



## REQUEST FOR PROPOSAL (RFP) CYCLE 4 Research Opportunity

### 1.0 BACKGROUND

The Universities Space Research Association (USRA) is collaborating with Standard Chartered Bank (SCB), New York State Technology Enterprise Corporation (NYSTEC), and NASA to explore the short-term and long-term benefits of new Artificial Intelligence (AI) algorithms designed to run on hybrid quantum-classical computing machinery.

### 1.0 OVERVIEW

The Universities Space Research Association (USRA) is pleased to invite proposals for Cycle 4 of the Quantum Artificial Intelligence Laboratory Research Opportunity, which will allocate computer time for research projects to be run on the D-Wave System at NASA Ames Research Center (ARC).

Successful projects will be allowed to remotely access the quantum annealer, and to run a number of jobs up to a maximum allocated runtime usage.

The Call is open to all qualified researchers affiliated to accredited universities and not-for-profit organizations (**PROPOSERS**) within the United States. For-profit corporations, universities and not-for-profit not in the United States are not eligible for this RFP but we encourage to reach out with unsolicited proposals to discuss case-by-case opportunities.

The computer time will be provided free of charge. No financial support is offered for the completion of the project.

Proposals are sought for research on fundamental and applied aspects of physics and artificial intelligence, as well as demonstrations of advanced programming techniques for quantum annealing (Ising mappings, decomposition/hybridization with other computation systems, novel embedding/compiling methods, use of reverse annealing, annealing pauses and offsets), with the objective to advance the state-of-the-art in quantum computing and its application to artificial intelligence.

The D-Wave System currently features the D-Wave 2000Q chip. High-level descriptions of the computer and its programming can be found on D-Wave website <http://www.dwavesys.com/resources/tutorials>. The specific machine installed at ARC currently has more than 2000 qubits in the working graph.

For detailed information and application instructions, visit the Quantum AI Lab website at <https://riacs.usra.edu/quantum/qisprogram>.

### 2.0 QUALIFICATIONS OF THE PROVIDER AND ELIGIBILITY

USRA may make such reasonable investigations as deemed proper and necessary to determine the ability of the **PROPOSER** to perform the work. The machine time is allowed only for research



purposes, in no cases it should be used as part of a system in “production” stage.

USRA further reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy USRA that such offeror is properly qualified to carry out the obligations of the contract and to complete the work contemplated.

### Who May Propose:

Participation in this Research Opportunity is open to scientists from all categories of accredited educational institutions and not-for-profit organizations within the United States.

### 3.0 PROPOSAL PREPARATION AND SUBMISSION REQUIREMENTS

Proposals should be as thorough and detailed as possible so that USRA may properly evaluate your capabilities to conduct the proposed research. The proposal will consist of a document detailing the research project (max 5 pages), with a cover page (see Appendix A). The cover page is not included in the page count. The document will need to answer the following questions:

- (a) Introduce the questions under investigation and the main bibliographical references connected to the proposed research.
- (b) Describe the scientific investigation that you plan to run on the D-Wave machine. Please specify what you have already done and what is planned to be done if awarded the machine time.
- (c) Describe your objectives on how to make use of the results of your investigation. Are you planning to publish the results of these investigations, are these runs exclusively for internal use of your research group? Will codes developed be provided to the public via an open-source license?
- (d) Provide milestones and expectations for the proposed project.
- (e) Please describe the members of the project team and the collaborators (including potential collaborators) that will contribute to this research project. Specify also if you plan or desire to collaborate with researchers in the Quantum Artificial Intelligence Laboratory (see <https://quantum.nasa.gov>) or Standard Chartered Bank.

The answer to the previous questions should be framed within a 5 pages long document (minimum font size 10) and may contain equations and figures. The proposer can complement the document with additional information as well as additional documents that might or might not be considered by the review panel, under their discretion.

### Ownership of Proposal Data

Ownership of all data, materials and documentation originated and prepared for USRA pursuant to the RFP shall belong exclusively to USRA, **unless such data, materials and documentation are clearly marked by PROPOSER as proprietary.**



Trade secrets or proprietary information submitted by **PROPOSER** shall not be subject to public disclosure; however, **PROPOSER** must invoke the protection, in writing, either before or at the time the data is submitted in order to request confidential treatment of such information.

The written notice must specifically identify the data or materials to be protected and state the reasons why protection is necessary. The proprietary or trade secret material submitted must be identified by some distinct and conspicuous method such as highlighting or underlining and must indicate only the specific words, figures, or paragraphs that constitute trade secret or proprietary information. The classification of an entire proposal document as proprietary or trade secret is not acceptable.

### **Deadline for Submission**

Proposals should be submitted starting immediately for full consideration in the first set of proposal selections for this Cycle. The call for proposals will remain open through December 2020. USRA will preferentially approve proposals submitted on a first come first serve basis. Proposals must be submitted online at <https://riacs.usra.edu/quantum/rfp>. Scientific Questions about this RFP can be directed to the USRA Science Operations Manager, Dr. Davide Venturelli ([dventurelli@usra.edu](mailto:dventurelli@usra.edu)). Contractual questions can be directed to **USRA** Contracts Manager, Elena Einstein ([eeinstein@usra.edu](mailto:eeinstein@usra.edu)).

Note that the award can be assigned any time after submission, so proposers are encouraged to submit their proposals early.

**Term the Agreements for computing time:** September 1, 2020 - December 31, 2020

### **4.0 EVALUATION AND AWARD CRITERIA**

Proposals submitted in response to this Call will be evaluated in a competitive peer review. The peer review panel, including its chair, will be recruited from the academic or government community.

Based on the results of the peer review, a recommendation for the total program will be submitted to a selection committee chaired by USRA with representation from NASA and SCB and possibly other sponsors of the program who will make the final proposal selection.

The following factors will be used in evaluating proposals for the QuAIL Research Opportunity:

- (i) The overall scientific merit of the proposed investigation (including the degree to which the investigation uses unique capabilities of the D-Wave System and the quantum annealing technique)
- (ii) The competence and relevant experience of the Principal Investigator and any Collaborators to carry the investigation to a successful conclusion.
- (iii) The relevance of the scientific objective for advancing the knowledge on quantum computing and for practical applications in science, engineering and industrial domains.

**USRA** reserves the right to select only a portion of a proposer's investigation, in which case the PI of the proposal will be given the opportunity to accept or decline the implementation of the partial selection.



## 5.0 SPECIFIC PROPOSAL CONSIDERATIONS

### 5.1.1 Available Software and Technical Support

Researchers awarded with machine time will be provided the use of D-Wave Ocean API (available in Python) to interface the computer remotely under a uniform Third Party Researcher Agreement. This includes documentation and support from **USRA** scientists on technical issues. **NASA** Ames Research Center requires secure authentication to access the quantum front end system which will be provided upon completing **NASA** Requirements including online training for IT Security and passing **NASA** security reviews. The clearing procedure will be described in a PI handbook.

#### Subjects of research

In case of a large number of applicants, priority will be given to research topics which can be related to the missions of **USRA**, **NASA**, **NYSTEC**, the Air Force Research Laboratory **AFRL** and **SCB**.

#### Education and Public Outreach (E&PO)

**USRA** reserves the option to promote briefly the project objectives and investigators on related websites and during E&PO initiatives, as well as inviting the project representatives to selected events. Upon completion of the research project and publication of the results, selected projects may be contacted by **USRA** to collaborate in designing an E&PO program meant to diffuse the results of the investigation.

#### Run Time Allocation

An estimation of the required computing time/cycles to conduct the research project must be provided by the PI in the cover page of the proposal, including preferred periods of time for the use of the computer on a monthly basis. Should a research project require more runs than originally requested and allocated, additional time may be awarded in agreement with program management. The successful proposals will be assigned instructions and tokens to be able to perform calculations remotely on the hardware, as specified in the PI handbook.

## 6.0 AWARD

**USRA** may cancel this Request for Proposals or reject proposals at any time, and is not required to furnish a statement of the reason why a particular proposal was not deemed to be the most advantageous.

Should **USRA** determine in writing and in its sole discretion that **PROPOSER's** proposal is acceptable; the parties will commence negotiations to put in place a research agreement which will include the requirements, terms, and conditions of the solicitation and **PROPOSER's** proposal as negotiated. Either Party to the agreement may unilaterally terminate the Agreement by providing thirty (30) calendar days written notice to the other Parties.

Generally, intellectual property developed through research using the quantum computer will be



retained by those conducting the research, subject to each individual's employer's intellectual property policies. The research agreement executed between **USRA** and successful **PROPOSERS** will describe the specific rights related to Intellectual Property.

**PROPOSER** shall have the right to publish results of its research in any publication, provided that **PROPOSER** shall give proper credit to the funding sources of this program, and whenever possible, give credit to **USRA** in published reports regarding the research. An illustrative acknowledgment statement is printed on the PI handbook.

## **7.0 REPORTING AND DELIVERY REQUIREMENTS**

The only deliverable will be a final report illustrating the output of the performed research, including a list of the publications or other products that resulted from the award.

For more information see the Quantum Research Agreement that will be posted on the website.

## **8.0 GENERAL TERMS AND CONDITIONS**

The award of a research agreement under this RFP shall, without limitation, be subject to the terms and conditions of the Quantum Research Agreement that will be posted on the website. Any exceptions to these terms and conditions by **PROPOSERS** must be presented in detail with the proposal, with adequate rationale therefor.

## **9.0 SPECIAL TERMS AND CONDITIONS**

### **PROPOSER Conduct While on Government Premises**

While on Government premises or remotely using the Quantum Computer which is on Government premises, **PROPOSER** shall comply with the governing rules, regulations, and procedures. Such rules and regulations are generally set forth in Agency-wide or local installation management instructions, handbooks, or announcements. See the Quantum Computer Research Agreement Exhibit A for specific details.

### **Computer Job Queue Slots and Remote Access**

Remote access to the computer will be subject to **NASA** policies (e.g., all users of the quantum computer will need to take IT Security Training using the **NASA** SATERN Training System).