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Request for Qualifications:

TECHNICAL SUPPORT FOR THREE DIMENSIONAL MAPPING OF DISSOLVED HYDROCARBONS AND OIL DROPLETS USING A REMOTE ENVIRONMENTAL MONITORING UNIT AUTONOMOUS UNDERWATER VEHICLE

Issue Date: July 13, 2018

Due Date: August 10, 2018 (Time 2:00 ET)

The University of New Hampshire (UNH) Coastal Response Research Center (CRRC) is soliciting proposals for Technical Support for Three Dimensional (3D) Mapping of Dissolved Hydrocarbons and Oil Droplets Using a Remote Environmental Monitoring UnitS (REMUS) Autonomous Underwater Vehicle (AUV) as identified in the Project Scope of Work herein. Any Proposer wishing to submit a proposal must comply with the requirements contained in this Request for Qualifications (RFQ). Any interpretations, corrections or changes to this RFQ will be made as addenda. Addenda will be posted and available on the CRRC website.

The purpose of this project is to provide technically sound, science-based support to the CRRC as part of its Five-Year Grant from NOAA's Office of Response and Restoration (ORR). Specifically, the project supports an agreement that NOAA ORR and the Bureau of Safety and Environmental Enforcement (BSEE) have to support emergency response and Natural Resource Damage Assessment (NRDA) and develop standard approaches for future response and assessments.

An RFQ process will be used to select the successful Proposer that will become a subawardee to UNH. The selection process will consist of two phases. During Phase 1, proposers will submit qualifications to be considered, specifically addressing their ability to meet the technical requirements listed in this RFQ (e.g., documented field experience characterizing oil on water and oil in the water column at a subsurface release marine field site, possession of or access to a REMUS 600). Only those Proposers that respond to Phase 1 on or before the August 10, 2018 deadline and meet the qualifications criteria will be included in Phase 2 of the selection process. The Phase 1 pre-qualification step will streamline the

process, insuring that only those Proposers that have the unique and specific technical expertise/equipment/experience required for this project are considered. Phase 2 will evaluate the ability of each of the Proposers pre-qualified in Phase 1 to perform the work detailed in this RFQ document within the available time and budget.

1. BACKGROUND

The ability to rapidly characterize spilled oil in the ocean during spills is a main goal of any Federal On-Scene Coordinator. Many advances have been made with respect to refining technology for oil detection, especially during and in the aftermath of the 2010 Gulf of Mexico Deepwater Horizon (DWH) oil spill response and NRDA. One of the lessons learned from NOAA's response and assessment efforts following that incident is that AUVs have potential to overcome constraints and logistical challenges encountered with tethered data collection platforms and airborne or surface based methods (Kukulya et al., 2016). These systems can provide rapid in situ detection of spilled oil at fine spatial and temporal scales (Camilli et al., 2010; Ryan et al., 2011). One system of particular interest is the propeller-driven REMUS, which is a relatively lightweight, easily deployable vehicle that requires a minimal logistical footprint and a small operational team.

A recent investment by the Department of Homeland Security (DHS) has enabled the outfitting of the REMUS with a suite of sensors ideal for quantifying and characterizing oil in the water column (http://adac.uaa.alaska.edu/home/project_4_auv). Currently, the sensor configuration includes commercial-off-the-shelf (COTS) sensors for ADCP/DVL, CTD, dissolved oxygen, oil detection fluorescence and optical backscatter, as well as a GoPro camera. The AUV can also be modified to include miniaturized holographic imagers and water sampling capabilities. AUVs equipped with these capabilities can be strong assets for spill response and NRDA decision-making as data can help determine the composition, weathering, fate and transport of oil. Sensors provide for measuring dissolved and particulate hydrocarbons, oil droplet size distribution and gas bubbles, where fractionation influences exposure routes, determines potential injuries to natural resources and drives what response tools (e.g., booms, in situ burning, physical and chemical dispersion) may be employed.

Limited field trials have highlighted the utility of AUV systems, such as the REMUS systems to provide rapid, high quality assessments of oil quantity and state at fine spatial and temporal scales in the water column in support of response and assessment efforts (e.g., http://adac.uaa.alaska.edu/css/images/pdf/LRAUV%20Field%20Test%20Report%20-%20November%203%202016%20.pdf). However, there is a need for further development and testing of REMUS AUV systems to provide rapid assessments of spilled oil at finer spatial and temporal resolutions during response and assessments. In particular, there is a need to develop a longer range and deeper diving REMUS AUV system that includes integration of a holographic camera to help characterize oil droplets, gas bubbles and plankton. Additionally, a discrete water sampling system should be developed so that the mission can pair water sampling with fluorometry readings, enhancing the ability to characterize PAH concentrations in the water column more accurately and overall to further enhance capabilities for conducting 3D mapping of oil in the environment.

2. OBJECTIVES/SCOPE

The overall objective of the proposed project is to support BSEE and NOAA's effort to employ a REMUS 600 AUV, equipped with a sensor suite for oil quantification, to characterize oil being released (slick and suspended) in the vicinity of the MC20 site in the Northern Gulf of Mexico. In addition, a decision-support tool (DST) package will be developed that improves response and assessment operations for characterizing oil in the water column. This DST package will be developed for a REMUS, but could potentially be incorporated into other AUVs used in oil spill response and assessments. Project deliverables will significantly improve spill response decision-making and enhance water column damage assessment capabilities.

3. ANTICIPATED RFQ SCHEDULE

A. Release of RFQ: **July 13, 2018**
B. Phase 1 Electronic Submissions Deadline: **August 10, 2018 (2:00 pm ET)**
C. Notification of Phase 1 Selection Process: **August 24, 2018**
D. Phase 2 Electronic Submission Deadline: **September 18, 2018**
E. Notification of Phase 2 Selection: **September 25, 2018**

CRRC, at its sole discretion, may modify this schedule as it deems appropriate.

Phase 1 packages will be submitted electronically by emailing the proposal as an attachment to a secure UNH data storage site at: REMUS_6.exhhwlk16wj64d7o@u.box.com

Late submissions will not be considered. One hard copy of the Phase 1 and 2 packages must also be submitted to Nancy Kinner (216 Gregg Hall, 35 Colovos Rd, University of New Hampshire, Durham, NH 03824) no more than 72 hours after the electronic copy submission deadlines. Failure to meet the deadlines will disqualify a proposal/package.

All packages must be submitted in Adobe Acrobat (pdf) format in one continuous file. Electronic and hard copies copies must be identical. Do not password protect or otherwise encrypt electronic proposal submissions. The font must be Times New Roman 12 pt. single-spaced with all 1-inch margins.

A panel consisting of the UNH CRRC co-director, the NOAA ORR project lead and two additional NOAA ORR employees with expertise related to the project will evaluate submission packages.

Phase 1 submission is designed to determine the Proposer's qualifications to meet the metrics listed in Section 8 of this RFQ. Specifically, Phase 1 submission must demonstrate the Proposer's ability to conduct the project. See Section 13 for the contents of the Phase 1 submission.

If a Proposer demonstrates the ability to meet the metrics in the Phase 1 submission, a Phase 2 proposal will be requested by CRRC. The Phase 2 proposal will include a detailed project narrative regarding the scope of work, a detailed budget (not to exceed the available funding), and a detailed schedule. The proposal will be reviewed by the same panel as Phase 1. Interviews with the Proposers may be conducted by Zoom e-conferencing during Phase 2. Phase 2 proposals will only be accepted from those Proposers selected by the panel to submit.

All questions regarding this RFQ should be submitted in writing via email to nancy.kinner@unh.edu. Written and email communications must be from the Proposer's authorized Principal Investigator.

4. PROJECT TASKS

4.1 AUV Development

A suite of sensors shall be developed and integrated on a REMUS 600 AUV (600 m depth rating) to quantify, characterize, and determine droplet size of released oil in the water column that includes fluorescence, back scatter, holographic imaging, camera, and water sampler for a comprehensive 3 day oil-water mapping mission at the MC20 site in the Northern Gulf of Mexico.

Current AUV capabilities (e.g., REMUS 100) include the following commercial-off-the-shelf (COTS) instrument capabilities: Iridium, ACOMMS (Acoustic micromodem communications), 1200 kHz up/down ADCP (Acoustic Doppler Current Profiler), Kearfott inertial navigation system (INS, model T-16), NBOSI CTD (Conductivity Temperature-Depth), AADI Dissolved Oxygen probe, and a Sea-Bird / Wet Labs, Inc. SeaOWL-UV-A (Sea Oil-in-Water locator) optical sensor. The latter is configured with three wavelength pairs to measure simultaneously dissolved hydrocarbons (fluorescence) and oil droplets (optical backscatter). It was produced specifically for autonomous platforms, and offers 5x the optical resolution than its predecessor a CDOM ECO fluorometer (excitation/emission λ 360/470 nm) capable of reliably sensing dissolved hydrocarbons at low concentrations during the *Deepwater Horizon* (DWH) Spill and in wave tank testing (Conmy et al., 2014). A successful demonstration of this REMUS 100 system was conducted in Fall 2016 at the Arctic Domain Awareness Center (ADAC) meeting.

A similar payload shall be developed, configured and tested for further sensor integration outfitted on a REMUS 600. This will include the SeaOWL-UV-A, a high resolution camera, a holographic imager capable of capturing images of oil droplets and plankton and other particles with sufficient resolution to distinguish and characterize major plankton taxa, oil droplets and gas bubbles ranging in size from um to cm (Loomis, 2011; Deepwater Horizon Oil Spill Water Column Technical Working Group, 2012) , and a water sampler system collecting a minimum of 8 samples per deployment with minimum size of 100-125 mL/sample to provide rapid, regular or directed sampling with sufficient spatial coverage to compliment these *in situ* measurements (e.g., fluorometry, optical, holographic imagery). The REMUS 600 system will be developed, configured, calibrated, tested and achieve readiness for immediate field deployment.

4.2 Data transfer and mapping schema

A process for real-time data visualization shall be developed from sensors, measurement and sample collection into NOAA's Common Operational Platform (COP) response data management and visualization tool ERMA (https://erma.noaa.gov/gulfofmexico/erma.html), with data package upload to NOAA's data management application DIVER (https://www.diver.orr.noaa.gov/). Rapid upload data visualization to ERMA from the REMUS 600 and other sensor platforms will include coordination with NOAA on data formats and display. Field effort planning and actual sampling locations and tracks shall be provided in GIS formats compatible with ERMA.

Field data and laboratory analysis and results will be delivered and loaded into NOAA's DIVER data warehouse application using a standard electronic data deliverable (EDD) format, where applicable. EDDs for chemistry, biological and field measurement are available on the DIVER website (https://www.diver.orr.noaa.gov/web/guest/field-forms-and-templates). All data deliverable packages will include field definitions, metadata, and calibration documentation, where appropriate. Data deliverable formats for plume spatial distributions should meet requirements for incorporation into numeric trajectory models (e.g., GNOME) and oil droplet formation models such as VDROP-J.

4.3 Field testing and reporting

Operations readiness and utility shall be demonstrated for the REMUS 600 system for oil detection, quantification and characterization on the surface and in-water in the field at the MC20 site in the northern Gulf of Mexico. A minimum 3-day daily field trial shall be conducted with the REMUS 600 system deployed from a chartered vessel. The REMUS 600 system will collect continuous *in situ* measurements of fluorescence, particles, temperature, salinity, depth, position, and dissolved oxygen and transmitted in real time to ship board operators. The flight patterns of the system will be specifically determined by a NOAA field team, but will likely include both surface and subsurface coverage in pre-determined gridded assignments as well as using auto-detection capabilities of the REMUS based on fluorometry readings. Additionally, discrete water samples characterizing oil in water chemical concentrations will be collected with a water sampler system (specific sampling design to be developed in consultation with the NOAA field team) and analyzed by the EPA (separate from this proposal) for hydrocarbons and BTEX using GC-FID and GC-MS. These combined data sources should provide for characterization of dispersed oil concentration and partitioning into the water column to compliment slick detection (e.g., 3D mapping of oil in the water column) and extent from above the water. Work will be conducted with NOAA scientists to compare these results with existing data collected previously at the MC20 site and, if applicable, at the Ohmsett wave tank and shall be described in a data analysis and interpretation report.

The subawardee will provide logistical support for a 3 day sampling mission including a workboat suitable to conduct sampling and transit to and from the site daily, unless it is determined that a larger vessel allowing for overnight on-water accommodations is required. Field logistics will also include coordination with NOAA National Environmental Satellite, Data, and Information Service (NESDIS) to provide additional satellite imagery, when available, which will serve as a basis for the daily water sampling schedule. The subawardee's sampling team will deploy coincident with satellite passes to allow for surface water characterization comparisons to in situ data collections. The satellite acquisitions will include Worldview-2 (WV-2) and WV-3, Aster, Landsat, or others as available per NOAA NESDIS.

Additionally, Unmanned Aircraft Systems (UAS) operations must be provided by the subawardee to guide on-water operations. Specifically, the UAS operations will include a multi sensor oil detection array that includes at a minimum visible multi-spectral imagery using a high definition (HD) video

camera with data communications capable of providing a live video feed to the operator, and collections of thermal IR imagery (fitted with a FLIR camera). This real-time UAS video will be used to observe the oil slick from above and position the boat over the target oil slick for in-water AUV operations. In addition, the camera will collect still imagery at regular intervals, with time, elevation, aspect, angle off nadir, to be saved with the image file for geo-referencing, post-processing interpretation and analysis of floating oil characterization in comparison with satellite data. Finally, at the onset of each day's sampling, fixed wing 'spotter' aircraft provided by the subawardee will communicate with the on-water field team specific characteristics of the overall floating oil including size, direction, extent and characteristics of oil thickness over the extent of the slick.

5. DELIVERABLES:

1. A guidance document including recommendations on use of the REMUS 600 as a response decision-support tool. The contents must be non-proprietary and suitable for publication on web.
2. Draft data and technical progress reports.
3. A final report with feedback and associated revisions from the field sampling team and project managers, non-proprietary and suitable for publication on the web and in the peer-reviewed literature.
4. Final data delivery into the COP (i.e., ERMA) and for archiving with BSEE.

5.1 Schedule and Distribution of Deliverables

Deliverable	Reviewed by	Due Date
Quarterly Reports	CRRC and NOAA Leads	Within one month after end of quarter (counting from award date).
Draft Field Data Summary Report	CRRC and NOAA Leads	Within 6 weeks of completion of field testing
Draft Guidance Document and Project Report	CRRC and NOAA Leads	Within 6 weeks of completion of draft Field Data Summary Report
Final Guidance Document and Project Report	CRRC and NOAA Leads	Within two months of project review process (includes feedback from NOAA field sampling team, project leads and associated revisions) and 2 months prior to end of period of performance
Final data delivery into COP and for archiving with BSEE	CRRC and NOAA Leads	Upon completion of final project reports.

6. PERIOD OF PERFORMANCE

The period of performance for the subawardee shall be for 12 months after the contract is signed, pending funding availability. This project must be completed by November 1, 2019 and no extensions will be granted.

7. SPECIAL MATERIAL REQUIREMENTS

The subawardee is required to build out a REMUS 600 AUV per the specifications in this RFQ.

8. METRICS FOR SUCCESSFUL PERFORMANCE BY PROPOSERS AND SUBAWARDEE

Criteria	Score (pts)
a) Successful development and integration of a sensor and sampling suite (e.g., fluorescence, back scatter, holographic imaging, camera and water sampler) into a REMUS 600 suitable for 3D characterization of oil in the water column.	10
b) Ability to support remote field operations, specifically in the vicinity of the MC20 site. This includes ability to maintain position in, adjacent to, and under the floating oil and at the direction of the field sampling team.	10
c) Ability to conduct the field-testing and 3D mapping in one 3-day field exercise. Previous site familiarity and sampling experience will enhance successful delivery.	10
d) Ability to use multiple remote sensing platforms (e.g., fixed wing, Satellite, UAS) and sensor packages (e.g., multispectral optical, FLIR, SAR) to find and characterize the floating oil in the vicinity of the MC20 site in real time and in post-processing.	10
e) Ability to produce rapid workflows that include data intake, export, analysis and data product delivery in near-real time and in support of Common Operational Platforms (COP) and modeling tools.	10
f) Ability to produce a best practices and field guide document for REMUS 600 developed for oil detection and characterization capabilities	10
g) Ability to produce a report documenting oil characterization at surface and depth associated with and in relation to releases at depth and with surface slick using data collected from REMUS 600 and remote sensing platforms.	10
h) Ability to complete all activities within 12 months according to the performance schedule	10
i) Previous experience characterizing oil on water and oil in the water column in a controlled laboratory setting, at an oil testing facility, and from a subsurface release in the marine field, including arranging logistics and analyzing and interpreting site-related data.	10
j) Previous experience outfitting and testing REMUS AUVs with sensor suites used to quantify and characterize oil in the water column.	10
TOTAL POINTS	100 points

9. TRAVEL

It is anticipated that carrying out the above tasks may require the subawardee to travel as directed by CRRC and NOAA. The purpose of the travel may include, but is not limited to, collaboration and planning with CRRC, NOAA, EPA and BSEE research teams. Two collaboration meetings are envisioned and can be held in the most cost-effective venue as determined by the CRRC and NOAA project leads. Additional travel will be required for the subawardee to provide field support during deployment for hydrocarbon mapping at the MC20 site in the Gulf of Mexico for a field period of 3 days, and additional 1-3 days for travel, equipment, and sample preparations. Travel expenses shall be authorized in advance by CRRC and must be associated with the performance of the project.

10. INVOICES/PROGRESS REPORTING

Invoices may be submitted no more frequently than monthly but no shorter than quarterly to UNH CRRC. Invoices will be itemized by element of cost and include progress achieved, anticipated activities, issues, and resolution of issues anticipated.

Original invoices (via pdf email) will be submitted to:

ATTN: Kathy Mandsager
Coastal Response Research Center
220 Gregg Hall, 35 Colovos Rd
University of New Hampshire
Durham, NH 03824
Kathy.Mandsager@unh.edu

11. CONFLICT OF INTEREST ASSESSMENT

The Federal Government is currently involved in active litigation with the Taylor Energy Company, concerning the MC20 site, and the nature of the litigation does not allow for the existence of conflicts of interest. The subawardee will need to certify that they do not now have and have not had any recent business or contractual agreements (directly or indirectly) with the Taylor Energy Company. The subawardee shall further disclose any business or contractual agreements (directly or indirectly) with the Taylor Energy Company that arise subsequent to the initiation of this contract.

12. BUDGET

The total budget for this scope of work shall be $677,029.

13. PHASE 1 PROPOSAL REQUIREMENTS

Submit the following information and documentation:

A. Experience and Background
   i. Submit a narrative documenting the Proposer's overall background and experience relative to this project, including experience from other related projects. Awards, publications or other recognition received by the Proposer relative to work on similar projects should be included.

ii. A list should be provided of the key personnel who are proposed for work on this project, to include any subcontractors.
iii. Include resumes for each of these individuals detailing qualifications, experience, work history, education and any related licenses or certifications.

B. Approach to Project Management
i. Provide a description of the Proposal's approach to managing this project including the field project and the outfitting of the REMUS 600.
ii. Provide a narrative that demonstrates a knowledge and understanding of the work required for conducting this project.
iii. Explain how the Proposer plans to address the logistics required to lead the field project and coordinate within the NOAA team.
iv. Explain how the Proposer will organize and conduct meetings and general communications.

C. Projects of Similar Scope

List up to 5 projects that the Proposer has done of a similar nature to the project. Provide the following information:

i. Project sponsor and contact information
ii. Sponsor's project officer
iii. Sponsor's project date (start/end)
iv. Sponsor's project title
v. Project status (started, % complete)
vi. Scope of project (no more than 150 words)
vii. List of reports or publications associated with the project

D. Organization Structure
i. Submit a list of Proposer's staffing resources by discipline and the number of personnel within each discipline.
ii. If Proposer's staffing resources includes subcontractors, submit the name of the entities who will perform each activity.
iii. Submit an organizational diagram clearly identifying key personnel as well as other staffing resources who will to contribute to this project. For each individual in the organization diagram, include each individual's name, title, and affiliation, and indicate their functional relationship to each other.
iv. Provide a narrative that clearly defines responsibilities, contractual relationships and roles of all individuals in the organizational diagram.
v. Provide a narrative of the Proposer's recent, current, and projected workloads at the time of submission and provide a statement of Proposer's commitment of personnel and other resources and equipment (e.g., REMUS 600, boat time) to the project.
vi. Provide a narrative of all key personnel's recent, current and projected workloads at the time of submission and provide a statement of the availability for this project.

E. Statement of Financial Capability

i. Provide a statement of the Proposer's financial and legal capability (e.g., insurance) for conducting this project.

F. Statement of Access to Required Project Resources
   i. Provide a narrative of the Proposer's access to the required equipment, logistical resources and data analysis/management tools.

14. CRRC AND UNIVERSITY OF NEW HAMPSHIRE RESERVE THEIR RIGHTS TO:

- Disregard all non-conforming proposals.
- Reject any and all proposals that fail to satisfy the requirements and specifications in this RFQ.
- Accept the proposal which is the best overall proposal, based on the selection criteria listed in the RFQ.
- Waive minor irregularities in any proposal.
- Issue addenda or otherwise revise the requirements in this RFQ.
- Reject all proposals, with or without cause.
- Issue requests for new proposals.
- Cancel this RFQ.

15. SUBCONTRACTORS

If the Proposer proposes to use subcontractors in the course of this project, this information shall be a part of the proposal. Such information shall be subject to review, acceptance and approval of the CRRC/UNH, prior to any award. CRRC/UNH reserves the right to approve or disapprove of any subcontractor candidate in its best interest and to require the Proposer to replace subcontractor with one that needs CRRC/UNH approval.

The Proposer shall ensure that all of the Proposer's subcontractors perform in accordance with the terms and conditions of the project. The Proposer shall be fully responsible for all of the subcontractors' performance, and liable for any of Proposer's subcontractors' non-performance and all of Proposer's subcontractor's acts and omissions.

16. PHASE 2 PROPOSAL REQUIREMENTS

Only those Proposers that respond to Phase 1 on or before the August 10, 2018 deadline and meet the qualifications criteria will be included in Phase 2. Upon notification of acceptance, the Phase 2 submission deadline will be September 18, 2018. Specific details on Phase 2 submissions will be provided to those Proposers that have been selected to participate.

17. CONTACT:

The UNH CRRC lead is:
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Professor Civil & Environmental Engineering
UNH Co-Director
Coastal Response Research Center
603.862.1422
Nancy.Kinner@unh.edu

The NOAA ORR project lead is:
Lisa DiPinto, Ph.D.
Chief Scientist
NOAA, Office of Response and Restoration
Lisa.Dipinto@noaa.gov