NOTICE OF FUNDING OPPORTUNITY (NOFO)
Economic Research and Analysis of the National Need for Technology Infrastructure to Support the Internet of Things (IoT)

EXECUTIVE SUMMARY

- **Federal Agency Name:** National Institute of Standards and Technology (NIST), United States Department of Commerce (DoC)

- **Funding Opportunity Title:** Economic Research and Analysis of the National Need for Technology Infrastructure to Support the Internet of Things (IoT)

- **Announcement Type:** Initial

- **Funding Opportunity Number**: 2019-NIST-TPO-IOT-01

- **Assistance Listing (CFDA Number):** 11.620; Science, Technology, Business, and/or Education Outreach

- **Dates:** Applications must be received at Grants.gov no later than 11:59 p.m. Eastern Time, Wednesday, July 24, 2019. Applications received after this deadline will not be reviewed or considered. Paper applications will not be accepted.

  Applicants should be aware, and factor in their application submission planning, that the Grants.gov system is expected to be closed for routine maintenance at the following times. Applications cannot be submitted when Grants.gov is closed:

From 12:01 A.M. Eastern Time Saturday	To 6:00 A.M. Eastern Time Monday
June 15, 2019	June 17, 2019
July 20, 2019	July 22, 2019

  NIST expects to complete its review, selection of successful applicants, and award processing by August 2019. NIST expects the earliest start date for awards under this NOFO to be October 2019.

  Applicants are strongly urged to read Section IV.2.b. Attachment of Required Application Documents of this NOFO with great attention. Applicants should carefully follow the instructions and recommendations regarding attachments and use the Download Submitted Forms and Applications feature on www.Grants.gov to check that all required attachments were contained in their submission.

Applications submitted without the required documents will not pass the Initial Administrative Review, described in Section V.3.a. of this NOFO.

When developing the submission timeline, please keep in mind that: (1) all applicants are required to have current registrations in the electronic System for Award Management (SAM.gov) and Grants.gov; (2) the free annual registration process in SAM.gov (*see* Section IV.3. and Section IV.7.a.(1).(b) of this NOFO) generally takes between three and five business days but can take more than two weeks; and (3) applicants will receive e-mail notifications over a period of up to two business days as the application moves through intermediate systems before the applicant learns via a validation or rejection notification whether NIST has received the application. (See Grants.gov for full information on application and notification through Grants.gov). Please note that a federal assistance award cannot be issued if the designated recipient's registration in SAM.gov is not current at the time of the award.

- **Application Submission Address:** Applications must be submitted using Grants.gov.

- **Funding Opportunity Description:** The NIST's Technology Partnerships Office (TPO) is seeking applications from eligible applicants for activities to assess the potential economic impacts, resulting from Federal research investments, of meeting the Nation's need for technology infrastructure[1] to support the Internet of Things (IoT). By identifying technological and economic trends in IoT research and assessing critical gaps in the Nation's IoT technology infrastructure, the recipient will produce an economic study to help guide industry, academia, and federal researchers in their efforts to accelerate the critical research needed for timely IoT development.

- **Anticipated Amounts:** In Fiscal Year 2019 (FY19), NIST anticipates funding one award for approximately $400,000 with a project performance period of (2) years. The award will be fully funded in the first year.

- **Funding Instrument:** Cooperative Agreement

- **Eligibility:** Eligibility for the program listed in this NOFO is open to all non-Federal entities. Eligible applicants include accredited institutions of higher education; non-profit organizations; for-profit organizations incorporated in the United States; state, local, territorial, and Indian tribal governments; foreign

[1] Technology infrastructure can loosely be defined as the broad base of quasi-public technologies (technologies with varying degrees of public good content) and technical knowledge that supports firms', universities', and laboratories' research, production, distribution and marketing of novel and improved products, processes, and services (e.g., higher quality, more effective, more efficient, more productive).

public entities; and foreign organizations. Please note that individuals and unincorporated sole proprietors are not considered “non-Federal entities” and are not eligible to apply under this NOFO. Although Federal entities are not eligible to receive funding under this NOFO, they may participate as unfunded collaborators.

- **Cost Sharing Requirements:** Non-federal cost share is not required for awards issued pursuant to this NOFO.

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FULL ANNOUNCEMENT TEXT

I. Program Description

The statutory authority for the NIST Economic Research and Analysis of the National Need for Technology Infrastructure to Support the Internet of Things (IoT) is 15 U.S.C. § 272(b)(4) and (c)(27).

1) Background Information

In FY17, the Federal Government invested over $140 billion in federally-funded research and development (R&D). Over $50 billion of this research was conducted at nearly 300 government-owned, government-operated (GOGO) and government-owned, contractor-operated (GOCO) laboratories across the country.[2] Some of this work will yield extraordinary long-term economic impacts through the generation of new knowledge and job-creating technological breakthroughs that support U.S. competitiveness in the global economy. To ensure that the benefits of this research are fully realized by the taxpayer, its results must be transferred to the private sector. Traditional forms of technology transfer include licensing intellectual property and entering into cooperative research and development agreements; however, other forms of technology transfer also convey research results and know-how to the private sector and produce economic benefits. These can include

[2] https://ncsesdata.nsf.gov/fedfunds/2015/html/FFS2015_DST_010.html

publications, postdoctoral research programs, and participation in standards development organizations (SDOs). Maximizing the utilization of the results of federally funded research, including research related to the development of standards, is in the best interest of taxpayers.

Recognizing the importance of focused agency efforts to improve federal technology transfer, the Lab-to-Market initiative was established in 2014[3]. These agency strategic efforts are ongoing through designation as a Cross Agency Priority (CAP) goal in the FY19 President's Management Agenda[4]. In addition, the National Science and Technology Council (NSTC)'s Committee on Science and Technology Enterprise chartered a new subcommittee to oversee CAP goal efforts in five areas: Improve Federal Technology Transfer Practices and Policies, Increase Private Sector Engagement, Build a More Entrepreneurial R&D Workforce, Support Innovative Technology Transfer Tools, and Understand Trends and Benchmarks. NIST currently leads these efforts, with participation from 11 R&D agencies in total. Within the Understand Trends and Benchmarks strategy, specific efforts have focused on ways to demonstrate the economic benefits of technology transfer efforts by federal agencies.

2) Overview

Approximately 35%, or $50.6 billion, of the Federal government's total R&D investment is funded through intramural research at GOGO and GOCO labs. This investment in fundamental research expands the frontiers of human understanding and yields extraordinary long-term economic impact through the creation of new knowledge and ultimately new industries. NIST has a leadership role within a large group of public and private stakeholders and aids this group in establishing goals, measuring performance, establishing standards, streamlining administrative processes, and facilitating partnerships that encourage commercialization of these federally funded research and development efforts.

To support this role, NIST engages in ongoing efforts to track technology transfer activity metrics and directs economic research studies that estimate the importance of federal technologies and supporting technical infrastructure. NIST uses its leadership role to help facilitate the economic assessment of all federal laboratories and their technology transfer efforts.[5]

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[3] https://www.nist.gov/tpo/lab-market

[4] https://www.whitehouse.gov/wp-content/uploads/2018/03/Presidents-Management-Agenda.pdf, page 47. "CAP Goal 14: Improve the transfer of federally-funded technologies from Lab-to-Market".

[5] For instance, NIST gathers the data for the annual *Technology Transfer Summary Report to the President and Congress*, which summarizes the technology transfer activities and transfer vehicles used by 11 Federal agencies that have significant Federal laboratory operations.

While university technology transfer systems and outcomes have been extensively studied by the academic community, there have been far fewer studies of the impact of intramural research performed by federal laboratories. In an effort to address this research gap, NIST is offering this funding opportunity, which is directed at assessing the potential impact of Federal investments in a young area of research: the Internet of Things (IoT) infrastructure. The NIST Technology Partnerships Office is seeking applications from eligible applicants for activities to support the goals of the Lab-to-Market initiative to understand global trends and benchmarks through the publication of research on federal technology transfer efforts.[6] Research proposals must support the overall and goals of the Lab-to-Market program. As NIST supports Lab-to-Market activities on behalf of 11 R&D agencies, to the extent possible research proposals must be aligned with both NIST research and the broader federal laboratory research landscape.

The IoT ecosystem comprises a network of devices and systems (everything from consumer appliances and industrial machines to intelligent vehicles and municipal infrastructures) that have the capability of collecting and exchanging data and implementing changes within those systems. This connectivity for enhanced functionality promises significant improvements in the performance, efficiency, and cost savings in many applications. In recent years, IoT systems and applications have become a major source of commercial and industrial innovation and as such, have the potential of delivering a technological revolution similar in scale to that caused by the development of the Internet. Given this transformative impact of IoT technologies and their applications, the IoT has been identified as one of the growing areas of federal R&D investments and federal technology transfer or the "Lab-to-Market" process.

Advanced IoT technologies and systems are essential to national security, economic prosperity, human safety and well-being, with applications aimed at addressing challenges in healthcare, transportation, and smart cities. However, like many early-stage technologies that federal labs focus on, it can take 10 or more years to move an IoT related technology from incubation to market maturation.

Different interested parties in the IoT ecosystem include, but are not limited to, developers, vendors, researchers, consumers, investors, regulators, policy-makers, and others with interests across the full spectrum of IoT application areas ranging from smart appliances and industrial systems to intelligent transportation, smart cities, and beyond. For purposes of this NOFO, the awardee, in collaboration with NIST, will further define the interested communities / parties and the relevant areas of IoT technologies and IoT infrastructure to be measured, and further identify the associated gaps and challenges.

[6] https://www.nist.gov/tpo/lab-market

Several federal agencies participate in research involving the IoT infrastructure. Examples of the different Federal agencies' involvement in IoT run the gamut from IoT-related standards development to collaboration with industry to understand the varying needs of IoT deployment. In July 2017, the General Accountability Office (GAO) issued a report entitled *Internet of Things: Communities Deploy Projects by Combining Federal Support with Other Funds and Expertise*.[7] The report identified IoT-related activities, including broad federal research and oversight of IoT-related technologies.[8] The summary of GAO report states:

> 8 of the 11 agencies GAO reviewed are involved in broad research efforts, often on communication systems—both wired and wireless network systems. In addition, nine agencies have oversight efforts that include providing IoT-related guidance, often on data security and privacy.

The GAO report includes a relevant listing of many of the federal agencies involved in IoT, with their mission statements, in Appendix I: Information on Selected Federal Agencies. Appendix I to the GAO report is reproduced as Appendix I to this NOFO.

3) Program analysis and quantification of the prospective impact of future Federal investments in the IoT infrastructure

This **prospective** study will be very broad in terms of required disciplines and experience, which include, but are not limited to, technology assessment, industry and consumer behavioral and structural analyses, microeconomic modeling of technology and commercialization patterns, industries, quantitative and qualitative analyses of technology infrastructure impacts as well as consumer survey and data collection techniques.

The aim of the analysis is to identify the gaps in the Nation's IoT technology infrastructure and to estimate the potential economic value of eliminating those gaps through Federal research investments.

The specific goals of this study are to:

> (1) assess the technological and economic trends in the research, development, adoption, and deployment of IoT related technologies, including demonstrated and anticipated adopters of IoT technologies,

[7] https://www.gao.gov/assets/690/686106.pdf

[8] GAO reviewed documents and interviewed officials from 11 federal agencies identified as having a key role in supporting IoT in communities, including agencies that support research or community IoT efforts or that have direct authority over IoT issues. GAO also interviewed a sample of representatives from multiple stakeholder groups as well as relevant literature since 2013.

across relevant industry sectors and stakeholders, including technologies being developed and transferred from federal agencies and laboratories;

(2) identify and qualitatively assess gaps in the technology infrastructure (i.e., hardware, software, networking components, applications, systems, standards, etc.) needed to support the IoT, in terms of industry investment criteria and research mechanisms used;

(3) produce a quantitative empirical ranking of the technology infrastructure gaps, based on novel data and modeling, reflecting the economic benefit of eliminating the identified technology infrastructure gaps;

(4) estimate the economic benefits that would accrue from future Federal research investments focused on eliminating the top three ranked gaps;

(5) assess the expected U.S. and international government policy responses - specific to phases in the R&D cycle, technology transfer efforts, and subsequent scale-up (capital formation) - given the economic assessment of the identified IoT infrastructure needs;

(6) identify potential areas for future IoT-related federal research investments that would enhance U.S. competitiveness and national and economic security;

(7) broadly disseminate the results of the prospective economic impact assessment of the benefits that would accrue from eliminating the top three ranked gaps using Federal research funding; and

(8) contribute to the development of the next generation of researchers focused on science, R&D, and technology transfer impact analysis.

NIST therefore invites applications from eligible applicants to assess the economic impact of meeting critical technology infrastructure needs in the IoT through Federal research investments. The awardee will characterize the current state of the IoT technology infrastructure, identify technical gaps to widespread development and deployment of IoT, and estimate the qualitative and quantitative economic impact of eliminating the top three ranked gaps. The awardee will identify key research, technologies, and guidance being developed by and transferred from federal departments, agencies and laboratories that can support the development and deployment of IoT technologies and applications.

The awardee is expected to disseminate the results of their work to the public through publications and white papers in appropriate scientific or technical literature,

and through presentations at public meetings or technical events. It is expected that awardees will fulfill their obligations consistent with Section C.03 Intellectual Property Rights of the Department of Commerce Financial Assistance Standard Terms and Conditions. *See* Section VI.2.b. of this NOFO.

II. Federal Award Information

1. Funding Instrument

The funding instrument that will be used is a cooperative agreement. The nature of NIST's "substantial involvement" will generally include collaboration with the recipient organization in developing and implementing the approved scope of work.

2. Funding Availability

In FY19, NIST anticipates funding one award for approximately $400,000 with a project performance period of (2) years. The award will be fully funded in the first year.

III. Eligibility Information

1. Eligible Applicants

Eligibility for all programs listed in this NOFO is open to all non-Federal entities. Eligible applicants include institutions of higher education, non-profit organizations, for-profit organizations, state and local governments, Indian tribes, hospitals, and foreign organizations. Please note that individuals and unincorporated sole proprietors are not considered "non-Federal entities" and are not eligible to apply under this NOFO. Although Federal entities are not eligible to receive funding under this NOFO, they may participate as unfunded collaborators.

2. Cost Sharing or Matching

Matching funds are not required.

IV. Application and Submission Information

1. Address to Request Application Package

The application package is available at Grants.gov under Funding Opportunity Number 2019-NIST-TPO-01.

2. Content and Form of Application Submission

a. Required Forms and Documents. The Application must contain the following:

(1) SF-424 (R&R), Application for Federal Assistance. The SF-424 (R&R) must be signed by an authorized representative of the applicant organization.

For SF-424 (R&R), Items 5, 14, and 19, use the Zip Code + 4 format (##### - ####) when addresses are called for.

For SF-424 (R&R), Item 17, the list of certifications and assurances is contained in the SF-424B (item (3) below).

SF-424 (R&R), Item 18. If the SF-LLL, Disclosure of Lobbying Activities form (item (6) below) is applicable, attach it to field 18.

Instructions for filling in the SF-424 (R&R) can be found in the 2019-NIST-TPO-01 Application Instructions document found on Grants.gov, as well as at Instructions SF-424 (R&R), Application for Federal Assistance.

(2) Research & Related Budget (Total Fed + Non-Fed). The budget should reflect anticipated expenses for the full term of the project, considering all potential cost increases, including cost of living adjustments.

The budget should be detailed in these categories:

A. Senior/Key Person;
B. Other Personnel;
C. Equipment Description;
D. Travel;
E. Participant/Trainee Support Costs
F. Other Direct Costs;
G. Direct Costs (automatically generated);
H. Indirect Costs;
I. Total Direct and Indirect Costs (automatically generated);
J. Fee (not relevant to this competition);
K. Total Costs and Fee (automatically generated);
L. Budget Narrative and Justification document (item (8) below) should be attached to field L.

A separate detailed R&R Budget must be completed for each budget period during the proposed award (e.g., annual basis). To add

additional budget periods (e.g., year 2), click "Add Period" embedded at the end of the form. Instructions for completing the Research & Related Budget (Total Fed + Non-Fed) form can be found in the 2019-NIST-TPO-01 Application Instructions document on Grants.gov, as well as at Instructions Research & Related Budget (Total Fed + Non-Fed) – Budget.

(3) SF-424B, Assurances – Non-Construction Programs. The SF-424B is required for all applicants that have not updated their System for Award Management (SAM.gov) entity registration since February 2, 2019 to include the Federal financial assistance certifications and representations (certs and reps). If an applicant has updated their SAM.gov entity registration since February 2, 2019 to include the certifications and representations, then the SF-424B is not required.

(4) CD-511, Certification Regarding Lobbying. Enter "2019-NIST-TPO-01" in the Award Number field. Enter the title of the application, or an abbreviation of that title, in the Project Name field.

(5) Research and Related Other Project Information. Answer the highlighted questions and use this form to attach the Project Narrative (item (7) below), the Indirect Cost Rate Agreement (item (9) below), and the Data Management Plan (item (10) below). Instructions for completing the Research and Related Other Project Information can be found in the 2019-NIST-TPO-01 Application Instructions document on Grants.gov, as well as at Instructions Research and Related Other Project Information. Please note that the Project Summary/Abstract field, which has a place to attach an optional Project Summary/Abstract, is not relevant to this competition.

(6) SF-LLL, Disclosure of Lobbying Activities (if applicable).

(7) Project Narrative. The Project Narrative is a word-processed document of no more than twenty (20) pages (double-spaced between lines), which is responsive to the program description (*see* Section I. of this NOFO) and the evaluation criteria (*see* Section V.1. of this NOFO). The projective narrative should contain the following information:

a. Executive Summary. An executive summary of the proposed approach, consistent with the evaluation criteria (see Section V.1. of this NOFO). The executive summary should include information indicating how each evaluation criterion and its sub-factors are

addressed. A table can be helpful in providing this information. The executive summary should not exceed two (2) pages.

b. Project Approach. A description of the applicant's approach to clearly address the program goals (see Section I. of this NOFO). This section should address the Problems, Solutions and Technical Approach evaluation criterion (see Sections V.1.a. and V.1.c. of this NOFO).

c. Statement of Work. A complete statement of work covering all aspects of the project, including a schedule of measurable events and milestones as well as measurable performance objectives that can be used to determine the success of the project. This section should address the Statement of Work and Potential Impact of the Results evaluation criterion (see Section V.1.b. of this NOFO).

d. Qualifications. A description of the qualifications of the key personnel, the time commitments of the key personnel, and how the project staff qualifications will enable them to conduct the project work. This section should address the Qualifications and Experience of Key Personnel and Resource Availability evaluation criterion (see Section V.1.d. of this NOFO).).

e. Resumes of Key Personnel must be included. Resumes are not included in the page count of the Project Narrative. Resumes included as part of the application must be a maximum of two pages each. Additional pages beyond the two pages per resume will not be considered during the evaluation of the application**.**

f. Dissemination Plan. A description of the applicant's approach to broadly disseminate the results of the prospective economic impact assessment to the public. The plan should include an approach to publish results through publications and white papers in appropriate literature, and through presentations at public meetings or technical events.

g. Similar Research Applications. Provide a list of all current and pending applications for similar research, including the amounts requested and the source that was or is considering the applications.

(8) Budget Narrative and Justification.

There is no set format for the Budget Narrative and Justification; however, further explanation must be provided for the specific cost

categories and line items identified in the Instructions Research & Related Budget (Total Fed + Non-Fed) – Budget, as well as any other information you deem necessary for NIST's consideration. The Budget Narrative and Justification must be attached to the Research & Related Budget (Total Fed + Non-Fed).

The written justification should include the necessity and the basis for the cost. Proposed funding levels must be consistent with the project scope, and only allowable costs should be included in the budget. Information on cost allowability is available in the Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200 (http://go.usa.gov/SBYh), which apply to awards in this program.

The Budget Narrative does not count against the twenty (20) page limit of the Project Narrative.

This section will be evaluated in accordance with the Budget Narrative evaluation criteria (see Section V.1.e. of this NOFO). It will also be reviewed to determine if all costs are reasonable, allocable, and allowable under 2 C.F.R. Part 200 Subpart E, Cost Principles.

Information needed for each category is as follows:

A. **Senior/Key Person** – At a minimum, the budget justification should include the following: name, job title, commitment of effort on the proposed project in terms of average number of hours per week or percentage of time, salary rate, total direct charges on the proposed project, description of the role of the individual on the proposed project and the work to be performed.

   Fringe benefits should be identified separately from salaries and wages and based on rates determined by organizational policy. The items included in the fringe benefit rate (e.g., health insurance, parking, etc.) should not be charged under another cost category.

B. **Other Personnel** - Data is requested at the project role level, and not at the individual level for Other Personnel. The budget justification should include the following: job title, commitment of effort on the proposed project in terms of average number of hours per week or percentage of time, salary rate, total direct charges on the proposed project, description of the role of the position on the proposed project and the work to be performed.

Fringe benefits should be identified separately from salaries and wages and based on rates determined by organizational policy. The items included in the fringe benefit rate (e.g., health insurance, parking, etc.) should not be charged under another cost category.

C. **Equipment Description** – Equipment is defined as an item of property that has an acquisition cost of $5,000 or more (unless the organization has established lower levels) and an expected service life of more than one year. The budget justification should list each piece of equipment, the cost, and a description of how it will be used and why it is necessary to the successful completion of the proposed project. Please note that any general use equipment (computers, etc.) charged directly to the award should be allocated to the award according to expected usage on the project. Applicants should provide at least two (2) quotes, if available, for equipment costing $25,000 or more. If two (2) quotes are not available, please provide a statement as to why two (2) quotes are not available. Any items that do not meet the threshold for equipment can be included under the Materials and Supplies line item in Section F, Other Direct Costs.

D. **Travel** - For all travel costs, required by the recipient to complete the project, including attendance at any relevant conferences, the budget justification for travel should include the following: destination; names or number of people traveling; dates and/or duration; mode of transportation, lodging and subsistence rates; and description of how the travel is directly related to the proposed project. For travel that is yet to be determined, please provide best estimates based on prior experience. If a destination is not known, an approximate amount may be used with the assumptions given for the location of the meeting.

E. **Participant/Trainee Support Costs** – Participant support costs are stipends, subsistence allowances, travel, and registration fees paid to or on behalf of participants or trainees, who are not employees of your organization, for conferences or training projects. The budget justification should indicate the names or number of participants or trainees, a description and calculation of costs per person, a description and date of the event, and a description of why the cost is necessary for the successful completion of the proposed project.

F. **Other Direct Costs** – For costs that do not easily fit into the other cost categories, please list the cost, and the breakdown of the total costs by quantity or unit of cost. Include the necessity of the cost for

the completion of the proposed project. Only allowable costs can be charged to the award.

Each subaward or contractual cost should be treated as a separate item in the Other Direct Costs category. Describe the services to be provided and the necessity of the subaward or contract to the successful performance of the proposed project. Contracts are for obtaining goods and services. Subawardees perform part of the project scope of work. For each subaward, applicants must provide budget detail justifying the cost of the work performed on the project.

H. Indirect Costs – Commonly referred to as Facilities & Administrative Costs, Indirect Costs are defined as costs incurred by the applicant organization that cannot otherwise be directly assigned or attributed to a specific project. For more details, *see* Section IV.2.b.(9) of this NOFO.

(9) Indirect Cost Rate Agreement. If indirect costs are included in the proposed budget, provide a copy of the approved negotiated agreement if this rate was negotiated with a cognizant Federal audit agency. If the rate was not established by a cognizant Federal audit agency, provide a statement to this effect. If the successful applicant includes indirect costs in the budget and has not established an indirect cost rate with a cognizant Federal audit agency, the applicant will be required to obtain such a rate in accordance with Section B.06 of the Department of Commerce Financial Assistance Standard Terms and Conditions, dated April 30, 2019.

Alternatively, in accordance with 2 C.F.R. § 200.414(f), applicants that have never received a negotiated indirect cost rate may elect to charge indirect costs to an award pursuant to a de minimis rate of 10 percent of modified total direct costs (MTDC), in which case a negotiated indirect cost rate agreement is not required. Applicants proposing a 10 percent de minimis rate pursuant to 2 C.F.R. § 200.414(f) should note this election as part of the budget portion of the application.

(10) Data Management Plan. Consistent with NIST Policy 5700.00[9], *Managing Public Access to Results of Federally Funded Research,* and NIST Order 5701.00[10], *Managing Public Access to Results of Federally*

[9] https://www.nist.gov/sites/default/files/documents/2017/05/09/Final-P-5700.pdf
[10] https://www.nist.gov/sites/default/files/documents/2017/05/09/Final-O-5701_0.pdf

Funded Research", applicants must include a Data Management Plan (DMP).

The DMP is a supplementary document of not more than two pages that must include, at a minimum, a summary of proposed activities that are expected to generate data, a summary of the types of data expected to be generated by the identified activities, a plan for storage and maintenance of the data expected to be generated by the identified activities, and a plan describing whether and how data generated by the identified activities will be reviewed and made available to the public. As long as the DMP meets these NIST requirements, it may take the form specified by the applicant's institution or some other entity (e.g., the National Science Foundation[11] or the National Institutes of Health[12]).

All applications for activities that will generate scientific data using NIST funding are required to submit a DMP or explain why data sharing and/or preservation are not within the scope of the project.

For the purposes of the DMP, NIST adopted the definition of "research data" at 2 C.F.R. § 200.315(e)(3) (available at http://go.usa.gov/3sZvQ).

Reasonable costs for data preservation and access may be included in the application.

The inclusion of the DMP will be considered as part of the administrative review (*see* Section V.3.a. of this NOFO); however, the DMP will not be evaluated against any evaluation criteria.

(11) Subaward Budget Form. The Research & Related Subaward Budget Attachment Form is required if sub-recipients and contractors are included in the application budget.

Instructions for completing subaward budget forms are available by visiting the R & R Family section of the Grants.gov Forms Repository and scrolling down to the R & R Subaward Budget Attachment(s) Form and selecting "Instructions."

(12) Current and Pending Support Form. Any application that includes investigators, researchers, and key personnel must identify all sources of current and potential funding, including this proposal. Any current project support (e.g., Federal, state, local, public or private foundations, etc.)

[11] http://www.nsf.gov/bfa/dias/policy/dmp.jsp
[12] http://grants.nih.gov/grants/policy/data_sharing/data_sharing_guidance.htm

must be listed on this form. The proposed project and all other projects or activities requiring a portion of time of the Principal Investigator (PI), co-PI, and key personnel must be included, even if no salary support is received. The total award amount for the entire award period covered, including indirect costs, must be shown as well as the number of person-months per year to be devoted to the project, regardless of the source of support. Similar information must be provided for all proposals already submitted or that are being submitted concurrently to other potential funders.

Applicants must complete the Current and Pending Support Form, using multiple forms as necessary to account for all activity for each individual identified in the PI, co-PI and key personnel roles. A separate form should be used for each identified individual.

Applicants must download the Current and Pending Support Form from the NIST website at https://www.nist.gov/oaam/grants-management-division/current-and-pending-support and reference the guidance provided as it contains information to assist with accurately completing the form.

b. Attachment of Required Documents

Items IV.2.a.(1) through IV.2.a.(5) above are part of the standard application package in Grants.gov and can be completed through the download application process.

Item IV.2.a.(6), the SF-LLL, Disclosure of Lobbying Activities form, is an optional application form which is part of the standard application package in Grants.gov. If item IV.2.a.(6), the SF-LLL, Disclosure of Lobbying Activities form is applicable to this proposal, attach it to field 18 of the SF-424 (R&R), Application for Federal Assistance.

Item IV.2.a.(7), the Project Narrative, should be attached to field 8 (Project Narrative) of the Research and Related Other Project Information form by clicking on “Add Attachment”.

Item IV.2.a.(8), the Budget Narrative and Justification, should be attached to field L (Budget Justification) of the Research and Related Budget (Total Fed + Total Non-Fed) form by clicking on “Add Attachment”.

Items IV.2.a.(9), the Indirect Cost Rate Agreement, IV.2.a.(10), the Data Management Plan, and IV.2.a.(12), the Current and Pending Support Form, must be completed and attached by clicking on “Add Attachments” found in item 12 (Other Attachments) of the Research and Related Other

Project Information form.

Item IV.2.a.(11), the Subaward Budget Form(s), if applicable to the submission, should be attached to the Research & Related Subaward Budget (Total Fed + Non-Fed) Attachment(s) Form in the application package.

Following these directions will create zip files which permit transmittal of the documents electronically via Grants.gov.

Applicants should carefully follow specific Grants.gov instructions at www.Grants.gov to ensure the attachments will be accepted by the Grants.gov system. A receipt from Grants.gov indicates only that an application was transferred to a system. It does not provide details concerning whether all attachments (or how many attachments) transferred successfully. Applicants will receive a series of e-mail messages over a period of up to two business days before learning whether a Federal agency's electronic system has received its application.

Applicants are strongly advised to use Grants.gov's "Download Submitted Forms and Applications" option to check that their application's required attachments were contained in their submission.

After submitting the application, check the status of your application here: CHECK APPLICATION STATUS . If any, or all, of the required attachments are absent from the submission, follow the attachment directions found above, resubmit the application, and check again for the presence of the required attachments.

If the directions found at https://www.grants.gov/help/html/help/index.htm#t=GetStarted%2FGetStarted.htm are not effective, please contact the Grants.gov Help Desk immediately. If calling from within the United States or from a U.S. territory, please call 800-518-4726. If calling from a place outside the United States or a U.S. territory, please call 606-545-5035. E-mails should be addressed to support@grants.gov. Assistance from the Grants.gov Help Desk will be available around the clock every day, with the exception of Federal holidays. Help Desk service will resume at 7:00 a.m. Eastern Time the day after Federal holidays.

Applicants can track their submission in the Grants.gov system by following the procedures at the Grants.gov site (http://go.usa.gov/cjamz). It can take up to two business days for an application to fully move through the Grants.gov system to NIST.

NIST uses the Tracking Numbers assigned by Grants.gov, and does not issue Agency Tracking Numbers.

c. Application Format

(1) Paper, Email, and Facsimile (fax) Submissions. Will not be accepted.

(2) Figures, Graphs, Images, and Pictures. Should be of a size that is easily readable or viewable and may be displayed in landscape orientation. Any figures, graphs, images, or pictures will count toward the page limits for the Project Narrative.

(3) Font. Easy to read font (10-point minimum). Smaller type may be used in figures and tables but must be clearly legible.

(4) Page Limit. The Project Narrative is limited to twenty (20) pages double spaced, noting the limit of two (2) pages for the Executive Summary. Resumes are not included in the page count of the Project Narrative. However, if resumes are included, resumes must be a maximum of two (2) pages each.

(5) Page Limit Exclusions:
SF-424 (R&R), Application for Federal Assistance;
SF-424B, Assurances – Non-Construction Programs;
CD-511, Certification Regarding Lobbying;
SF-LLL, Disclosure of Lobbying Activities;
Budget Narrative and Justification;
Indirect Cost Rate Agreement;
Data Management Plan;
Subaward Budget Form;
Current and Pending Support Form

(6) Page Layout. The Proposal must be in portrait orientation.

(7) Page size. 21.6 centimeters by 27.9 centimeters (8 ½ inches by 11 inches).

(8) Page numbering. Number pages sequentially.

(9) Application language. English. All documents must be in English, including but not limited to the initial application, any additional documents submitted in response to a NIST request, all reports, and any correspondence with NIST.

(10) Typed document. All applications, including forms, must be typed; handwritten forms will not be accepted.

d. Application Replacement Pages. Applicants may not submit replacement pages and/or missing documents once an application has been submitted. Any revisions must be made by submission of a new application that must be received by NIST by the submission deadline.

e. Pre-Applications. Pre-applications will not be accepted under this NOFO.

f. Certifications Regarding Federal Felony and Federal Criminal Tax Convictions, Unpaid Federal Tax Assessments and Delinquent Federal Tax Returns. In accordance with Federal appropriations law, an authorized representative of the selected applicant(s) may be required to provide certain pre-award certifications regarding federal felony and federal criminal tax convictions, unpaid federal tax assessments, and delinquent federal tax returns.

3. Unique Entity Identifier and System for Award Management (SAM). Pursuant to 2 C.F.R. part 25, applicants and recipients are required to: (i) be registered in SAM before submitting its application; (ii) provide a valid unique entity identifier in its application; and (iii) continue to maintain an active SAM registration with current information at all times during which it has an active Federal award or an application or plan under consideration by a Federal awarding agency, unless otherwise excepted from these requirements pursuant to 2 C.F.R. § 25.110. NIST will not make a Federal award to an applicant until the applicant has complied with all applicable unique entity identifier and SAM requirements and, if an applicant has not fully complied with the requirements by the time that NIST is ready to make a Federal award pursuant to this NOFO, NIST may determine that the applicant is not qualified to receive a Federal award and use that determination as a basis for making a Federal award to another applicant.

4. Submission Dates and Times

Applications must be received at Grants.gov no later than 11:59 p.m. Eastern Time, Wednesday, July 24, 2019. NIST will consider the date and time recorded by Grants.gov as the official submission time. Applications received after this deadline will not be reviewed or considered. Paper applications will not be accepted.

Applicants should be aware, and factor in their application submission planning, that the Grants.gov system is expected to be closed for routine maintenance at the following times. Applications cannot be submitted when Grants.gov is closed:

From 12:01 A.M. Eastern Time Saturday	To 6:00 A.M. Eastern Time Monday
June 15, 2019	June 17, 2019
July 20, 2019	July 22, 2019

When developing the submission timeline, please keep in mind that: (1) all applicants are required to have current registrations in the electronic System for Award Management (SAM.gov) and Grants.gov; (2) the free annual registration process in the SAM.gov (*see* Sections IV.3. and IV.7.a.(1).(b). of this NOFO) generally takes between three and five business days but can take more than two weeks; and applicants will receive e-mail notifications over a period of up to two business days as the application moves through intermediate systems before the applicant learns via a validation or rejection notification whether NIST has received the application. (See Grants.gov for full information on application and notification through Grants.gov.) Please note that a Federal assistance award cannot be issued if the designated recipient's registration in the System for Award Management (SAM.gov) is not current at the time of the award.

5. **Intergovernmental Review**
   Applications under this Program are not subject to Executive Order 12372.

6. **Funding Restrictions**
   Applications for product development and/or commercialization are not considered responsive to this NOFO. Profit or fee is not an allowable cost.

7. **Other Submission Requirements**

   a. **Applications must be submitted electronically.**

      (1) Applications must be submitted at Grants.gov.

      (a) Applicants should carefully follow specific Grants.gov instructions to ensure that all attachments will be accepted by the Grants.gov system. A receipt from Grants.gov indicating an application is received does not provide information about whether attachments have been received. For further information or questions regarding applying electronically for the 2019-NIST-TPO-01 announcement, contact Leon Sampson by phone at 301-975-3086 or by e-mail at grants@nist.gov.

      (b) Applicants are strongly encouraged to start early and not wait until the approaching due date before logging on and reviewing the instructions for submitting an application through Grants.gov. The Grants.gov registration process must be completed before a new

registrant can apply electronically. The typical registration process takes three to five business days. If problems are encountered, the registration process can take two weeks or more. Applicants must have a valid unique entity identifier number and must maintain a current registration in the Federal government's primary registrant database, the System for Award Management (https://www.sam.gov/), as explained on the Grants.gov Web site (also *see* Section IV.3. of this NOFO). After registering, it may take several days or longer from the initial log-on before a new Grants.gov system user can submit an application. Only individuals authorized as organization representatives will be able to submit the application, and the system may need time to process a submitted application. Applicants should save and print the proof of submission they receive from Grants.gov. If problems occur while using Grants.gov, the applicant is advised to (a) print any error message received and (b) call Grants.gov directly for immediate assistance. If calling from within the United States or from a U.S. territory, please call 800-518-4726. If calling from a place other than the United States or a U.S. territory, please call 606-545-5035. Assistance from the Grants.gov Help Desk will be available around the clock every day, except for Federal holidays. Help Desk service will resume at 7:00 a.m. Eastern Time the day after Federal holidays. For assistance using Grants.gov, the applicant may also contact support@grants.gov.

(c) To find instructions for submitting an application on Grants.gov, applicants should refer to the "Applicants" tab in the banner just below the top of the Grants.gov home page. Clicking on the "Applicants" tab produces two exceptionally useful sources of information, Applicant Actions and Applicant Resources, which applicants are advised to review.

Applicants will receive a series of e-mail messages over a period of up to two business days before learning whether a Federal agency's electronic system has received its application.

Applicants should pay close attention to the guidance under Grants.gov's "Applicant FAQs,"as it contains information important to successful submission, including essential details on the naming conventions for attachments to applications.

All applicants should be aware that adequate time must be factored into applicants' schedules for delivery of their application.

Applicants are advised that volume on Grants.gov may be extremely heavy leading up to the deadline.

The application must be both received and validated by Grants.gov. The application is "received" when Grants.gov provides the applicant a confirmation of receipt and an application tracking number. If an applicant does not see this confirmation and tracking number, the application has not been received. After the application has been received, it must still be validated. During this process, it may be "validated" or "rejected with errors". To ascertain whether the application was rejected with errors and the reasons for the rejection, the applicant must log in to Grants.gov, select "Applicants" from the top navigation, and select "Track my application" from the drop-down list. If the status is "rejected with errors," the applicant may still seek to correct the errors and resubmit the application before the deadline. If the applicant does not correct the errors, the application will not be forwarded to NIST by Grants.gov.

Refer to important information in Section IV.4. Submission Dates and Times, to help ensure the application is received on time.

b. Amendments. Any amendments to this NOFO will be announced through Grants.gov. Applicants may sign up on Grants.gov to receive amendments by e-mail or may request copies by e-mail from kathleen.mctigue@nist.gov.

V. Application Review Information

1. Evaluation Criteria

The evaluation criteria that will be used in evaluating applications and their assigned weights are as follows:

a. Problems, Solutions and Technical Approach. (0-45 points, sub-criteria below receive equal weight) Reviewers will evaluate the extent to which the applicant's proposed approach clearly addresses the program goals (*see* Section I. of this NOFO); specifically, reviewers will evaluate the likelihood and extent to which the proposed methodologies will result in efficiently and effectively conducting the following activities:

(1) Qualitative assessment of the technological and economic trends in research, development, adoption, and deployment of IoT-related technologies across relevant industry sectors and stakeholders, including the federal government;

(2) Qualitative assessment of eliminating the gaps in the technology infrastructure in terms of industry investment criteria and research mechanisms used;
(3) Quantitative empirical rankings with respect to the economic benefit of eliminating the gaps;
(4) Quantitative assessment of the benefits that would accrue from eliminating the top three ranked gaps using Federal research funding; and
(5) Broadly disseminating the results of the prospective economic impact assessments of the benefits that would accrue from eliminating the top three ranked gaps using Federal research funding.

b. Statement of Work and Potential Impact of the Results. (0-20 points)

(1) Reviewers will evaluate the appropriateness, quality, reasonableness, and completeness of the applicant's statement of work, including the plans to manage the project tasks, timeline, and work of all project staff, to ensure realization of project goals and objectives.

c. Development of the Scientific Field. (0-10 points, sub-criteria below receive equal weight) Reviewers will evaluate the extent to which the fields of science, R&D, and technology transfer impact analysis are likely to be positively impacted by applicant's plan for:

(1) disseminating project data and results broadly to the public through publication in the appropriate scientific and technical literature and white papers and presentations at public meetings or other technical events, and
(2) contributing to the development of the next generation of researchers focused on science, R&D, and technology transfer impact analysis.

d. Qualifications and Experience of Key Personnel and Resources Availability. (0-15 points, sub-criteria below receive equal weight)

(1) Reviewers will evaluate the appropriateness and extent of the qualifications and experience of the key personnel and proposed staff, to assess the likelihood of achieving the objectives of the project. In particular, for key personnel, the following will be evaluated for their adequacy and the extent to which they are likely to contribute to the overall success of the project:

i. Any past experience with evaluating the economic impact of the IoT technology infrastructure;
ii. Any past experience with conducting prospective economic impact studies;

iii. Any past experience in the following disciplines: technology assessment, high-tech industry behavioral and structural analyses, microeconomic modeling of complex technology development and commercialization patterns, high-tech industry survey and data collection techniques, and quantitative and qualitative analyses of technology, including IoT (if an applicant as an organization cannot demonstrate expertise in these disciplines, the reviewers will evaluate the feasibility and likelihood of success of the applicant's plan to obtain such expertise to meet the objectives of this NOFO); and

iv. Any previously demonstrated ability to achieve positive outcomes in endeavors with program objectives that are similar to those described in Section I. of this NOFO.

e. Budget Narrative. (0-10 points). Reviewers will assess the budgeted costs against the proposed activities to determine the practicality of the proposed budget with respect to developing and implementing the proposed project.

2. Selection Factors

a. The Selecting Official, the Director of the Technology Partnerships Office, or designee, will make a final award recommendation to the NIST Grants Officer. The Selecting Official shall generally select an application for award based on the rank order of the applications (*see* Section V.3. of this NOFO) and on one or more of the following selection factors:

(1) Results of the merit reviewers' evaluations.
(2) The availability of funding.
(3) Whether the project duplicates other projects funded by NIST or other Federal agencies.
(4) Alignment with the NOFO objectives.
(5) Regional diversity.

3. Review and Selection Process

Proposals, reports, documents and other information related to applications submitted to NIST and/or relating to financial assistance awards issued by NIST will be reviewed and considered by Federal employees, or non-Federal personnel who have entered into conflict of interest and confidentiality agreements covering such information, when applicable.

a. Initial Administrative Review of Applications. Applications received by the deadline will be reviewed to determine eligibility, completeness, and

responsiveness to this NOFO and to the scope of the stated program objectives (*see* Section I. of this NOFO). Applications determined to be ineligible, incomplete, and/or nonresponsive may be eliminated from further review. However, NIST, in its sole discretion, may continue the review process for an application that is missing non-substantive information, the absence of which may easily be rectified during the review process.

b. Full Review of Eligible, Complete, and Responsive Applications. Applications that are determined to be eligible, complete, and responsive will proceed for full reviews in accordance with the review and selection process below:

(1) Merit Review. At least three (3) objective reviewers, who may be Federal employees or non-Federal personnel, with appropriate professional and technical expertise relating to the topics covered in this NOFO, will evaluate and score each eligible, complete, and responsive application based on the evaluation criteria (*see* Section V.1. of this NOFO). While every application will have at least three (3) reviewers, applications may have more than three (3) reviewers if specialized expertise is needed to evaluate an application. During the review process, the reviewers may discuss the applications with each other, but scores will be determined on an individual basis. Based on the numerical average of the reviewers' scores, a rank order will be prepared and provided to the Selecting Official for further consideration. The Selecting Official will then recommend a funding recipient based upon rank order and the selection factors (*see* Section V.2. of this NOFO).

(2) Selection. The Selecting Official will make final award recommendations to the NIST Grants Officer. The Selecting Official shall generally select and recommend the most meritorious application for an award based upon the rank order of the applications. The Selecting Official retains the discretion to select and recommend an application out of order based on the Selection Factors (see Section V.2. of this NOFO). NIST reserves the right to negotiate the budget costs with any applicant selected to receive an award, which may include requesting that the applicant removes certain costs. Additionally, NIST may request that successful applicants modify objectives or work plans and provide supplemental information required by the agency prior to award. NIST also reserves the right to reject an application where information is uncovered that raises a reasonable doubt as to the responsibility of the applicant. NIST may select some, all, or none of the applications,

or part(s) of any application. The final approval of selected applications and issuance of awards will be by the NIST Grants Officer. The award decisions of the NIST Grants Officer are final.

c. Federal Awarding Agency Review of Risk Posed by Applicants. After applications are proposed for funding by the Selecting Official, the NIST Grants Management Division (GMD) performs pre-award risk assessments in accordance with 2 C.F.R. § 200.205, which may include a review of the financial stability of an applicant, the quality of the applicant's management systems, the history of performance, and/or the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-Federal entities.

In addition, prior to making an award where the total Federal share is expected to exceed the simplified acquisition threshold (currently $150,000), NIST GMD will review and consider the publicly available information about that applicant in the Federal Awardee Performance and Integrity Information System (FAPIIS). An applicant may, at its discretion, review and comment on information about itself previously entered into FAPIIS by a Federal awarding agency. As part of its review of risk posed by applicants, NIST GMD will consider any comments made by the applicant in FAPIIS in making its determination about the applicant's integrity, business ethics, and record of performance under Federal awards. Upon completion of the pre-award risk assessment, the Grants Officer will make a responsibility determination concerning whether the applicant is qualified to receive the subject award and, if so, whether appropriate special conditions that correspond to the degree of risk posed by the applicant should be applied to an award.

4. Anticipated Announcement and Award Date

Review of applications, selection of successful applicants, and award processing is expected to be completed by August 2019. The earliest start date for awards under this NOFO is expected to be October 2019.

5. Additional Information

a. Safety. Safety is a top priority at NIST. Employees and affiliates of award recipients who conduct project work at NIST will be expected to be safety-conscious, to attend NIST safety training, and to comply with all NIST safety policies and procedures, and with all applicable terms of their guest research agreement.

b. Notification to Unsuccessful Applicants. Unsuccessful applicants will be notified by e-mail and will have the opportunity to receive a debriefing

after the opportunity is officially closed. Applicants must request within 10 business days of the email notification to receive a debrief from the program office. The program office will then work with the unsuccessful applicant in arranging a date and time of the debrief.

c. **Retention of Unsuccessful Applications.** Unsuccessful applications will be retained in accordance with the General Record Schedule 1.2/021.

VI. Federal Award Administration Information

1. **Federal Award Notices.** Successful applicants will receive an award package from the NIST Grants Officer.

2. **Administrative and National Policy Requirements**

   a. **Uniform Administrative Requirements, Cost Principles and Audit Requirements.** Through 2 C.F.R. § 1327.101, the Department of Commerce adopted Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards at 2 C.F.R. Part 200, which apply to awards in this program. Refer to http://go.usa.gov/SBYh and http://go.usa.gov/SBg4.

   b. **Department of Commerce Financial Assistance Standard Terms and Conditions.** The Department of Commerce will apply to each award in this program, the Financial Assistance Standard Terms and Conditions in effect on the date of award. The current version, dated April 30, 2019, is accessible here. Refer to Section VII. of this NOFO, Federal Awarding Agency Contacts, Grant Rules and Regulations, if you need more information.

   c. **Pre-Award Notification Requirements.** The Department of Commerce will apply the Pre-Award Notification Requirements for Grants and Cooperative Agreements dated December 30, 2014 (79 FR 78390), accessible at http://go.usa.gov/hKkR. Refer to Section VII. of this NOFO, Federal Awarding Agency Contacts, Grant Rules and Regulations, for more information.

   d. **Funding Availability and Limitation of Liability.** Funding for the program listed in this NOFO is contingent upon the availability of appropriations. NIST or the Department of Commerce will not be responsible for application preparation costs, including but not limited to if this program fails to receive funding or is cancelled because of agency priorities. Publication of this NOFO does not oblige NIST or the

Department of Commerce to award any specific project or to obligate any available funds.

e. **Collaborations with NIST Employees.** If an applicant proposes collaboration with NIST, the statement of work should include a statement of this intention, a description of the collaboration, and prominently identify the NIST employee(s) involved, if known. Any collaboration by a NIST employee must be approved by appropriate NIST management and is at the sole discretion of NIST. Prior to beginning the merit review process, NIST will verify the approval of the proposed collaboration. Any unapproved collaboration will be stricken from the application prior to the merit review. Any collaboration with an identified NIST employee that is approved by appropriate NIST management will not make an application more or less favorable in the competitive process.

f. **Use of Government-Owned Intellectual Property.** If the applicant anticipates using any Government-owned intellectual property to carry out the work proposed, the applicant should identify such intellectual property. This information will be used to ensure that no Federal employee involved in the development of the intellectual property will participate in the review process for that competition. In addition, if the applicant intends to use Government-owned intellectual property, the applicant must comply with all statutes and regulations governing the licensing of Federal government patents and inventions, described in 35 U.S.C. §§ 200-212, 37 C.F.R. Part 401, 2 C.F.R. §200.315, and in Section C.03 of the Department of Commerce Financial Assistance Terms and Conditions dated April 30, 2019.

   Any use of government-owned intellectual property by a recipient of an award under this announcement is at the sole discretion of the Federal Government and will be negotiated on a case-by-case basis if a project is deemed meritorious. The applicant should indicate within the statement of work whether it already has a license to use such intellectual property or whether it intends to seek one.

   If any inventions made in whole or in part by a Federal employee arise in the course of an award made pursuant to this NOFO, the United States Government may retain its ownership rights in any such invention. Licensing or other disposition of Federal Government's rights in such inventions will be determined solely by the Federal Government, and include the possibility of the Federal Government putting the intellectual property into the public domain.

g. **Research Activities Involving Human Subjects, Human Tissue, Data**

or Recordings Involving Human Subjects Including Software Testing. Any application that includes research activities involving human subjects, human tissue/cells, or data or recordings from or about human subjects, must satisfy the requirements of the Common Rule for the Protection of Human Subjects ("Common Rule"), codified for the Department of Commerce at 15 C.F.R. Part 27. Research activities involving human subjects that fall within one or more of the classes of vulnerable subjects found in 45 C.F.R. Part 46, Subparts B, C and D must satisfy the requirements of the applicable subpart(s). In addition, any such application that includes research activities on these subjects must be in compliance with all applicable statutory requirements imposed upon the Department of Health and Human Services (DHHS) and other Federal agencies, all regulations, policies and guidance adopted by DHHS, the Food and Drug Administration (FDA), and other Federal agencies on these topics, and all Executive Orders and Presidential statements of policy on applicable topics. (Regulatory Resources: http://www.hhs.gov/ohrp/humansubjects/index.html which includes links to FDA regulations, but may not include all applicable regulations and policies).

On January 19, 2017, a final rule was published in the *Federal Register* that made significant amendments to the Common Rule: https://www.federalregister.gov/documents/2017/01/19/2017-01058/federal-policy-for-the-protection-of-human-subjects. These amendments, known as the "2018 Requirements," took effect on January 21, 2019. Any new award made by NIST after January 21, 2019 will be subject to the 2018 Requirements.

NIST uses the following Common Rule definitions for research and human subjects research:

Research: A systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge. Activities which meet this definition constitute research for purposes of this policy, whether or not they are conducted or supported under a program which is considered research for other purposes. For example, some demonstration and service programs may include research activities.

Human Subject: A living individual about whom an investigator (whether professional or student) conducting research: (i) Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or (ii) Obtains,

uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens.

(1) *Intervention* includes both physical procedures by which information or biospecimens are gathered and manipulations of the subject or the subject's environment that are performed for research purposes.

(2) *Interaction* includes communication or interpersonal contact between investigator and subject.

(3) *Private information* includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, and information which has been provided for specific purposes by an individual and that the individual can reasonably expect will not be made public (for example, a medical record). Private information must be individually identifiable (i.e., the identity of the subject is or may readily be ascertained by the investigator associated with the information) in order for obtaining the information to constitute research involving human subjects.

(4) *Identifiable biospecimen* includes a biospecimen for which the identity of the subject is or may readily be ascertained by the investigator or associated with the biospecimen.

See 15 C.F.R. § 27.102 (Definitions).

1) **Requirement for Federalwide Assurance.** If the application is accepted for (or awarded) funding, organizations that have an Institutional Review Board (IRB) are required to follow the procedures of their organization for approval of exempt and non-exempt research activities that involve human subjects. Both domestic and foreign organizations performing non-exempt research activities involving human subjects will be required to have protocols approved by a cognizant, active IRB currently registered with the Office for Human Research Protections (OHRP) within the DHHS that is linked to the engaged organizations. All engaged organizations must possess a currently valid Federalwide Assurance (FWA) on file from OHRP. Information regarding how to apply for an FWA and register an IRB with OHRP can be found at http://www.hhs.gov/ohrp/assurances/index.html. *See* 15 C.F.R. § 27.103. NIST relies only on OHRP-issued FWAs and IRB Registrations for both domestic and foreign organizations for NIST supported research involving human subjects. NIST will not issue its own FWAs or IRB Registrations for domestic or foreign organizations.

2) **Administrative Review.** The NIST Human Subjects Protection Office (HSPO) reserves the right to conduct an administrative review[13] of all applications that potentially include research involving human subjects and were approved by an authorized non-NIST institutional entity (an IRB or entity analogous to the NIST HSPO) under 15 C.F.R. § 27.112 (Review by Institution). If the NIST HSPO determines that an application includes research activities that potentially involve human subjects, the applicant will be required to provide additional information to NIST for review and approval. The documents required for funded proposals are listed in each section below. Most documents will need to be produced during the proposal review process; however, the Grants Officer may allow final versions of certain required documents to be produced at an appropriate designated time post-award. Research involving human subjects may not start until the NIST Grants Officer issues an award explicitly authorizing such research. In addition, all amendments, modifications, or changes to approved research and requests for continuing review and closure will be reviewed by the NIST HSPO.

3) **Required documents for proposal review. All applications involving human subjects research must clearly indicate, by separable task, all research activities believed to be exempt or non-exempt research involving human subjects, the expected institution(s) where the research activities involving human subjects may be conducted, and the institution(s) expected to be engaged in the research activities.**

   a. **Not research determination.** If an activity/task involves human subjects as defined in the Common Rule, but the applicant participant(s) indicates to NIST that the activity/task is not research as defined in the Common Rule, the following information may be requested for that activity/task:

      (1) Justification, including the rationale for the determination and such additional documentation as may be deemed necessary by NIST to review and/or support a determination that the activity/task in the application is not research as defined in the Common Rule.

[13] Conducting an "administrative review" means that the NIST HSPO will review and verify the performing institution's determination for research not involving human subjects or exempt human subjects research. In addition, for non-exempt human subjects research, the NIST HSPO will review and confirm that the research and performing institution(s) are in compliance with 15 C.F.R. Part 27, which means HSPO will 1) confirm the engaged institution(s) possess, or are covered under a Federalwide Assurance, 2) review the research study documentation submitted to the IRB and verify the IRB's determination of level of risk and approval of the study for compliance with 15 C.F.R. Part 27, 3) review and verify IRB-approved substantive changes to an approved research study before the changes are implemented, and 4) review and verify that the IRB conducts a continuing review at least annually, as appropriate.

(2) If the applicant participant(s) used a cognizant IRB that provided a determination that the activity/task is not research, a copy of that determination documentation must be provided to NIST. The applicant participant(s) is not required to establish a relationship with a cognizant IRB if they do not have one.

NIST will review the information submitted and may coordinate further with the applicant before determining whether the activity/task will be defined as research under the Common Rule in the applicable NIST financial assistance program or project.

b. Research not involving human subjects. If an activity/task is determined to be research and involves human subjects, but is determined to be *not human subjects research* (or *research not involving human subjects*) under the Common Rule, the following information may be requested for that activity/task:

(1) Justification, including the rationale for the determination and such additional documentation as may be deemed necessary by NIST to review and/or support a determination that the activity/task in the application is not research as defined in the Common Rule.
(2) If the applicant participant(s) used a cognizant IRB that provided a determination that the activity/task is research not involving human subjects, a copy of that determination documentation must be provided to NIST. The applicant participant(s) is not required to establish a relationship with a cognizant IRB if they do not have one.

c. Exempt research determination with no IRB. If the application appears to NIST to include exempt research activities, and the performer of the activity or the supplier and/or the receiver of the information or biospecimens from human subjects **does not** have a cognizant IRB to provide an exemption determination, the following information may be requested during the review process so that NIST can evaluate whether an exemption under the Common Rule applies (*see* 15 C.F.R. § 27.104(b) and (d)):

(1) The name(s) of the institution(s) where the exempt research will be conducted.
(2) The name(s) of the institution(s) providing the biospecimens or information from human subjects.
(3) A copy of the protocol for the research to be conducted; and/or the biospecimens or information from human subjects to be collected/provided, not pre-existing samples (*i.e.,* will proposed research collect only information without personal identifiable information, will biospecimens or information be de-identified and when and by whom was

the de-identification performed, how were the materials or data originally collected).

(4) For pre-existing biospecimens or information from human subjects, provide copies of the consent forms used for collection and a description of how the biospecimens or information were originally collected and stripped of personal identifiers. If copies of consent forms are not available, explain.

(5) Any additional clarifying documentation that NIST may deem necessary in order to make a determination whether the activity/task or use of biospecimens or information from human subjects is exempt under the Common Rule.

d. Research review with an IRB. If the application appears to NIST to include research activities (exempt or non-exempt) involving human subjects, and the proposed performer of the activity has a cognizant IRB registered with OHRP, and linked to their Federalwide Assurance, the following information may be requested during the review process:

(1) The name(s) of the institution(s) where the research will be conducted.

(2) The name(s) and institution(s) of the cognizant IRB(s), and the IRB registration number(s).

(3) The FWA number of the applicant linked to the cognizant IRB(s).

(4) The FWAs associated with all organizations engaged in the planned research activity/task, linked to the cognizant IRB.

(5) If the IRB review(s) is pending, the estimated start date for research involving human subjects.

(6) The IRB approval date (if currently approved for exempt or non-exempt research).

(7) If any of the engaged organizations has applied for or will apply for an FWA or IRB registration, those details should be clearly provided for each engaged organization.

If the application includes research activities involving human subjects to be performed in the first year of an award, additional documentation may be requested by NIST during pre-award review for those performers, and may include the following for those research activities:

(1) A signed (by the study principal investigator) copy of each applicable final IRB-approved protocol.

(2) A signed and dated approval letter from the cognizant IRB(s) that includes the name of the institution housing each applicable IRB, provides the start and end dates for the approval of the research activities, and any IRB-required interim reporting or continuing review requirements.

(3) A copy of any IRB-required application information, such as documentation of approval of special clearances (*i.e.,* biohazard, HIPAA, etc.) conflict-of-interest letters, or special training requirements.
(4) A brief description of which portions of the IRB submitted protocol are specifically included in the application submitted to NIST, if the protocol includes tasks not included in the application, or if the protocol is supported by multiple funding sources. For protocols with multiple funding sources, NIST will not approve the study without a non-duplication-of-funding letter indicating that no other federal funds will be used to support the tasks proposed under the proposed research or ongoing project.
(5) If a new protocol will only be submitted to an IRB if an award from NIST is issued, a draft of the proposed protocol.
(6) Any additional clarifying documentation that NIST may request during the review process to perform the NIST administrative review of research involving human subjects. (*See* 15 C.F.R. § 27.112 (Review by Institution)).

This clause reflects the existing NIST policy and requirements for Research Involving Human Subjects. Should the policy be revised prior to award, a clause reflecting the policy current at time of award may be incorporated into the award.

If the policy is revised after award, a clause reflecting the updated policy may be incorporated into the award.

For more information regarding research projects involving human subjects, contact Anne Andrews, Director, NIST Human Subjects Protection Office (e-mail: anne.andrews@nist.gov; phone: (301) 975-5445).

3. Reporting

a. Reporting Requirements. The following reporting requirements described in Sections A.01, Reporting Requirements, of the Department of Commerce Financial Assistance Standard Terms and Conditions, dated April 30, 2019, apply to awards in this program:

(1) Financial Reports. Each award recipient will be required to submit an SF-425, Federal Financial Report on a semi-annual basis for the periods ending March 31 and September 30 of each year. Reports will be due within 30 days after the end of the reporting period to the NIST Federal Program Officer, Grants Officer and Grants Specialist named in the award documents. A final financial report is due within 90 days after the end of the project period.

(2) Research Performance Progress Report (RPPR). Each award recipient will be required to submit a RPPR to the Federal Program Officer, NIST Grants Officer and Grants Specialist named in the award documents on a semi-annual basis for the periods ending March 31 and September 30 of each year. Reports will be due within 30 days after the end of the reporting period. The RPPR shall conform to the requirements in 2 C.F.R. § 200.328 (http://go.usa.gov/xkVgP) and Department of Commerce Financial Assistance Standard Terms and Conditions, Section A.01.

A final RPPR shall be submitted within 90 days after the expiration date of the award, and publication citation information as well as links to publicly available data shall be submitted as soon as they become available.

If a recipient's Data Management Plan (DMP) has changed since their last submission of a technical progress report, the recipient must include their revised DMP in the next technical progress report following the revision to the DMP. The revised DMP must include all the requirements described in Section IV.2.a.(10). of this NOFO.

(3) Patent and Property Reports. From time to time, and in accordance with the Uniform Administrative Requirements (*see* Section VI.2. of this NOFO) and other terms and conditions governing the award, the recipient may need to submit property and patent reports.

(4) Recipient Integrity and Performance Matters. In accordance with section 872 of Public Law 110-417 (as amended; see 41 U.S.C. 2313), if the total value of a recipient's currently active grants, cooperative agreements, and procurement contracts from all Federal awarding agencies exceeds $10,000,000 for any period of time during the period of performance of an award made under this NOFO, then the recipient shall be subject to the requirements specified in Appendix XII to 2 C.F.R. Part 200, http://go.usa.gov/cTBwC, for maintaining the currency of information reported to SAM that is made available in FAPIIS about certain civil, criminal, or administrative proceedings involving the recipient.

b. Audit Requirements. The Department of Commerce Financial Assistance Standard Terms and Conditions, Section D.01, and 2 C.F.R. Part 200 Subpart F, adopted by the Department of Commerce through 2 C.F.R. § 1327.101, require any non-Federal entity (i.e., including non-profit institutions of higher education and non-profit organizations) that expends Federal awards of $750,000 or more in the recipient's fiscal year to conduct a single or program

specific audit in accordance with the requirements set out in the Subpart. Additionally, unless otherwise specified in the terms and conditions of the award, entities that are not subject to Subpart F of 2 C.F.R. Part 200 (e.g., for-profit commercial entities) that expend $750,000 or more in DOC funds during their fiscal year must submit to the Grants Officer either: (i) a financial related audit of each DOC award or subaward in accordance with Generally Accepted Government Auditing Standards; or (ii) a project specific audit for each award or subaward in accordance with the requirements contained in 2 C.F.R. § 200.507. Applicants are reminded that NIST, the Department of Commerce Office of Inspector General, or another authorized Federal agency may conduct an audit of an award at any time.

c. **Federal Funding Accountability and Transparency Act of 2006.** In accordance with 2 C.F.R. Part 170, all recipients of a Federal award made on or after October 1, 2010, are required to comply with reporting requirements under the Federal Funding Accountability and Transparency Act of 2006 (Public Law No. 109-282). In general, all recipients are responsible for reporting sub-awards of $25,000 or more. In addition, recipients that meet certain criteria are responsible for reporting executive compensation. Applicants must ensure they have the necessary processes and systems in place to comply with the reporting requirements should they receive funding. Also see the Federal Register notice published September 14, 2010, at 75 FR 55663 available here http://go.usa.gov/hKnQ.

VII. Federal Awarding Agency Contacts

Questions should be directed to the following:

Subject Area	Point of Contact
Programmatic and Technical Questions	Kathleen McTigue Phone: 301-975-8530 E-mail: Kathleen.mctigue@nist.gov with '2019-NIST-TPO-01' in subject line
Technical Assistance with Grants.gov Submissions	Leon Sampson Phone: 301-975-3086 Fax: 301-975-6368 E-mail: grants@nist.gov Or grants.gov Phone: 800-518-4726

Subject Area	Point of Contact
	E-mail: support@grants.gov
Grant Rules and Regulations	Dean Iwasaki Phone: 301-975-8449 Fax: 301-975-6368 E-mail: dean.iwasaki@nist.gov

VIII. Other Information

1. **Personal and Business Information**

The applicant acknowledges and understands that information and data contained in applications for financial assistance, as well as information and data contained in financial, performance and other reports submitted by applicants, may be used by the Department of Commerce in conducting reviews and evaluations of its financial assistance programs. For this purpose, applicant information and data may be accessed, reviewed and evaluated by Department of Commerce employees, other Federal employees, and also by Federal agents and contractors, and/or by non-Federal personnel, all of whom enter into appropriate conflict of interest and confidentiality agreements covering the use of such information. As may be provided in the terms and conditions of a specific financial assistance award, applicants are expected to support program reviews and evaluations by submitting required financial and performance information and data in an accurate and timely manner, and by cooperating with Department of Commerce and external program evaluators. In accordance with 2 C.F.R. § 200.303(e), applicants are reminded that they must take reasonable measures to safeguard protected personally identifiable information and other confidential or sensitive personal or business information created or obtained in connection with a Department of Commerce financial assistance award.

In addition, Department of Commerce regulations implementing the Freedom of Information Act (FOIA), 5 U.S.C. Sec. 552, are found at 15 C.F.R. Part 4, Public Information. These regulations set forth rules for the Department regarding making requested materials, information, and records publicly available under the FOIA. Applications submitted in response to this Federal Funding Opportunity may be subject to requests for release under the Act. If an application contains information or data that the applicant deems to be confidential commercial information that should be exempt from disclosure under FOIA, that information should be identified, bracketed, and marked as Privileged, Confidential, Commercial or Financial Information. In accordance with 15 CFR § 4.9, the Department of Commerce will protect from disclosure confidential business information contained in financial assistance applications and other documentation provided by applicants to the extent permitted by law.

2. Public Website

NIST TPO has a public website, http://www.nist.gov/tpo, that provides information pertaining to this Funding Opportunity[14]. Any amendments to this NOFO will be announced through Grants.gov.

Applicants must submit all questions pertaining to this funding opportunity in writing to kathleen.mctigue@nist.gov with 2019-NIST-TPO-01 in the subject line.

[14] Refer to Section VII. of this NOFO, Federal Awarding Agency Contacts, Programmatic and Technical Questions, if more information is needed.

Appendix I: Information on Selected Agencies

Source: GAO Report: INTERNET OF THINGS, Communities Deploy Projects by Combining Federal Support with Other Funds and Expertise, Appendix I[15]

Table 1: Selected Federal Agencies, Mission, and Example of Relevant Support for IoT Applications in Communities

Selected federal agency	Mission	Example of relevant support for IoT applications in communities
Department of Commerce's National Institute of Standards and Technology (NIST)	NIST works to promote U.S. innovation and industrial competitiveness by advancing measurement science, standards and technology in ways that enhance economic security and improve our quality of life.	• Serves as a focal point for conducting scientific research and development measurements, standards, and related technologies in the federal government. • Supports the development and application of standards, guidelines, and related tools to improve the cybersecurity of connected devices and the environments in which they are deployed. • Collaborates with stakeholders across government, industry, international bodies, and academia, via the NIST IoT Cybersecurity program in order to cultivate trust and promote U.S. leadership in IoT.
Department of Commerce's National Telecommunications & Information Administration (NTIA)	NTIA is the Executive Branch agency principally responsible by law for advising the President on telecommunications and information policy.	• Manages federal spectrum and identifies potential commercial spectrum. • Develops policy on issues related to the Internet economy, including online privacy and cybersecurity.

[15] *See* Appendix II for information related to the U.S. Department of Agriculture (USDA), which was not included in Appendix I to the GAO report.

		• Performs research and engineering to support telecommunications policy and spectrum management.
Department of Energy (DOE)	DOE works to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.	• Supports fundamental scientific research for energy and is the nation's largest supporter of basic research in the physical sciences, including the use of IoT technologies in helping ensure a resilient, reliable, and flexible electricity system. • Supports applied research and development on energy efficient buildings, building equipment, and mobility systems.
Department of Health and Human Services (HHS)	HHS is the federal government's principal department responsible for protecting the health of Americans and providing essential human services.	• Promotes awareness of and mitigates risks to network-enabled medical devices.
Department of Homeland Security (DHS)	DHS~~'s Cybersecurity and Infrastructure Security Agency~~ is the lead federal agency for securing civilian government computer systems, and works with industry and state, local, tribal, and territorial governments to secure critical infrastructure and information systems, among other things.	• Works to analyze and reduce cyber threats and vulnerabilities. • Coordinates the response to cyber incidents to ensure that our computers, networks, and cyber systems remain safe. • ~~Provides technical services to federal r non-federal entities such as on-site vulnerability testing or incident response~~
Department of Justice (DOJ)	DOJ enforces the law and defends the interests of the United States according to the law; ensures public safety against threats foreign and domestic;	Investigates and prosecutes cybercrimes where exploitation of IoT vulnerabilities cause communal harm.

	provides federal leadership in preventing and controlling crime; seeks just punishment for those guilty of unlawful behavior; and works to ensure fair and impartial administration of justice for all Americans.	Recommends precautions to shield IoT devices from cyber intrusions and to prevent their use in disruptive cyber-attacks. Formed a threat analysis team to study the security of IoT.
Department of Transportation (DOT)	DOT is the principal department responsible for implementing national transportation policy and administering most federal transportation programs.	Conducts research, development, and outreach activities to facilitate the adoption of information and communication technology to enable society to move safely and efficiently.
Environmental Protection Agency (EPA)	EPA works to protect health and the environment.	Awards grants, conducts research, challenges, and educational activities in areas relating to public health and environmental monitoring, such as air quality sensors.
Federal Communications Commission (FCC)	FCC is an independent U.S. government agency overseen by Congress. It is the United States' primary authority for administering communications laws and regulating use of spectrum and communications technology, except with respect to the operations of other federal agencies.	Identifies and allocates spectrum to support evolving service needs including IoT. Formed a technological Advisory Council, which has produced position statements, recommendations, forecasts, and related materials on IoT technologies. Participates with industry to understand evolving needs for IoT deployment.
Federal Trade Commission (FTC)	FTC works to prevent business practices that are anticompetitive or deceptive or unfair to consumers; to enhance informed consumer choice and public understanding of the competitive process; and to	Recommended a series of concrete steps that businesses can take to enhance and protect consumers' privacy and security when using IoT devices.

	accomplish this without unduly burdening legitimate business activity.	
National Science Foundation (NSF)	NSF works to promote the progress of science; to advance the national health, prosperity, and welfare; to secure national defense; and for other purposes.	Supports research and education across all fields and disciplines of science and engineering and at all levels of education, including IoT technologies.
Office of Science and Technology Policy (OSTP)	OSTP works to help coordinate science and technology policy across the government; build partnerships among federal, state, and local governments and the private sector; and develop policies related to science and technology policy.	Oversees Networking and Information Technology Research and Development program, which is a multiagency effort that seeks to provide research and development (R&D) foundations for assuring continued U.S. technological leadership and meeting the needs of the Federal government for advanced information technologies.

Appendix II: Additional Federal Agency Information[16]

Selected federal agency	Mission	Example of relevant support for IoT applications in communities
United States Department of Agriculture (USDA)	USDA has a vision to provide economic opportunity through innovation, helping rural America to thrive; to promote agriculture production that better nourishes Americans while also helping feed others throughout the world; and to preserve our Nation's natural resources through conservation, restored forests, improved watersheds, and healthy private working lands.	• Including data collection programs such as The Long-Term Agroecosystem Research (LTAR) Network system. • Use of unmanned aircraft systems (UASs, or drones) in agriculture as well as sensors and other devices in precision agriculture that would collect data and give producers best data for managing their product.

[16] As noted in footnote 15, USDA was not included in Appendix I to the GAO report. USDA is included here because USDA provides relevant support for IoT applications in communities.