COORDINATING RESEARCH COUNCIL, INC.
5755 NORTH POINT PARKWAY, SUITE 265
ALPHARETTA, GA 30022
TEL: 678/795-0506 FAX: 678/795-0509
WWW.CRCAO.ORG

June 29, 2022
In reply, refer to:
CRC Project No. SM-E-18

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a written proposal to provide services for "V2X Requirements to Support the SAE J1634 Short Multi-Cycle Test" (CRC Project No. SM-E-18). A description of the project is presented in Exhibit A, "Statement of Work."

Please indicate by letter, fax, or email by **July 20, 2022** if you or your organization intends to submit a written proposal for this research program. CRC will answer technical questions regarding the Request for Proposal if they are submitted in writing. CRC will then return written answers to all of the bidders, along with a copy of the original questions.

A CRC technical group composed of industry representatives will evaluate your proposal. CRC reserves the right to accept or reject any or all proposals. Key contract language examples are presented in Exhibits B, C, D, and E. CRC must adhere to standard contract language with minor adjustments only in extraordinary circumstances. **Failure to agree to these contract clauses as written may result in the project being awarded to another contractor.**

Important selection factors are listed in Exhibit F. CRC evaluation procedures require the technical group to complete a thorough technical evaluation before considering costs. After developing a recommendation based on technical considerations, the costs are revealed and the recommendation is modified as needed.

The proposal must be submitted as two separate documents. The technical approach to the problem will be described in part one, and a cost breakdown that is priced by task will be described in part two. The cost proposal document should include all costs associated with conducting the proposed program. The technical proposal should not be longer than 10 pages in length (not including resumes). **The schedule / timeline information must be included in the technical proposal; failure to do so may result in your proposal being set aside as non-responsive.**

CRC expects to negotiate a cost-plus fixed fee or cost reimbursement contract for the research program.

The technical and cost proposals should be submitted to:
Christopher J. Tennant Email: **ctennant@crcao.org**

The deadline for receipt of your proposal **August 3rd, 2022**

EXHIBIT A

CRC Project No. SM-E-18

Statement of Work

Background

US EPA and California Air Resources Board require electric vehicle range to be determined using the SAE J1634 recommended practice, Battery Electric Vehicle Energy Consumption and Range Test Procedure. The Multi-Cycle Test (MCT) procedure is a combination of UDDS and HFEDS drive cycles to determine the energy consumption, and constant speed driving to measure the Usable Battery Energy (UBE). While the MCT reduces test time compared to the previous Single Cycle Test (SCT), it still requires 6-12+ hours of time on the chassis dyno, depending on the range of the EV.

In the 2021 revision of SAE J1634, the Short Multi-Cycle Test (sMCT) was introduced. The sMCT significantly reduces laboratory test burden by performing a 2.1 hour drive cycle on the chassis dyno followed by discharging the remaining battery energy into a battery cycler. The battery discharge can be done outside of the chassis dyno test cell into a battery cycler where the remaining UBE is measured.
There is a need to develop standard methods and recommended guidelines for performing the energy discharge utilizing an industry standard V2X (Vehicle to X, where X can be grid, vehicle, building, etc) communication protocol together with a battery cycler.

Objective

Evaluate potential industry standard V2X communication protocols (such as ISO 15118-20 and SAE J2836). Provide a comparison of protocol options and identify a recommended protocol. Develop guidelines, procedure, quality checks and best practices to perform the SAE J1634 (April 2021) EV battery discharge utilizing the recommended V2X protocol. This shall include requirements for the vehicle battery discharge control, communication between vehicle and battery cycler, and battery cycler control.

A second phase will perform whole vehicle correlation of the MCT, sMCT, and sMCT+ test cycles using the protocols developed in the first phase. It will determine the differences in range and total energy consumption of the sMCT+, sMCT, and MCT, and demonstrate if the differences in range and total energy consumption of the sMCT are worse case or within 3% of MCT. The study will follow J1634 (April 2021). In addition to comparing the test cycles it will validate and confirm performance of the system.

Statement of Work

The second phase is outlined in this document but is not part of the project encompassed by this Statement of Work. It is discussed so that the contractor knows there may be a second phase and what it is likely to include. The prospective contractor's proposal is for phase 1 only. Any future work (Phase 2) will be competitively bid using the CRC contract award process.

- Phase 1 will provide method for certification of an electric vehicle using J1634 (April 2021) while discharging the vehicle battery through an EV battery cycler using an industry standard protocol.

- Phase 2 will demonstrate the method following J1634 (April 2021) with an electric vehicle and quantify any differences between MCT, sMCT and sMCT+ test cycles using the protocols developed in phase 1. This will validate and confirm performance of system.

Project will provide:

- A review of potential protocols for V2X for suitability for control of J1634 (April 2021) battery discharge for determining usable battery energy (UBE).
- Guidelines on communication and commands required to perform the J1634 (April 2021) sMCT EV battery discharge procedure. These should include the option to read battery voltage and/or current from the vehicle using the V2X protocol.
- A work instruction for completion of a J1634 (April 2021) test using testing equipment available in 2022 or at the time this project starts.
- A process that automates the DC Discharge of the J1634 (April 2021) test. The discharge will be set to the required output power as defined in J1634 (April 2021).
- The minimum requirements for a configurable software package that can execute the battery discharge test while defining the configurable parameters and required output.
- Potential vehicle dyno mode requirements. The test procedure may require the DC discharge rate to be higher and to stop at a lower SOC than the vehicle may allow during typical V2X discharging. The discharge rate to be determined per J1634 (April 2021).
- Recommended discharge rate limits meeting safety guidelines
- A list of known lab equipment and minimum required performance specifications that would enable automated testing with cycler as per J1634 (April 2021).
- A recommended safety practice for unsupervised discharge of a vehicle.
- A recommended instrumentation list allowing for execution of a compliant J1634 (April 2021) test.

Requirements

- Measure battery voltage and current from the vehicle per J1634 (April 2021) using either:
    - the V2X communication protocol or
    - from vehicle network communications or
    - via external equipment, such as a power analyzer.
        - Potentially up to 8 individual current measurements may be required

  Note: Battery voltage or current measurements made by the vehicle's own on-board sensors (such as those available via a diagnostic port) may be used for calculating discharge energy if these measurements are equivalent to those produced by applicable external measurement equipment.

Deliverables

Phase 1 deliverables include:

- A kick-off meeting/call between CRC and the contractor to discuss project scope and align expectations.
- Twice a month calls between CRC and the contractor to discuss model development and preliminary results and identify any information gaps before finalizing findings and starting the final report.
- Written monthly status updates delivered in a timely fashion to CRC administration
- Quarterly status presentations to the Sustainable Mobility Committee (SMC) may be required
- A final report outlining the procedure with sufficient detail to enable a non-participating automaker or lab to implement the method, the draft of which will be reviewed and approved by CRC before final release.
    - The contractor is free to publish a journal article containing the results of the study. (CRC rules around publications and permissions shall apply.)

Project Schedule

CRC expects that this effort should be performed over a period of up to 12 months following contract execution. However, the contractor will propose an appropriate timeline for completing the study, including milestones for study deliverables.

Project Management

CRC and its project technical panel will provide management and oversight for this project. These entities are hereafter referred to collectively as the project sponsor.

EXHIBIT B

REPORTS

A. CONTRACTOR shall submit a technical progress report covering work accomplished during each month of the contract performance. The report shall contain a description of overall progress, plus a separate description for each task or other logical segment of work on which effort was expended during the reporting period. Periodic conference calls may also be requested by CRC to update the technical committee overseeing the project.

B. CONTRACTOR shall submit to CRC a draft final report on or before DRAFT FINAL REPORT DUE DATE. The *Draft Final Report* shall be reviewed and returned to CONTRACTOR with comments no later than forty-five (45) days thereafter. The report shall document, in detail, all of the work performed under the contract including data, analyses, and interpretations, as well as recommendations and conclusions based upon results obtained. The report shall include tables, graphs, diagrams, curves, sketches, photographs, and drawings in sufficient detail to comprehensively explain the results achieved under the contract. The report shall be complete in itself and contain no reference, directly or indirectly, to the monthly progress reports and should be suitable for publication in the peer-review literature. Additional rounds of review may be required prior to acceptance of the Final Report. If applicable, data from the research shall be provided in a format suitable for releasing to the public along with the final report.

The draft report must have appropriate editorial review corrections made by the contractor prior to submission to CRC to avoid obvious formatting, grammar, and spelling errors. The report should be written in a formal technical style employing a format that best communicates the work conducted, results observed, and conclusions derived. Standard practice typically calls for a report structure that includes:

- CRC Title Page and Disclaimer Statement (both provided by CRC)
- Table of Contents
- List of Figures
- List of Tables
- List of Acronyms and Abbreviations
- Executive Summary
- Background
- Approach (including a full description of all experimental materials and methods)
- Results
- Conclusions (may also include Recommendations if CRC requests them)
- List of References
- Appendices as appropriate for the scope of the study.

Incomplete draft reports or reports of poor quality requiring additional outside editorial review may have outside editorial services charged back to the project budget.

EXHIBIT C

INTELLECTUAL PROPERTY RIGHTS

Title to all inventions, improvements, and data, hereinafter, collectively referred to as ("Inventions"), whether or not patentable, resulting from the performance of work under this Agreement shall be assigned to CRC. CONTRACTOR shall promptly disclose to CRC any Invention which is made or conceived by CONTRACTOR, its employees, agents, or representatives, either alone or jointly with others, during the term of this agreement, which result from the performance of work under this agreement, or are a result of confidential information provided to CONTRACTOR by CRC or its Participants. CONTRACTOR agrees to assign to CRC the entire right, title, and interest in and to any and all such Inventions, and to execute and cause its employees or representatives to execute such documents as may be required to file applications and to obtain patents covering such Inventions in CRC's name or in the name of CRC's Participants or nominees. At CRC's expense, CONTRACTOR shall provide reasonable assistance to CRC or its designee in obtaining patents on such Inventions.

To the extent that a CRC member makes available any of its intellectual property (including but not limited to patents, patent applications, copyrighted material, trade secrets, or trademarks) to CONTRACTOR, CONTRACTOR shall have only a limited license to such intellectual property for the sole purpose of performing work pursuant to this Agreement and shall have no other right or license, express or implied, or by estoppel. To the extent a CRC member contributes materials, tangible items, or information for use in the project, CONTRACTOR acknowledges that it obtains only the right to use the materials, items, or information supplied for the purposes of performing the work provided for in this Agreement, and obtains no rights to copy, distribute, disclose, make, use, sell or offer to sell such materials or items outside of the performance of this Agreement.

EXHIBIT D

RELATIONSHIP OF PARTIES

It is agreed and understood that CONTRACTOR is acting as an independent contractor in the performance of any and all work hereunder, and to the extent caused by CONTRACTOR, CONTRACTOR shall be solely liable and responsible for the payment of all legal claims for damages made by its employees or agents, or by another person or persons, on account of any property damage or on account of personal injury sustained or suffered by, or on account of the death, of any person or persons, or on account of any other legal claims arising or growing out of CONTRACTOR's negligence in the performance of the agreement; and CONTRACTOR undertakes to indemnify CRC against any such liability.

EXHIBIT E

KEY PERSONNEL REQUIREMENTS

Certain skilled experienced professional and/or technical personnel are essential for successful performance by CONTRACTOR of its obligations and work under this Agreement. These personnel are persons whose resumes were submitted for evaluation of the Proposal and are identified by CRC as "Key Personnel". CRC awards contracts based on several requirements and the reputation and experience of Key Personnel are a significant requirement. CONTRACTOR agrees that CONTRACTOR will not remove or replace any Key Personnel from the contract work without compliance with paragraphs (a) and (b) hereof.

(a) If any Key Personnel for whatever reason becomes, or is expected to become, unavailable for work under this Agreement (or any specific Project) for a continuous period exceeding thirty (30) work days, or is not expected to perform the work hours and volume of work indicated in the proposal or initially anticipated, the CONTRACTOR shall immediately notify CRC and shall, subject to the concurrence of CRC, promptly replace such Key Personnel with personnel of at least substantially equal ability and qualifications acceptable to CRC.

(b) All requests for approval of substitutions of Key Personnel hereunder must be in writing to CRC and provide a detailed explanation of the circumstances necessitating the proposed substitutions. Requests for substitution must contain a complete resume for the proposed substitute Key Personnel, and any other information requested by CRC needed to approve or disapprove the proposed substitution. CRC will evaluate such requests and notify CONTRACTOR of approval or disapproval thereof in writing. CRC is not responsible for, and shall not be charged, any fees or other costs related to such replacement Key Personnel's performance of the services until the replacement Key Consultant has obtained the same proficiency and knowledge regarding the services as the former Key Personnel.

(c) If CRC determines that suitable and timely replacement of Key Personnel who have been reassigned, terminated or have otherwise become unavailable for the contract work is not reasonably forthcoming or that the proposed replacement Key Personnel would impair the successful completion of the contract or the services ordered, at the option of CRC, (i) the Agreement (in whole or in part related to the applicable contract work) may be terminated by CRC or (ii) the contract price or fixed fee may be equitably adjusted downward to compensate CRC for any resultant delay, loss, or damage, in an amount acceptable to CRC

EXHIBIT F

PROPOSAL EVALUATION CRITERIA

1) Merits of proposed technical approach.
2) Previous performance on related research studies.
3) Personnel available for proposed study – related experience.
4) Timeliness of study completion.
5) Cost.