2019 Cyber Physical Systems (CPS) Program Solicitation(19-553)

Slide 2:

DAVID CORMAN:

Welcome everyone and good afternoon! We are glad you could join us for this webinar focused on NSF's Cyber Physical Systems Program Solicitation. I am David Corman, a Program Director for the Computer Network and Systems Division, in the Computer and Information Science and Engineering Directorate at NSF. Before we start, I want to discuss a few housekeeping guidelines: The webinar will be 1 hour in duration, we will present for approximately 40 minutes, and then the remainder of the time will be dedicated to a question-and-answer (Q&A) session with participants. That said, please save your questions until the end of the presentation.

The Q&A session will be guided by the operator, so please follow the instructions from them for that part of the webinar. We have a large number of participants on the call today, so there may be a delay before you get an opportunity to ask a question. A few frequently asked questions (FAQ) have been populated and will be reviewed at the end of the webinar. A summary list of the questions and answers will be published on the CPS solicitation Home Page within the next three weeks.

To kick off today's webinar, I want to introduce the Division Director for Computer and Network Systems (CNS) in the Directorate for Computer and Information Science and Engineering (CISE), Dr. Ken Calvert. I also have with me:

- Dr. Kishan Baheti, Program Director in the Directorate of Engineering (ENG) in the Division of Electrical, Communications & Cyber Systems (ECCS)
- Dr. Bruce Kramer, Program Director in Engineering in the Division of Civil, Mechanical and Manufacturing Innovation (CMMI),
- Dr. Steven Thomson, representing the National Institute of Food and Agriculture (NIFA) for the United States Department of Agriculture (USDA)
- Dr. Christopher Hartshorn, representing the National Cancer Institute (NCI) for the National Institutes of Health (NIH)
- Program Directors in CISE/CNS, Dr. Fay Cobb Payton, and Dr. Jonathan Sprinkle.

Now I'll turn it over to Ken to present the context and go over the details of the solicitation.

Slide 3:
KEN CALVERT:
Good afternoon (or good morning, for those of you on the west coast). Thanks again for your interest today.

CPS refers to engineered systems using computation and communication that are deeply embedded in, and interact with, physical processes to transform the behavior and capabilities of physical systems. The goal of the program is to develop the core system science needed to engineer complex CPS upon which people can depend with confidence.

In the webinar today, we will provide an overview of the CPS program, before discussing details of the 19-553 solicitation. That discussion will include research challenges, information on projects, and partnerships within Federal and other agencies, as well as the opportunity for Transition to Practice supplements for projects, project description sections that are required, resources that are available and frequently asked questions.

Slide 4:
KEN CALVERT:
First, some background on the history of the CPS program. NSF released the first CPS solicitation in FY 2008. There are more than 300 active projects in the CPS program, comprising a cumulative investment since 2008 of more than $332 million dollars.

CPS are engineered systems that are built from, and depend upon, the seamless integration of computation and physical components. CPS tightly integrate computing devices, actuation and control, networking infrastructure, and sensing of the physical world. The systems may include human interaction with or without human aided control. CPS may also include multiple integrated system components operating at wide varieties of spatial and temporal time scales. They can be characterized by architectures that may include distributed or centralized computing, multi-level hierarchical control and coordination of physical and organizational processes.

Advances in CPS should enable capability, adaptability, scalability, resilience, safety, security, and usability far beyond what is available in the simple embedded systems of today. CPS technology will transform the way people interact with engineered systems – just as the Internet has transformed the way people interact with information. CPS are driving innovation and competition in a range of sectors,

including agriculture, aeronautics, building design, civil infrastructure, energy, environmental quality, healthcare and personalized medicine, manufacturing, and transportation.

In FY 2019, NSF is working closely with multiple agencies across the federal government, including the National Institute of Food and Agriculture (NIFA), Department of Homeland Security (DHS), Department of Transportation (DOT), and National Institutes of Health (NIH). Key goals are to identify basic CPS research directions that are common across multiple application domains, including those with high potential for later transition to practice. NSF is also working with German Science Foundation (DFG) to support research in the Networked CPS area.

Now I'll turn it back over to David and the rest of the team to present the context and go over the details of the solicitation.

Slide 5:
DAVID CORMAN:
Thank you, Ken.
The CPS Solicitation (19-553) is different from previous solicitations. This year the deadline is 60 days after release for small and medium projects, which is shorter than the typical 90 days after release. For the Frontier projects the submission window is September 12, 2019-September 26, 2019.

The medium project budget cap has increased compared to last year, and is now $1,200,000. Transition to Practice budget has maximum of $400,000 or 1/3 of award – whichever is less. Mare details are provided in the solicitation.

The NSF CPS program has entered into a joint effort with the German Research Foundation's (DFG) to encourage collaboration between US NSF PIs and DFG PIs. Broadening Participation was already required for Frontier projects, and starting this solicitation must be in place for medium projects by the time of the award. The focus area of Smart and Connected Communities has been reintroduced for this solicitation. And finally, there are specific sections or subsections that must be included in the Project Description, including two research focus subsections in the research description, that must be included for the proposal to be reviewed. Please take this seriously.

Slide 6:

DAVID CORMAN:
It is extremely important to pay attention to the due dates of this year. The Submission Window Date(s) are due by 5 p.m. submitter's local time, April 01, 2019 - April 12, 2019 for Small and Medium Projects and September 12, 2019 - September 26, 2019 for Frontier.

Now, Kishan Baheti, Program Director in the Directorate of Engineering (ENG) in the Division of Electrical, Communications & Cyber Systems (ECCS), will talk about the 2019 CPS Research Challenges.

Slide 7:
KISHAN BAHETI:
Thank you, David.
It is essential that proposals not simply describe the development of a CPS, but also emphasize the areas of CPS-focused research contributing to this development in which novel and foundational research contributions are being made. Therefore, we ask proposers to consider the CPS research impacts arising from the following challenges:

The questions essential when addressing emerging spaces driving new CPS concepts are: What new areas of CPS research are emerging as we consider the intertwining of social and technical dimensions of research? What are the impacts of new concepts found in application domains? How do approaches of control, computation, and networking scale downward to micro-scale systems or upward to societal-scale systems? The program especially welcomes projects in this area that explore next-generation CPS applications.

For Highly Dynamic Systems: Think about: What new CPS research ideas emerge as we consider systems, and systems of systems with highly dynamic behaviors spanning spatial, temporal, and component dimensions? Examples of such systems are found in agricultural and infrastructure application domains. How can this research translate to other domains?

For CPS and the Data Revolution, the proposal needs to address: What new challenges emerge as we move from model-driven CPS fundamentals into an integrated data-driven model-based approach? How does such an approach change perspectives on verification and validation? How does it transform our perspective on systems (e.g., in a medical context) where concepts of modeling may be challenged by dynamic and uncertain behaviors with limited observables?

For CPS Security, the proposal needs to address: What makes CPS security different from traditional cyber security? Are there new directions, or does CPS introduce new risks, at the intersection of the cyber and physical space that promise higher levels of security than those obtained by purely physical or cyber methods?

Internet of Things (or IoT) devices sense and communicate information, and in some cases act upon that information. Their rapid emergence brings potential benefits to consumers and opportunity for huge economic growth, but it also presents important challenges in security, safety, and privacy. How can CPS research enable a vision of an "Internet of Dependable and Controllable Things" while preserving the potential benefits?

Finally, CPS technologies are central to achieving the vision of Smart and Connected Communities (S&CC), which spans many sectors and disciplines and includes the important attributes of efficiency, safety, security, and a positive impact on quality of life within cities and communities. Projects with an S&CC focus must address foundational research that also advances CPS. Projects are encouraged to include a demonstration or pilot activities, designed and carried out together with one or more communities, and must explain how the impact of the activities will be measured.

Next, Bruce Kramer, Program Director in the Directorate of Engineering (ENG) in the Division of Civil, Mechanical and Manufacturing Innovation (CMMI), will be explaining the classes of projects in greater detail.

Slide 8:
BRUCE KRAMER:
Thank you.
This year there will be three classes of projects: Small, Medium and Frontier. All proposals for the following three classes of research and education projects, that differ in scope and goals, will be accepted. The proposer is expected to describe in the Project Description how the project fits within the selected category in terms of its scope and goals:

Small projects may be requested with total budgets of up to $500,000 for periods of up to three years. They are well suited to exploration of emerging and innovative ideas with substantial potential for impact. Proposals for Small projects are required to clearly describe why/how the research, if successful, would influence the field of CPS.

Medium projects may be requested with total budgets ranging from $500,001 to $1,200,000 for periods of up to three years. They are well suited to multi-disciplinary efforts that accomplish clear goals requiring an integrated perspective spanning the disciplines. Proposals for medium projects are required to clearly describe why the research to be undertaken requires this multi-disciplinary approach. The research plan must include validation of theory through empirical demonstration in a prototype or testbed.

Slide 9:
BRUCE KRAMER:
The last project class is Frontier Projects. Frontier projects may be requested with total budgets ranging from $1,200,001 to $7,000,000 for periods of four to five years. The proposal must clearly identify and address critical CPS science, engineering, and/or technological challenges that cannot be achieved by a set of smaller projects. Frontier projects should look to push the boundaries of CPS well beyond today's systems and capabilities. The goal, scale, and degree of integration of the proposed research must clearly require this major investment. The research plan must include validation of theory through empirical demonstration in a prototype or testbed. Additional requirements, including sharing results, testbeds and artifacts and the expected use of the CPS Virtual Organization, requirements for the education plan, and the broadening participation plan, are discussed in detail in the solicitation.

Slide 10:
DAVID CORMAN:
NSF is working closely with multiple agencies across the federal government, including the United States Department of Agriculture (USDA) National Institute of Food and Agriculture (NIFA); Department of Homeland Security (DHS); Department of Transportation (DOT) Federal Highway Administration (FHWA) and institutes from the National Institutes of Health (National Cancer Institute, National Institute of Biomedical Imaging and Bioengineering, and National Center for Advancing Translational Science). The key goals are to identify basic CPS research directions that are common across multiple application domains, including those with high potential for later transition to practice. NSF is also working with the German Science Foundation (DFG) to support research in the Networked CPS area.

Next, Steven Thomson, who is representing the National Institute of Food and Agriculture (NIFA) for the United States Department of Agriculture (USDA) will be explaining the collaboration between NSF and USDA in greater detail.

Slide 11:
STEVEN THOMSON:
Thank you, David.
The collaboration with the U.S. Department of Agriculture National Institute of Food and Agriculture. USDA/NIFA is pursuing an aggressive research agenda to meet the "grand challenges" for agriculture and society. These challenges have a common underlying theme: delivering food, fiber, fuel, and feed within a changing global climate while reducing agriculture's environmental footprint and managing biotic threats to production. NIFA has embarked on a multi-horizon research agenda that is addressing these challenges. Foundational and applied research in CPS are an important element of this agenda.

These CPS efforts address USDA goals indicated in the website including: protecting agricultural health, enhancing conservation planning, ensuring lands and watersheds are sustainable, healthy, and productive, and mitigation of wildfire risk. Projects are expected to engage academia, industry, stakeholders/users, students, and other organizations to identify critical research needs and to conduct both basic and applied research.

For this solicitation, NIFA encourages projects that advance science and technology applied to Smart & Connected Communities (both rural and urban) and to real-time agricultural data analytics and control. While other applications of CPS in agriculture might be considered, strong preference will be given to these two topics. Please refer to the solicitation for additional discussion.

David will be explaining the collaborations between NSF, DHS and DOT

Slide 12:
DAVID CORMAN:
Thank you, Steven.
The collaboration with the U.S. Department of Homeland Security Science and Technology Directorate Homeland Security Advanced Research Projects Agency (HSARPA) encourages research and development in cybersecurity to enhance the resilience of critical information infrastructure. HSARPA seeks to develop and transition new technologies, tools, and techniques to secure systems, networks, and infrastructure. Its research interests span a broad range of technology maturity levels ranging from foundational research in cybersecurity technology, to development and transition to practice.

HSARPA has particular interests in security technologies relevant to CPS and IoT. CPS related to automotive/heavy-vehicle, emergency response, and building automation are considered especially relevant for HSARPA. Relevant technologies include cybersecurity approaches for guarding against malicious attacks on CPS as well as diagnostics and prognostics that aim to identify, predict, and prevent or recover from faults. HSARPA is interested in CPS technologies that address privacy concerns and manage the use of sensitive information while protecting individual privacy. Validation, verification, and certification that speed up design cycles while ensuring high confidence in system safety and functionality also align well with HSARPA interests.

More information about relevant DHS S&T cybersecurity technology interests can be found on the website and in the solicitation.

Slide 13:
DAVID CORMAN:
Our next collaboration is with the U.S. Department of Transportation Federal Highway Administration. FHWA has interest in research and development that provides improved safety and mobility in the development and operation of the highway system. At the same time, CPS for highway transportation must be scalable, reliable, adaptable, and secure while also being cost-effective.
The following are examples of how CPS research could respond to public needs across transportation and other domains:

- Traffic management and control systems;
- Leveraging the differences between machines and people in sensing, analytics, and control;
- Increasing safety and convenience for vulnerable travelers; and
- Technologies that extend the infrastructure lifecycle and reduce costs through automated maintenance.

Solutions in these areas (presented as illustrative examples) should keep in mind the open nature of the transportation system, as well as legacy components and the distributed nature of asset ownership and operations. Solutions in additional areas aligned with DOT interests are welcomed.

FHWA encourages leveraging existing tools and infrastructure for connected and automated vehicles and real-world data, including the use of CARMA. Additional motivations, examples of DOT interests, and more information can be found at these websites.

Next, Christopher Hartshorn, who is representing the National Cancer Institute (NCI) for the National Institutes of Health (NIH), will be explaining the collaboration between NSF and NIH.

Slide 14:
CHRISTOPHER HARTSHORN:
Thank you, David. The National Institutes of Health expects to fund two general types of research projects: Small and Medium.

Applications being proposed should be relevant to the missions of the participating NIH institutes: NCI, NIBIB, and NCATS.

The NIH encourages CPS research and technology development to enhance health, lengthen life, and reduce illness and disability. In this solicitation NIH is interested in the development of CPS research and technology to achieve functional independence in humans; improve quality of life; assist with behavioral therapy and personalized care; monitor or generate efficacious readouts of therapeutic effects of therapies; and promote wellness/health.

Advances in sensors, wearable devices, and patient-facing technologies hold great promise in improving healthcare across the continuum from prevention to survivorship. Little is known, however, about how advances in CPS can integrate these technologies and interfaces to increase patient engagement and activation.

One vision of medical CPS could be the development of personalized patient-care systems which are tightly knit with other non-medical CPS systems. Such a closed-loop environment could enable optimal and timely delivery of healthcare improvements at a significant cost reduction, and solutions should consider the amount of data produced and its analysis.

Several additional examples of medical CPS research and development are detailed in the solicitation. Note that these are not an exhaustive list of potential interests

Applicants should describe how the ideas being proposed will address the healthcare needs of the end user (healthy individuals, patient populations with specific targeted diseases, persons with disability, and/or health disparity populations).

Back to you David.

Slide 15:
DAVID CORMAN:
Thanks Christopher.
Our final partnership to discuss is the Joint Research Collaboration with the German Science Foundation (DFG)

This program encourages the collaboration between US NSF PIs and DFG PIs. The NSF CPS program will entertain Medium projects from US PIs collaborating with German counterparts on foundational as well as some applied aspects of Networked Cyber-Physical Systems (netCPS) research.

This research focus will entertain issues encompassing ambitious vision in foundational aspects of netCPS in general, including setting up frameworks for design, analysis, performance evaluation, etc. that account for netCPS's multilayered and dynamically co-evolving networks. Additional discussion on this motivation and relevant topics are further discussed in the solicitation.

Projects driven by motivating examples from application domains are strongly encouraged (for example, 5G wireless applications, such as autonomous vehicles, healthcare/telemedicine, and the modern industrial internet including the IoT). Complementary expertise of the US and German participants from different industry sectors potentially utilizing or having an interest in the netCPS methodology is expected. Submissions to DFG are due April 3, and the project descriptions and certain other documents submitted to DFG and NSF should be identical. Interested proposers are encouraged to contact relevant program directors at NSF and DFG prior to submitting proposals pursuant to this collaboration.

Slide 16:
DAVID CORMAN:
Foundational research is transforming engineered systems and driving innovation in a wide variety of application domains, thereby enabling new levels of economic opportunity and growth, safety and security, health and wellness, and overall quality of life in the Nation's local communities. NSF is inviting supplemental funding requests for high-impact Transition to Practice (TTP) activities that can enable on-going CPS projects to go beyond their original, planned research activities.

Proposals for Small, Medium, or Frontier projects may include a TTP option. Proposed activities under the TTP option MUST NOT be described in the Project

Description section, and instead MUST be described in a Supplementary Document of no more than five pages. The TTP option is meant to leverage proposed research activities and ideas to move results beyond the laboratory. Proposals including this option should clearly describe how the results will be further developed, matured and experimentally deployed in organizations or industries. Any software developed in this program area is required to be released under an open source license listed by the Open Source Initiative; this requirement is specific to the TTP option supplement. The TTP funding request may not exceed more than one-third of the base award amount or $400,000, whichever is less. Additional details and requirements of the TTP Option, including the solicitation-specific review criteria and how the budget should be specified, are included in the solicitation. Proposers who submit a TTP are advised to carefully consider those criteria when designing the TTP.

Next, Bruce will be talking about the Project Description for the 19-553 solicitation

Slide 17:
BRUCE KRAMER:
Thanks.
The CPS 2019 solicitation requires the following sections into the project description: Research Description, Evaluation/Experimentation Plan, Project Management and Collaboration Plan, and Broader Impacts. We will go into more details in the next slides.

Slide 18:
BRUCE KRAMER:
The Research Description must include the following subsections: Intellectual Merit and CPS Research Focus. Proposals that fail to include one or more of these sections or subsections will be returned without review (RWR), without exception.

The Intellectual Merit subsection is required in the PAPPG. The Research Description section must describe the technical rationale and technical approach of the CPS research. It should describe the challenges that drive the research problem. It must identify how the research integrates cyber and physical components. It must explain how the proposal goes beyond sensing and how the system "closes the loop". For research focusing on "tools for CPS design or verification", the proposal must show how these tools are applicable to CPS, which have cyber and physical components that "close the loop". This section should describe specific activities for performing the research. It should provide the project research plan including descriptions of major tasks, the primary organization

responsible for each task, and the milestones. The research description must include a Gantt chart which lays out the sequence of major activities and their inter-dependencies.

The CPS Research Focus subsection of the Research Description is where the PI describes the specific core research areas as previous described in which the novel and foundational research contributions are being made. This section must also explain how the project research fits the Program Description for the class of proposal: Small, Medium, or Frontier.

The Evaluation**/**Experimentation Plan describes how the research concepts proposed will be demonstrated and validated. It should present metrics for success. It should identify critical experiments, and describe how the research will be demonstrated, including through simulation, prototyping, and integration with real (including sub-scale) cyber-physical systems. For Medium and Frontier projects, the validation plan must include experimentation on an actual cyber-physical system.

The Project Management and Collaboration Plan summarizes how the project team is appropriate to realize the project goals and how the team will assure effective collaboration. It should provide a compelling rationale for any multi-institution structure of the project, if appropriate. The plan should identify organizational responsibilities and how the project will be managed, including approaches for meeting project goals. Specific details of how the management and collaboration plan will be evaluated are described in detail in the solicitation. Note that in the case of Frontier projects, the plan should also identify a single individual who will be responsible for executing the management and collaboration plan, identify any specific roles for, and the amount of the budget to be allocated for project administration. Frontier projects must also include a kick-off meeting with all participants in coordination with NSF, as well as at least annual in-progress meetings with NSF. For Frontier projects, PIs and all co-PIs must be present in-person for the kick-off meeting. We also strongly prefer that PIs and all co-PIs for each Frontier project (including collaborative projects) be present in-person for annual in-progress meetings.

Slide 19:
BRUCE KRAMER:
In addition to the specific information required in the PAPPG, the Broader Impacts section should provide plans for integrating research outcomes into education and more broadly advancing CPS education. It should also describe how the research

and education outcomes will be disseminated in a manner that enables the CPS research community and others to use the results in ways that go beyond traditional academic publications. For Frontier proposals, the education and outreach discussion should be described within a separate subsection titled Education and Outreach Plan, within Broader Impacts, and must provide significant detail on the planned activities to explain how it will have meaningful impact

Slide 20:
BRUCE KRAMER:
NSF has long been committed to Broadening Participation in Computing (BPC) and Engineering (BPE). The underrepresentation of many groups—including women, African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, Native Pacific Islanders, and persons with disabilities—in computing and engineering deprives large segments of the population of the opportunity to be creators of technology and not only consumers. Ending underrepresentation will require a range of measures, including institutional programs and activities as well as culture change across colleges, departments, classes, and research groups.

With this solicitation, CISE is expanding a pilot effort started last year encouraging the research community to engage in meaningful activities to broaden participation. This new activity builds on many of the programs, research, and resources created in CISE's long history of support for BPC, and it aligns with the recommendations of the Strategic Plan for Broadening Participation produced by the CISE Advisory Committee in 2011. Specifically:

- For Frontier CPS proposals, a meaningful BPC plan is required as a one- to three-page Supplementary Document and will be evaluated during merit review.

- Each Medium project team **is strongly encouraged to submit a BPC or BPE plan.** Medium projects must, by the time of award, have in place an approved BPC / BPE plan. CISE PIs of Medium proposals are therefore strongly encouraged to consider this eventual requirement as they develop their proposals, and to include one- to three-page descriptions of their planned BPC or BPE activities under Supplementary Documents in their submissions.

- PIs of Small proposals are strongly encouraged to include plans, or begin preparing to include plans, for broadening participation activities in their proposals.

For more information please visit these websites. Fay Cobb Payton, Program Director for the Computer Network and Systems Division, in the Computer & Information Science & Engineering Directorate at NSF, will discuss BPC plans in greater detail.

Slide 21:
FAY COBB PAYTON:
Thank you, Bruce.
As the CISE BP Strategic Plan states, BPC is a community-wide effort in recognition of the fact that BPC "will take more than good intentions or business as usual, to reverse longstanding underrepresentation. It will take committed, focused, and sustained efforts on the part of many in the computing community." Efforts of almost all are required for change.

Slide 22:
FAY COBB PAYTON:
There are three primary guiding principles for the BPC effort. First, broadening participation in computing (or BPC) requires **culture change** in colleges, universities, departments, classes, and amongst all stakeholder groups from K thru 12 schools to professional organizations.

Second, culture change is hard. It begins though with enhanced exposure to BPC throughout the computing community. This means including underrepresented students in research groups, collaborating with internal and/or external partners to enhance student awareness of opportunities in computing, and serving as a representative to the community-at-large to expand the idea of who can contribute to the computing fields.

Last, but certainly not least, everyone is not an expert in BPC, and therefore, we encourage your approach to appropriate to your experience in BPC efforts, and the context of your research group, department, university and relevant organizations. This is not a one size fits all approach.

Slide 23:
FAY COBB PAYTON:

Last fall, a group of BPC experts meet to review more than 650 BPC Plans that were submitted in CISE proposals. After completing the reviews, the panelists wrote the White Paper [link] mentioned above. It is located on the BPCnet.org site and linked from the CISE BPC Website, and is an extraordinarily useful description of their thoughts in evaluating the plans and their conclusions about the elements of a good plan.

Slide 24:
FAY COBB PAYTON:
A good plan describes:

1. The **context**, or problem or need to be addressed, the proposed approach rationale, and the goals of the effort,
2. The **strategy**, or the activities, resources needed by the PIs and collaborators to ensure the project is viable and responsive to the needs and strengths of the target audience,
3. The **target**, or clear demographic data on the intended population, and finally
4. The **measurement and dissemination** plan to meaningfully measure progress made towards the PIs' stated BPC goals and thoughtfully share the results so others can learn about effective, evidence-based models and strategies.

The White Paper includes a detailed rubric in its Appendix, but we recognize that all of our PIs are not ready to submit or carry out a fully developed plan. The body of the paper contains a "developmental rubric" that will help PIs determining appropriate next steps in developing a plan appropriate to their experience and their local context.

Slide 25:
FAY COBB PAYTON:
In summary, BPC activities should be intentional, ongoing, can integrate with how you conduct nearly all teaching, research, and outreach activities, and include evaluation to address the underrepresentation gaps within the computing community.

PIs are encouraged to propose BPC activities that align with existing successful programs:

- If your department has a BPC Plan, participate in its activities.
- If your department doesn't have a plan, work to develop one.

- Consider working with university-wide programs such as AGEP or LSAMP.
- Consider working with local or national organizations such as the Girls Scouts, 4H, CSTA, ACM-W, CRA-W, NCWIT, IAAMCS, etc.

Find out more about all these opportunities at BPCnet.org.

Slide 26:
FAY COBB PAYTON:
Here are a number of resources that provide additional clarity and support for taking the first steps in determining your BPC plan. Thank you for your time and attention, Jonathan Sprinkle, Program Director for the Computer Network and Systems Division, in the Computer & Information Science & Engineering Directorate at NSF, will now share CPS-specific resources.

Slide 27:
JONATHAN SPRINKLE:
Thank you, Fay.
We have more resources that could help you with more information. Our NSF-CPS website provides a list of contact information for program directors affiliated with CPS. You can also get a list of funded awards and you find the entire solicitation.

The CPS Virtual Organization is an important resource at which you can find out information about previous PI meetings, posters and videos of CPS research.

Slide 28:
JONATHAN SPRINKLE:
Here are the points of contact that you can find in the NSF-CPS website.

Slide 29:
JONATHAN SPRINKLE:
The following reflective questions may help guide you in considering a response to the solicitation:
How does the research integrate cyber and physical components?
- How does this go beyond a difficult domain problem?
- What are the challenges that drive the research problem?
- How does the proposal go beyond sensing? I.e., how the system "closes the loop”?

- What is the CPS Research Focus? What are the specific core areas of CPS-focused research in which novel and foundational research contributions are being made?
- How will the proposed concepts will be validated? What are the metrics for success?
- How are the research outcomes translational to other application domains?

Slide 30:
JONATHAN SPRINKLE:
With this, you can email your questions to cpsquestions@nsf.gov

Slides 31-37:
JONATHAN SPRINKLE:
Next are some frequently asked questions that we have received.

Slide 38:
DAVID CORMAN:
Thank you again for your interest in the CPS Program! Please check our NSF-CPS website, consider serving as a CPS reviewer in our panels and again if you have any questions do not hesitate to reach out.