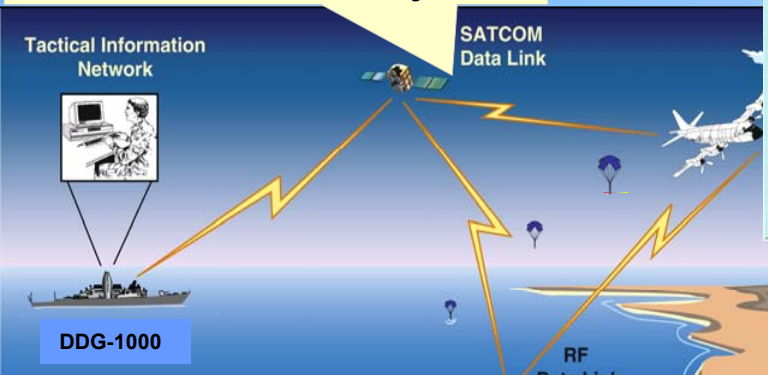


Supercavitating Vehicles and Weapons

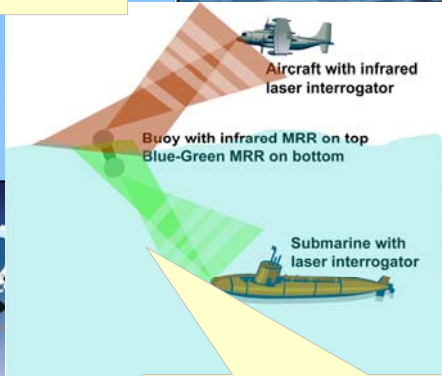
Autonomous Network-Centric Mine Warfare and Countermeasures



Network-Centric Unmanned Systems for ASW: Deployable Autonomous Distributed System

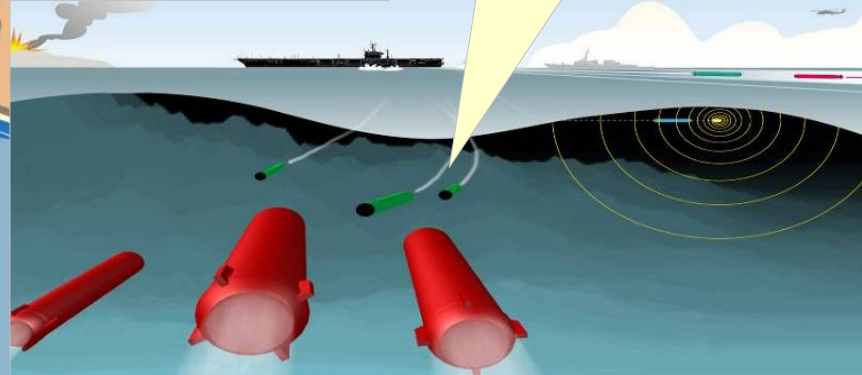


Intelligent Swarms of Unmanned Underwater Vehicles



Submarine Communications at Depth and Speed: Lasers and Modulating Retro-Reflectors

Adaptive Acoustic Countermeasures and Anti-Torpedo Torpedoes





A Swiftly Changing Planet



- In an era of increasing globalization, new technology is more readily available—and more quickly—than ever before
- The natures of “combatant” and “weapon” are changing, and new challenges can come from anywhere in the world

- We must accept the fact that adversaries will use our technology against us
- To stay competitive on tomorrow’s battlefields, we must:
 - **Ensure** our people and research enterprises are more innovative
 - **Maintain** our technological advantage

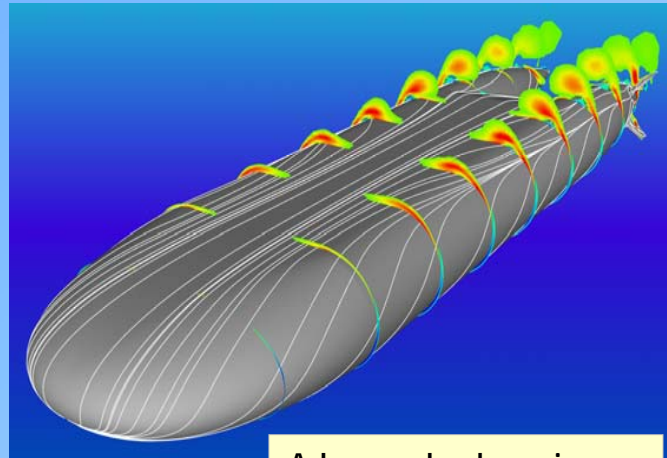




Relevant and Revolutionary



Supercavitating weapons and transports



Advanced submarine and ship designs



Unpiloted logistics and support aircraft



Radically augmented human performance

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

— ADM Gary Roughead, CNO



Long-range, ultra-high-endurance air platforms



The Home of Innovation



The Office of Naval Research is THE destination for innovative ideas and the birthplace of next-generation science and technology



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