Naval Innovation and Disruptive Technology

Lawrence Schuette
Office of Naval Research
Director of Innovation
5 September 2007
larry.schuette@navy.mil
“This Conference seeks to exploit the unique and often contrasting nature of commercial industry and military sponsored science and technology efforts.

Many of the rapidly evolving disruptive technologies will most likely be developed by agile commercial marketplace attributes.

Larger and longer to develop disruptive technologies will probably be championed by the DoD for application as pure national security capabilities.

The Conference seeks to exploit the hybrid situation. Specifically the identification and adaptation of technology products that result in a high end military capability.”

This talk will explain the range of Navy S&T Innovative Technology Programs.
DoN S&T Guidance

**Future Naval Capabilities (FNCs)**
Focused on requirements-driven, transition-oriented thrust areas. Its objective is to provide enabling capabilities to fill identified gaps in Naval Power 21 warfighting and enterprise capabilities identified by OPNAV and MCCDC requirements analyses.

**Innovative Naval Prototypes (INPs)**
...Investments should be planned with the critical mass to achieve a level of maturity suitable for transition within 4-8 years. Programs in this category may be disruptive technologies that, for reasons of high risk or radical departure from established requirements and concepts of operation, are unlikely to survive without top leadership endorsement ... at a greater technological risk than FNCs can accept ...
Navy S&T has a long-term focus but is responsive to near-term Naval needs.
## INPs Compared to Other ONR Programs

<table>
<thead>
<tr>
<th>% of Portfolio</th>
<th>Discovery and Invention</th>
<th>Future Naval Capability</th>
<th>Direct Fleet Support / Quick Reaction</th>
<th>Innovative Naval Prototype</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;40</td>
<td>&gt;30</td>
<td>~10</td>
<td>~10</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Focus</th>
<th>Expanding frontiers of knowledge in areas of naval interest</th>
<th>Transitioning mature S&amp;T to acquisition program of record</th>
<th>Solving emergent fleet / force needs</th>
<th>Demonstrating Leap-ahead technology</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Motivation</th>
<th>General Naval needs and opportunities</th>
<th>OPNAV-identified capability gap</th>
<th>Fleet-identified need</th>
<th>Significant military advantage</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Example</th>
<th>Ocean Acoustics</th>
<th>38 MW water jet for JHSV</th>
<th>IED Jammer</th>
<th>Electromagnetic Railgun</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Innovation</th>
<th>Disruptive or sustaining.</th>
<th>Sustaining - makes an existing capability better</th>
<th>Disruptive or sustaining.</th>
<th>Disruptive - makes an existing capability obsolete</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Time frame</th>
<th>continuing</th>
<th>3-5 years</th>
<th>1-2 years</th>
<th>4-8 years</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Typical TRL entry point</th>
<th>TRL-0</th>
<th>TRL-3</th>
<th>TRL-4 to TRL-5</th>
<th>TRL-2 to TRL-3</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Typical TRL end point</th>
<th>TRL-3 to TRL-4</th>
<th>TRL-6</th>
<th>TRL-7</th>
<th>TRL-6</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Technical Difficulty</th>
<th>High</th>
<th>Medium</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Operational Integration Complexity</th>
<th>N/A</th>
<th>Usually straightforward</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Approval Level to start a program</th>
<th>ONR Department</th>
<th>Technology Oversight Group (3-Star)</th>
<th>ONR Corporate</th>
<th>DON Corporate Board (4-Star)</th>
</tr>
</thead>
</table>
Going From Idea to INP

**Ideas**
- Developed within ONR
- Developed outside ONR
- Developed through workshops and war games

**Submitted**
- Anyone can propose.
- Reviewed by director of innovation and appropriate ONR departments.
- "Heilmeier-like" criteria.
- Input from key stakeholders.
- If promising, undergoes additional review and development as an INP candidate.
- No "pocket veto."

**Concepts**
- Approval by CNR as a viable candidate.
- Technical and operational due diligence by independent examiners.
- Management team established.
- Work toward defined entrance criteria
  - Budget and schedule refinement
  - Technical maturity of key components
  - Preliminary CONOPS
  - Notional Transition strategy

**Candidates**
- CNR Approval
- Corp. Board Approval
- Approved
  - Adequate funds in budget.
  - Entrance exams complete.
  - "Acquisition lite" documentation.
  - Go / no-go reviews and decisions based on defined technical goals at 2-3 year intervals.
  - CONOPS refinement.
  - By final POM cycle before completion, transition plan is established.

**Approved**
- Any time
- 2x per year
- Annually
- *Goal is <1 year from CNR approval to Corp Board approval. Longer wait times may occur due to missing a POM cycle or waiting for outcome of a critical experiment or study.*

**Rejected, delayed, or referred to another process**
- 2 - 8 Months
- 1 - 3 Years*
- 4 - 8 Years

**Going From Idea to INP**

*Goal is <1 year from CNR approval to Corp Board approval. Longer wait times may occur due to missing a POM cycle or waiting for outcome of a critical experiment or study.*
Business Rules

- **Preserve** competition as long as possible within budget, time, and milestone constraints of INP
- Ensure open architecture enables continued competition in acquisition and life cycle phases
- Provide incentive to contractors where possible
- Reduce system and platform costs
- Reduce system and platform life cycle costs
  - Ensure open architecture facilitates future technology insertion and innovation
  - Reduced manning
- Ensure innovation by enabling participation by small and start-up businesses
INP Program Snapshot

Guidance
- Innovative and game-changing.
- High risk, high payoff.
- Useable prototype available at completion.
- Deputy PMs from Acquisition PEOs to facilitate transition.

$991M
Planned / Proposed
FY08-13

Current INPs
- EMRG
- SBE
- TACSAT
- PLUS

FY-10 INPs
- FEL
- INT TOPSIDE
EM Railgun INP

**Relationship to Strategic Plan**

**“Leap Ahead” Characteristics**

<table>
<thead>
<tr>
<th>EMRG</th>
<th>Power Projection</th>
<th>“Leap Ahead” Characteristics</th>
</tr>
</thead>
</table>
|      | Future Naval Fires | • 2 orders of magnitude increase in surface combatant lethality against land targets.  
  |                  | • Replace propellants and energetics with electric power and kinetic energy. |
Tactical Satellite (TACSAT) INP

1) ELINT + SEI + AIS

2) Data Exfiltration

3) Maritime Hyperspectral Imaging (MHSI)

4) Comm-X Demo

<table>
<thead>
<tr>
<th>TACSAT</th>
<th>Relationship to Strategic Plan</th>
<th>“Leap Ahead” Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Maritime Domain Awareness</td>
<td>• Low cost and responsive access to space.</td>
</tr>
<tr>
<td></td>
<td>• Vessel tracking</td>
<td>• Control and tasking by tactical users.</td>
</tr>
<tr>
<td></td>
<td>• Information, Analysis, and Communications</td>
<td>• Advanced sensors and comms</td>
</tr>
</tbody>
</table>
Seabase Enablers INP

T-Craft
Multi-Mode Vehicle Delivery Craft
T-Craft: High Speed Beach-able Transport
40kt in SS-4 with beaching & amphibious mode

Fuel Efficient Self Deployment

Sea Base
High Speed Transit
Fully Amphibious

ISB
2000 – 2500nm

T-Craft Payload Capacity:
Between 4 and 10 M1 Tanks

Good Seakeeping Mode at the Sea Base

25 – 250nm

OBJECTIVE

<table>
<thead>
<tr>
<th>SBE</th>
<th>Relationship to Strategic Plan</th>
<th>“Leap Ahead” Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fleet and Force Sustainment</td>
<td>Radical new approach to amphibious delivery. Combines JHSV and JMAC-like characteristics in one vehicle.</td>
</tr>
</tbody>
</table>
### Persistent Littoral Underwater Surveillance (PLUS) INP

#### Relationship to Strategic Plan

**Assured Access and Hold at Risk**
- ASW, distributed surveillance

#### “Leap Ahead” Characteristics

- Find quiet diesel subs without putting high value platforms at risk
- High end ASW capability embedded in distributed network of low-cost autonomous mobile nodes.
<table>
<thead>
<tr>
<th>FEL</th>
<th>Relationship to Strategic Plan</th>
<th>“Leap Ahead” Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Survivability and Self Defense</td>
<td>• Speed of light weapon trumps speed and maneuverability of threat weapons.</td>
</tr>
<tr>
<td></td>
<td>– Speed of light engagement</td>
<td>• Replace propellants and energetics with directed energy.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Deep magazine.</td>
</tr>
</tbody>
</table>
## FY-10 INP – Integrated Topside

**CVN-76 Mast**

46 to 51 antennas

> 3500 pounds (Ant. Only)

NEW

4 panels, 20 meters\(^2\)

< 1800 pounds

<table>
<thead>
<tr>
<th>Integrated Topside</th>
<th>Relationship to Strategic Plan</th>
<th>“Leap Ahead” Characteristics</th>
</tr>
</thead>
</table>
|                    | • Affordability, Maintainability, and Reliability  
  • Information, Analysis, and Communications | • Dominate the EM Spectrum  
• Multi-function apertures break down barriers between comms, EW, and sensing. |
## INPs in the Pipeline

<table>
<thead>
<tr>
<th>Technology at Appropriate Level</th>
<th>Programmatic Defined</th>
<th>Game Changer</th>
<th>Outreach / Due Diligence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Connector for Distributed Ops</strong></td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Compact Directed Energy System for Air Platforms</strong></td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Free Electron Laser</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>High bandwidth comms with submerged submarines and UUVs</strong></td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Integrated Topside</strong></td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Persistent Air Platform</strong></td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Radically Augmented Human Performance</strong></td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Submarine Advanced Propulsion</strong></td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Supercavitating Weapon</strong></td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Super Endurance Aircraft Propulsion</strong></td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>UV Sentry System</strong></td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td><strong>WMD Standoff Detection</strong></td>
<td>N</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

... Your Ideas for new INPs?
Questions?
Ideas?
larry.schuette@navy.mil