



National Science Foundation
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Smart and Autonomous Systems FAQ

1. For the purposes of this solicitation, what are **Intelligent Physical Systems**?
 2. Are purely software agents in the scope of S&AS?
 3. Why have a solicitation for proposals on Smart & Autonomous Systems?
 4. What is the difference between Foundational and Integrative proposals?
 5. In addition to Intellectual Merit and Broader Impacts, are there program-specific review criteria?
 6. Can my project address themes other than the five primary Research Themes?
 7. Can I receive feedback on my idea for a proposal prior to submission?
 8. May industry or for-profit organizations submit proposals?
 9. Does participation as Senior Personnel count towards the limit on the number of proposals?
 10. Are there any required, program-specific Supplementary Documents?
 11. What is the difference between Supplementary Documents and Single Copy Documents?
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1. For the purposes of this solicitation, what are Intelligent Physical Systems?

They are integrated hardware and software systems that interact with the physical world and are characterized by five primary features, described as Research Themes in the solicitation: cognizant, taskable, reflective, ethical, and knowledge-rich. Intelligent Physical Systems are capable of operating with little or no human supervision for a sustained period of time, can operate in dynamic environments, are aware of their own limitations, are able to diagnose and potentially repair hardware and software malfunctions, and are able to respond behaviorally and ethically to vague or open-ended instructions.

2. Are purely software agents in the scope of S&AS?

No. Research relevant only to purely software (non-embodied) agents is not within the scope of this program. For example, chatbots and purely software medical diagnostic systems (i.e., without a specific hardware component) are out of scope. Research on software/algorithms for Intelligent Physical Systems, without a specific hardware component or test bed, may be appropriate for a Foundational-class project (see below).

3. Why have a solicitation for proposals on Smart & Autonomous Systems?

A major reason is to foster a community that has a focus on the research issues to enable autonomy in Intelligent Physical Systems. While other NSF programs have funded research in the area of autonomy, autonomy has not been the main focus of those programs. For instance, the National Robotics Initiative (NRI) focuses on human-robot interaction and collaboration, under the concept of "co-robots." Cyber-Physical Systems (CPS) is a broad program to develop the core system science needed to engineer complex cyber-physical systems that people can use or with which they interact and upon which they depend.

S&AS overlaps these programs, but emphasizes autonomy and self-awareness: a robotic system in a typical NRI project will have frequent human interaction; S&AS could consider proposals for research that allow systems to go for years without needing human intervention. A network of sensors in a CPS project may adapt to dynamic conditions without necessarily being data-rich or introspective; proposals to S&AS must explicitly address the goal of achieving Intelligent Physical Systems that exhibit long-term autonomy requiring minimal human intervention and are cognizant, taskable, reflective, ethical and knowledge-rich.

4. What is the difference between Foundational and Integrative proposals?

Foundational projects should propose highly innovative, fundamental techniques, theories, and technologies that contribute to the development of knowledge-rich Intelligent Physical Systems that are cognizant, taskable, reflective, and ethical. Foundational projects may focus on just one of these themes and are not required to utilize a physical test bed. Project budgets range from \$350,000 to \$700,000 in total costs for up to three years.

Integrative proposals focus on innovative integration of two, or more, of the themes and evaluation of the resultant system on a physical test bed. Integrative projects should have longer-term vision, with objectives that could not be attained simply by a collection of smaller projects provided with similar resources, and will preferably involve multiple PIs from different disciplines. Project budgets range from \$500,000 to \$1,400,000 in total costs for up to four years.

5. In addition to Intellectual Merit and Broader Impacts, are there program-specific review criteria?

Yes. All proposals must explicitly address the goal of achieving one or more of the five features that characterize Intelligent Physical Systems. See the section "Research Themes" in the Program Description for explanation of these five features of Intelligent Physical Systems.

In addition, Integrative projects will be reviewed based on the innovation in the integration of the system and the evaluation plan for the system in its intended setting.

6. Can my project address themes other than the five primary Research Themes?

Projects incorporating other themes directly relevant to smart and autonomous systems are acceptable so long as they focus primarily on at least one of the five primary Research Themes.

7. Can I receive feedback on my idea for a proposal prior to submission?

Yes. You are welcome to contact relevant program officers associated with the solicitation, preferably by sending email to S&AS@nsf.gov, to discuss the appropriateness of your ideas. Such discussions should ideally take place early in your proposal writing process.

8. May industry or for-profit organizations submit proposals?

No. Only universities and colleges and non-profit, non-academic organizations may submit proposals. Industry, FFRDCs, and for-profit organizations may only be subawardees.

9. Does participation as Senior Personnel count towards the limit on the number of proposals?

Yes. An individual can participate as PI, co-PI, or Senior Personnel on **no more than two proposals** submitted in response to this solicitation.

10. Are there any required, program-specific Supplementary Documents?

Yes. All projects should include a List of Project Personnel and Partner Institutions.

All projects that include more than one investigator must include a Collaboration Plan of up to 2 pages. The length and degree of detail should be commensurate with the complexity of the proposed project. For example, a Collaboration Plan for 2 PIs in the same department at the same institution need not be as detailed as a Collaboration Plan for PIs working in several different disciplines at different institutions.

11. What is the difference between Supplementary Documents and Single Copy Documents?

Supplementary Documents, including Data Management Plan, List of Project Personnel and Partner Institutions, Collaboration Plan (if required), and Postdoctoral Mentoring Plan (if required), are associated with a project, uploaded by the lead institution, and are made available to reviewers.

Single Copy Documents, such as Collaborators and Other Affiliations (COA: required) and Suggested Reviewers (appreciated) are associated with a proposal, used only by program directors, and are not shared with reviewers. NSF requires each PI, co-PI, and Senior Personnel to enter COA; to make this information machine searchable, we require the use of a spreadsheet template that can be uploaded directly (as .xls or .xlsx) into Fastlane for each individual. The spreadsheet template can be found at <https://www.nsf.gov/cise/collab>.