Statement of Interest

Number W912HZ-14-SOI-0008

Project to be initiated in 2014

Project Title: Coastal Ocean Data Systems (CODS): Development and Testing New Advancements in Spectral Wave Measurements, Models and Coastal Process Methods for Risk-Based Guidance.

Responses to this Request for Statements of Interest will be used to identify potential investigators for a research and development project to be a funded by the U.S Army Corps of Engineers (USACE) Engineer and Research and Development Center's Coastal and Hydraulics Laboratory, Vicksburg, MS (ERDC/CHL). This project is expected to last five (5) years. Approximately $3M is expected to be available to support this project in the first year. Funding for future years (4 option periods) may also be available at an estimated amount of $3M/year for an anticipated total of $15M for this project including base and option years.

Background:

The study of surface gravity waves has been an on-going research initiative since the U.S. Army Corps of Engineers (USACE) entered in the field of coastal engineering. Nearly all studies promoted by research activities performed along the US coastline are affected by temporal and spatial variation in the wave climate. Waves are the primary forcing function affecting the USACE's coastal engineering work and mission. The problem of estimating a wave field in any body of water is extremely challenging. Without a wave monitoring program[1] there would not be any means to perform this evaluation, let alone continue developments in the field of wave modeling. This also holds true with the added response to quantify the influence of climate change to assess the risks of future damage of our coastal environment. Research activities in the area of waves are stimulated by measuring waves themselves. For example, we would not know how well our numerical wave models perform or be able to improve those technologies without measurements; we would not know how the wave environment is being affected by climate change; and we would not know the accuracy level in different measurement platforms. Beach and nearshore monitoring program is vital to quantify long-term, seasonal, and storm-induced dune, beach, and nearshore environment changes. These data also promote research and development of methodologies essential to the determination of erosion and accretion rates, sand budgets, inlet or entrance shoaling potential, beach fill requirements, and shoreline impacts of man's activities and natural events.

Long-term statistical data on physical environmental parameters, such as the wave climate, erosion and/or accretion rates along the shore, coastal currents, water levels, and the location, quantity, and quality of sand resources, are needed for numerical model revisions and upgrades and for coastal navigation, coastal flood protection, and beach erosion control project planning, design, construction, operation, and maintenance. Without these data stimulating research

[1] Regulation No. 1110-2-1406.

efforts (model development, improvements, new methodologies built) there would be considerable negative impacts on commercial, private, and public usage of US waterways. In addition, public, private and commercial property in coastal zones would be at increased risk of physical damage and risk of public safety from flooding and long-term erosion would also increase.

Brief Description of Research:

In the field of surface gravity wave estimation and research, there is a dire need for data in order to update and improve state-of-the-art wave modeling technologies. The collection of high-resolution directional wave measurements at strategic locations along all US coastal waters is essential to a continued collaborative development and evaluation of state-of-the-art wave modeling technologies that support public, private, and commercial users. High-resolution directional wave measurements are used to assess predictive spectral wave model performance, and are paramount to understanding the mechanisms affecting the temporal and spatial variability in the wave climate. New and innovative techniques are needed to quantify model to measurement errors. Field experiments with multiple buoy systems are needed to perform necessary analysis on wave generation source terms (atmospheric input, nonlinear wave-wave interaction, dissipation, shallow water wave-bottom effects, etc.) and will lead to better wave models and more accurate long-term wave estimates.

In the wave research community (theoretical, modeling, and application), it has been accepted practice to assume wave measurements as being *ground truth*, or the measurements are exactly what nature produces. Recent evidence has prompted a re-evaluation of this basic premise. A wave buoy containing a sensor actually measures the buoy motion and not the free surface. There are very complex mathematical algorithms that convert the buoy response to an estimate of the waves. If the buoy's hull (size, composition, shape), super- and sub-structures to the mooring varies so will the response function. Data gathered as a part of this research will be used to modify and improve existing analytical tools such as the WaveEval Tool to provide critical guidance to the entire wave modeling community.

With an increased amount of long-term data records available, tracking monthly, annual, and multi-decadal changes in climate variability will be related to large-scale markers such as the Pacific Decadal Oscillation, the North Atlantic Oscillation, and the El Nino Southern Oscillation (PDO, NAO, and ENSO). Long-term measurements seldom are continuous, and occasionally miss storm extremes. New and innovative techniques (Neural Network, temporal correlation functions, and geo-statistical interpolation) to fill those gaps are needed in the USACE's wave climate studies.

Managing sediment to benefit a region potentially saves money and allows use of natural processes to solve engineering problems. Using regional sediment management concepts will significantly improve the Corps' mission accomplishments. To meet these goals the USACE has developed a Coastal Lidar and Radar Imaging System (CLARIS). This system will operate during storms, collecting topography data of the beach, bathymetry, and wave data in the surf-zone. The data compiled from recent field experiments has lead to a better understanding of

small-scale morphological changes in the beach face. More of these field studies are needed as well as new innovative modeling efforts to achieve a more definable approach for all of the US coastal waters. A strong collaboration between the USACE staff and the proposers is desired.

Objectives:

The project has three primary objectives: collect, analyze and archive critical data using innovative methods; evaluate observation techniques, and execute field experiments using new technologies. A proposal requires a collaborative research and development effort between the vendor and the USACE to develop new and innovative methods analyzing, research existing and new data sets, test new measurement technologies, and conduct field experiments collecting data on wave run-up, small scale beach morphological changes to be used to develop, test and calibrate dynamical models. The project will include:

- Collection, analysis and archival of real-time directional wave observation for sites along all US coasts (including the Great Lakes and US Territorial waters)
    - Assessment of temporal/spatial variability of wave measurements
    - Analysis of long term (decadal) variation in the wave climate
    - Development of methods and analysis procedures for intra-measurement (directional wave system evaluations)
    - Spectral wave model development/improvements
- Evaluation testing of sensors and observational techniques for the measurement of ocean waves, currents, topography, and bathymetry
    - Expendable wave measurement drifters
    - Marine radar systems
    - Laser sensing of beaches
- Execution of field experiments
    - Collection of run-up, flooding, and small-scale shoreline change
    - Develop and improve existing or new technologies to estimate littoral zone processes and their impact on the shoreline

Tasks by Year:

<u>Base Year</u>

- Wave Measurements: Collect and archive real-time directional wave observations for sites along the US coasts.
    - Development and testing of wave sensors, and intra-measurement analysis improvements.
    - Analysis of archived wave data, and assessment of gap filling techniques for long-term wave records
- Analysis of archived CLARIS and wave data derived from 2013 field experiment

<u>Option Year 1</u>

- Wave Measurements: Collect and archive real-time directional wave observations for sites along the US coasts
    - Development and testing of wave sensors, and intra-measurement analysis improvements.

    - Finalize gap filling methodologies. Test alternate data sets
- Planning for Beach Processes Experiment
    - Assessment of location, equipment and staff support

Option Year 2

- Wave Measurements: Collect and archive real-time directional wave observations for sites along the US coasts
    - Development and testing of wave sensors, and intra-measurement analysis improvements.
- Conduct Beach Processes Experiment
    - Based on the planning work derived from Option Year 1

Option Year 3

- Wave Measurements: Collect and archive real-time directional wave observations for sites along the US coasts
    - Development and testing of wave sensors, and intra-measurement analysis improvements.
- Beach Processes Experiment
    - Analysis of data
    - Preliminary testing of modeling tools

Option Year 4

- Wave Measurements: Collect and archive real-time directional wave observations for sites along the US coasts
    - Development and testing of wave sensors, and intra-measurement analysis improvements.
- Beach Processes Experiment
    - Publish findings
    - Migrate modeling technologies for public use

Requirements:

Successful applicants should have expert knowledge, experience handling wave measurement systems (deployment, and recovery); and beach processes, measurement techniques, and modeling skill. They should also have technical expertise in the field of wave data evaluation, (QA/QC), statistical analysis, higher order analysis skills (e.g. Neural Network) data archiving systems and dissemination of the data to the public in usable form.

Government Furnished Property and Services:

The Government will collaborate with the investigator to identify new wave monitoring sites, protocols, new modeling technologies and data quality measures for wave measurements and access to the WaveEval Tools. The Government will also collaborate with the investigator to identify the Beach Processes Experiment, use of the CLARIS system during the field experiment, and coordinate any additional senor systems mutually required for a successful study.

Materials Requested for Statement of Interest/Qualifications:

Please provide the following via e-mail to:
preston.a.brent@usace.army.mil (maximum length 2 pages, single spaced 12 pt. font)

1) Name, Organization and Contact Information
2) Brief Statement of Qualifications including:
    a. Biographical Sketch
    b. Relevant past projects and clients with brief description of project
    c. Staff, faculty and students available including area of expertise
    d. Brief description of capabilities to successfully complete this project

Note: a proposed budget is NOT requested at this time.

Review of Statements Received: Based on a review of the Statements of Interest received, an investigator or investigators will be invited to prepare a full study proposal. Statements of Interest will be evaluated based on investigators specific experience and capabilities in areas related to the study requirements. Additionally, the evaluation method and selection criteria for research and development awards must be: 1) The technical merits of the proposed research and development; and 2) Potential relationship of the proposed research and development to the USACE missions.

Please send responses or direct questions to:

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Timeline for Review of Statements of Interest: Review of Statements of Interest will begin after the SOI has been posted on the CESU website for 10 working days.