Naval Science and Tech
Naval Research Investment Strategy

Strategic goal of Naval Science

Provide the foundation for overwhelming and enduring technological superiority for American Naval forces

Investment principles:
• Invest in high-quality, Naval-unique, and Naval-relevant science
• Balance near-term and long-term investments
• Focus investments to produce capabilities
• Maintain broad S&T connections and awareness to avoid surprise and exploit opportunities
• Leverage other agencies’ investments for Naval applications
Naval Research - Driving Navy Technology Transformation

Today's Navy and Marine Corps

Operational Navy and Marine Corps

Next Navy and Marine Corps

Acquisition Community

Navy and Marine Corps After Next

DON Science & Technology

Present .......... 5 Years .......... 20 Years ........
Naval Transformation Roadmap

*Power and Access . . . From the Sea*

Transformational Processes

Sea Trials

**Sea Warrior**

Sea Enterprise

Transformational Capabilities

- Sea Strike
- Sea Shield
- Sea Basing

S&T: enables both Processes and new Capabilities
Naval Transformation Roadmap

• **Sea Strike**
  – Persistent Intelligence Surveillance and Reconnaissance
  – Time sensitive Strike
  – Information Operations
  – Ship-to-Objective Maneuver

• **Sea Shield**
  – Theater Air and Missile Defense
  – Littoral Sea Control
  – Anti-Submarine warfare
  – Mine Countermeasures
  – Homeland Defense

• **Sea Basing**
  – Accelerated Employment and Deployment Times
  – Enhanced Sea-borne Positioning of Joint Assets

• **FORCEnet**
  – Fully integrated and shared tactical pictures
  – Integration of Force element

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Supported by Naval Transformation Process

**Sea Warrior** – Maximizing human capital

**Sea Trial** – Process for innovation

**Sea Enterprise**: Maximizing Business efficiencies
"Sovereign Seabase"
NRL Accomplish

- NRL COMMISSIONED (1923)
- DISCOVERY OF SKIP DISTANCE EFFECT (1924)
- FIRST U.S. RADAR PATENTS (1934)
- FIRST RADAR INSTALLED ON USS NEW YORK (1939)
- FIRST CONCEPT & PROPOSAL FOR NUCLEAR SUB (1939)
- SUBMARINE, AIRBORNE & OTH RADARS & IFF (1940)
- FIRST EXPERIMENT IN SPACE (1946)
- PRINCIPLES OF MODERN FRACTURE MECHANICS (1947)
- SUBMARINE LIFE SUPPORT (1950)
- SYNTHETIC LUBRICANTS (1950)
- PURPLE K POWDER (1959)
- VANGUARD I LAUNCHED (1958)
- FIRST EXPERIMENT IN SPACE (1960)
- FIRST U.S. INTELLIGENCE SATELLITE (1960)
- HUMAN SPACEFLIGHT (1963)
- AFFF DEVELOPED (1967)
- GPS CONCEPT DEVELOPED & VALIDATED (1967)
- UNMANNED VEHICLE DEEP OCEAN SEARCH (1972)
- SPECIFIC EMITTER IDENTIFICATION (1977)
- WORLD’S FIRST FIBER OPTIC ACOUSTIC SENSOR (1977)
- GPS PROTOTYPE IN ORBIT (1977)
- MAGNETIC MATERIALS & SEMICONDUCTORS FOR COMPUTING (1980)
- HIGH ENERGY MAGNETS (1980)
- NAVY’S OPERATIONAL GLOBAL ATMOSPHERIC MODEL (1981)
- NOBEL PRIZE TO DR. J. KARLE (1985)
- BIO-BASED SENSORS-DESERT STORM (1991)
- NQR DETECTION FOR EXPLOSIVES & NARCOTICS (1993)
- CLEMENTINE SPACECRAFT (1994)
- DECADAL IMPACT OF EL NINO DISCOVERED (1994)
- SHARP RECONNAISSANCE SYSTEM FIRST OPERATIONAL GLOBAL EDDY-RESOLVING OCEAN MODEL (2001)
- MESOSCALE METEOROLOGY PREDICTION SYSTEMS (2000 & BEYOND)
- DRAGON EYE UAV
- MICRO UAVs
- CBR SENSORS FOR FLEET & HOMELAND SECURITY
- SHARP RECONNAISSANCE SYSTEM FIRST OPERATIONAL GLOBAL EDDY-RESOLVING OCEAN MODEL (2001)
- MESOSCALE METEOROLOGY PREDICTION SYSTEMS
- METHANE HYDRATE RESEARCH
MicroSat Demonstration of On-Demand Tactical Payloads

**System Description:**
- Expands FORCEnet for Naval Fires Decisions
- Enabled by Micro-Sat Tech. and Tactical Launch
- MDA Modified C4 Missile

**Description**
- Very Small, Low Cost, Tactical Payloads
  - SIGINT, Imaging, Communications
- Quick to Orbit
  - Using New Tactical Launch Techniques
  - Orbit Selected by Region of Conflict
- On the Shelf Payload Inventory
  - Select From Several different Capabilities, Determined by Need
  - Autonomous Check Out and Calibration
  - Highly Automated for Tactical Operations
- Enabled Through Micro-Satellite Technologies

**SEA POWER 21 Warfighting Capabilities**

**Transformational Aspects:**
- Enhance FORCEnet Capability
  - On Demand Payloads for Conflict of Interest
  - Mission Call-Up in 1-2 Weeks
- Asset Controlled by Forces
  - Sensor Data and Tasking Broadly Available to Joint Forces via SIPRNET
  - Reduces O&M Costs by Order of Magnitude
  - Direct Tasking and Data Access by Forces

**Missions:**
- Provide Tactical Sensors
- Network Expeditionary Sensor Grid

**Programmatics**
- Develop Payloads for Sea Trial
- Could Transition to Operational System in FY09
- Leverage Non-Traditional Launch Alternatives in Development by Other Agencies (DARPA, MDA, Air Force)
- $30 – 50 Million/yr
# Ocean Floor Bio-Fuel Cell

<table>
<thead>
<tr>
<th>Objective:</th>
<th>Results:</th>
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<tr>
<td>Harvest energy at seafloor to indefinitely operate autonomous marine deployed sensors and Instrumentation.</td>
<td>• Prototype deployed devices generate 300 mWatt/meter² continuous power indefinitely.</td>
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<td><strong>Approach:</strong></td>
<td>• Does not foul after 2.5 years continuous operation (ongoing)</td>
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<td>2-electrode device sits on ocean floor and generates electrical power by oxidizing marine sediment organic matter with seawater oxygen</td>
<td>• Optimization underway</td>
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<td><strong>Impact:</strong></td>
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<td>• Long-term uninterrupted instrument operation</td>
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<td>• Approach may be scaled up and used in methane rich environments for kWatt generation</td>
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Combating Terrorism Technology Task Force  
(CT$^3$F-“Team Tango”)

**Background:**
DDR&E established *Team Tango* to produce DoD integrated plan for technology against terrorism (17 Sep 01):
- Detection, Indications & Warnings
- Survivability & Denial
- Consequence Management & Recovery
- Attribution & Retaliation

Full Naval participation in collaboration with other Services and Defense agencies. Deliverables have included (in partnership with USAF and DTRA) thermobaric weapons used in Gardez, Afghanistan.

**ONR/NRL/MCWL Rapid Execution:**
- Advanced Sensors for Tactical Naval UAV
- Chemical Agent Detection and Biological Agent Collection using small UAVs
- *Deployed to Southwest Asia for maritime interdiction service, January 2002.*
InfraLynx
Critical Infrastructure Augmentation & Linkage System

To Rapidly Provide Critical Infrastructure Restoration After Terrorist Attack or Natural Disasters. Facilitates Coordinated Civilian/Military Rescue and Recover Efforts.

- Mobile Crisis Response System:
  - Phone Service (POTS)
  - Private Cellular Network
  - Conventional Comms (VHF/UHF/800)
  - VOIP Connectivity (VTC, Comms)
  - Comms Crossband & Gateway
  - Networks (VPN, NIPR, SIPRNET)
  - Secure Voice (STU)
  - Fax
**CT_ANALYST**

Hand Held CBR Dispersion Prediction System with Zero Delay and High Fidelity

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### Enabling Capabilities
- Can provide instantaneous predictions of urban and facility contaminant transport **before it happens**.
- Designed for use by the military, police, firemen, and other emergency managers for contaminant releases from accidents, natural disasters and terrorist attacks.

### System Includes
- Web broadcast of graphical results to PDAs
- Network transmitted sensor data into CT_Analyst
- Immediate data fusion of anecdotal information, qualitative data and sensor data
- Instantaneous point-and-click computation of exposed and soon-to-be exposed regions
- Situation-based escape routes and building threat doses quickly projected for emergency management use
- Multiple sources, coordination of remotes and automatic backtrack to unknown source locations included

### Status
- Potential military and civilian users lining up but no technology insertion program
- CT_Analyst delivered to Chicago OEMC & DC EMA
- Advanced concepts for extended regional coverage being developed
Dragon Eye

- Small Unit reconnaissance and threat detection capabilities.
- Man-portable, 4lb., hand or bungee launched air vehicle, and a Ground Control Station (GCS) to provide command and control and receive the aircraft’s video and GPS position.
- Joint Effort Between NRL and the Marine Corps Warfighting Laboratory.
- Vehicle characteristics will enable an operational capability in adverse weather conditions.
- Autonomous flight capability to allow one-person operation.
- Endurance is 30-60 minutes at 35kt airspeed with an electric propulsion system.
- Interchangeable 1 lb. Modular commercial off-the-shelf components payloads for Dragon Eye include daylight, low light, and infrared imaging systems and robust communications links.
Summary

**Balance**

- Immediate response to Fleet and Homeland Security emerging requirements
- Balance near-term and long-term investments
  - Near-term focus on next Navy and Marine Corps (FNCs and experimentation, Swamp Works, Tech Solutions)
  - Long-term focus on the Navy and Marine Corps After Next (Grand Challenges and National Naval Responsibilities)

**Integration**

- Focus investments to deliver capabilities

**Involvement**

- Maintain broad S&T connections and awareness to avoid surprise and exploit opportunities

**Relevance**

- Invest in high-quality, Naval-unique, and Naval-relevant science
To inspire and guide innovation that will provide technology-based options for future Navy and Marine Corps capabilities…

...and to avoid technological surprise.