



Post Office Box 38
 Solomons, MD 20688
 Phone: 410-326-7385
 Fax: 410-326-7428
www.act-us.info

REQUEST FOR TECHNOLOGIES

Title: Performance Verification of Variable Fluorescence

Date: January 5, 2015

Programs: Alliance for Coastal Technologies (ACT),

Application Deadline: Application (form with signed cover letter) must be received by
5:00 p.m. Eastern Time on February 27, 2015.

Summary:

The Alliance for Coastal Technologies (ACT), in association with the U.S. Coast Guard Research and Development Center (USCG RDC), Maritime Administration (MARAD), Naval Research Laboratory (NRL), Maritime Environmental Resource Center (MERC), and Great Ships Initiative (GSI), is currently accepting applications from developers and manufacturers of commercially available compliance tools that use variable fluorescence to determine concentrations of live organisms in ballast water and to identify non-compliance with international and national ballast water discharge standards. This Performance Verification will follow the ACT Technology Evaluation model with a Protocol Workshop in the Washington DC area in March 2015, and subsequent controlled laboratory and field testing at 3 to 4 sites in the US in spring and summer 2015. Participation in this effort will be open to all qualifying applicants, and results will be made available to the public in individual summary reports.

Please visit www.act-us.info/rft.php for more information on this Performance Verification and to download application forms. Initial applications are due February 27, 2015. Questions can be directed to Dr. Mario Tamburri (tamburri@umces.edu) or Dr. Lisa Drake (lisa.drake@nrl.navy.mil).

Synopsis of Program:

International and US ballast water regulations will only be successful at reducing environmental and economic risks from aquatic invasive species if treatment systems operate effectively and reliability and if vessel owners and operators comply with the regulations. Even small rates of non-compliance can often prevent environmental regulations from achieving their goals. This is an important consideration in the case of ballast water invasive species, where risk factors are difficult to measure accurately, and risk reductions from widespread compliance may not be adequate to offset the high risks posed by just a few vessels that discharge ballast water not meeting the set standards.

To address this issue, vessel compliance monitoring strategies, technologies, and methodologies are now being developed. Given the complexity and logistic constraints of directly measuring live organisms in ballast water discharge during normal vessel operations, phased compliance monitoring approaches have been proposed, which provide increasing levels of confidence. For example, a tiered monitoring framework might include: (1) vessel reporting and inspections, (2) measures of treatment operations and performance, (3) indirect measures of exceedance of the discharge standard, and (4) direct measures of compliance with the discharge standard.

While multiple approaches to compliance monitoring will likely be used to varying degrees, indirect measure of exceedance may ultimately be widely adopted for routine monitoring, if the tools: (a) can be validated and standardized, (b) are simple to use, and (c) provide sufficient confidence that a discharge is not in compliance. One such suite of tools may be chlorophyll and variable (i.e., pulsed or modulated) fluorometers, which are similar to sensors used in shipboard oil content monitors but have been adapted and tuned to provide estimates of the abundance of living, photosynthetic organisms. This Performance Verification exercise is designed to serve as the validation step for variable fluorescent fluorometers and to provide the independent, rigorous evaluations needed for their use in shipboard compliance monitoring.

It is important to note that the organizations involved do not certify technologies, nor do they guarantee that a technology will operate at the levels verified. They do not rank technologies or compare their performance; do not label or list technologies as acceptable or unacceptable; and do not seek to determine “best available technology” in any form. ACT will avoid all potential pathways to picking “winners and losers” but rather focus on the individual performance instruments put forward for verification testing. Although this Performance Verification will apply to all instruments evaluated under common testing protocols, no direct comparisons will be made between instruments from different manufacturers, and instrument-specific Verification Statements will be released to the public for each instrument type as a final report.

Focus of Performance Verification:

This evaluation will be carried out in series of laboratory and field tests during the spring and summer of 2015. The specific Test Plan will be developed in collaboration with accepted applicants, a Technical Advisory Committee (listed below), ACT and partner technical staff, and it will include both laboratory and field-based components. Laboratory tests will be designed to evaluate instrument accuracy, precision, and detection limits over a range of conditions. Field tests will be designed to address instrument accuracy and reliability in diverse environments.

Eligible Technologies Must Be:

- Commercially available technologies.
- New, near-commercial technologies ready for the market with available quality testing data to support performance claims.
- Designed to measure chlorophyll, variable fluorescence, or both and estimate concentrations of live organisms in the ballast water discharge regulated category of $\geq 10 \mu\text{m}$ and $< 50 \mu\text{m}$ in size (i.e., < 10 live organisms per milliliter of water).

At least one instrument will be requested from each participant, depending on the specific evaluation protocols developed. ACT and partner technical staff will operate the sensors during the verification testing and will return all units when the evaluation is complete. Qualifying applicants will also be asked to participate in the design of evaluation protocols. The results and summaries from all verifications will be provided to qualifying applicants and made public after evaluations are complete. Because of limited resources, only one sensor model or type per individual developer, manufacturer, or distributor may be selected for this Performance Verification, depending on the numbers of qualifying applicants. We will, however, consult with applicants if this selection process is necessary.

Benefits of Technology Verification:

Technology developers will be provided an independent, scientifically objective process for testing their instruments in a diverse range of coastal environments and under actual situations for which their products were designed. Moreover, this effort will provide potential investors and users of innovative approaches with information on how technologies perform in comparison to conventional methods. This process of verification will ultimately aid in the implementation of accurate and reliable

technologies that will enable the effective compliance monitoring and ultimately help prevent the spread of invasive species from ballast water.

Specific benefits for technology developers, manufacturers, and vendors:

- Access to expertise in demonstrating, verifying, and applying coastal monitoring technologies.
- An opportunity to test a technology on a nation-wide basis under different environmental conditions.
- An unbiased, reputable evaluation of technology performance.
- Increased credibility from having independent performance data.
- Increased potential of regulatory acceptance due to the recognition of results.
- Increased recognition nationally and internationally through outreach.
- A potential market advantage that customers and users may consider in their technology purchasing decisions.
- Increased confidence for investors.

Specific benefits for technology users:

- Critical information on the performance of compliance monitoring tools required to address regulations and an important environmental concern.
- Easily accessible information on and relevant data on emerging technologies.
- Credible technology performance verifications independent of developer, manufacturer, or vendor claims.
- Performance-based verification testing addressing realistic data quality objectives under varying environmental conditions.

Application Process and Acceptance:

The application and acceptance process consists of three steps: application, conditional acceptance, and agreement on a test plan.

Step 1. Preliminary Application - Applicants (developers, manufacturers, and distributors) are requested to provide detailed information about the technology proposed for testing and about their organization, by submitting a signed cover letter (no longer than two pages) and by completing the ACT Application for Evaluation form (available at www.act-us.info/evaluation/rft.php). The purpose of the application is to assess if the instrument meets the criteria/requirements set forth in this Request for Technology, if the facilities are capable of conducting an appropriate and safe evaluation, and to ensure that no conflict of interest exists. Preliminary applications will be screened and categorized based on at least the following criteria:

- Does the technology fit the stated theme?
- Does the technology address the stated priorities?
- Is the technology applicable to compliance monitoring of ballast water discharge?
- Is the technology based on sound scientific and technical principles?
- Is the technology sufficiently commercial-ready for verification testing?
- Can the applicant demonstrate ownership of the technology?

The Application package is also meant to ensure a clear understanding of the instrument intended for evaluation, including the scientific and engineering principles of operation, previous performance data (if applicable), and potential users/customers. The application should include appropriate peer-reviewed literature, technical articles, reports, process flow diagrams, equipment specification sheets, operating instructions, and other related materials to enable the reviewer to fully understand the technology and any data and information that is available to support the application.

Step 2. Developing a Test Plan – ACT and partner technical staff, the Technology Advisory Committee, a QA/QC Coordinator, and representatives for each qualifying applicant will gather for a workshop tentatively scheduled for March 2014, in Washington DC, to discuss a draft a Verification Plan, which will include:

- Requirements for qualifications of test personnel.
- Requirements for health and safety of test personnel, the public, and the environment.
- Proposed methods and procedures for laboratory and field verification including: a) set-up, b) period of operation, c) operation parameters, and d) experimental design with number of replicates and controls.
- A standard measure or existing, accepted technology for the new technology to be calibrated by or tested against.
- Proposed methods and procedures for storing, retrieving, analyzing, and reporting data.
- Appropriate QA/QC strategy.

The draft will be externally reviewed for appropriateness of experimental design and statistical analyses before a Final Verification Plan is submitted to the qualifying applicants. Although none of the organizations involved do not conduct direct comparisons of instruments being evaluated, the standardization of methods in Verification Plans will allow the assessment of the various instruments simultaneously and permits end-users to draw their own conclusions regarding the in situ salinity sensor that best meets their needs.

Step 3. Final Test Plan and Verification Agreement - All protocols, methods and procedures agreed to at the workshop will be included in a final Test Plan, which will be circulated with a Test Agreement to all participating instrument developers/manufacturers. Each participant will be required to sign the Agreement prior to initiating the first series of laboratory testing in the spring of 2015. Draft Agreements are available for review upon request and include a statement that all parties agree to conduct the evaluation in accordance with the final Verification Test Plan and that the results will be released to the public. The agreement will also state that there will be no modifications to final Verification Plan, regardless of unforeseen circumstance encountered during testing, without written consent from all parties. Furthermore, the agreement will clearly state that although the developers, manufacturers, or distributors will be allowed to view the Verification Statements before they are released to the public, they will not be allowed to make changes to the final report. However, it will be possible to include comments (in the form of a one page letter) from the developers/manufacturers as an appendix to Verification Statements. Finally, it will be noted that all data collected during verifications by the instruments tested are the property of the individual participating technology developer/manufacturer and cannot be used by any other party without consent.

Deadlines and Dates:

- Initial Application (form with signed cover letter) must be received by 5:00 p.m. Eastern Time – February 27, 2015
- Notification of Acceptance – March 4, 2014
- Protocol Workshop, Washington DC – March TBD, 2015
- Final verification protocols and Test Plan – April 10, 2015
- Laboratory testing tentatively scheduled to begin in May 2015.

Additional Information and Forms:

Please visit www.act-us.info/rft.php or <http://www.maritime-enviro.org/News.php> for more information on this Performance Verification and to download application forms. Initial applications are due February 27, 2015. Questions can be directed to Dr. Mario Tamburri (tamburri@umces.edu) or Dr. Lisa Drake (lisa.drake@nrl.navy.mil).