Impressed Current Cathodic Protection Anodes and Reference Cells

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This publication constitutes a Request for Information (RFI) and no formal Request for Proposals (RFP), solicitation, and/or additional information regarding this request will be issued. The Naval Research Laboratory (NRL) will not issue paper copies of this request. The responses to this RFI will be considered in the planning and definition of Future Naval Capabilities (FNC) programs. This is not a commitment to fund any effort submitted in response to this request. The Government will not reimburse any costs associated with the development and submission of materials in response to this request.

This RFI solicits industry and academic sources to express their capability to provide impressed current cathodic protection (ICCP) anodes and reference cells for use on Navy ships and submarines. The subject electrodes will be used to supply current (anodes) and monitor electrochemical potential (reference cells) during operation of ICCP systems mounted on the external hull and internal seawater free flood areas of ships and submarines.

It is anticipated that the anodes to be developed under the FNC will include new ICCP anode materials/concepts and develop new enhanced durability ICCP components with advanced capabilities. Advances in multifunctional materials and materials by design have created the ability to customize materials for specific purposes. Technologies of interest for the development of new anode materials include, but are not limited to conductive polymers and non-traditional high surface area electrode configurations for catalytic surfaces and electrochemical current delivery. New anodes are not limited to novel materials but also novel designs using new or traditional materials. New anodes should also have significant mechanical durability. Mechanical ruggedness is defined as the ability to withstand unplanned, but reasonable impact loads such as hammer drops and non-traditional and unexpected usages such as a step or hand-hold. Basic anode material current supply capability should be a minimum to supply 25 Amps with a system power supply driving voltage of nominally 15 Vdc. Voltage drop along the length of the anode shall be minimized. Life and reliability requirements are targeted at greater than existing technologies (30 years for anodes). Anodes should have uniform and consistent performance over their life cycle. Anodes developed must operate in a seawater environment of variable salinity and temperature and be compatible with ship systems in general. Anode holders and casing materials shall be resistant to hypochlorous acid and hypochlorite generated on the anode surface during operation. Anodes electrical connections to power supply cables must be at significant hydrostatic pressures. In addition, there is a desire for anodes to allow for change out underwater, without drydocking.

It is anticipated that the reference cells to be developed under the FNC will minimize performance and reliability issues associated with the legacy reference cells in use on VIRGINIA Class submarines. This has resulted in nuisance alarms, non-optimal operation of the Impressed Current Cathodic Protection (ICCP) system, and substantial rework and repair. In addition, reference cells in tanks and other confined spaces are frequently damaged or destroyed due to the lack of ruggedness and ease of damage in these areas. Long term performance of existing and next generation digital controlled ICCP systems requires a high level of performance from reference cells. Condition based maintenance diagnostics for ships' underwater hull and ballast tanks rely on reference cell gathered data. Unknown amounts of drift in reference cell readings and unplanned failures of reference cells can disable these advanced systems. The need exists for increased reliability/maintainability in reference electrode assemblies. New materials/chemistries or conceptual designs for a stable microprocessor controlled electrochemical half-cell for seawater environments, are of interest. These half cell sensor materials must be fully reversible under seawater conductivity and temperature regimes. They must be able to operate in seawater/freshwater solutions that have a range of resistivity from 18 Ohm-cm to 20,000 Ohm-cm, with an operating temperature range of 30-95F. Sensors that are able to survive harsh toxic environments (such as sulfide containing seawater solutions) that limit existing technologies, are of additional interest. Other capabilities of interest are self calibration and 'STAR' (Self Test and Repair) concepts. Reference cells should be designed such that installation and power up is simple and straight forward and cabling connections should be designed to survive significant levels of hydrostatic pressure and pressure cycling. Life and reliability requirements are targeted at greater than existing technologies (12 years). Reference cells should be of resolution and accuracy of +/-1 mV (DC) and drift should be minimized, controllable and well defined. On-board reference cell diagnostic or prognostic features are desirable. These features will aid in development of systems that can fully exploit reference cell capabilities and performance over time. Reference cells developed must operate in a seawater environment of varying conductivity and temperature and be compatible with ship systems in general. Reference cells should require minimal maintenance and designed so that components are modular and underwater replaceable.

Collaboration and teaming between sensor/ material / process developers is encouraged to achieve the technical goals and manufacturing capability. An Industry Day will be held on May 05, 2011 to provide additional information and discussion on this topic. Details and registration information may be found at

https://secure.onr.navy.mil/events/regdetail.asp?cid=719

Attendance is voluntary and not required to respond to this RFI; however, registration is required to attend the Industry Day. Time will be allowed during the industry day for potential offerers to interface with other interested commercial and academic parties.

Submissions

To minimize costs to potential contractors in responding to the subject announcement, each contractor is encouraged to submit an initial White Paper of no more than five (5) pages in length for each specific technology offered. A single source may submit multiple White Papers. White Papers may be submitted via e-mail to the Points of Contact Listed below. Alternatively, hard copies (1 original + 2 copies) may be mailed to the Points of Contact. All White Papers must be received by the requested due date (13 June 2011). Technology maturity and manufacturing capability shall be included. Each source should also provide a two (2) page maximum resume or curriculum vitae for the Principal Investigator.

Immediate questions and responses to this sources sought should be transmitted via email to Melissa.Rivera-Weedin@nrl.navy.mil in either Microsoft Word or pdf format. All responses shall be received on or before the response date noted above, 12:00 Noon, Eastern time. If paper copies are sent, they must be received at Naval Research Laboratory, Attn: Melissa Rivera-Weedin (Code 3220.mr), 4555 Overlook Ave, SW, Washington, D.C. 20375-5320. The package should be marked with the RFI Number, due date and time.

The U.S. Postal Service continues to irradiate letters, flats, Express and Priority Mail with stamps for postage and other packages with stamps for postage destined to government agencies in the ZIP Code ranges 202 through 205. Due to potential delays in receiving mail, offerors are encouraged to use alternatives to the mail when submitting proposals.

Other business opportunities for NRL are available at our website http://heron.nrl.navy.mil/contracts/rfplist.htm

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Place of Performance:
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Opportunity History

- **Original Synopsis**
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