

**BROAD AGENCY ANNOUNCEMENT**  
**No-Touch Geophysical Strength Properties**  
**for**  
**Navy Autonomous Underwater Vehicles (AUV)**  
**And Remotely Operated Vehicle (ROV) Systems**

**1.0 BACKGROUND**

The Naval Facilities Engineering Service Center (NAVFAC ESC) provides ocean engineering program management and technical services to the U.S. Navy for matters regarding seafloor geotechnical engineering. This announcement seeks out technologies and methodologies to determine several geotechnical properties of the seafloor through remote sensing techniques.

Relevant to note is that several sensors currently provide limited geotechnical information without requiring direct contact with the seafloor. Sub-Bottom Profiling, swath bathymetry, electro-resistivity, seismic refraction, and electromagnetic sensors are all examples of these techniques, several which are frequently utilized with Autonomous Underwater Vehicles (AUV's) and Remotely Operated Vehicles (ROV's).

While many of these sensors provide information on bottom topography and sub-surface layering, no capability currently exists to utilize those approaches—or a combination of approaches—to estimate seafloor strength or sediment classification. In addition to potential solutions based on such aforementioned existing technologies, this announcement seeks out emerging/developing technologies that may be deemed more appropriate for the subject application.

Proposals will be selected for award, consistent with the availability of Government funding and based on the evaluation criteria as described in section 6.0. The availability of Government funding is dependent upon many factors. Currently, the estimated timeline for the subject award is somewhere in the period of the second quarter of FY-2012.

The Government understands the associated impacts, uncertainties, and changes that occur over time; and the potential that the proposals received may need to be updated for current cost information at the time of award.

**2.0 DESCRIPTION**

This announcement constitutes a Broad Agency Announcement (BAA) for the Naval Facilities Engineering Service Center (NAVFAC ESC) under FAR 6.102(d)(2). This announcement is open for 45 days from publication. The white paper must be submitted by 7 DEC 2011 at 12:00 pm Pacific Daylight Time (PDT). Feedback will be provided on each submission no later than one month after receipt, 12:00 pm PDT. Those invited to submit full proposals will be required to submit a full proposal no later than 10 FEB 2012 at 12:00 pm PDT.

The evaluation of the responses to this announcement will be conducted in two (2) phases:

- PHASE 1 gives the offeror the opportunity to submit a white paper. White papers will be reviewed, and formal technical and cost proposals may be requested from sources whose approaches are selected for further consideration. The purpose of the white paper is to preclude unwarranted effort on the part of an offeror whose work is not of interest under this announcement. However, if an offeror chooses, they can submit a full proposal even if advised of low government interest in the white paper. The white papers shall consist of the details/information outlined in the attached White Paper and/or Proposal Submission Instructions.
- PHASE 2 is the proposal submission, evaluation and award phase. A Government evaluation team will review all eligible proposals, and evaluate and rate each proposal against the evaluation criteria set forth in this announcement see section 6.0.

This announcement seeks out technologies and methodologies used to autonomously collect geotechnical data and use it to deduce geotechnical properties of the seafloor. This data must be collected without direct physical interface to the seafloor in the specific mission area of interest. It is assumed that the sensor utilized will not require a physical interface with the seafloor.

Note that this announcement seeks a demonstration and proof of concept that would best satisfy the performance requirements. Said demonstration would not require development of a self-contained prototype capable of being utilized in the field; only demonstration of a working instrument that collects and processes the data to provide the required geotechnical information.

Geophysical properties to be collected include: surface sediment classification, layering of sediments up to five meters below the surface, porosity, consistency, and a reasonable estimate of drained and un-drained soil shear strength.

This technology or methodology would ultimately be operated aboard a NAVY shipboard environment. The term “shipboard environment” is meant to encompass operations from Navy, Military Sealift Command (MSC), and commercial platforms. The term “autonomously collect” is used to signify that the system should be stand-alone, with the potential to be deployed as a module aboard an AUV or ROV system.

To be eligible for consideration and possible contract award, the technology or methodology shall be in either basic research (Category 6.1), applied research (Category 6.2), advanced technology development not for a specific system/hardware (Category 6.3A), or demonstration and validation (Category 6.3B). Furthermore, the technology or methodology shall address the performance areas cited in section 3.0.

### 3.0 PERFORMANCE REQUIRMENTS

The baseline Navy hardware requirements are as follows:

Note: specific information regarding the geotechnical parameters (including definitions, calculations, tests, and standards) can be found in the “*Handbook for Marine Geotechnical Engineering*” by the Naval Facilities Engineering Service Center [1]. The handbook is available for free download at [www.dtic.mil](http://www.dtic.mil).

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Download URL: <http://handle.dtic.mil/100.2/ADA541417>

- At minimum the sensor-suite must be able to characterize seafloor surface soil characteristics. See Figure 1 for an example.

- Targeted soil classification levels: *See section 3.2 of Reference [1] for specific soil classifications.*

- Clay
- Silt
- Sand
- Gravel
- Cobbles
- Boulders
- Bedrock

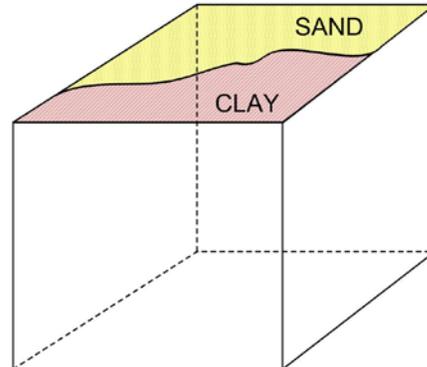


Figure 1: Example of Surface Soil Classification

- It is required that the sensor detects the thickness of sediment layers up to five (5) meters (maximum) below the surface of the seafloor.
  - Results will show bedding or layering.

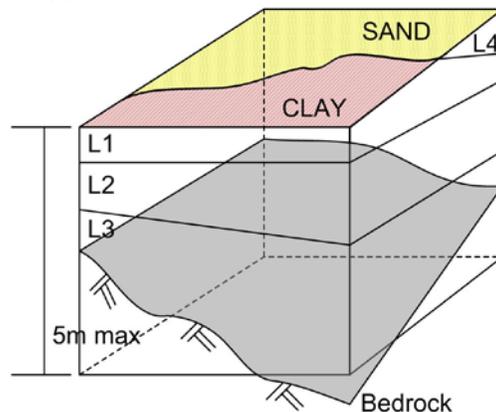


Figure 2: Example of sediment layering

- It is desired that the sensor obtain one or more of the following targeted soil characteristics:
  - Consistency (soft/loose, stiff/dense, hard/very-dense); see figure 3
  - Subsurface soil types (clay, silt, sand, gravel, cobbles, boulders and bedrock) be defined in the different layers; see figure 4
  - Porosity, Void Ratio, Bulk Density (see section 4.3.6.2 of [1]), and/or water content (see section 3.3.3 of [1]); see figure 5
  - Drained and Un-drained soil shear strength (see section 3.4 of [1]) with:
    - Level of uncertainty defined by a coefficient of variation
    - Goal: accuracy approaching +/- 1 K-Pascal (kPA); see figure 6

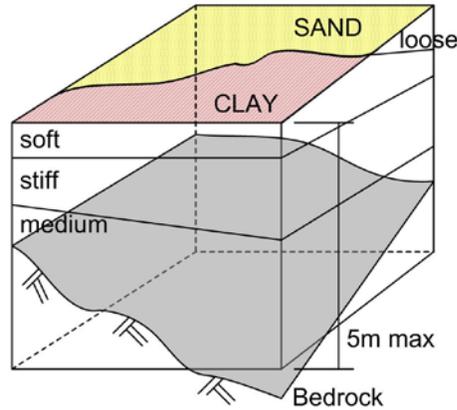


Figure 3: Consistency of layers

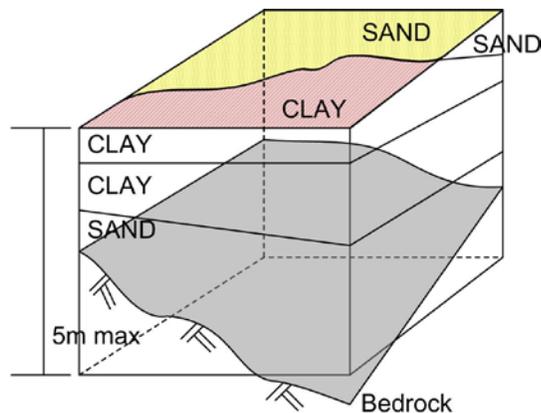


Figure 4: Layered Soil Type

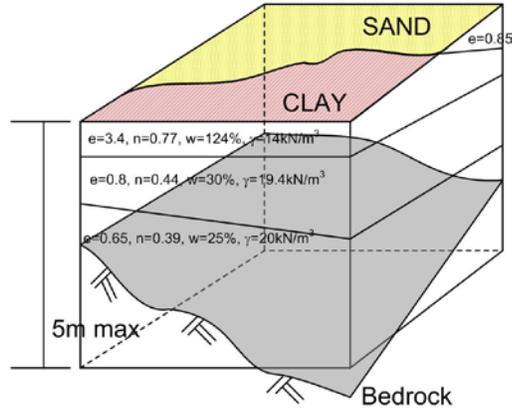


Figure 5: Porosity, Void Ratio, and Bulk Density (represented in different layers)

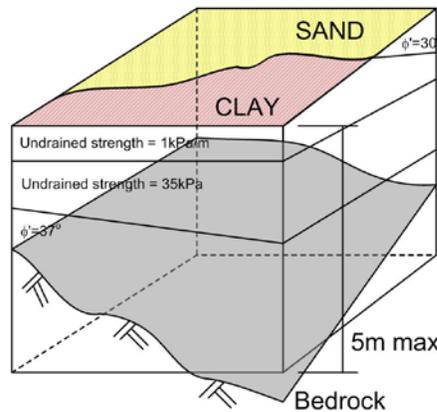


Figure 6: Soil Strength represented in different layers

The sensor-suite shall be configured for installation and operation in a shipboard environment. The shipboard systems shall be capable of performing its function safely while undergoing ship motions, shock, vibration, and electro-magnetic interference (EMI).

A higher sensor maturity in the area of data quality is preferred.

**3.1 Assumed Operating Conditions:** The performance requirements specified in section 3.2 assume the following operating conditions:

3.1.1 Operating Depth: The performance requirements assume that the system will operate in the ocean at any feasible depth. Goal is to operate at depths of up to 2000-meters.

3.1.2 Measurement Quantity Concept of Operations: Acceptable measurement shape and quantities (i.e. point vs. line vs. swath) are as of yet undetermined and shall be dependent on CONOP speed and instrument capability.

3.1.3 Post-Mission Analysis: The performance requirements assume that the data will be downloaded during mission sorties and post-processed on site. If the sensor suite is tethered via umbilical to a shipboard system, it is preferred that the data be retrieved and processed real-time.

3.1.4 Shipboard pitch, roll, and list conditions: In accordance with the nature of this announcement and the potential broad range of various geotechnical instruments, CONOPS, and OPTEMPO; the following is offered in an effort to provide some general insight to the shipboard environment:

3.1.4.1 The performance requirements are obviously platform specific, and therefore the associated impacts and limitations are of primary interest.

<u>Condition</u>	<u>Amount</u>	<u>Period</u>
Pitch	4 degrees	11 seconds
Roll	15 degrees	15 seconds
List	5 degrees	continuous
Sea State	3	continuous

3.1.5 Electrical Conditions: The availability of shipboard source power should be assumed to be up to 440 Vac, 3 phase, and 60 hertz with maximum voltage variation of plus 10%, minus 20% of rated voltage at 122 °F.

3.1.6 Operator Qualifications: The data output of the instrument must be understandable to any layperson. Soil properties shall be calculated and defined in accordance to procedures and standards set forth in Reference [1]. The desired graphical output shall be produced real-time, so an in-situ judgment can be made by a layperson to determine soil strength properties.

## 4.0 NOTIONAL PROJECT PLAN

The notional project plan is anticipated to be funded in incremental phases that potentially correlate to a base period with subsequent optional periods. These periods are anticipated to correlate to demonstrated technology readiness levels (TRLs). The following is a notional outline of potential phases:

- Base Period 1 (TRL 4): Proof of concept laboratory testing and preliminary system design.
- Optional Period 2 (TRL 5-6): Component/subsystem development and testing, and detailed system design.
- Optional Period 3 (TRL 7): System prototype demonstration in an operational environment.

## 5.0 WHITE PAPER SUBMITTALS

WHITE PAPER SUBMITTALS TO THIS BAA CAN BE MADE USING THE INSTRUCTIONS ASSOCIATED WITH THIS SOLICITATION:

Submit the white papers to [timothy.petro@navy.mil](mailto:timothy.petro@navy.mil), [blake.jung@navy.mil](mailto:blake.jung@navy.mil) and [lynn.torres@navy.mil](mailto:lynn.torres@navy.mil). Separate white papers may be submitted for each additional topic

or additional technology or methodology. The white papers shall be evaluated according to the CRITERIA stated in this announcement, see section 6.0. White Papers will be evaluated on their own merits and will not be evaluated against each other. A peer review board will evaluate the white papers to this BAA. White Papers that meet all of the evaluation criteria will be accepted into the BAA program, but may not receive a request for a full proposal.

## **6.0 EVALUATION CRITERIA**

The white papers and full proposals will be evaluated based on the following CRITERIA (listed in descending order of importance):

1. The scientific/technical merits and objectives of the white paper.
2. The contractor's capabilities related experience, techniques, or unique combination of these that are integral factors in achieving the contractor's proposed objectives.
3. The qualifications, capabilities, and experience of the principal investigator, team leader, or key personnel who are critical in achieving the objectives of the white paper.
4. The cost relative to the proposed scientific/technical approach. Once accepted into the program, the white papers/or proposals will be shared with appropriate DON personnel for consideration.

NOTE: An eligible white paper or a request for a full proposal does not guarantee a contract. Multiple contracts may result.

CRITICAL NOTE: A contractor is required to register with the Department of Defense Central Contractor Registration (CCR). No contract award will be made to any contractor that is not registered with the DOD CCR. The DOD CCR may be reached at (888) 227-2423, OR WEBSITE [WWW.CCR.GOV](http://WWW.CCR.GOV).

### NOTES:

1. The preceding data should be sufficient for completing the white paper form.
2. There are no solicitation documents applying to this BAA beyond what is attached to this synopsis. Request for a solicitation package will not be acknowledged. Those interested in participating in the BAA program must follow the instructions of this solicitation for submitting a white paper.
3. There is no commitment by the Navy to either make any contract awards or to be responsible for any money expended by the contractor for contract award.
4. As no funding for contracts has been reserved in advance, NAVFAC ESC will be sharing qualified abstracts with other Federal Government activities to seek funding. Some Federal Government activities may employ civilian contractors to determine the applicability of an offered technology to specific environmental projects. Any information that may be sensitive to review by such personnel should not be submitted.
5. Eligibility notification will be sent to all contractors who have submitted a white paper, after the Technical Evaluation Board (TEB) has reviewed all white papers submitted the defined cut-off date.

6. For technical questions regarding this BAA, contact NAVFAC ESC at (805) 982-5577 or via this e-mail address: [timothy.petro@navy.mil](mailto:timothy.petro@navy.mil). Technical questions may also be sent to NAVFAC ESC at (805) 982-1166 or via this email address: [blake.jung@navy.mil](mailto:blake.jung@navy.mil).
7. Direct contractual questions to [lynn.torres@navy.mil](mailto:lynn.torres@navy.mil), (805) 982-4720.
8. The contractor should expect a receipt notification of the white paper or full proposal by the Government within one week of submission. If the contractor does not receive a notification of white paper or full proposal receipt, the contractor should call or e-mail NAVFAC ESC by using the phone number or e-mail address provided above.
9. Historically Black Colleges/Universities and Minority Institutions will be recognized according to DFARS 226.7002.

REFERENCE (1): *SP-2209-OCN, Handbook of Geotechnical Engineering, March 2011,*  
NAVAL FACILITIES ENGINEERING COMMAND, PORT HUENEME, CA

Download the Handbook at: <http://handle.dtic.mil/100.2/ADA541417>