

## Call for FY 2022 DoD Dedicated HPC Project Investment (DHPI) Partnering & Collaboration

**Full Proposal submissions due by: 30 Jun 2022**

### **Critical Dates:**

Call for Partnering & Collaborations: **20 April 2022**

Proposal submission: **30 June 2022 COB**

Service/Agency ranking provided to DHPI panel chair: **8 July 2022**

Anticipated award announcement: **July 2022**

### **A. Purpose**

The DoD High Performance Computing Modernization Program (HPCMP) invites proposals for Dedicated High Performance Computing Project Investments (DHPIs). These are defined as joint projects and collaborations between the HPCMP and the proposal team for two to four-year collaborations. Example collaborations could be topics in computational methods, data science, workflow, etc. that would benefit from dedicated small-scale HPC systems. Projects will necessitate a rich collaboration between research engineers/scientists and HPCMP computational experts. Projects must extend the current capabilities that result from applying HPC solutions to address DoD priorities.

### **B. Targeted Areas from HPCMP Strategic Focus Areas** (see Table 2 from cover sheet)

Annually the HPCMP will release a **request to potential DHPI collaborators** in the *Strategic Focus Areas* that are of high priority to DoD and HPCMP. Proposals must address a topic in one of these areas.

### **C. Critical Elements of Proposal**

#### **Justification:**

- The **main criterion** for collaboration projects is that the computational challenge being proposed has the potential to yield significant advances in technical domains/workflow that address DoD's most important challenges. It is essential that proposals leverage HPCMP technical experts to enhance this potential progress.
- Proposers must be capable of using a dedicated DHPI system that will be located at a DSRC. The proposal team's organization will be required to reimburse the DSRC for system maintenance, operations, and contracting costs of the system. Any specialized networking gear and/or commercial software requirements will be the responsibility of the proposal team organization.
- Proposals must document the proposed HPCMP collaborators, their role/expertise, and have their organization concurrence for their participation.

***[\*\* Prospective principal investigators should carefully consider whether their technical goals can be met by the HPCMP framework (noted above) before submitting a DHPI proposal. \*\*]***

**Eligibility:**

- All computational scientists and engineers in DoD research, development, test and evaluation, and acquisition engineering programs who are eligible to use HPCMP resources under the program’s current guidelines may submit a proposal.
- DHPI systems **will only be hosted at DSRC** facilities. Exceptions to the above DHPI site location requirements must be endorsed with written concurrence from the HPCMP Director prior to proposal submission.

**Awards:**

The dedicated DHPI system will be procured by the HPCMP and located at a DSRC. Selected DHPI proposer organizations **must provide funds for:**

1. facility preparation,
  2. system operation and maintenance (including cybersecurity),
  3. contracting costs for system acquisition,
  4. software beyond that typically provided by the HPC system original equipment manufacturer (OEM) and required for basic system operation, and
  5. specialized networking equipment.
- **DHPI awards will not include funding to support labor associated with this award.**
  - **DSRCs are prohibited from using HPCMP funds to support the DHPI system.**
  - **Individuals from component elements of the HPCMP cannot be the principal investigator for these projects.**

**Financial Execution:**

The requestor’s **ability to reimburse HPCMP as agreed to in the proposal are essential for the success of the collaboration.** The HPCMP will work with the proposer team to configure an appropriate system and will accept responsibility for the procurement of the system.

During the period after award the awardee will provide **quarterly status updates** to the HPCMPO regarding the progress and schedule for the activity. If any DHPI system reimbursements from the proposer’s organization are not received on an agreed upon schedule, the HPCMPO will re-evaluate the status of the project. Results from this evaluation **could result in an award rescission.**

**Proposal Composition:** To be competitive the proposal should have the following characteristics.

1. Well written and concise.
2. Address all the stated factors in **Section D: Proposal Contents.**
3. The “justification” needs to effectively capture the uniqueness of the request. **Classified proposals will require either a classified proposal or classified addendum to the proposal.** The proposal should clearly articulate the estimated ROI to Service/Agency mission. Speculative statements such as “customer needs us to do this work,” “we need dedicated computing to support our program”, etc. **will not receive an award.**

4. The proposed system must be used to expand the benefit and use of HPC to support the DoD and HPCMP mission objectives.
5. The proposal must include sufficient technical requirements so the HPCMP can configure the appropriate DHPI system.
6. The nature of the proposed collaboration with the HPCMP must be documented. This includes the HPCMP team members (a letter of support from the HPCMP Director for the HPCMP team members is required) and detailed articulation of how the collaboration will enhance the effort.
7. A detailed project timeline that includes intermediate go/no-go events.
8. A letter of support and commitment from the proposer's organization leadership (an SES-level individual) is required. The letter should specify the commitment to the financial contributions required and articulate why the proposed collaboration is important to address DoD mission objectives.
9. There are two sets of reviewers for DHPI proposals.
  - a. Service/Agency Principals: These reviewers, and their review teams, are responsible for determining the mission importance of the science and the potential for subsequent ROI. They will review the sections titled "DoD Relevance" and "Technical Approach" along with other elements of the proposal to produce a Service/Agency recommendation.
  - b. HPCMP DHPI evaluation panel: These reviewers are responsible for determining the soundness of all elements of the proposal – including the science and the technical elements ("algorithmic aspects"). The proposal should have a strong technical basis and include domain experts in the appropriate disciplines.

#### **D. Process, Evaluation, and Post Award**

##### **Proposal submission:**

Submitters should ensure that their submissions have been vetted and endorsed by their organizational executive leadership. All questions should be directed to the email site below.

All unclassified communications and proposals (**two files in PDF format; 1) completed cover page, and 2) entire proposal**) should be submitted to

**dhpi2022@hpc.mil**

Classified communications and proposals should be coordinated by contacting the HPCMP at the above email address. Specific instructions will be provided to facilitate classified proposals.

##### **Selection Process:**

1. After submission to the HPCMPO **each Service/Agency's HPC Advisory Panel (HPCAP)** member's team will review proposals.
  - a. The primary focus will be the determination of the mission importance **for the science and the potential for subsequent ROI.**
  - b. Proposals must be endorsed and prioritized by the Service/Agency HPCAP member prior to HPCMP consideration. The Service/Agency principal's scoring will provide succinct information regarding the relative priority of the submitted proposals.

2. The Service/Agency principal will submit the Service/Agency rankings to the DHPI panel chair.
3. The HPCMP DHPI evaluation panel will consider the factors detailed in the “Proposal Contents” section of the proposal and will independently score each proposal. The DHPI panel chair will then facilitate the aggregation of Service/Agency scores with the DHPI evaluation panel’s scores. If required, the DHPI panel chair will communicate with Service/Agency principal(s) to resolve any differences in scoring between the two review panels.

**HPCMP DHPI Evaluation Panel Process:**

A review panel convened by the HPCMP will evaluate proposals against the following criteria:

1. Merit of the proposed project (Sections 1, 2, 3 and 4): Based on the project’s goals, solution approach, and technical quality, does the project represent a potential **significant contribution and ROI** to the RDT&E and/or acquisition engineering community?
2. Technical approach used to address the project’s requirements (Sections 5, 6 and 7).
  - Based on software applicability, software scalability, and anticipated large-scale computational requirements, can the project effectively leverage the requested resources?
3. Potential for significant progress (Sections 8, 9, and 10):
  - Based on the team’s track record, staff’s qualifications, and software readiness, does the project team have the potential to complete the proposed work?
4. Does the required system expand the benefits and uses of HPC in a way that supports the HPCMP mission objectives? (Sections 11 and 12)

The above criteria are of equal importance. All evaluations will be used to formulate a proposed set of awards for consideration by the DHPI selection authority (Director, HPCMP). ***Only technically sound, mission critical projects will be considered.***

**Post Award Project Review Schedule:**

DHPIs will be reviewed by the HPCMP **quarterly** against proposed milestones. **Annually** the DHPI project leader **must present a progress report (both a paper and a presentation)** to the HPCMP. This report should include such information as:

1. How the system is being utilized (software used, problems being addressed, etc.).
2. The level of system utilization.
3. Significant technical **impacts and ROI realized** from DHPI usage.
4. Detailed revised plans for the next year’s project efforts with **potential impacts**.
5. Any milestone delays and the reason.

## **E. Proposal Contents**

*Proposals should be formatted as single-spaced, standard 12-point font, and one one-inch margins. The submission **must be a single PDF document**. Proposals must contain the following sections – ordered and numbered as indicated. Suggested lengths for each section are provided. Proposals that do not conform to this structure will not be evaluated.*

**Cover Page:** Include the proposal cover page (template provided).

**Summary Page:** (Length: **1 page maximum**; see example at end of document)

- *Title:* Provide the title of the project.
- *DoD Impact/ROI:* Briefly discuss the projected DoD impact and expected ROI.
- *Scientific and Technical Goals:* Briefly summarize the scientific and technical objectives.
- *Technical Approach:* Briefly summarize the technical approach.
- *Dedicated HPC Hardware<sup>1</sup>:* Provide a brief description of the hardware requirements, including the size and type of system, that will meet your requirements. Additionally, indicate the DSRC that would be your choice for the system and why. Specific hardware recommendations can be included as an example but the HPCMP will make the final configuration and vendor selection. **[The system's total cost for acquisition cannot exceed \$2,000,000.]**

**Note: Due to supply chain challenges the system that HPCMP selects may be unavailable post award. Alternatives will be considered. However, if no adequate solution is available then the award may be delayed or rescinded.**

- *Special Circumstance(s):* Summarize the reason(s) why this project requires a dedicated DHPI and any special circumstances such as security requirements, networking, etc.
- *Major Applications Software:* List major applications software that will be used. [The cost for any non-OEM software is the responsibility of the proposer's organization.]
- *Technical and Computational Challenges:* Summarize any anticipated technical and computational challenges.
- *Collaboration:* Summarize how the HPCMP collaborators will be integrated into the project.
- *Duration:* Specify the duration of the project.

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<sup>1</sup> The DoD HPCMP is required to comply with DFARS 225.7012 (cannot purchase a supercomputer unless it is manufactured in the United States). DHPI systems are also subject to these DFARS.

## **F. Proposal Structure**

### **1. *Executive Endorsement:*** (Length: 1-2 pages)

A letter from an appropriately authorized executive official (a member of the Senior Executive Service) of the supporting organization **MUST be included**. The letter should indicate

- a. the organization's abilities to meet financial execution requirements (i.e. fund the site preparation and operations and maintenance costs of the system for the duration of the project),
- b. the importance of the proposed work,
- c. the anticipated results/products, and
- d. the DoD and Service/Agency priority of the work.

### **2. *Executive Summary:*** (Length: 1-2 pages)

### **3. *Introduction:*** (Length: ½ to 1 page)

Introduce the project in broad terms. Include a general discussion of ongoing related work in both your organization and the scientific, technology, and/or testing community.

### **4. *DoD Relevance:*** (Length: ½ to 1 page)

Clearly state the DoD and Service/Agency mission relevance of the proposed work and potential impacts and ROI from the effort including what current and future defense systems it will support, if any.

### **5. *Scientific Description:*** (Length: 2-4 pages)

Articulate the scientific elements of the proposed effort. This description must convey a suitable amount of details so that the domain experts on the evaluation panel can judge the proposed project's scientific merit.

### **6. *Technical Approach:*** (Length: 2-4 pages)

- a. Clearly state the technical goals of the project and discuss the science, technology, and/or engineering steps (workflows) that are required to meet these objectives.
- b. Clearly state the performance goals that are expected; such as software execution time, algorithm migration to alternative architectures (such as GPGPU, FPGA, etc.), and benefits in processing large datasets.
- c. Discuss technical challenges that will likely be encountered during the course of the project.

### **7. *Computational Approach:*** (Length: 2-4 pages)

- a. Describe the computational methodology and algorithms, and estimate the size and structure of the problem with as many supporting details as possible.
- b. State the advantage to be gained by exploiting HPC capability.
- c. Discuss in detail the applicability and readiness of any software targeted for use by the project, particularly as the software relates to the proposed dedicated

hardware. Projects should be prepared to utilize the system upon installation and acceptance. All possible algorithm/software development and evaluation should be complete. **Only software development required to migrate and optimize the software to the DHPI system is allowed.**

- d. Provide evidence of the benefit of the application of high performance computing to improving mission efficiency (For example, HPC would substantially reduce time to compute solutions for large run matrices or provide for increased accuracy or resolution in results obtained) or software efficiency on scalable systems by plotting the performance as a function of the number of processing cores for each code that is to be used for the project.
- e. Discuss the computational challenges that will likely be encountered during the course of the project.

**8. Milestones/Deliverables:** (Length: 1 to 2 pages)

- a. Provide a schedule in tabular form that lists milestones, deliverables, and mission impacts spanning the life of the project. The schedule should include the acquisition schedule for the system, testing and stabilization of the system and the subsequent project milestones.
- b. Provide a detailed project plan for achieving these goals and a project timeline that includes intermediate go/no-go events. Dates can be expressed as a function of date of availability of DHPI system.
- c. At the conclusion of the project determine the final ROI.

**9. Progress to Date:** (Length: ½ to 1 page)

Discuss any progress to date, providing evidence of preliminary work. Discuss the work that remains and why it must now be performed via a DHPI.

**10. Key Personnel:** (Length: as necessary)

- a. Include a complete CV for the Principal Investigator for the project.
- b. Summarize in a single paragraph the expertise of each participant, highlighting relevant previous work, and discuss why their qualifications suit them for their proposed role in this project.
- c. Include a list of HPCMP collaborators and their role.

**11. Justification for Dedicated Resources:** (Length: ½ to 1 page)

Clearly explain why the proposed work requires dedicated resources and cannot be performed using shared resources available at a DSRC.

**12. Description of Required Resources:** (Length: 1-2 pages)

Fully describe the attributes of the desired system and justify each of its attributes.

- a. System size, system type, processors, accelerators [if any], memory, interconnect, O/S, storage, login nodes, external network interfaces as they relate to project requirements.

- b. Summarize and justify any system software (e.g., batch schedulers and compilers).
- c. Summarize any commercial or open source software you will need for your work. Any costs associated with commercial software are the responsibility of the proposer's organization.
- d. For classified DHPIs indicate the security level required for the system. Note the preferred method of access (i.e. SDREN, SIPRNet, JWICS, etc.) Additionally, if any specialized networking equipment such as encryptors is required it will be the responsibility of the proposer's organization to purchase.



## **G. DHPI Proposal Checklist**

Based on the HPCMP's past experience reviewing DHPI proposals, the following checklist is provided to assist *Proposers* in preparing their proposals. Proposals that do not meet the following requirements will not be reviewed.

1. The Cover Page must be completed and provided as a **PDF file**.
2. The Proposal must be provided as a **single PDF file**.
3. The project associated with the proposal must have an up-to-date entry in the HPCMP's requirements database that reflects its resource requirements.
4. The proposal must include a letter from an appropriately authorized **executive official of the supporting organization (a SES)**, stating that the organization will fund the site preparation and operations and maintenance costs of the system for the duration of the project.
5. The **proposed system must be 100% used for the proposed project**. Use of the system for other non-DoD, educational or commercial purposes is not allowed.
6. Justification that the resource requirements of the project cannot be met at a DSRC (using standard queues, the ARS, or a DSP).

The *Proposer* is strongly encouraged to address the following suggestions. Proposals that fail to do so will still proceed through the review process, but will be at a disadvantage.

1. The required CV of the principal investigator and summaries for other participating personnel should include background and experience relevant to the proposed project.
2. Data demonstrating the scalability of the proposed software should be included. The size of the proposed system should be justified by the resource requirements of the software; i.e., the total expected number of runs at expected core counts should generally consume the proposed hardware.
3. Requests for small amounts of HPC features not crucial to the project and to be used for preliminary investigations are not appropriate (e.g., requesting a 100-node cluster with two GPU-equipped nodes "just so we can see how they work").
4. Classified **must submit a proposal or proposal addendum that is classified**. Contact the HPCMP to discuss how a classified proposal should be submitted.
5. Schedule milestones should be substantive and measurable. Vague milestones that will be met by default (e.g., "work on input data") are discouraged.
6. A **DHPI is not an appropriate purpose for ongoing operational computing requirements**. Additionally, if a subject agency's first DHPI, if any, has already demonstrated a proof-of-concept and/or innovative use of HPC technology, subsequent DHPI proposals that address the same requirements will be at a significant disadvantage in the evaluation process.
7. The ability to achieve financial execution expectations are essential and should be well documented.

**Example Summary Page**

## **Real-time Image and X-scan Processing for Discernment of Theatre Bridge Integrity**

**Requirements Project Number:** ARMY123456

**DoD Impact/ROI:** In 2014, the Army lost over 30 tanks to compromised bridges, and had to slow the advance of its forces into enemy territory, as it mitigated losses through manual inspection of bridges and in-the-field calculation of structural integrity (determined to have an accuracy of only 51%). The proposed implementation will provide highly accurate discernment of bridge strength with quick turn-around (~5 minutes), allowing the rapid, safe advance of forces.

**Technical Goals:** Real-time determination of bridge integrity prior to crossing potentially compromised, weak structures with heavy battlefield assets

**Technical Approach:** Soldiers will transmit multiple images and X-scans of the target structure via a live link between the battlefield and the DHPI system. X-scans reveal discontinuities in the density of structural members and identify the material used to form each member via a database of X-scan profiles for 1 million possible known materials. Image and X-scans will be processed using the advanced XYZ method for automatically determining the load that each square inch of a structure's surface can bear, thereby, identifying a strategic path for crossing a target bridge. AutoBridgeAnalyzer developed by the ABC agency will be used to apply the XYZ method, using structured grids.

**Dedicated HPC Hardware:** 512 compute core shared memory system with 1GB of memory per core; 2 additional nodes for image and scan preprocessing; 1 addition node for communication with the satellite earth station; 10 TB of scratch disk space; 1 GigE interconnect or better; Linux OS; must not exceed 4 racks; must not exceed 45kW

**Special Circumstances:** TOP SECRET, real-time response required

**Major Applications Software:** AutoBridgeAnalyzer

**Technical and Computational Challenges:** The XYZ method is new and has not been applied in the field, although controlled experiments have shown that its accuracy is consistently 99% at one square meter resolution and 90% at one square inch resolution. AutoBridgeAnalyzer is memory and communications intensive and benefits greatly from shared memory.

**Duration:** FY 2020 – FY 2023 (4 years)

## Acronyms

ARS	Advanced Reservation System
COB	Close of Business
CV	Curriculum Vitae
DHPI	Dedicated High Performance Computing Project Investment (HPCMP)
DoD	Department of Defense
DREN	Defense Research and Engineering Network (HPCMP)
DSP	Dedicated Support Partition
DSRC	DoD Supercomputing Resource Center (HPCMP)
FFRDC	Federally Funded Research & Development Center
FPGA	Field Programmable Gate Array
GPU	Graphics Processing Unit
GPGPU	General Purpose GPU
HPC	High Performance Computing
HPCAP	High Performance Computing Advisory Panel (HPCMP)
HPCMP	High Performance Computing Modernization Program
HPCMPO	HPCMP Office
JWICS	Joint Worldwide Intelligence Communication System
O/S	Operating System
O&M	Operations & Maintenance
OEM	Original Equipment Manufacturer
PDF	Portable Document Format
RDT&E	Research, Development, Test and Evaluation
SCI	Sensitive Compartmented Information
SDREN	Secret DREN
SES	Senior Executive Service
SIPRNet	Secret Internet Protocol Router Network
TS	Top Secret
UARC	University Affiliated Research Center