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Hello, thank you for your interest in this revised CyberTraining Solicitation – we are very excited!

I am Sushil Prasad, a program director in CISE's Office of Advanced Cyberinfrastructure, or OAC. I am a rotator from Georgia State University, now completing my third year at NSF. We launched the CyberTraining Solicitation last year to fill the gap in education and training space for our current and future research workforce in advanced cyberinfrastructure and in computational and data science. Unexpectedly, we had an excellent response with 40 unique proposals. Out of those, we could award 12 projects.

Today, I will summarize key aspects of the CyberTraining solicitation, pointing out the revisions to the solicitation and a few new submission requirements. I have with me a few other Cognizant Program Directors, as this solicitation has participations from many directorates. We will also mention various directorates' programmatic areas of interest. After our presentation, we will take any questions.

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The overarching goals of this program are to

- (i) prepare, nurture, and grow the current and future national scientific research workforce for *creating, utilizing, and supporting* advanced cyberinfrastructure;
- (ii) ensure *broad adoption* of CI tools, methods, and resources by the research community to enable new modes of discovery; and
- (iii) integrate core literacy and discipline-appropriate advanced skills in advanced CI as well as in computational and data science and engineering into the *educational curriculum/instructional material fabric* of the Nation spanning undergraduate and graduate courses.

Let me note that for the purpose of this solicitation, advanced cyberinfrastructure, which I will refer to now on also as CI, is broadly defined as the resources, tools, and services for advanced computation, data handling, networking and security.

This solicitation calls for developing innovative, scalable training and education programs to address the emerging needs and unresolved bottlenecks in scientific and engineering research workforce development, from the postsecondary level to active researchers.

The target communities at various stages of their career pipelines comprise the undergraduate and graduate students, researchers and educators, as well as *CI Professionals*

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As part of this investment, this solicitation also seeks to broaden CI access and adoption particularly by

- (i) those scientific disciplines and institutions with lower levels of CI adoption; and
- (ii) harnessing the capabilities of larger segments of diverse underrepresented groups.

Proposals involving these communities are especially encouraged.

In the short term, we invite projects that will result in innovative informal as well as formal training models and pilot activities.

These will complement and leverage the state of art in curricular offerings and best practices in academia and elsewhere.

It is also the long term goal that we are really excited about!

The projects should aim to contribute to the larger goal of an educational ecosystem enabling “Computational and Data Science for All scientists and engineers”

This embraces computation as the third pillar and data-driven science as the fourth pillar of the scientific discovery process -- in addition to the traditional first and second pillars of theory and experimentation.

As you can see, we are very ambitious!

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Prospective principal investigators (PIs) are strongly encouraged to engage all relevant stakeholders by forging alliances and forming backbones for what is known as collective impact;

This is particularly necessary to address unresolved bottlenecks such as to inform the development of forward-looking curriculum/instructional material for the research workforce of this nation.

Therefore, each project shall have

- a board of expert advisors or
- a network of funded/unfunded collaborators
- Who can help to periodically scrutinize the project methods, or to refine the curriculum/instructional material, or to inform professional associations or other nongovernmental organizations responsible for curriculum, accreditation, and professional examinations.

Proposals shall articulate well-designed programs with potential for significant impacts, including serving as templates and providing curriculum/instructional materials that can be adopted by other institutions, or larger communities or disciplines.

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The CyberTraining program is led by the Office of Advanced Cyberinfrastructure (or the OAC). It also includes participation from

- The division of Computing and Communication Foundation (CCF) of CISE, and

- a new participation from Big Data Regional Innovation Hubs and Spokes program of CISE.

It also has participation from

- the Division of Graduate Education (DGE) in the Directorate for Education and Human Resources (EHR), as well as
- all the divisions within the Directorates of Engineering (ENG), Geosciences (GEO), and Mathematical and Physical Sciences (MPS).
- Some of these directorates/divisions have specific programmatic areas of interest, while others welcome proposals that broadly enhance their relevant research communities in consultation with the Cognizant Program Officer.
- Therefore, the prospective PIs are strongly encouraged to contact the Cognizant Program Officers in OAC as well as in the participating directorates/divisions relevant to their proposals in order to ascertain whether the focus and budget of the proposed activities are appropriate for this solicitation.
- Let me highlight that an intent of the CyberTraining program is to stimulate co-funding between OAC and one or more domain directorates/divisions.

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Other revision highlights are as follows:

To ensure relevance to community needs and to facilitate adoption, those proposals of interest to one or more domain divisions must include at least one PI/co-PI with expertise relevant to the targeted research discipline.

Likewise, all proposals shall include at least one PI/co-PI with expertise relevant to OAC.

Next, the definitions of the submission tracks are streamlined, which I will describe.

Finally, the list of additional solicitation specific review criteria is updated.

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The CyberTraining program focuses on three scientific communities, and, correspondingly, offers three tracks for project submission

CI Contributors (CIC) is the community of computational and data scientists and engineers who research and develop new CI capabilities, and new approaches and methods.

- The CIC track is for the development of contributor-level CI skills and advanced domain skills;
- the target population spans graduate and undergraduate students, postdoctoral fellows, and researchers who are current and future CI Contributors.

CI Users (CIU) is the community of domain scientists and engineers who effectively exploit advanced CI capabilities and methods for their research.

- The CIU track is for user-level core literacy in advanced CI skills as well as in computational and data science and engineering skills;
- the target population spans undergraduate and graduate students, postdoctoral fellows, and researchers who are the current and future CI Users.

Finally, CI Professionals (CIP) is the community of research CI and professional staff who explore, develop, deploy, manage, and support effective use of research CI.

- The CIP track is for the development of technical and research CI professional skills of future CI professionals, including undergraduate and graduate students, postdoctoral fellows, and research scientists, and for skills refinement and career development of current CI professionals.

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As you conceive of novel training and educational activities, we would like to challenge you and your team to explore the following aspects for short-term impacts:

- (i) preparing a better scientific research workforce for advanced CI-enabled research;
- (ii) broadening adoption and accessibility both as users and contributors of shared computing and data resources by various disciplines, categories of institutions, and underrepresented groups;
- (iii) developing or updating curriculum/instructional material to feed into undergraduate and graduate courses, strategically advancing the goal of informing disciplinary or general education core curriculum/instructional material, or informing discipline-appropriate curriculum/instructional material for advancing skill sets; - As you see, this is a new short-term emphasis.

Continuing on

- (iv) creating alliances and backbones for collective impact;
 - (v) providing on-demand, personalized accessibility;
 - (vi) exploring innovative ways of drawing students into computational studies (“X+Computing” and “Computing+X”); and finally,
 - (vii) Leveraging and contributing to NSF-funded CI and research projects [such as the eXtreme Science and Engineering Discovery Environment (XSEDE), NanoHub, Laser Interferometer Gravitational-wave Observatory (LIGO), and Natural Hazards Engineering Research Infrastructure (NHERI)].
- Of course, not all projects will be addressing all these challenges.

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Training and education is a **vehicle** for achieving long term goals while meeting short term objectives.

In the longer term, you should explore how your project contributes to one or more of the following program goals:

- (i) How does it contribute to an educational ecosystem enabling computational and data science for all scientists and engineers with an understanding of computation as the third pillar and data-driven science as the fourth pillar of scientific discovery process; or

- (ii) How does it contribute to re-envisioning the advanced CI ecosystem as an integral and enabling element of the scientific and engineering research enterprise; or
- (iii) How it helps establish deeper engagement with various disciplines, institutions, and underrepresented groups; or
- (iv) How it contributes to ubiquitous and scalable educational cloud infrastructure for online, dynamic, personalized lessons and certifications.

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All proposals should have well-identified proposal elements which clearly address the solicitation-specific review criteria shown here, in addition to addressing the intellectual merit and broader impact criteria.

Reviewers will be asked to evaluate these aspects by answering the following questions:

1. Are the training, education, and research workforce challenges identified sound?
2. What is the potential of the project to enable new modes of discovery and use of advanced CI resources, tools, and services in fundamental research? This is new.
3. How well would the project advance the goal of integrating skills in advanced CI as well as computational and data science and engineering into institutional and disciplinary curriculum/instructional material? This also is new.
4. To what extent can the project meet its broadening access and community adoption challenges?
5. How well would the project engage key stakeholders and forge partnerships for collective impact? – This has new emphasis.
6. What is the potential for the project to scale and for its key aspects to be sustained beyond NSF funding?
7. Are the plans for recruitment and evaluation sound?
8. Are the plans for management and collaboration effective?

- I do want to clarify that research in education is not the goal for this solicitation.

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Here are the FY'18 award framework:

Each CyberTraining award will range from \$300,000 to \$500,000 per award and will be up to 3 years in duration.

- The number of awards will be at least 7.
- A minimum budget of \$3.5M is expected, contingent upon the availability of funds.
- Budget can be higher, as in the last round, with possible *co-funding from participating Directorates/Divisions*.
- There are three tracks for submissions as mentioned earlier.
 - Your project can overlap tracks, but do identify your major thrust when you submit.
 - The CyberTraining submissions are due by Feb 14, 2018.
 - As I said earlier, the prospective investigators are **strongly encouraged** to contact the Cognizant Program Officers in OAC, i.e., me, **and** in the participating directorate/division(s) relevant to their proposal

- This is to ascertain whether the focus and budget of the proposed activities are appropriate for this solicitation.
- You typically can start consultation by sending an email to us with a 1-page NSF-style project summary – use CyberTraining in the subject line.
- We are asking that you complete such consultations at least one month in advance of the submission deadline.
- In their Project Summary, the principal investigators should include the names of the Cognizant Program Officers that they consulted with and who showed interest in their project.
- And finally, if you are not submitting a proposal and are interested in serving in panels, please let us know as well, by sending your expertise and a brief CV.

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Let me provide some example projects by track, serving only to exemplify the nature of the three submission tracks:

For CI Professionals track, here are two examples:

- (a) Training and certification of *CI Professionals* in cybersecurity technology and management for advanced CI-enabled research; or
- (b) working with natural science researchers for advanced visualization, or for supporting scientific gateways;

For CI Contributors track, examples can be

- (a) Training geoscience graduate students to develop scalable, parallel and distributed software for high-performance computing; or
- (b) Training the next generation of researchers on the NHERI DesignSafe Cyberinfrastructure tools with holistic computational models for future, adaptive buildings;

And, for CI Users track, a example project can be

- (a) Instructor training for computational science literacy across all STEM disciplines in minimum core topics;

Another project can be

- (b) Software and data literacy for natural science students.

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In the solicitation, each participating division/directorate has included its programmatic areas of interest.

Starting with OAC, it is concerned about all the three communities of CI Professionals, CI Contributors, and CI Users, both current and future generations.

- OAC encourages proposals on technical and research CI professional skills development of future CI Professionals as well as on skill refinement and career development of current CI Professionals.
- OAC also encourages proposals, relevant to the domain directorates, for training as well as cross-training of the computational and data scientists and engineers who are current and future CI Contributors in contributor-level CI topics such as scalable scientific software

development and modeling and simulation, and in advanced domain topics such as domain-specific tools, datasets, and models.

- OAC is also interested in the larger goal of preparing the Nation's scientific and engineering research workforce - well-versed in basic CI and computational and data science and engineering literacy. This CI User workforce preparation starts with undergraduate students across all disciplines, and continues to graduate students and postdoctoral fellows, particularly in disciplines and areas with low levels of CI adoption.

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Eva could not be here, so I am summarizing her slide.

GEO is not highlighting specific areas in the context of this solicitation.

There are four divisions within GEO: The Office of Polar Programs (OPP) , The Division of Atmospheric and Geospace Sciences (AGS) , The Division of Earth Sciences (EAR) , and The Division of Ocean Sciences (OCE).

GEO welcomes proposals for all three CyberTraining tracks that broadly enhance the GEO-relevant communities in these divisions in consultation with the Cognizant Program Officer.

The next slide would be presented by Jo Culbertson, the Cognizant program officer for ENG/CMMI division.

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Examples of potential training topics: Effective use of parallel computing methods; integration of different models in multi-scale modeling; model validation and coupling models and experimental data; uncertainty quantification; effective software development process; effective data mining techniques and integration of different types of data; efficient extraction of dynamic models and real-time model updating using very large data sets and real-time finite, horizon-constrained optimal control (model-predictive control systems) for complex dynamic systems

Examples of projects in CMMI research areas: Collaborations with NSF-funded National Hazards Engineering Research Infrastructure (NHERI) DesignSafe Cyberinfrastructure, focusing on 1) creating holistic computational models for future, adaptive buildings for which experimental data and computational models for components are available at different scales and 2) creating workflows that link computational building models with simulation codes and visualizations—and making these tools accessible to enable next-generation researchers on the NHERI DesignSafe Cyberinfrastructure.

The next slide would be presented by Bogdan Mihaila, the Cognizant program officer for the MPS directorate.

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MPS is not highlighting *specific* areas in the context of this solicitation.

- ✓ Support workshops and summer schools focused on training students and postdocs in computational methods on advanced computing architectures.
- ✓ High-performance computing and data analytics methods introduced in the context of specific scientific applications relevant to MPS communities.
- ✓ Lectures accompanied by problem sessions and hands-on activities on actual hardware.
- ✓ Online sharing of workshop materials and recorded presentations on dedicated websites

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Other Cognizant Program Directors could not be here, but their directorates' programmatic areas interest are in the solicitation.

Here are some frequently asked questions:

Q1. Can my proposal address more than 1 track?

Yes. The intent is to identify the track that is closely aligned to the main thrust of your project, while allowing overlap with other track(s).

Q2. Is the consultation with a Cognizant Program Officer required?

No. But its is strongly encouraged that you consult with me (with OAC leading this solicitation) and any other Cognizant Program Officer at least a month in advance, and mention this in your Project Summary.

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Q3. Can the duration of my project be fewer than 3 years

Yes, the duration can be from 1 to 3 years.

Q4. Can my project primarily train/re-train for jobs in the IT industry?

No, ALL proposals, including cybersecurity proposals, must be relevant to

- Scientific Research Workforce Development, and

- Advanced Cyberinfrastructures.

This relevance will, of course, vary from undergrads, to grads, to CI professionals, and across disciplines.

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This completes our slide presentation. Please note that these slides and the transcript for this webcast as well as an audio recording will be available at www.nsf.gov/events – e v e n t s.

Now, we welcome your questions. You may also email to sprasad@nsf.gov.

Thank you!