

Statement of Work

1. Title

1.1. Scientific Investigation of Fuel Cells for Navy and Marine Applications.

2. Objective

2.1. *The Contractor will investigate the benefits of fuel cells for Marine Corps and Navy applications and determine if they can be used to charge small lithium ion batteries. This effort will include a study of two systems, a methanol fuel cell for Marine Corps applications and a seawater semi-fuel cell for surveillance applications.*

3. Requirements

3.1. *The Contractor must have a bachelor's degree in materials science with at least 3 years related experience and must demonstrate an understanding of fuel cell technology as it relates to Navy or Marine Corps system needs. Prior experience within the 6.2 development of the Navy and Marine Corps power sources is required. The Contractor's knowledge must include experience in portable fuel cells, such as methanol, and a metal/water semi fuel cell system. The Contractor's should possess market research knowledge for portable fuel cell systems and other power sources within the 50-500 watt range with specific experience developing and testing methanol fueled fuel cell systems. There should be a clear understanding of how electrochemical systems are characterized including knowledge of constant current/power discharges and cyclic voltammetry. In order to assess the benefits of fuel cells to recharging lithium polymer cells in the field, the Contractor must have, hands-on experience with cycling of these systems. Experience must be demonstrated in the following electrochemical techniques:*

3.1.1. *Discharge of fuel cells or semi-fuel cells under constant current or constant load.*

3.1.2. *Cycling of rechargeable lithium polymer batteries under constant current or constant load.*

3.1.3. *Experience in battery systems such as MACCOR or TechWare is strongly encouraged.*

3.2. *Scope of Work: The Contractor will assess methanol fuel cells and a seawater semi-fuel cell.*

3.3. *The seawater semi-fuel cell performance shall be characterized as a function of:*

- 3.3.1. Carbon type, at least 2 different materials
 - 3.3.2. Anode Material, at least 2 different aluminum, 1 magnesium
 - 3.3.3. Sea water temperature, at least 3 temperatures
 - 3.3.4. Oxygen content, at least 2, one of which simulates a littoral environment and the other deep ocean
 - 3.3.5. Cell Design, at least 2
 - 3.3.6. Current Density, at least 3
 - 3.3.7. Catalyst, at least 1
 - 3.3.8. As a result of the information gathered in Section 4.1, the Contractor in consultation with the Technical Point of Contact will identify the optimal fuel cell components. Fuel cells, employing these components, will be assembled. This design will undergo characterization including tests to determine the feasibility of using this technology to charge a small lithium ion cell in a littoral environment. At least 3 tests shall be conducted to verify this concept.
- 3.4. The methanol fuel cell shall be assessed to determine the state of the art and its usefulness to the military. To accomplish this task the Offeror shall conduct a literature search and contact scientists working in the field. The result of this effort shall be a report noting the benefits and disadvantages of the fuel cell. The report shall include suggestions of areas requiring further research.
4. The Contractor shall work at the government facility located in West Bethesda, MD.
 5. The government shall provide workspace and necessary resources to the contractor if available.
 6. The government shall provide equipment to analyze the various fuel cell and lithium battery technologies. These include:
 - 6.1. MACCOR Cyclers
 - 6.2. Techware Cyclers
 - 6.3. Environmental Chambers

6.4. Seawater baths

6.5. Oxygen Meters

6.6. Various materials to assemble a semi-fuel cell including: aluminum/magnesium anodes, carbon electrodes, and separator materials

6.7. Lithium ion cells for comparison purpose

7. Performance and Delivery

7.1. All technical work shall be completed no later than 12 months from date of award.

7.2. Laboratory notebooks, containing information performed during this investigation, shall remain the property of the government. The laboratory notebook shall contain an accurate and detailed account of the investigation so that a published paper in a journal or conference is achievable. All notes shall be clearly written and updated daily. Graphs and data reduction shall be placed in the laboratory notebook.

7.3. The Contractor shall provide technical information to the Project Technical Lead in the form of scientific reports, EXCEL spread sheets, graphs or Power Point Presentations.

7.4. Travel: Local and or long distance travel may be required to meet project objectives. The technical lead will alert the Contractor when and where travel is required. It is expected that long distance travel will be required for the following places: 1 trip to Rayovac (Madison, Wisconsin), 1 trip to the Electrochemical Society Meeting (Quebec City, Canada), 1 trip to Ball Aerospace (Boulder Colorado).

7.5. Technical Point of Contact: Dr. Patricia H. Smith. (301) 227-4168

7.6. Services Information: The Contractor shall not exercise personal judgment on behalf of the Government. The Government shall not assign sub-tasks or prepare work schedules but shall allow the Contractor to meet delivery schedules established in the overall task or project. The technical lead shall monitor work via contractor reports as requested.