Large Displacement Unmanned Undersea Vehicle Innovative Naval Prototype Industry Day

March 10th, 2011
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
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<tbody>
<tr>
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The Office of Naval Research invests in innovative operational concepts to develop the science and technology (S&T) that ensures our warfighters always have the technological edge.

ONR Mission — “to plan, foster, and encourage scientific research in recognition of its paramount importance to future Naval power and national security.” — Public Law 588 of 1946
Autonomy and Unmanned System Research span:

- Across the Resource Allocation Portfolio
- Part of each Focus Area of the S&T Strategic Plan
ONR Code 32
Areas of Responsibility

ASW
Operational Environments
MCM

Marine Mammals

UUVs

Research Vessels
1300-1310  Introductions and ONR Overview
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1600-1620  How to do Business with ONR
1620-1630  Conclusions
LDUUV INP Industry Day

Importance of Innovation

Dr. Larry Schuette

ONR Director of Innovation
The Innovative Challenge

• It is time to be innovative
• It is time to look outside of the box
• **YOU** are the game changer
  • Don’t be conservative with your ideas
  • Seek out new partnerships
  • Be diverse in your perspectives
  • We want an EMRG like response

What you propose will help define what is possible for not only LD UUV but also the Navy as a whole
Agenda

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Sharpening the Edge
Serving the Next Generation Warfighter ... Now

LDUUV INP Industry Day
Administration Process

Daniel Deitz
Code 321
ONR UUV Energy Industry Day Questions/Comments

- MUST use template
- One (1) question/comment per form
- MUST submit to the following email address: IndustryDayQuestionsLargeUUVS&T@onr.navy.mil

Responses to Questions/Comments will NOT be sent to individuals or posted online

- Questions/Comments will be used to refine the anticipated opportunity announcement (BAA)
- That BAA will provide an additional opportunity for questions, with responses to those questions published as described in the BAA

Deadline for Industry Day question submittal: 0900 March 16, 2011
Program Funding

• Unable to discuss funding/budgets at this time due to government budget process
  • Information on available funds will be provided in the published BAA(s)

• ONR is looking for the best value with regards to this research

Information within this briefing reflects our anticipated needs

Information in any subsequently published BAA(s) will supersede any information in this brief
Program Eligibility

- UUV technologies are on the US Munitions List, and therefore may have ITAR restrictions

- All Key Personnel must be U.S. Citizens

- Proposers must possess an active PKI certificate (ECA) from 30 days after contract award through the duration of the performance period
  - Will be required for access to a secure sharing web site for report and briefing materials submission
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<tr>
<td>Pre-Proposal Conference/Industry Day</td>
<td>03/10/2011</td>
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<tr>
<td>Briefs Available for Review</td>
<td>1200 03/11/2011 EST</td>
</tr>
<tr>
<td>Industry Day Questions/Comments Due</td>
<td>0900 03/16/2011 EST</td>
</tr>
<tr>
<td>Time</td>
<td>Topic</td>
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PMS 406 Mission Statement

Mission: Develop, acquire, deliver, and maintain operationally effective Unmanned Maritime Systems (UMS)

Joining Traditional Acquisition with Advanced Development
Unmanned Maritime Systems Portfolio

- **UISS**
- **ASW USV**
- **Seafox USV**
- **BPAUV**
- **SMCM UUV UOES 1 & 2**
- **SMCM UUV**
- **Large Displacement UUV**
- **UISS Increment 2**
- **MUSCL UOES**

Acquire, deliver, and maintain operationally effective Unmanned Maritime Systems (UMS) as fully functional and integrated systems for the war fighter, and to direct UMS experimentation and technology maturation to develop future UMS capability.
Summary

- Unmanned Systems will be an integrated part of our Force (CNOG 2011)

- UxVs remain high SecNav and CNO priorities

- Close coordination between ONR/OPNAV/PMS 406 is necessary for timely transition to POR

We need to instill within the Navy an urgency that UNMANNED MARITIME SYSTEMS are CRITICAL to the NAVY’S FUTURE
Agenda

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UUV Technology Strategy

Objectives:

- Multidisciplinary Research
  - New ideas, biomimetics, SBIR
- Basic & Applied Efforts
  - Mature component technologies
  - Autonomy
  - Feasibility of systems concepts
- Mission-Oriented Technology Demonstrations
**ONR Investment history leading to ocean gliders**
- Drifting ocean samplers 1950-1990 (SOFAR, RAFOS, ALACE)
- Vertically profiling drifting samplers 1990s (P-ALACE, ARGO)
- Powered vehicles matured in 1990s (AutoSub, REMUS, SAHRV)

**Ocean Gliders developed in late 1990s**
- Steerable through pitch, roll and buoyancy changes - vertically soaring
- Deployed globally – Labrador Sea, Gulf of Alaska, PAC, LANT, Cross Kuroshio, Gulf Stream
- Average mission time 3 - 4 months, max to date 7 months

**Ocean Gliders demonstrated in RIMPAC 04, TASWEX 04, SMART SEARCH 05, TASWEX 05, RIMPAC 06, VALIANT SHIELD 07, RIMPAC 08**
- T-AGS, small boat, contract vessel launch/recovery
- USS Buffalo (SSN 715) launch via DDS
- Progressively increasing complexity/numbers, sensors

**Significant improvement in Battlespace characterization**

**OSD, ONR, SPAWAR TTI Funded to accelerate transition**
- Navy Glider Consortium refining designs
- Providing CNMOC 6 hardened prototypes (3 FY07, 3 FY08)
- Signed TTA - OPNAV N84, ONR, SPAWAR PMW-180 and CNMOC
- CNMOC purchased 12 R&D variant Gliders for FY07-FY09
- Operator training, sampling strategies, C2, CONOPS refinement
- Oceanographer of the Navy N2/N6F5

**Littoral Battlespace Sensing POR- purchase of 150 Gliders by FY12**

**Rapid Transition – Ocean Gliders**
an example of S&T to Fleet use

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S&T Developments in Man Portable and Light Weight UUVs Technology

**Improved Navigation**
- Low power INUs for UUVs
- USBL Navigation
- Robust DVL/ADCP
- Low Power Navigation
- FBN

**Platform Improvements**
- Net Cutting
- Autonomous Recovery
- Forward Fin Module
- Hovering Module
- Anchor Module
- Ballast Module
- Payload Delivery Modules

**Control & Autonomy**
- UUV JAUS Standards
- ASTM F41 Architecture
- Hierarchy Autonomy
- Behavior Autonomy
- Obstacle Avoidance
- Onboard CAD/CAC
- Anti-Tamper
- CfN Mission Planning
- Precision Positioning

**Modularity**
- Standard Interfaces
- Flooded or Dry Payload Sections
- Expandable Payloads

**Launch & Recovery**
- USV L&R
- Autonomous RHIB L&R
- Ship L&R
- Submerged L&R / Docking Station

**Communications**
- Acoustic Comms
- Fast RF Comms

**Sensors**
- Marine Sonics DF Sidescan
- EdgeTech Sidescan
- SSAM DF
- RTG / LSG
- ASW
- ATLAS FLS
- LF sensors
- Video w/LED Bar
- Blazed Array Sensors
- Environmental Sensors
- Chemical Sensors
- BOSS

**Propulsion**
- Low Noise & Power Motors

**Power Systems**
- Li Ion Batteries
- Safe Pressure Tolerant Li Ion Batteries
- High Endurance Power Tow Module

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Importance Of Large UUVs

The Chief of Naval Operations is planning a major push toward unmanned underwater vehicles with high stamina

Inside the Navy - 10/18/2010

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# Large UUVs

## Missions:
- Persistent ISR
- ASW Hold at Risk
- Long Range Oceanography (future)
- Payload Delivery (MIW, ASW, SOF, EOD, TCS)

<table>
<thead>
<tr>
<th>Class</th>
<th>Diameter (inches)</th>
<th>Displacement (lbs.)</th>
<th>Endurance High Hotel Load (hours)</th>
<th>Endurance Low Hotel Load (hours)</th>
<th>Payload (ft³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Man-Portable</td>
<td>3 - 9</td>
<td>&lt; 100</td>
<td>&lt; 10</td>
<td>10 - 20</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td>LWV</td>
<td>12.75</td>
<td>~ 500</td>
<td>10 - 20</td>
<td>20 - 40</td>
<td>1 - 3</td>
</tr>
<tr>
<td>HWV</td>
<td>21</td>
<td>&lt; 3,000</td>
<td>20 - 50</td>
<td>40 - 80</td>
<td>4 - 6</td>
</tr>
<tr>
<td>Large</td>
<td>&gt; 36</td>
<td>~ 20,000</td>
<td>100 - 300</td>
<td>&gt;&gt; 400</td>
<td>15 - 30 + External Stores</td>
</tr>
</tbody>
</table>

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Product Description:
• Reliable Long Endurance UUV capable of 60+ days of operation in the Littorals
• Program will develop the needed Autonomy, Energy, and Core UUV systems to operate in complex ocean environment near harbors, shore, and high surface traffic locations

Key Program Goals
• 5x – 10x Current UUV Energy Density
• Autonomous in the Littorals:
  • Open Architecture
  • Open Ocean/Over the Horizon Operations

Warfighting Payoff:
• Enables realization of fully autonomous UUVs operating in complex near shore environments to increase capability
• Cost effectively closes war fighter capability and capacity gaps in critical mission areas
• Extends and multiplies the reach of the platform into denied areas and reduces platform vulnerability
Develop leap ahead capability in UUV Technologies in:

- Energy Systems
- Autonomy (operate in the Littorals)
- Endurance Technologies
The BAA will have three sections:

- Energy Systems
- Autonomy (operate in the Littorals)
- Endurance Technologies

Each of the three sections will be evaluated separately. You may propose to one or multiple sections of the BAA. If an organization proposes to multiple sections of the BAA, a separate proposal is needed for each section. Proposals must clearly mark which section they are proposing to and follow the BAA guidelines for that section. A single proposal for the entire BAA will be considered non-responsive.

An organization may propose to a component or all components in each section.

ONR is focused on finding the best technologies available. Therefore, this BAA will focus on component technology proposal and not system level proposal.
Energy Systems

• UUVs will need more power than current batteries technology can provide
• New technologies (fuel cells and combustors) offer additional energy density over batteries
• Goal of 1000 Whrs/liter

Significant unique S&T challenges to meeting UV power source requirements include:

• air-independent operation (have to carry oxidizer)
• long endurance (40+ hours up to 30 days)
• rapid, safe refuelability
• maintain stealth (low/no signature)
• environmentally friendly (fuels and oxidizers)
• weight/volume constraints
• buoyancy
• quick start-up
• cost effective

Specific energy, Wh/kg
Autonomy

Environmental Complexity
Increased complexity in:
- Terrain/bathymetry variation
- Object frequency, density, intent
- Weather variations
- Mobility constraints
- Communication dependencies

Human Interaction
- Type of operators/users (workload, skill levels, etc.)
- Frequency, duration, robot initiated interactions
- Decreased level of situational awareness

World Ocean Traffic

Littoral Traffic Density

Current Gliders and MCM UUVs

LD UUV Littoral Missions

Mission Complexity
- Subtasks, decision making
- Organization, collaboration
- Performance
- Vehicle knowledge requirements

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Endurance Technologies

- Reduced Power
- Reduced Biological Growth
- Reliability
- Open Architecture
"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
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Energy System for Large Displacement Unmanned Undersea Vehicle Innovative Naval Prototype (INP)

Industry Day Briefing

Dr. Michele Anderson
Program Officer
ONR Code 33

Ms. Maria Medeiros
Program Officer
ONR Code 33
Background

• Current and future Naval UUVs$^1$ require longer endurance: days or months
• High Energy density batteries are insufficient
• Solutions beyond battery-only technology capabilities are required

1 – This refers to propelled vehicles, not gliders
LD UUV INP Program Research Opportunity

- Develop and demonstrate energy dense air-independent, rechargeable/refuelable energy system technologies for a 120” energy section length capable of the threshold and objective metrics outlined below
- The program is expected to employ a phased approach to achieve a Technology Readiness Level (TRL) of 6 by the end of the program

<table>
<thead>
<tr>
<th></th>
<th>Threshold Metrics</th>
<th>Objective Metrics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Section Length</td>
<td>304.8 cm (120”)</td>
<td>304.8 cm (120”)</td>
</tr>
<tr>
<td>Energy Volume (liter)</td>
<td>2043¹.</td>
<td>2043¹.</td>
</tr>
<tr>
<td>106.7 cm (42.0”) (ID) x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>304.8 cm (120”) (Length)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Note 1. Estimated available volume</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy Mass (kg) w/o hull &amp; bulkhead</td>
<td>2043 (neutrally buoyant)</td>
<td>2043 (neutrally buoyant)</td>
</tr>
<tr>
<td>Energy (kWh)</td>
<td>817²</td>
<td>1800²</td>
</tr>
<tr>
<td><em>Note 2. Includes ~10% reserve</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration (hrs)</td>
<td>46 Days (1104 Hrs)</td>
<td>70 Days (1680 Hrs)</td>
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Program Plan

- Multiple awards are anticipated in the form of Indefinite Delivery/ Indefinite Quantity (IDIQ) contracts
- Program duration for the energy portion of the INP comprises four years- from FY12 to FY15
- Additional time (INP ends in FY16) will go towards vehicle integration and in water testing

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<th>Phase</th>
<th>Time Period</th>
<th>Metric</th>
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<td>Phase I</td>
<td>24 months</td>
<td>Must reach TRL-4 (Component and/ or breadboard validation in laboratory environment)</td>
</tr>
<tr>
<td>Phase II</td>
<td>24 months</td>
<td>Must Reach TRL-6 (System/subsystem model or prototype demonstration in a relevant environment)</td>
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Program Eligibility

- UUV Energy is on the US munitions list, and therefore may have ITAR restrictions
  - All Key Personnel must be U.S. Citizens

- Proposers must possess an active PKI certificate (ECA) from 30 days after contract award through the duration of the performance period
  - Will be required for access to a secure sharing web site for report and briefing materials submission
Phase I Objectives

- **Performance period 24 months in duration**
  - Conduct subscale (>40% peak power) component and/or full-scale critical component and integration testing and analysis as a basis to meet at a minimum the THRESHOLD metrics and the THRESHOLD mission profile at a TRL 4 system level demonstration
  - Develop a preliminary Energy System 3D Solid Model demonstrating attainment of the performance specifications
  - Provide a development plan that addresses how the desired performance and environmental metrics will be met
  - Generate a table listing the weights and volumes of all the representative full-system energy section components, TRLs of the subcomponents, and necessary Balance of Plant (BOP) items
  - Conduct a Preliminary Hazards Analysis
Phase II Objectives

• Performance period 24 months in duration
  – Projects have at least met THRESHOLD metrics
  – Likelihood to meet OBJECTIVE metrics and OBJECTIVE
    mission profile
  – TRL-6 land based demonstration in a UUV energy section
    hull
    • A full scale UUV Energy Section hull and interface
      documentation will be provided by the government
  – Conduct a Critical Design Review (CDR)
  – Develop all necessary Standard Operating Procedures
    (SOPs), maintenance schedules, drawings, and parts list for
    the energy system
### Program Goals

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<td>106.7 cm (42.0”) × 304.8 cm (120”)</td>
<td>2043¹</td>
</tr>
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<td></td>
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## Additional Desired Metrics

<table>
<thead>
<tr>
<th>Specification</th>
<th>Metric</th>
</tr>
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<tbody>
<tr>
<td>Platform Diameter Size</td>
<td>106.7 cm (42” ID)</td>
</tr>
<tr>
<td>Energy Density</td>
<td>400-900 Wh/liter, neutrally buoyant</td>
</tr>
<tr>
<td>Endurance</td>
<td>≥ 1000 hours</td>
</tr>
<tr>
<td>Start/Stop Cycles</td>
<td>5 hibernation cycles</td>
</tr>
<tr>
<td>Refuelability</td>
<td>Yes</td>
</tr>
<tr>
<td>Scalable</td>
<td>Yes, up to 152.4 cm (60”) dia. And 120 days (2880 hrs) continuous operation</td>
</tr>
<tr>
<td>Open vs. Closed Cycle</td>
<td>Closed</td>
</tr>
<tr>
<td>Operating Depth</td>
<td>304.8 M (1000’) (depth independent desirable)</td>
</tr>
<tr>
<td>Power Profile</td>
<td>To Be Provided</td>
</tr>
<tr>
<td>Power Transients</td>
<td>Threshold: 2 hrs continuous operation at peak power. Objective: 4 hrs continuous operation at peak power.</td>
</tr>
<tr>
<td>Safety Considerations</td>
<td>For demonstration commercial ship safety consideration</td>
</tr>
<tr>
<td>Peak Power</td>
<td>To Be Provided</td>
</tr>
<tr>
<td>Power Quality</td>
<td>To Be Provided</td>
</tr>
<tr>
<td>Orientation: Roll, Pitch</td>
<td>±45 Degrees (operation), ±90 Degrees (storage, pitch only)</td>
</tr>
<tr>
<td>Refueling Turn-around Time</td>
<td>24 hrs</td>
</tr>
<tr>
<td>Maintenance Specifications</td>
<td>To Be Provided</td>
</tr>
<tr>
<td>Safety</td>
<td>To Be Provided</td>
</tr>
<tr>
<td>Key Interfaces</td>
<td>To Be Provided</td>
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</table>
# Environmental Metrics

## Specification | Metric

### Environment (Operating Conditions)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Salinity</strong></td>
<td>0 to 50 parts per thousand (ppt)</td>
</tr>
<tr>
<td><strong>Salinity Variation</strong></td>
<td>± 10 ppt during a single sortie</td>
</tr>
<tr>
<td><strong>Water Temperature</strong></td>
<td>-1.1°C – 35.0°C (30°F to 95°F)</td>
</tr>
<tr>
<td><strong>Air Temperature</strong></td>
<td>-28.9°C to 50°C (-20°F to 122°F)</td>
</tr>
<tr>
<td><strong>Temperature Shock</strong></td>
<td>-28.9°C to 50°C (-20°F to 122°F)</td>
</tr>
<tr>
<td><strong>Shipboard Shock</strong></td>
<td>MIL-S-901D (Grade B) while secured to transportation pallet</td>
</tr>
<tr>
<td><strong>Shipboard Vibration</strong></td>
<td>MIL-STD-167-1</td>
</tr>
<tr>
<td><strong>Humidity</strong></td>
<td>0-100 % relative humidity</td>
</tr>
<tr>
<td><strong>Salt Fog</strong></td>
<td>Marine Environment</td>
</tr>
<tr>
<td><strong>Fungus</strong></td>
<td>Avoid Materials that promote fungal growth</td>
</tr>
<tr>
<td><strong>Icing/Freezing Rain</strong></td>
<td>Operate where icing may occur from sea splash/spray</td>
</tr>
<tr>
<td><strong>Electromagnetic Environment</strong></td>
<td>MIL-STD-461F (RE101, RE102, RS101, RS103)</td>
</tr>
</tbody>
</table>

### Environment (Non Operating Conditions)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transportation Altitude</strong></td>
<td>0 to 12,192 M(0-40,000 ft) (pressurized or non-pressurized)</td>
</tr>
<tr>
<td><strong>Transportation &amp; Storage Temperature</strong></td>
<td>-40.0°C to 108.9°C (-40°F to 160°F)</td>
</tr>
<tr>
<td><strong>Transportation Shock &amp; Vibration</strong></td>
<td>Withstand ground, air, rail, ship transport (MIL-STD-1366E guidance)</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>Long-term maintenance-free storage (minimum 6 months)</td>
</tr>
</tbody>
</table>

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited
• Phase I should achieve this profile at a minimum TRL-4 in a bench-top demonstration
• Tabular profile of data will also be provided in the BAA
Objective Mission Profile

- Phase II should achieve this profile at TRL-6 in a land-based UUV energy section demonstration.
- Tabular profile of data will also be provided in the BAA.

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.
Summary

- Slides from today’s briefings will be posted by noon EST 11 March 2011 on FedBizOps & the ONR web site
- Any upcoming BAA will be posted on FedBizOps & the ONR web site
- Industry Day questions
  - MUST use template available at FedBizOps & the ONR web site
  - MUST submit to the following e-mail address: IndustryDayQuestionsLargeUUVS&T@ONR.navy.mil
  - Deadline for Industry Day question submittal: March 16, 2011 by 0900 EST
An embedded link to the Question Template has been included here.

Please remember that all questions must use this format when submitted to: IndustryDayQuestionsLargeUUVS&T@ONR.navy.mil

Deadline for Industry Day Question submittal: 0900 March 16th, 2011
## Technology Readiness Levels

<table>
<thead>
<tr>
<th>Technology Readiness Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRL 1</td>
<td>Lowest Level of Technology Readiness. Scientific Research Begins to Be Translated Into Technology’s Basic Properties.</td>
</tr>
<tr>
<td>TRL 2</td>
<td>Active Research and Development Is Initiated. This Includes Analytical and Laboratory Studies to Physically Validate Analytical Predictions of Separate Elements of Technology.</td>
</tr>
<tr>
<td>TRL 4</td>
<td>Basic Technology Components Are Integrated to Establish That the Pieces Will Work Together.</td>
</tr>
<tr>
<td>TRL 5</td>
<td>Fidelity of Breadboard Technology Increases Significantly Enough to Justify Being Ready for Testing in a Simulated Environment.</td>
</tr>
<tr>
<td>TRL 6</td>
<td>Prototype Near or at Planned Operational System. Major Step From Level 6, Requiring the Demonstration of an Actual Prototype in an Operational Environment.</td>
</tr>
<tr>
<td>TRL 7</td>
<td>Representative Model or Prototype System, Which Is Well Beyond the Breadboard Tested 5 Is Tested in a Relevant Environment.</td>
</tr>
<tr>
<td>TRL 8</td>
<td>Technology Has Been Proven to Work in It’s Final Form and Under Expected Conditions.</td>
</tr>
<tr>
<td>TRL 9</td>
<td>Actual Application of the Technology in It’s Final Form and Under Mission Conditions.</td>
</tr>
</tbody>
</table>

**System Test, Launch & Operations**

**System/Subsystem Development**

**Technology Demonstration**

**Technology Development**

**Research to Prove Feasibility**

**Basic Technology Research**
<table>
<thead>
<tr>
<th>Reference</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>DI-SAFT 80101B</td>
<td><a href="https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=209470">https://assist.daps.dla.mil/quicksearch/basic_profile.cfm?ident_number=209470</a></td>
</tr>
<tr>
<td>Mil-S-901D (Grade B)</td>
<td><a href="http://www.assistdocs.com/search/document_details.cfm?ident_number=2640&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DS%2D901D&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC">http://www.assistdocs.com/search/document_details.cfm?ident_number=2640&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DS%2D901D&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC</a></td>
</tr>
<tr>
<td>Mil-STD-167-1</td>
<td><a href="http://www.assistdocs.com/search/document_details.cfm?ident_number=35544&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D167%2D1&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC">http://www.assistdocs.com/search/document_details.cfm?ident_number=35544&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D167%2D1&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC</a></td>
</tr>
<tr>
<td>Mil-STD-461 (RE101,RE102,RS101,RS103)</td>
<td><a href="http://www.assistdocs.com/search/document_details.cfm?ident_number=35789&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D461&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC">http://www.assistdocs.com/search/document_details.cfm?ident_number=35789&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D461&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC</a></td>
</tr>
<tr>
<td>Mil-STD-1366E</td>
<td><a href="http://www.assistdocs.com/search/document_details.cfm?ident_number=35789&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D461&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC">http://www.assistdocs.com/search/document_details.cfm?ident_number=35789&amp;StartRow=1&amp;PaginatorPageNumber=1&amp;doc%5Fid=MIL%2DSTD%2D461&amp;status%5Fall=ON&amp;search%5Fmethod=BASIC</a></td>
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Agenda

1300-1310  Introductions and ONR Overview
1310-1330  Director of Innovation Overview
1330-1340  Admin Process
1340-1400  Requirements Overview
1400-1420  PMS 406 Acquisition Overview
1420-1440  Break
1440-1500  Large UUV Science and Technology
1500-1520  Large UUV Power and Energy
1520-1540  Large UUV Autonomy
1540-1600  Large UUV Endurance Technologies
1600-1620  How to do Business with ONR
1620-1630  Conclusions
ONR’s Goal for Autonomy

- Provide new capabilities to expand Naval forces
- Increase survivability of systems
- Enable faster decisions than the adversary can endure
- Reduce:
  - Personnel to operate UxVs
  - Comms requirements of UxVs
  - Cognitive load on warfighter

Missions driven from Navy and OSD Guidance

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited
Key Naval UxV Autonomy Challenges

- Operations in Diverse Littoral Environments
- Increased User skills needed to operate UxVs
- Limited Communication Connectivity with UxVs
- Complex missions with heterogeneous platforms requires increased Autonomy
- Rapid and dynamic responses needed to meet user requests in a complex operating space
Why is this a Hard Problem?

Mission Complexity
- Subtasks, decision making
- Organization, collaboration
- Performance
- Vehicle knowledge requirements

Environmental Complexity
- Increased complexity in:
  - Terrain/bathymetry variation
  - Object frequency, density, intent
  - Weather variations
  - Mobility constraints
  - Communication dependencies

Human Interaction
- Type of operators/users (workload, skill levels, etc.)
- Frequency, duration, robot initiated interactions
- Decreased level of situational awareness

Current Gliders and MCM UUVs

LD UUV Littoral Missions

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited
LDUUV Autonomy High Level Goals

• Natural interaction with unmanned systems
• Reduction of information the users process from unmanned systems
• Increases autonomy to allow seamless interaction between manned platforms and unmanned vehicles
• Dynamically varying levels of autonomy depending on environment
LDUUV Autonomy Components

**Mission Planning**
- Located in an shore Based operation Center or Onboard Platform
- Primary User interface with the LDUUV
- Initiates Mission plans including onboard autonomy settings
- Monitors LDUUV status
- Fuses other Navy information and LDUUV information

**On Vehicles (Mission Controller)**
- Runs real time onboard the LDUUV
- Adapts the LDUUUV plan to current environment
- Interfaces with the LDUUV Vehicle Controller (as per ASTM F41)
We anticipate proposals should contain the following information:
• Technical Approach - a description of how you would solve the problem and what capabilities to the LDUUV it would provide
  • Algorithms description
  • Sensors
  • Development Plan
• Power required for proposed approach
• Open Architecture – how does the proposed solution meet Navy Open Architecture desires?
• Past Performance
• Personnel Qualification
• Cost
Autonomy Capabilities

Autonomous Obstacle Avoidance - describe how the LDUUV will sense obstacles and methods to plan around them in the littorals

• Below Water obstacle avoidance
  • In water Column obstacles (mammals, submerged debris, …)
  • Bottom obstacles (cliffs, Sea mountains, man made structures, …)

• Above-water obstacles
  • Stationary above water obstacles (piers, sea walls, moorings, debris…)
  • Moving above-water obstacles (ships, personal watercraft,
Fishing detection and avoidance - propose technology solution to detect fishing activity, fishing nets, and the algorithms to avoid the activity.

- Fishing Activity
- Fishing Nets
- Dredging activity

Optimized Route Planning - Adapting to the environment and planning the route to reduce energy consumption

Note: one may propose on one or all aspects of Autonomy Capabilities.
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LDUUV INP Industry Day
Large UUV Endurance Technologies

Daniel Deitz
ONR 321
Large UUV Endurance

The Chief of Naval Operations is planning a major push toward unmanned underwater vehicles with high stamina

Inside the Navy - 10/18/2010
Endurance Issues

Fixing a broken component can be difficult on an unmanned system?

Current Repair bots

Science Fiction Repair bots

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited
Endurance Issues

Scarlet Night was piloted by Rutgers to be the first undersea Glider to cross the Atlantic
• Anticipated journey of 240 days
• Bio growths was seen on the hull of the vehicle

Biological growth and marine mammals can have significant impacts on UUV endurance

http://rucool.marine.rutgers.edu/atlantic/about_atlantic.html
1. Reduce power draw of core vehicle system to maximize Endurance
   - Low power processors technology
   - Low power sensors with new materials technology
   - New components with increased efficiency
   - Reduction of Biological Growth technologies

2. Increase reliability of the LDUUV system to be operate for 3 months without need for maintenance
   - Technology for increased reliability of components
   - New UUV architecture tolerant of component failure
     - Backup systems
     - Smart system for early prediction of failures
     - Other solutions

Goal: 3 months of operations without maintenance of the UUV
Endurance Factors

We anticipate proposals should contain the following information:
• Technical Approach - a description of how you would solve the problem and what capabilities to the LDUUV it would provide
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Large Unmanned Undersea Vehicle (UUV) Science and Technology

Contracting Information
Industry Day
10 March 2011

Chris Williamson
ONR Code 0252
703-696-6774
New Format

- Proposals submitted in response to ONR FY11 BAAs are required to use the Technical and Cost Proposal Template and Cost Proposal Spreadsheet located at:

Proposal Reminders

• Tips:

– Statement of work must be severable and self-standing without any proprietary restrictions

– Base and option periods must be priced separately. No un-priced options will be accepted.

– If applicable, provide signed copies of Data Rights Assertions with the proposal.
Proposal Reminders

– Offeror should have a DCAA or DCMA approved accounting system by time of award. Audits of purchasing and estimating systems should be current, if applicable.

– Offeror must be registered in Central Contractor Registry

– Offeror must complete on-line representations and certifications application at: https://orca.bpn.gov/
Proposal Reminders

– Offeror must also complete ONR contract-specific representations and certifications at:

– For any offeror that is a large business, university or nonprofit institution AND proposes costs greater than $650,000:
  • Provide a small business subcontracting plan
Proposal Reminders

– Submit signed consultant agreements showing hours, rates, statement of work.

– Provide supporting documentation for any proposed materials and/or equipment. Give plenty of details for proposed travel.

– Ensure current direct labor rates and indirect rates are on file at DCAA.
Subcontracts

- Certified cost or pricing data required for subcontractor proposals over $700,000.

- Subcontract proposal, along with supporting documentation (including direct/indirect rates), must be provided.
Fee – Weighted Guidelines

• Method focuses on four profit factors—
  – Performance risk
    • Technical--the technical uncertainties of performance.
    • Management/cost control--the degree of management effort necessary--
      – (i) To ensure that contract requirements are met; and
      – (ii) To reduce and control costs.
  – Contract type risk
    – Facilities capital employed (looks at capital investment -land, buildings, equipment)
    – Cost efficiency (incentive to reduce costs; looks at initiatives and prior successes
  • Anticipate revision to Guidelines – more focus on actual performance in managing costs
Wrap-Up

• Responses to BAA questions will be provided on FedBizOps, grants.gov, and the ONR website (www.onr.navy.mil)

• If there are discrepancies between this Industry Day brief and the BAA, the BAA/Special Notice takes precedence

• ONR Dir of Small Business: Brenda.pickett@navy.mil.