Call for FY 2015 DoD Dedicated HPC Project Investment (DHPI) Proposals

Introduction

Purpose: The DoD High Performance Computing Modernization Program (HPCMP) invites proposals for Dedicated High Performance Computing Project Investments (DHPIs). These are defined as two to three-year mission critical projects requiring small laboratory or test center on-site HPC systems.

Justification: The main criteria for considering a DHPI system is that the project's requirements cannot be met at a DoD HPCMP Supercomputing Resource Center (DSRC) due to special operational requirements (e.g. project classification above SECRET, real-time response, hardware-in-the-loop, embedded implementations, and/or emerging technologies). Improved batch turnaround time that can be serviced by shared resources is not sufficient justification for a proposal. The HPCMP provides two approaches for meeting out-of-the-ordinary computational requirements: the Advance Reservation System (ARS) for short-term, intermittent HPC usage, and Dedicated Support Partitions (DSPs) for longer term, dedicated usage. ARS is regularly available to all DoD HPC users who have received HPCMP resource allocations from their organization. DSPs require a proposal vetted through the appropriate HPC Service/Agency Principal, but proposals are entertained throughout the year. Both of these require a Service/Agency allocation of computational time. Prospective principal investigators should carefully consider whether their computational requirements might be met by one of these mechanisms before submitting a DHPI proposal.

Eligibility: All computational scientists and engineers in DoD research, development, and test and evaluation programs who are eligible to use HPCMP resources under the program's current guidelines may submit a proposal.

Awards: Requested awards should not exceed $2M and are limited to HPC hardware. Winning sites *must* provide funds for (1) facility preparation, (2) system operation and maintenance, and (3) software beyond that typically provided by the HPC systemoriginal equipment manufacturer and required for basic system operation. Partial awards may be granted, if appropriate. Depending on various circumstances, an award may result in a transfer of funds from the HPCMP to an award site or a system acquisition by the HPCMP on behalf of an award site.

Project Review: DHPIs are reviewed by the HPCMP semi-annually against proposed milestones. Each year (for a minimum of two years), the DHPI project leader must present a yearly progress report (both a paper and a presentation) to the HPCMP, until the HPCMP Director determines that sufficient progress has been made toward addressing the project's goals to warrant formal release of the DHPI from HPCMP oversight.

Submission: Proposals must be submitted by e-mail through the Service/Agency High Performance Computing Advisory Panel (HPCAP) principals to the HPCMP. Although proposals are due to the HPCMP on **31 July 2014**, each Service/Agency may establish earlier

internal deadlines so that proposals may be pre-screened and prioritized. The Service/Agency points-of-contact are as follows:

- Air Force: Submit proposals to the AFRL Research Collaboration and Computing Office, AFRL/RC, via e-mail (michael.ausserer@us.af.mil) by 17 July 2014. AFRL personnel should coordinate proposals with their TD's senior staff for any additional requirements prior to sending submissions. All proposals received will be reviewed and ranked. If selected, the proposal will be submitted to the HPCMPO via the appropriate HPCAP principal.

- Army: Submit proposals to Mr. Robert Sheroke (Robert.M.Sheroke.civ@mail.mil), Mr. Eldred Lopez (Eldred.I.Lopez.ctr@mail.mil), and Ms. Valerie Carney (Valerie.L.Carney.civ@mail.mil) via e-mail by 17 July 2014. Proposers should contact their local organizations for any additional requirements prior to sending submissions. All proposals will be reviewed and submitted to the Army HPCAP Principal (Ms. Nancy Harned, Executive Director for Strategic Planning and Program Planning, ASA(ALT)) for consideration and submission to the HPCMPO.

- Navy: Submit proposals to Ms Kathy Hollyer (Kathy.Hollyer.ctr@navy.mil) via e-mail by 17 July 2014.

- DTRA: Submit proposals to Ms. Jackie Bell (Jacqueline.Bell@dtra.mil) via e-mail by 17 July 2014.

- MDA: Submit proposals to Dr. Stuart Strong (Stuart.Strong@mda.mil) via e-mail by 17 July 2014.

- C3I (NGA): Submit proposals to HPCMPO (William.Ward@hpc.mil) via e-mail by 17 July 2014.

- DARPA: Submit proposals to Mr. Nick Lemberos (Nick.Lemberos@darpa.mil) and Mr. John McManus, John.Mcmanus.ctr@darpa.mil via e-mail by 17 July 2014.

Selection: Each Service/Agency may down-select proposals prior to submission to the HPCMP; the primary criterion should be mission criticality/relevance. Other criteria (outlined below) will be assessed by the technical evaluation team. Each Service may submit no more than three proposals, and each Agency may submit no more than two proposals. Proposals must be prioritized at submission. When three proposals are submitted, a total of 9 points must be allocated among the proposals (with more points being allocated to higher priority proposals). When two proposals are submitted, a total of 6 points must be allocated among the proposals. A minimum of 1 point must be applied to any one proposal. Assigning equal point totals to submitted proposals indicates to the HPCMP that they are of equal priority. *Point distributions should indicate the relative significance of the proposals for advancing a capability that is mission critical/relevant for DoD.*

Evaluation: The HPCMP will perform an initial review of each forwarded proposal to determine if the proposal is viable (see attached checklist) and if dedicated resources are warranted (Section 8). Next, a technical review panel convened by the HPCMP will evaluate proposals against the following criteria:

1. Technical merit of the proposed project (Sections 3 and 5): Based on the project's goals, solution approach, and technical quality, does the project represent a potential significant contribution to the scientific and engineering community?
2. Computational approach used to address the project's requirements (Sections 4 and 5): Based on software applicability, software scalability, and anticipated large-scale computational requirements, is the project worthy of the requested resources?
3. Potential for significant progress (Sections 5, 6, 7, and 13): Based on the team's track record, staff's qualifications, and software readiness, does the project have the potential to complete the proposed work?
4. Resource appropriateness and O&M/facilities support quality (Sections 9, 10, 11, and 12): Is the proposed hardware the right system for the proposed work, and is the host organization capable of deploying and sustaining the resource for the life of the project?

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. *Only technically sound, mission critical projects that cannot otherwise be executed via the use of DSRC resources will be considered.* It is anticipated that awards will be announced in the October-November 2014 timeframe.

Questions: Contact Dr. Bill Ward (William.Ward@hpc.mil, 601-831-4333).

Proposal Contents

Proposals are limited to 15 pages (single-spaced, standard 12-point font, one-inch margins) and must be a single Word or PDF document. The cover page, system quotation, certification of operations and/or maintenance support, and curricula vitae do not count against the 15-page limit. 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 may be returned without further evaluation.

Cover Page: (Length: 1 page maximum; please see example on Page 5.)

- *Title:* Provide the title of the project.

- *Requirements Project Number:* Provide the project number(s) (as reflected in the HPCMP requirements database) representing the project(s') requirements the DHPI will address. *A proposal cannot be considered unless its resource requirements are reflected in the HPCMP's requirements database. Please contact Cathy McDonald at require@hpc.mil for further details.*

- *CTA:* List the computational technology area (CTA) that best fits this project (see http://www.hpc.mil/index.php/technology-areas/computational-tech-areas)

- *DHPI Project Leader:* Provide the DHPI project leader's name and contact information. Only one person should be listed here. This individual is responsible for all interactions with the HPCMP office regarding their proposal and all interactions with other parties associated with the proposal.

- *Government Point of Contact:* Provide the DHPI's Government POC's name and contact information.

- *Sponsoring Service/Agency and Organization:* Provide the Service/Agency and organization sponsoring the DHPI.

- *Amount Requested:* Dollar amount requested for HPC hardware; cannot exceed $2 million); cannot include facility preparation, maintenance, or software beyond that typically provided by the HPC equipment OEM and required for basic system operation.

- *DoD Impact:* Briefly discuss the projected DoD impact.

- *Technical Goals:* Briefly summarize the technical objectives.

- *Technical Approach:* Briefly summarize the technical approach.

- *Dedicated HPC Hardware:* Provide a brief description of the hardware requirements including the size and type of the proposed dedicated HPC system.

- *Special Circumstance(s):* Summarize the reason(s) why this project requires dedicated HPC hardware and any special circumstances such as security requirements.

- *Major Applications Software:* List major applications software that will be used.

- *Technical and Computational Challenges:* Summarize any anticipated technical and computational challenges.

- *Duration:* Specify the duration of the project.

1. Introduction: 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. (Length: approximately ½ to 1 page)

2. DoD Relevance: Clearly state the DoD mission relevance of the project and what current and future defense systems it will support, if any. State the advantage to be gained by exploiting HPC capability. (Length: approximately ½ to 1 page)

3. Technical Approach: Clearly state the technical goals of the project and discuss the science, technology, and/or engineering steps that are required to meet these goals. Provide a

program plan for achieving these goals. Discuss technical challenges that will likely be encountered during the course of the project. (Length: approximately 2-4 pages)

4. *Computational Approach:* Describe the computational methodology and algorithms, and estimate the size and structure of the problem with as many supporting details as possible. 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. It is important that application codes be fully developed and ready to port to the proposed hardware at the onset of the project. Provide evidence of 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. Discuss the computational challenges that will likely be encountered during the course of the project. (Length: approximately 2-4 pages).

5. *Milestones/Deliverables:* Provide a schedule in tabular form that lists milestones and deliverables 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. Dates can be expressed as a function of date of availability of funding. FY15 funding is expected sometime between October and December of 2014. (Length: approximately 1 to 2 pages)

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

7. *Key Personnel:* Present key personnel, including those intended to provide operations and maintenance support for the system. Summarize the background of each participant, highlighting relevant previous work, and discuss why their qualifications suit them for their proposed role in this project. (Length: approximately ½ to 2 pages)

8. *Justification for Dedicated Resources:* Clearly explain why the proposed work requires dedicated resources and cannot be performed at a DSRC (Length: approximately ½ to 1 page)

9. *Description of Required Resources:* Fully describe the proposed system and justify each of its attributes (e.g. system size, system type, processors, accelerators [if any], memory, interconnect, O/S, storage, login nodes, external network interfaces) as they relate to project requirements. Also justify any system software (e.g., batch schedulers and compilers). Address any aspects of your physical or computational infrastructure (e.g. DREN connectivity, floor space, power, cooling, and application software licenses) that will be required to support the proposed hardware solution and provide evidence that such facility requirements will be addressed by the supporting organization.

10. *Ability to Operate and Maintain an HPC System:* Identify where the dedicated system will be placed and who will be responsible for system operation and maintenance. (Length: approximately 1-2 pages)

11. *System Quotation:* At the proposer's discretion, a system quotation may be included to provide further details of the required resources. System quotations do not count toward the 15-page proposal limit. Quotations should include all elements intended for purchase using the DHPI funds. If some elements are quoted costs and some estimated costs, please denote such. System quotations typically expire prior to DHPI project awards, and are, therefore, only used as a sample quote representing a potential configuration and its respective cost. Annual

maintenance costs, extended warranties, and other support costs included in any submitted quotes will not be considered as part of the DHPI costs to be borne by the HPCMP.

12. *Certification of O&M Support:* A letter from an appropriate official of the supporting organization MUST be included stating that the organization will fund the site preparation and operations and maintenance costs of the system for the duration of the project. This letter of O&M support does not count toward the 15-page proposal limit.

13. *Curricula Vitae:* Include curricula vitae (at most 2 pages each) for key personnel, listing relevant publications. Curricula vitae do not count toward the 15-page proposal limit.

DHPI Proposal Checklist

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

1. The proposal must be provided as a single PDF file.

2. The project associated with the proposal must have an up-to-date entry in the HPCMP's requirements database that reflects its resource requirements.

3. The proposal must include a letter from an appropriate official of the supporting organization stating that the organization will fund the site preparation and operations and maintenance costs of the system for the duration of the project. More specifically, a maintenance contract on the HPC system, provided by the HPC system manufacturer, is required; self-maintenance is not allowed.

4. 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.

5. Based on the initial review of the technical review panel, the resource requirements of the project cannot be met at a DSRC (using standard queues, the ARS, or a DSP).

The Principal Investigator is strongly encouraged to heed 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 CVs of the project personnel should include background and experience relevant to the proposed project. Staff roles should be described in Section 7. Lengthy, verbose CVs are discouraged.

2. A quotation from an HPC vendor should be included.

3. Projects that involve significant amounts of algorithm/software development will be viewed as unready to use HPC equipment.

4. 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.

5. Hardware requests should not stray far from HPC-type equipment. Requests for PCs, networking equipment, chillers, or other hardware deemed to be auxiliary in nature are not appropriate.

6. 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").

7. Proposals that cannot address required items due to classification sensitivity should submit a proposal that is itself classified. Contact the HPCMP to discuss how a classified proposal should be submitted.

8. Multi-site proposals should carefully justify why multiple sites are required. If the proposal includes hardware at multiple sites for unrelated (or only loosely related) projects, then multiple proposals should be submitted.

9. Schedule milestones should be meaty and measurable. Vague milestones that will be met by default (e.g., "work on input data") are discouraged.

Real-time Image and X-scan Processing for Discernment of Theatre Bridge Integrity (Sample Cover Page)

Requirements Project Number: ARMY123456

CTA: CSM

Project Leader: Iman Engineer, (123) 555-1111, iman.engineer@university.edu

Government Point of Contact: Ima Fed, (123) 555-2222, ima.fed@agency.gov

Sponsoring Service/Agency and Organization: U.S. Army, Material Command, Tele-engineering Unit

Amount Requested: $1,524,276

DoD Impact: 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 2015 – FY 2017 (3 years)