



Webinar: 2019 Cyber Physical Systems (CPS) Program)



- David Corman (NSF-CISE/CNS)
- Kenneth Calvert (NSF-CISE/CNS)
- Kishan Baheti (NSF-ENG/ECCS)
- Bruce Kramer (NSF-ENG/CMMI)
- Steven Thomson (USDA-NIFA)
- Christopher Hartshorn (NIH-NCI)
- Fay Cobb Payton (NSF-CISE)
- Jonathan Sprinkle (NSF-CISE)

March 18th, 2019



Welcome +

- **Kenneth Calvert** - NSF for Division Director for Computer and Network Systems (CNS) in the Directorate for Computer and Information Science and Engineering (CISE)
- **David Corman** - NSF Program Director in CISE/CNS
- **Kishan Baheti** - NSF Program Director in the Directorate of Engineering (ENG) in the Division of Electrical, Communications & Cyber Systems (ECCS)
- **Bruce Kramer** - NSF Program Director and Senior Advisor in the Directorate of Engineering (ENG) in the Division of Civil, Mechanical and Manufacturing Innovation (CMMI)
- **Steven Thomson** - USDA for National Institute of Food and Agriculture (NIFA)
- **Christopher Hartshorn** - NIH for National Cancer Institute (NCI)
- **Fay Cobb Payton** - NSF Program Director in CISE/CNS
- **Jonathan Sprinkle** - NSF Program Director in CISE/CNS



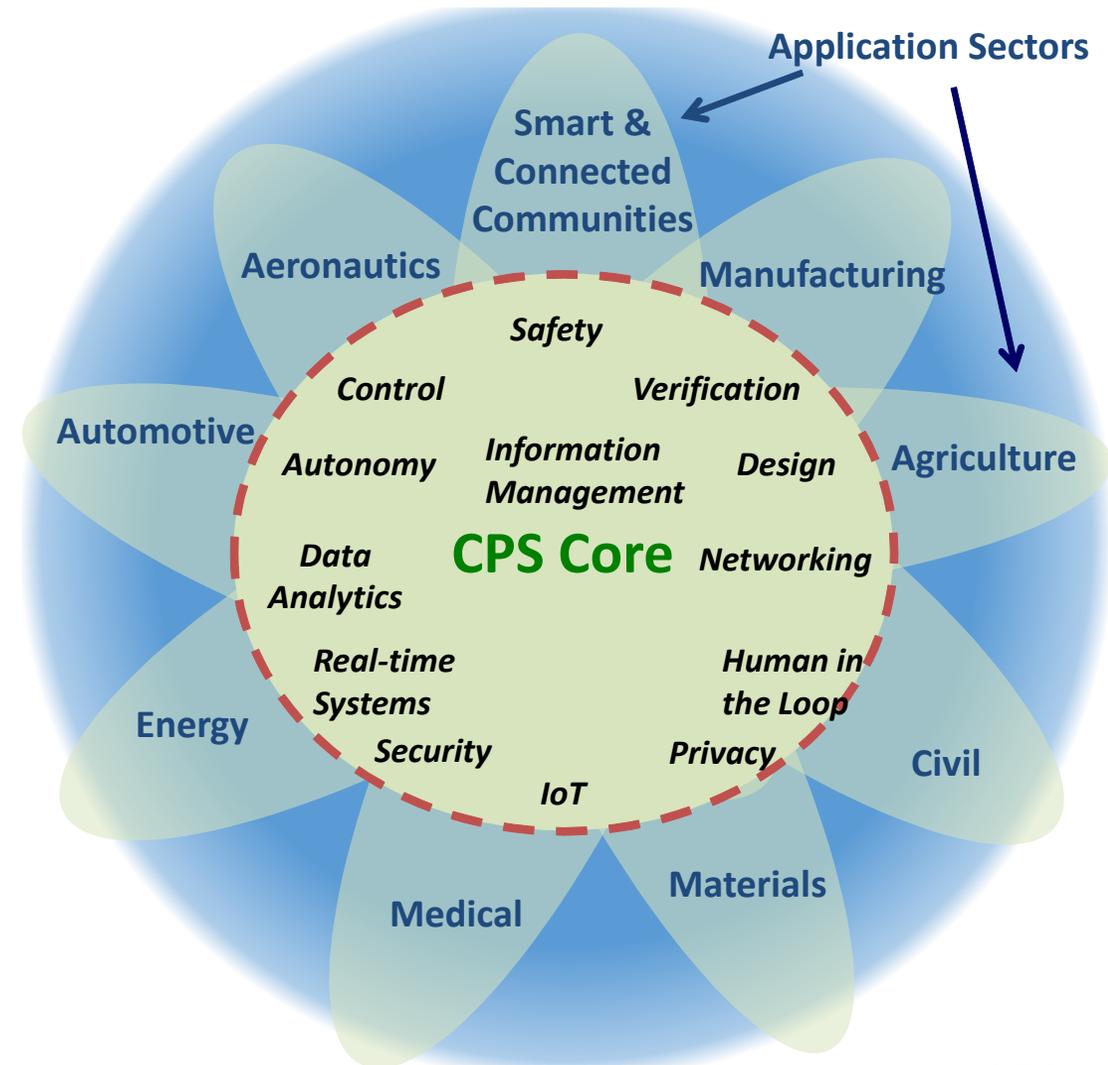
Outline

- Overview of the NSF CPS Program
- NSF 19-553 Solicitation
 - Research Challenges
 - Classes of Projects
 - Funding from Other Federal and International Agencies
 - Transition to Practice (TTP)
 - Project Descriptions
- Resources
- FAQ's



Overview of the CPS Program '1

- The goal of the CPS program is to develop the core system science needed to engineer complex cyber-physical systems upon which people can depend with high confidence
- Reveal cross-cutting fundamental scientific and engineering principles that underpin the integration of cyber and physical elements across all application sectors
- Participation from NIFA; DHS; DOT/FHWA; NIH; DFG
- Anticipated funding in 2019: \$51.5M



CPS 2019 Solicitation – What's New

- Deadlines
 - Proposal deadlines is 60 days for Small and Medium Projects
 - Proposals for Frontier due by September 12, 2019-September 26, 2019
- Budget:
 - Solicitation Budget (for FY 19) increased
 - Maximum budget for Medium proposals increased to \$1,200,000
 - TTP budget is maximum of \$400,000 or 1/3 of award – whichever is less
 - Separate TTP DCL 19-026
- Collaboration with German Science Foundation (DFG) for Networked CPS – requires collaboration between US and German researchers
- Broadening Participation requirement for Medium Proposals
- Focus area for Smart and Connected Communities added
- **Research focus subsection** in Research Description section of Project Description \$



2019 CPS Program: Solicitation Submission Window - due by 5 p.m. submitter's local time

- **Small and Medium:** April 01, 2019 - April 12, 2019 3
- **Frontier:** September 12, 2019 - September 26, 2019 3



2019 CPS Program: Research Challenges

Proposals must not simply describe the development of a CPS, but also emphasize the areas of CPS-focused research in which novel and foundational research contributions are being made

- **Emerging spaces driving new CPS concepts:** Explore next-generation CPS 6 applications 6
- **Highly Dynamic Systems:** Systems of systems, spanning spatial, temporal, and other dimensions
- **CPS and the Data Revolution:** New challenges emerging from model-driven CPS fundamentals into an integrated data-driven model-based
- **CPS Security:** Differences in CPS security beyond traditional cybersecurity
- **Beyond IoT:** Ways that CPS research enable a vision of an "Internet of Dependable and Controllable Things" while preserving the enormous potential benefits
- **CPS for Smart and Connected Communities:** Projects with an S&CC focus must address foundational research that also advances CPS



2019 CPS Program: Classes of Projects

- **Small Projects**

- Well suited to exploration of emerging and innovative ideas with substantial potential for impact
- Must clearly describe why/how the research, if successful, would influence the field of CPS
- Up to \$500,000 for periods of up to 3 years

- **Medium Projects**

- Well suited to multi-disciplinary efforts that accomplish clear goals requiring an integrated perspective spanning the disciplines
- Must 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
- \$500,001 to \$1,200,000 for periods of up to 3 years



2019 CPS Program: Frontier Projects

- Clearly identify and address critical CPS challenges that can not be achieved by a set of smaller projects
- 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
- Must include validation of theory through empirical demonstration in a prototype or testbed
- Must include a plan for sharing results, including testbeds and artifacts, with the CPS research community, including through the [CPS Virtual Organization \(CPS-VO\)](#)
- \$1,200,001 to \$7,000,000 for periods of 4 to 5 years



FY 2019 Funding from Other Federal and International Agencies

The proposer may also wish to consider well-justified international collaborations that add # significant value and leverage to the proposed research and/or education activities #

- 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)
- National Institutes of Health (NIH)
 - National Cancer Institute (NCI)
 - National Institute of Biomedical Imaging and Bioengineering (NIBIB)
 - National Center for Advancing Translational Science (NCATS)
- German Science Foundation (DFG)



2019 CPS Program: USDA/NIFA Program Interests

- Pursues 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
- These CPS efforts address USDA goals indicated here <https://www.usda.gov/sites/default/files/documents/usda-strategic-plan-2018-2022.pdf>
- NIFA also 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





2019 CPS Program: DHS Program Interests

- Interest in security technologies relevant to CPS and IoT.
 - CPS related to automotive/heavy-vehicle, emergency response, and building automation. Relevant technologies :
 - Cybersecurity approaches for guarding against malicious attacks on CPS
 - Validation, verification, and certification that speed up design cycles while ensuring high confidence in system safety and functionality
- For more information: <http://www.dhs.gov/science-and-technology/csd-projects> 0



2019 CPS Program: DOT-FHWA Program Interests



- Interest in research and development that provides improved safety and mobility in the development and operation of the highway system
- Interest in fundamental research that also is aimed towards solving important public needs and can scale across transportation systems and modes, and into other domains
- The approaches should consider the open nature of the transportation system, legacy components and processes, and the distributed nature of asset ownership and operations
- More information: <https://highways.dot.gov/research/research-programs/operations/CARMA> and https://www.its.dot.gov/research_areas/connected_vehicle.htm



2019 CPS Program: NIH Program Interests 1



- Interest to support 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 about how advances in CPS can integrate these technologies and interfaces to increase patient engagement and activation
- 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)



2019 CPS Program: Transition to Practice (TTP) Option Review Criteria

An optional component, above and beyond the requirement for experimentation. Proposers should carefully describe in their TTP option description and budget justification the scope of this additional activity, especially if it is anticipated in the early project years

- Clearly describe how the results will be further developed, matured and experimentally deployed in organizations or industries, including in networks and end systems
- The TTP funding request may not exceed more than 1/3 of the base award amount or \$400,000, whichever is less
- Any software developed in this program area is required to be released under an open source license listed by the Open Source Initiative (<http://www.opensource.org/>) (this requirement is specific to the TTP option supplement)

All Proposals Must Include the Following in the Project Description

- Research Description
- Evaluation/Experimentation Plan
- Project Management and Collaboration Plan
- Broader Impacts



Research Description, Evaluation, Project (Management and Collaboration Plan (

Proposals that fail to include one or more of these sections will be returned without review (RWR), without exception

- **Research Description:** Technical rationale and technical approach of the CPS research
 - A subsection: “Intellectual Merit”
 - A subsection: “CPS Research Focus” - core CPS research areas where the novel and foundational research contributions are being made
- **Evaluation/Experimentation Plan:** How proposed concepts will be validated and the metrics for success
- **Project Management and Collaboration Plan:** How the project team is ideally suited to realize the project goals and how the team will assure effective collaboration

Broadening Participation in Computing (BPC) and Engineering (BPE)

- The CPS commitment :
 - To enhance the community's awareness of and overcoming barriers to BPC and BPE
 - To provide information and resources to PIs so that they can develop interest, skills, and activities in support of BPC/BPE at all levels of the CPS community (K-12, undergraduate, graduate, and postgraduate)
- 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
- Medium Projects are **strongly encouraged** to include BPC/BPE plan and must, by the time of award, have in place an approved BPC/BPE plan
- Strongly encouraged for Small Projects
- More Information: <https://www.nsf.gov/cise/bpc/> and https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504870&org=EEC&from=home



Guiding Principles

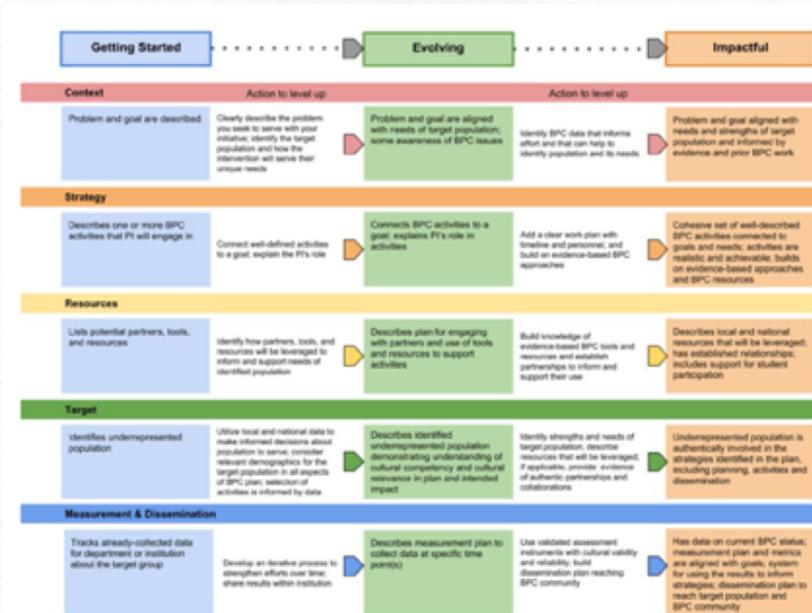
- BPC requires **culture change** in colleges/universities, departments, classes, research groups, professional organizations & K-12
- Culture change begins with **enhanced exposure** to BPC throughout the CISE community
- PI engagement must be **tailored to individuals and organizations** as appropriate



White Paper on the CISE BPC Plan Pilot

This document was developed by reviewers participating in the CISE Broadening Participation pilot, as a resource for PIs as they develop plans to include with proposal submissions. To protect the confidentiality of the review process, the names of the authors are not disclosed, nor are individual proposals discussed.

[READ THE WHITE PAPER](#)



<https://BPCnet.org>

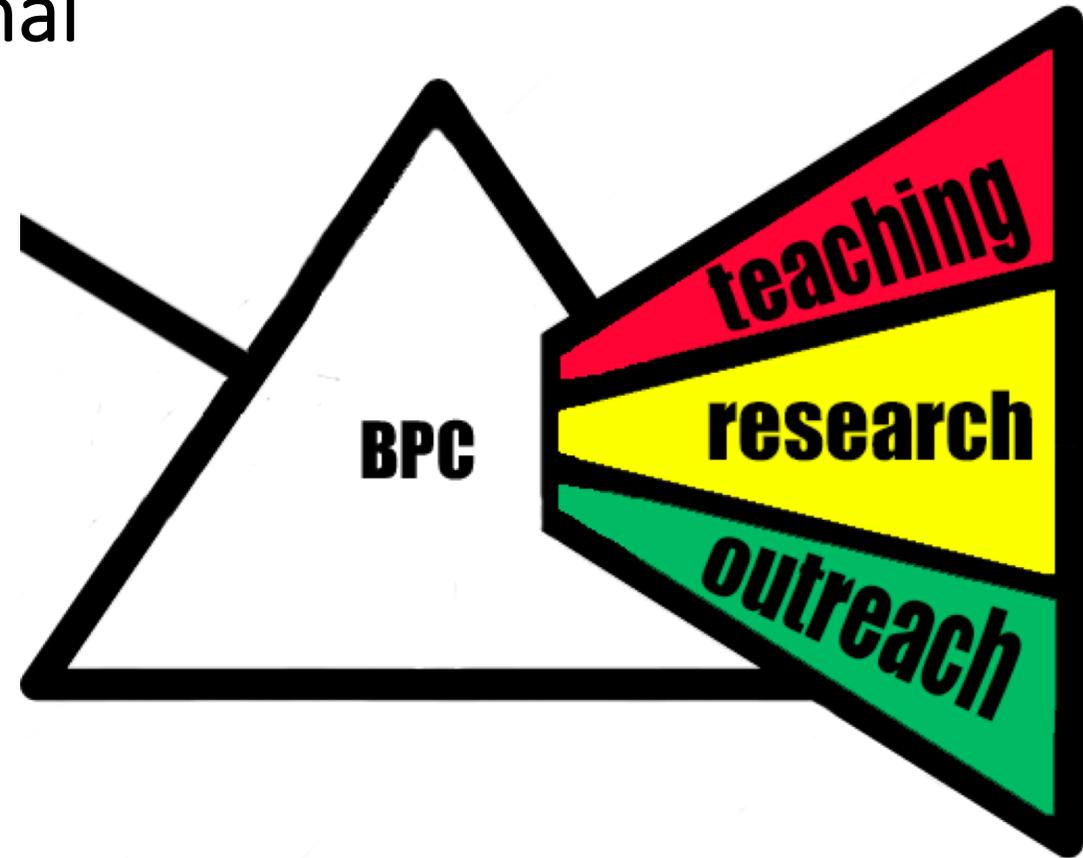
BPC Plan Rubric Framework \$

- **CONTEXT:** Problem or need to be addressed, rationale, and goals
- **STRATEGY:** Needed activities, resources to ensure the project is viable and responsive to the needs and strengths of the target audience
- **TARGET:** Clear demographic data on the intended population \$
- **MEASUREMENT AND DISSEMINATION:** Plan to meaningfully measure progress and thoughtfully share the results



Common Principles for BPC

- BPC activities should be **intentional**
- BPC activities should be **ongoing** and can **integrate** with how you conduct nearly all teaching, research, and outreach activities
- BPC activities should include **evaluation**



BPC Resources \$

- Broadening Participation in Computing: <https://www.nsf.gov/cise/bpc/> \$
- Informative BPC Slides: https://www.nsf.gov/cise/bpc/BPC_slides.pdf
- BPCnet Resource Portal: <https://bpcnet.org>
- BPC Is Easier Than You Think: <https://bit.ly/2BSFkUf>
- White Paper on the CISE BPC Plan Pilot: <https://bit.ly/2Tpu23W>
- NSF Highlights Expanded Efforts for BPC: <https://bit.ly/2H4MXuk>

BPC

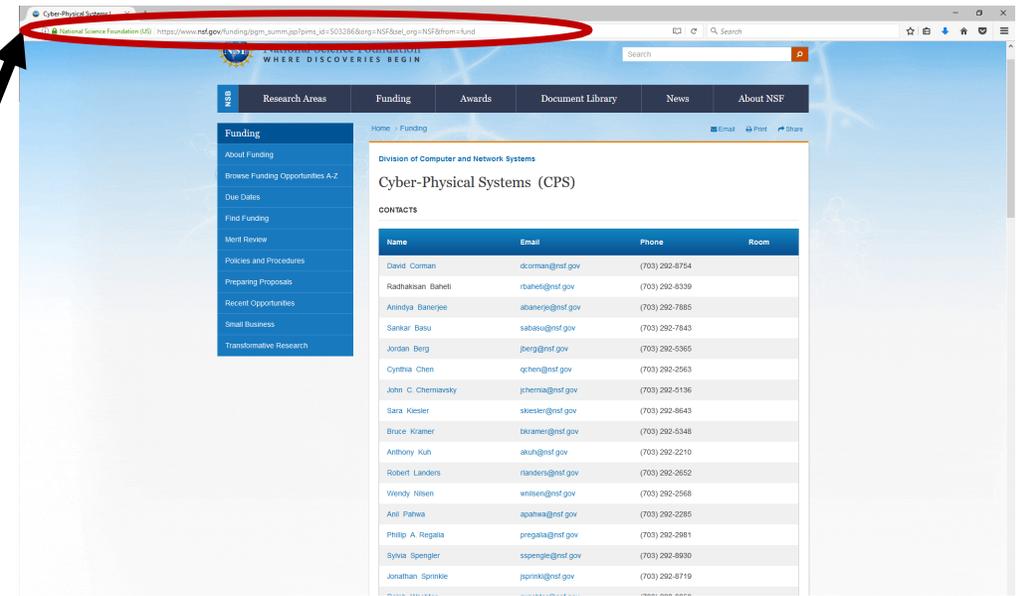
<https://www.nsf.gov/cise/bpc/> \$



Resources

- NSF-CPS
 - Contacts
 - Funded Awards
 - Solicitation

http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286&org=NSF&sel_org=NSF&from=fund



- CPS Virtual Organization
 - PI meeting
 - Posters
 - Videos

<https://cps-vo.org/>



2019 CPS Program: Points of Contact %

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- David Kuehn, Program Manager, DOT/FHWA, telephone: (202) 493-3414, email: david.kuehn@dot.gov
- Steven Thomson, National Program Leader, USDA/NIFA, telephone: (202) 603-1053, email: Steven.J.Thomson@nifa.usda.gov
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- Tiffani Lash, Program Director NIH/NBIB, telephone: (301) 451-4778, email: tiffani.lash@nih.gov
- Danilo Tagle, Associate Director for Special Initiatives, NIH/NCATS, telephone: (301) 594-8064, email: danilo.tagle@nih.gov
- Dana Wolff-Hughes, Health Scientist Administrator, NIH/OBSSR, telephone: (301) 496-0979, email: dana.wolff@nih.gov

Formulating Your Research Ideas ,

- 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? ,



FAQ's

- Question:
 - If an individual is part of two proposals in the Small and/or Medium category in April, would that individual be ineligible to participate in a Frontier proposal team in September?
- Answer:
 - In this case, the individual's participation as PI, co-PI, Senior Personnel, or Consultant on the Frontier proposal would result in the proposal (and any other proposals in the collaborative project) being returned without review. An individual can participate as PI, co-PI, Senior Personnel, or Consultant on no more than two proposals submitted in response to this solicitation

FAQ's

- Question:
 - How can industry participate in a CPS proposal beyond their support through a letter of commitment?
- Answer:
 - Industry can participate in a university proposal as a sub-awardee.
 - Industry cannot submit a separate proposal
 - GOALI proposals also supported



FAQ's cont..

- Question:
 - Can my proposal fund international collaborators?
- Answer:
 - Well-justified international collaborations that add significant value and leverage to the proposed research and/or education activities
 - NSF funds US researchers
 - International collaborators can be supported by outside means including the collaborator's international funding agency
 - Consider the US-DFG as an example

FAQ's cont...

- Question:
 - What is the NSF / DFG Collaboration?
- Answer:
 - Must be joint (US + DFG researchers)
 - Review via NSF panel and DFG process



FAQ's cont....

- Question:
 - For collaborations with DFG, how identical must the project descriptions and other documents be?
- Answer:
 - The DFG collaboration is analogous to collaborative proposals for the CPS solicitation, in which common documents describe the project description, references, etc. for the entire collaborative team. The main documents must be substantively identical, apart from small differences in formatting or presentation that do not affect the substance of the proposed work

FAQ's cont..... &

- Question:
 - What does multi-agency solicitation mean for proposal review process?
- Answer:
 - All proposals submitted to NSF and must comply with all **NSF CPS proposal requirements**
 - Agencies may contribute panelists
 - NSF Merit review process will be used
 - Agencies are typically looking for proposals that they normally do not receive from their agency specific solicitations



Final Words &

- Check the NSF CPS program webpage for program updates: & https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503286&org=NSF&sel_or_g=NSF&from=fund
- Please consider serving on CPS review panels. If you know of individuals who may be willing and able to serve on CPS Panels, please send us their names
- E-mail questions to cpsquestions@nsf.gov
- Slides, audio and transcript will be available at: https://www.nsf.gov/events/event_summ.jsp?cntn_id=297925&org=CISE

