UNITED STATES ADVANCED BATTERY CONSORTIUM LLC

DEVELOPMENT OF ADVANCED HIGH-PERFORMANCE BATTERIES FOR ELECTRIC VEHICLE (EV) APPLICATIONS

REQUEST FOR PROPOSAL INFORMATION (RFPI)

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1.0 Statement of Purpose/Objectives

The United States Advanced Battery Consortium (USABC) was formed in 1991 to sponsor development of advanced high-performance batteries for Electric Vehicle (EV) applications. USABC has carried out a number of battery development programs, focusing on low-cost and long-life batteries with varying power-to-energy ratios. With this request, the USABC intends to re-engage development activity in the area of high energy-to-power ratio batteries, and specifically those which utilize an advanced material as the negative electrode active material for a Li-Ion chemistry.

The purpose of this RFPI is to identify single developers or collaborative supplier teams developers having electrochemical energy storage technologies which have the capability of meeting or approaching the USABC commercialization criteria, as listed in the Appendix A which follows at the end of this document. The USABC expects that this work will be partially funded by the US Department of Energy though a cooperative agreement awarded to the USABC. The intended R&D approach of this subcontract is to develop an advanced energy storage cell first and then, if cell performance and the integration system experience of the developer is appropriate, building a module or system based on state of the art technologies in order to meet or surpass the technical requirements in Appendix A. If the cell developer believes that their proposal would be strengthened and could more likely meet the requirements in Appendix A through strategic collaboration with a key material, process or system developer or developers, a broader team-oriented proposal can also be submitted. Although project goals can be set that approach but not meet all of the USABC goals, a credible plan toward achieving all the USABC goals must be provided. The goals are for development which will result in commercialization of the cells or systems by CY 2020.

The USABC intends to capitalize on the knowledge it has gained through the HEV, PHEV, and EV research and development activities it has been engaged in. We expect developers to bring past experiences and lessons learned from their high power and/or high-energy work to bear on developing energy storage technologies for this application.

2.0 Business Objectives

This USABC RFPI represents a unique opportunity for developers to leverage their resources in combination with those of the automotive industry and the federal government. For the auto makers, this type of pre-competitive cooperation minimizes duplication of effort and risk of failure, and maximizes the benefits to the public of the government funds.

Beyond the efficient and timely usage of resources, the auto makers recognize that successful commercialization of these technologies will only be completed when the supplier base has been established for the selected components and subsystems. It is, therefore, a major business objective of USABC to enhance a supplier base as the development progresses. All developers submitting proposals will be required to demonstrate that they have the potential to develop a commercially viable business, which can produce sufficient volumes to meet automotive requirements, and provide engineering and testing support to meet automotive implementation requirements. Research organizations with current, direct affiliations with businesses that derive a majority of their income from related product sales, will also be considered. At the time of submittal, all developers will be required to have demonstration hardware and test results available for USABC inspection. Testing performed in accordance with the USABC battery test procedures is preferred, however not mandatory. Inspection and test of hardware by the USABC may be included in the selection process. Developers who do not have hardware and test results available for inspection by USABC at the time of submittal, need not respond.

3.0 Developmental Timing

The proposals must be accompanied by a development time chart characterizing the following:

1. Length of time the technology has been under development by the developer;
2. Length of time remaining to full scale, vehicle-size prototype hardware availability; and
3. Time line for commercialization, including any preproduction phases that may be planned.

4.0 Business Case

The submittal must be accompanied by a business case, divided into two sections. The first section shall state the cost assumptions used that will lead to the cost targets listed in Appendix A. These assumptions should be in general terms, broken down by major components, including material cost, processing cost and other costs. These costs should be presented in sufficient detail such that they can be used by the USABC to build confidence that its cost targets can be met by the technology.

The second portion of the business case is to address the anticipated capital investment required to support this initial program investment, including anticipated non-EV markets for the technology, sources of capital, etc. A copy of the USABC cost model, which is a multi-stage spreadsheet, is available on the USABC website, http://www.uscar.org/guest/article_view.php?articles_id=143. **USABC will not provide funding for capital expenses.**

5.0 Technical Challenges

Proposals must be accompanied by a clear description of the remaining technical challenges that the developer still needs to meet in order to commercialize the proposed technology and meet USABC's long-term criteria. A narration of the technical challenges that have already been met to reach the present state of the demonstration hardware will also be useful. Any testing, by USABC, of pre-contract demonstration hardware will be done in accordance with the USABC battery test procedures. These procedures can be found on the USABC website, http://www.uscar.org/guest/article_view.php?articles_id=86.

6.0 Information Requested

The information USABC is requesting from interested parties is specified in the following subsections. It includes: (1) a brief description of your company(s) background; (2) the advanced battery technology being proposed; (3) the development plan for the technology; (4) the proposed program deliverables, timing, and cost-share; (5) any formal or informal teaming arrangements planned; and (6) acknowledgement of export control compliance.

USABC does not expect to award contracts on the sole basis of responses to this RFPI. All responses will be considered by representatives of the partners and other participants and will be ranked in order of merit. The submitters of the most promising proposals will be contacted by USABC to enter into negotiations which may lead to firm contractual arrangements. If the government and other funding become available, as now expected, USABC intends to award one or more development contracts. However, nothing herein should be interpreted as a commitment to award a contract.

Information requested below should be answered as thoroughly as possible within a maximum of twenty five pages, in total, for the response to the RFPI. Your submission package should be sent via electronic mail and shall contain a cover letter, a complete copy of your proposal and, a signed copy of the RFPI Agreement. All technical and financial material submitted to the USABC must be in the English language. If you have any questions concerning the RFPI, please contact Meng Jiang @ 586-335-9726 or Maureen LaHote @ (313) 910-3720.

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO THIS USABC RFPI SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

ALL PROPOSALS ARE TO BE SUBMITTED TO THE CONSORTIUM IN ACCORDANCE WITH THE ATTACHED RFPI AGREEMENT WHICH MUST BE EXECUTED WITHOUT MODIFICATION AND ACCOMPANY THE PROPOSAL. NO PROPOSAL SHALL BE EVALUATED BY THE CONSORTIUM WITHOUT PRIOR EXECUTION OF SUCH RFPI AGREEMENT.

SEND, VIA ELECTRONIC MAIL, YOUR PROPOSAL (including signed RFPI Agreement) TO:

Maureen LaHote
Business Manager
United States Advanced Battery Consortium
E-mail: mlahote@uscar.org

USABC Proposal Template

Brief Company Background / Overview

1. Company structure and ownership, last year's financial statements
2. Experience bringing relevant product lines to market; in particular for automotive OEMs
3. Manufacturing, research and product development locations
4. Summary of total resources available for use in this proposed project.
5. Experience successfully executing R&D programs with DOE, other funding agencies, or in-house.

Technology Program Introduction

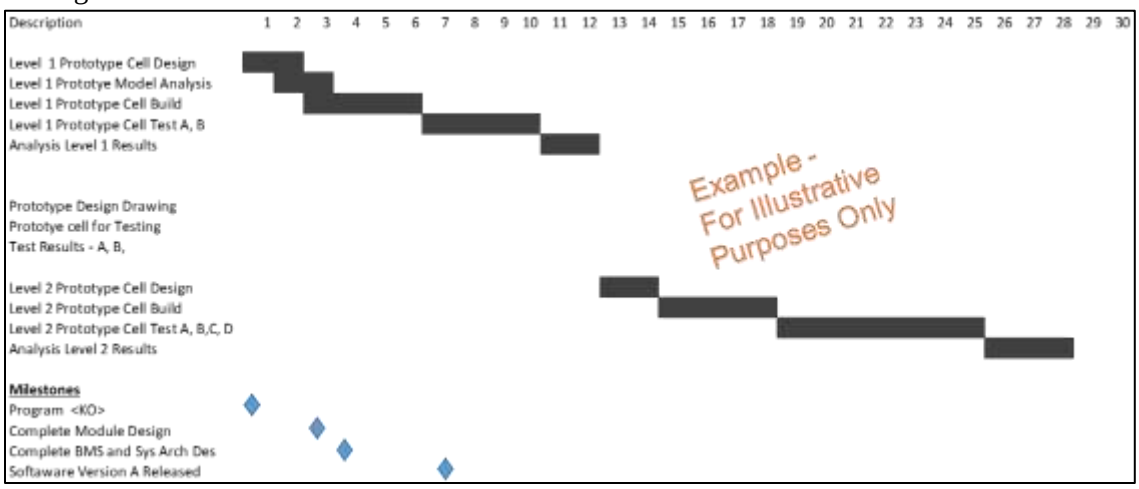
1. Technology description and statement of project objective.
2. What distinguishes this from other technologies and/or approaches?
3. Proposed program, length, cost, and value.
4. End of Program Objectives in relation to USABC goals
5. Technology Background
    a. Current Technology Status including analysis and test results
        i. Physical, performance, and life characteristics
    b. Technical challenges addressed
        i. Challenges to be addressed during course of project work
    c. Constraints or limitations that will not meet USABC goals in this project (if any)
        i. Packaging, safety, manufacturing, recycling, quality etc

Program Description

1. Gap analysis comparing current state of technology with USABC targets (Appendix A and B)
    a. Gap chart (see appx. A) with current status and planned end of program status
    b. Gap Analysis
2. Clearly state program goals and objectives and compare to USABC goals
3. Provide Program Development plan
    a. High level Work Breakdown Structure -Include main tasks and any identified subtasks, also include deliverables included in your timeline
    b. Describe the work proposed for all key elements (tasks) of the plan
    c. Describe contingency plans for critical aspects of the project
    d. Note: For selected projects, this section will be the focus of SOW development to reach a well-defined, high value program for the developer and for USABC.
4. Provide a cost estimate or model for the technology, the USABC cost model (a required program deliverable) is available at http://www.uscar.org/guest/article_view.php?articles_id=143

Development Timing Plan

1. Timing Chart



Example Timing Chart:

2. Table of Milestones and Deliverables
   - Quantified deliverables and specific timing required (see example)

Event # (keyed to WBS tasks)	Event Class	Event Title	Planned Month
M1.1.1	Milestone	Buy needed cells	2
M1.1.2	Milestone	Complete Module design	3
M1.2.1	Milestone	Complete BMS and system architecture design	4
M1.2.2	Milestone	Software Revision A Released	8
M1.2.3	Milestone	Software Revision FINAL Released	15
M1.3.1	Milestone	Release Feasibility Plan	1
D1.3.1	**Deliverable**	**Feasibility Study Report**	**15**
D1.4.1	**Deliverable**	**Ship 3 ea Modules to national labs for Baseline tests**	**5**
D1.4.2	**Deliverable**	**Ship 18 ea improved Modules to national labs for Final tests**	**18**
M1.5.1	Milestone	CAD model of Prototype Module	12
D1.5.1	**Deliverable**	**Module Design & Analysis Report**	**13**
D1.6.1	**Deliverable**	**12V SS Cost Model – Final**	**16**
M2.1	Milestone	Baseline Cell Configuration	4
M2.1.1	Milestone	cell electrolyte formulation identified	15
M2.2	Milestone	Final Cell Configuration	15
M2.2.1	Milestone	Packaging design freeze	14
D2.1	**Deliverable**	**Final Cell Technical Report**	**18**
D2.4.1	**Deliverable**	**Ship 5 ea cells to national labs for Baseline tests**	**5**
D2.4.2	**Deliverable**	**Ship 20 ea cells to national labs for Final tests**	**19**
M2.5.1	Milestone	cell Cost Model – Prototype	12
D2.5	**Deliverable**	**cell Cost Model – Final**	**15**
M0.1	Milestone	Kickoff Meeting	1
M0.2	Milestone	Program Gate Review Meeting	13
D0.1	**Deliverable**	**Quarterly Program Reports**	**Every 3**
D0.2	**Deliverable**	**DOE Annual Progress Reports**	**Annual**
D0.3	**Deliverable**	**Final Program Report**	**19**

Program Cost, Budget and Cost Sharing

1. Project cost table broken down by task; if subcontractors are included in the proposal include costs broken down by subcontractor as well.
    a. Note: Awarded projects must fill in the EERE 335 Budget form (http://www.uscar.org/guest/article_view.php?articles_id=87); it may be used in the proposal if desired.
    b. Note: For budgeting purposes be aware that a set of baseline cells, possibly one or more sets of midterm cells, and a final set of cells are normally required for testing in USABC projects, depending on project length. Testing is done both at the national labs and to a large extent the same tests are conducted at the supplier. Accordingly, a total of from 20 to 40 cells will typically need to be built at each of these points.
2. A table or graph of predicted cumulative spending rate over project period
3. Describe proposed cost share (a minimum of 50 percent developer cost share is contractually required and is recommended)
4. Provide confirmation that at least 75% of the direct labor billed to USABC for this project will be incurred within the United States

Program Management

1. Provide list of key personnel, in particular program manager, and % time allocated to the project
2. Provide a brief resume of key personnel to be assigned to the project

RFPI AGREEMENT

NOTWITHSTANDING PROPOSER'S MARKINGS TO THE CONTRARY, ALL INFORMATION SUBMITTED IN RESPONSE TO A UNITED STATES ADVANCED BATTERY CONSORTIUM (USABC) REQUEST FOR PROPOSAL INFORMATION (RFPI) SHALL BE TREATED ON A NON-CONFIDENTIAL BASIS.

AGREED:

BY _____

TITLE _____

PROPOSER _____

DATE _____

Appendix A

USABC Goals for High-Performance Batteries for Electric Vehicles (EVs)

End of Life Characteristics at 30°C	Units	System Level	Cell Level
Peak Discharge Power Density 30 s Pulse	W/L	1000	1500
Peak Specific Discharge Power, 30 s Pulse	W/kg	470	700
Peak Specific Regen Power, 10 s Pulse	W/kg	200	300
Useable Energy Density @ C/3 Discharge Rate	Wh/L	500	750
Useable Specific Energy @ C/3 Discharge Rate	Wh/kg	235	350
Useable Energy @ C/3 Discharge Rate	kWh	45	N/A
Calendar Life	Years	15	15
DST Cycle Life	Cycles	1000	1000
Cost @ 250k Units	$/kWh	125	100
Operating Environment	°C	-30° to +52°	-30° to +52°
Normal Recharge Time	Hours	< 7 Hours, J1772	< 7 Hours, J1772
High Rate Charge	Minutes	80%ΔSOC in 15 min	80%ΔSOC in 15 min
Maximum Operating Voltage	V	420	N/A
Minimum operating Voltage	V	220	N/A
Peak Current, 30 s	A	400	400
Unassisted Operating at Low Temperature	%	>70% Useable Energy @ C/3 Discharge Rate at -20°C	>70% Useable Energy @ C/3 Discharge Rate at -20°C
Survival Temperature Range, 24 Hr.	°C	-40° to +66°	-40° to +66°
Maximum Self-discharge	%/month	<1	<1

APPENDIX B –Attributes of Cell Technology Proposed for EVs for FY 2020 Commercialization

Cell Level Attributes (supplied by developer)	Units	Current State (baseline) (BOL)	End of Program Target (BOL)
Cell Capacity (C/3 Rate discharge)	Ah		
Cell Volume (without terminals/tabs)	Liter		
Cell Mass	kg		
Vmin continuous, Vmax continuous (0 and 100% SOC)	V, V		
Vmin pulse, Vmax pulse (10 sec pulses)	V, V		
Vnominal (Wh/Ah)	V		
Energy Density (volumetric)	Wh/l		
Specific Energy	Wh/kg		
Power Density (10 sec. HPPC power), 50% SOC	W/l		
Specific Power (10 sec. HPPC power), 50% SOC	W/g		
Target Cost / unit (>10 million cells/annum rate)	$		
Cell format (cylindrical/prismatic)	can/pouch/etc.		
Cell dimensions: (height x width x thickness)	mmxmmxmm		
Proposed Architecture to Achieve System Targets			
Battery Size Factor (BSF) – No. of Cells	#		
Parallel-Series Configuration	__p__s		