**COORDINATING RESEARCH COUNCIL, INC.**

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 **June 17, 2020**

In reply, refer to:

 CRC Project No. AV-29-20

Dear Prospective Bidder:

The Coordinating Research Council (CRC) invites you to submit a written proposal to provide services for “A Review of Current Experimental and Correlation Methods to Determine the Calorific Energy Content of Liquid Fuels” (CRC Project No. AV-29-20). A description of the project is presented in Exhibit A, “Statement of Work.”

Please indicate by letter, fax, or email by **July 1, 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 **July 17, 2020**

**EXHIBIT A**

**Statement of Work**

“A Review of Current Experimental and Correlation Methods to Determine the Calorific Energy Content of Liquid Fuels”

**Background**

Aviation fuel energy content represents a fundamental thermodynamic property, the energy available when a given weight of fuel is fully burnt under ideal conditions. Results are usually expressed as MJ/kg or Btu/lb. Aviation specifications set minimum values for this property to ensure aircraft will have sufficient flight range when loading a given quantity of fuel, for example:

* Aviation Gasoline ASTM D910[1] 43.5 MJ/kg minimum.
* Aviation Turbine Fuel ASTM D1655[1] 42.8 MJ/kg minimum.
* Jet B Wide-Cut Aviation Turbine Fuel ASTM 6615[1] 42.8 MJ/kg minimum

Experimental determination of energy content can be achieved by complete combustion of a known mass of fuel in excess oxygen using a Bomb Calorimeter. Such instruments must be carefully designed and operated to ensure accurate measurements, for example taking into account heat loss / gain from surroundings and thermal mass. Due to this complexity the aviation Industry prefer to utilize correlations to estimate fuel energy content, for example ASTM D3338[1] based on distillation, density and sulfur.

While aviation fuel Bomb Calorimeter measurements are rare, the availability of suitable equipment is important for:

* Referee determination if a cargo of fuel is close to specification minimum.
* Evaluation of new aviation fuel production routes where product cannot be assumed to be within the scope of the correlation methods.

During recent CRC / Energy Institute (EI) meetings it was observed that Industry methods for determination of calorific value, namely

* D4809[1] Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter (Precision Method)
* IP 12[2] Determination of Specific Energy

are becoming dated versus modern laboratory equipment. In addition, an understanding of the development history, scope and limitation of correlation methods such as D3338 is important to ensure appropriate use. As such, review of experimental / correlation techniques for aviation fuel energy content determination is proposed, the aim being to highlight opportunities for improvement / revision to benefit the Industry.

At the request of CRC members, the project has been divided into two phases:

* Phase 1 – Literature review of calorific instruments, methods and correlations.
* Phase 2 – Experimental study.

This statement of work covers Phase 1, options for Phase 2 to be considered on completion and tailored to the inform gathered.

*Note: As Industry centers of expertise may differ for Phase 1 and Phase 2 project delivery, tenders for each Phase will be issued independently. As such, an Offeror for Phase 1 does not also require the ability to complete Phase 2. Equally, an Offeror who is unsuccessful in bidding for Phase 1, or does not wish to bid, will be most welcome to bid for Phase 2.*

**Objective**

To provide a report reviewing current methods for the determination of the calorific energy content of liquid fuels.

**Scope of Work**

To provide a report reviewing current methods to determine the calorific energy content of liquid fuels covering:

(i) Laboratory methods / apparatus

(ii) Correlation methods

With respect to (i), to include:

• The manufacturer of the equipment

• Applicable fuel types (gasoline, kerosene, diesel, others)

• Ease of use

• Precision

• Qualification to known IP, ASTM or other standard method.

With respect to (ii), to include:

• A summary of the history of the correlation

• The fuels used to develop the correlation (number / type)

• Precision

• Qualification to known IP, ASTM or other standard method*.*

The source of the data in the final report to be formally recorded in a Reference section to allow manufacturers / documents to be traced for further evaluation if necessary. Given the challenge of obtaining accurate experimental measurements of calorific value, the identification of modern, automated units within the study is an important requirement.

**Schedule**

6 months

**Deliverables**

A report reviewing current methods for the determination of the calorific energy content of liquid fuels.

**References**

[1] Available from: ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959. United States.

[2] Available from: Energy Institute, 61 New Cavendish St, Marylebone, London W1G 7AR

**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.