**COORDINATING RESEARCH COUNCIL, INC.**

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 **September 3, 2020**

In reply, refer to:

 CRC Project No. CM-138-20

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a written proposal to provide services for “Development of Automated Driveability Rating System Using Trick Car” (CRC Project No. CM-138-20). A description of the project is presented in Exhibit A, “Statement of Work.”

Please indicate by letter, fax, or email by **September 17, 2020** 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.

The reporting requirements will be monthly progress reports and a summary technical report at the end of the contractual period. The reporting requirements are described in more detail in the attachment entitled “Reports” (Exhibit B). Contract language for intellectual property and liability clauses is presented in Exhibit C and in Exhibit D, respectively. Important selection factors to be taken into account are listed in Exhibit E. 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 shall not be longer than 10 pages in length (not including resumes). **The schedule / timeline information should be included in the technical proposal.**

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 is **October 2, 2020.**

**EXHIBIT A**

**Development of Automated Driveability Rating System Using Trick Car**

Background

CRC has interest in using driveability rating methods to determine the effect of fuel properties on vehicle driveability. These driveability rating methods may use either human raters or automated methods.

CRC project CM-138-17-1 “Computer Controlled Poor Driveability On Demand Training Vehicle” developed a training vehicle (a so-called “trick car”) for use in training human raters (1). The training vehicle was designed to be programmable to exhibit driveability characteristics like symptoms exhibited by on-road vehicles experiencing fuel driveability problems. Part of project development involved adjusting parameters of the various driveability functions to improve the “feel” of the functions as perceived by the human raters. This included both the characteristics and severity of the driveability functions.

For example, for hesitation during vehicle launch, the controller added a lag time between when the driver pressed the accelerator pedal and when the engine control unit (ECU) received the accelerator pedal signal. Once the accelerator pedal position exceeded 4%, the pedal position was intercepted by the controller and forced to zero for a specified length of time. This lag time varied from 230 to 1000 ms depending on the throttle setting (light, moderate, or wide open throttle) and on the severity of the desired hesitation event (trace, moderate, or heavy).

When writing the project report, it was observed that this project had succeeded in describing mathematically what a “hesitation” driveability event looks like. Therefore, it may be feasible to use this information to develop an Automated Driveability Rating System (ADRS) that uses this information to automatically rate driveability events.

For example, the ADRS could use accelerometers to measure the difference between accelerator pedal position and actual vehicle response. If the ADRS detected a time lag of about 1000 ms during a light-throttle vehicle launch, it would flag it as a “hesitation” with “heavy” severity. The ADRS could potentially be installed on any vehicle with access to the accelerator pedal position and suitable locations to install accelerometers and/or other sensors.

Objectives

Develop an ADRS applicable to most modern Light Duty (LD) vehicles (cars and LD trucks) capable of identifying and rating fuel-related driveability events including hesitation, stumble, surge, stall, and idle quality at severity of trace, moderate, and severe.

Experimental Plan

Develop an Automated Driveability Rating System and install it on the trick car developed in CRC project CM-138-17-1 (1). Use programmed driveability events to test and calibrate the ADRS. Use the trick car to demonstrate that the ADRS can successfully identify and rate driveability events including hesitation, stumble, surge, stall, and idle quality at severity of trace, moderate and severe. On-road and/or track testing must be used to demonstrate system capabilities. Features and operating characteristics of the trick car are described in the CRC project CM-138-17-1 report (1). The trick car was used in a training program to train human raters as described in the CRC project CM-138-18-1 report (2). These reports are available online at www.crcao.org.

It may be desirable to use human trained raters to verify that the ADRS is properly identifying and rating the driveability events. Define what an appropriate system verification test would entail both with and without using trained human raters. Price these two options separately in the proposal so the CRC project panel can decide whether they want to do one or the other or both. Design the ADRS with capability to be installed on most modern LD vehicles.

The ADRS may be designed to collect data on-board the vehicle during testing and download data to an off-board computer system for analysis later, or designed to collect and process data real-time on-board the vehicle. This will be left to the contractor’s discretion.

The ADRS should be designed to be readily transferrable from one vehicle to another to facilitate use of the system in a driveability study of a fleet of cars. Fast transfer between vehicles is desirable because in previous driveability studies, changing weather conditions made it necessary to test up to 10 cars within one hour. In this case it may be desirable to have sensors pre-installed on the vehicles and only transfer the control unit between vehicles. If the contractor has a different idea of how to accomplish this, we welcome suggestions.

The CRC project panel anticipates that the ADRS may require evaluation of signals from various types of sensors including accelerator pedal position, vehicle motion (accelerometer or gyroscope), sound, and/or vibration. Some of these sensors may need to be placed in various locations within the vehicle (chassis, engine or engine mount, under driver’s seat, inside cabin, etc.) for a reliable indication of driveability sensations experienced by a human driver.

Contractor will need to ship the trick car to their test facility from its location in San Antonio, Texas, and return the vehicle to San Antonio after the test program is concluded.

Deliverables

Deliverables include monthly written project status reports; periodic project status teleconferences as desired by the project Panel; an Automated Driveability Rating System including all controllers, sensors, hardware, and software required for system installation and operation; an operating manual describing installation and use of the ADRS; and a final report describing system development, operation, capabilities, and testing. The final report will include conclusions and recommendations for future development or improvement of the ADRS including feasibility of application of the ADRS to vehicle testing on a chassis dynamometer. The operating manual may be part of the final report.

References

1. Computer Controlled Poor Driveability On Demand Training Vehicle, CRC Project No. CM-138-17-1, Oct. 2018
2. CRC Driveability Workshop, CRC Report No. CM-138-18-1, Apr. 2020

**EXHIBIT B**

**REPORTS**

**MONTHLY TECHNICAL PROGRESS REPORTS**

The contractor shall submit a monthly technical progress report covering work accomplished during each calendar month of the contract performance. An electronic Microsoft® Word compatible file (<1 MB) of the monthly technical progress report shall be distributed by the contractor within ten (10) calendar days after the end of each reporting period. 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.

**FINAL REPORT**

The contractor shall submit to CRC a draft final report. The report shall document the test procedure, document details of each test iteration, and explain any observations noted. The test data will be recorded and reviewed, and the final report will include a certification that the test procedures were followed, noting any exceptions. The detailed data will also be supplied electronically to CRC.

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 CRC Title Page, Disclaimer Statement, Foreword/Preface, 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, List of References, and 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.

Comments regarding the report shall be furnished by the CRC committee to the contractor within one (1) month after receipt of the draft copy. Additional rounds of review may be required.

Within thirty (30) days after receipt of comments, the contractor shall make the requested changes and submit an electronic copy of the draft final report in both Microsoft Word and Adobe pdf file format. Once accepted, the contractor shall deliver five (5) hard copies of the final report to CRC. The final report may be prepared using the contractor’s standard format, acknowledging author and sponsors. An outside CRC cover page will be provided by CRC. The electronic copy will be made available for posting on the CRC website.

**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 X shall promptly disclose to CRC any Invention which is made or conceived by Contractor X, 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 X by CRC or its Participants. Contractor X 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 X 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 X, Contractor X 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 X 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

# LIABILITY

# It is agreed and understood that \_\_\_\_\_\_\_\_\_\_\_\_ is acting as an independent contractor in the performance of any and all work hereunder and, as such, has control over the performance of such work. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ agrees to indemnify and defend CRC from and against any and all liabilities, claims, and expenses incident thereto (including, for example, reasonable attorneys’ fees) which CRC may hereafter incur, become responsible for or pay out as a result of death or bodily injury to any person or destruction or damage to any property, caused, in whole or in part, by \_\_\_\_\_\_\_\_\_’s performance of, or failure to perform, the work hereunder or any other act of omission in connection therewith.

# EXHIBIT E

**PROPOSAL EVALUATION CRITERIA**

1) Merits of proposed technical approach.

2) Previous performance on related research studies.

1. Personnel available for proposed study – related experience.
2. Timeliness of study completion.
3. Cost.