A Guide for Preparing and Submitting White Papers to the Technology Innovation Program

About this Guide

This guide explains how you can participate in helping to develop new areas for future competitions for the Technology Innovation Program (TIP) by offering ideas in the form of a white paper. These white papers will be used by TIP staff in an effort to create a pipeline of societal challenges suitable for future funding opportunities. Societal challenges are problems that are not being addressed or funded but that could be addressed by innovative technologies and high-risk, high-reward research. The creative thoughts put forth in these white papers will be used to leverage nationally recognized science and technology reports, knowledge from NIST, other government agencies, scientific advisory bodies, industry organizations, and leading researchers from academic institutions.

TIP uses white papers to shape future competitions. Pertinent ideas, concepts and knowledge offered by stakeholders in these white papers combined with information from a variety of other sources, enables TIP to identify and address areas of critical national need and associated societal challenges suitable for TIP investment.

Note: This guide, and the solicitation for white papers associated with this guide, is neither a Request for Proposals (RFP) nor should it be viewed as a request for pre-proposals.   Rather, it is a way to include ideas from the public to identify problems of national interest that justify government support and can be addressed by technological innovations that are not currently being sufficiently supported to meet the challenge.

Submitting a white paper is not required, it is optional.

If you have previously submitted a white paper please do **not** resubmit that paper unless there have been significant changes.

What is the Technology Innovation Program?

The America COMPETES Act (PL 110-69) established the Technology Innovation Program (TIP) in August 2007. TIP was established with the purpose of assisting U.S. businesses and institutions of higher education or other organizations, such as national laboratories and nonprofit research institutes, to support, promote, and accelerate innovation in the United States through high-risk, high-reward research in areas of critical national need.

TIP provides funding to address the high-risk, high-reward research to address areas of critical national need. TIP selects topics for areas of critical national need based on input from within NIST, from the TIP Advisory Board, and from the public. We encourage you to send us a "white paper" in which you outline your idea for an area of critical national need and explain how your idea is consistent with the **three major selection criteria** noted below**.**

- Maps to Administration Guidance.
- Justifies Government Attention.
- Essentials for TIP Funding.

TIP is interested in what you consider to be large problems that are potentially inhibiting the growth and well-being of our Nation today. This is addressed through an understanding of areas of critical national need.

> An **area of critical national need** means an area that justifies government attention because the magnitude of the problem is large and the societal challenges that need to be overcome are not being addressed, but could be addressed through high-risk, high-reward research.

TIP funds the development of high-risk, high-reward, transformative research targeted to address key societal challenges associated with areas of critical national need. Funding could be provided to industry (small- and medium-sized businesses), universities, national laboratories, and nonprofit research institutions for research on potentially revolutionary research results (technologies). The results of the high-risk, high-reward research should have the potential for transformational results.

> A **transformational result** is a potential project outcome that enables disruptive changes over and above current methods and strategies. Transformational results have the potential to radically improve our understanding of systems and technologies, challenging the status quo of research approaches and applications.

The primary mechanism for this research support is cost-shared financial assistance awarded through a process of merit-based competitions. Recent awards have all been issued as cooperative agreements.

A societal challenge is associated with barriers preventing the successful development of solutions to the area of critical national need. TIP is specifically interested in technical issues that can be addressed through high-risk, high-reward research.

> A **societal challenge** *is a problem or issue confronted by society that when not addressed could negatively affect the overall function and quality of life of the Nation, and as such, justifies government action.*

High-risk, high reward research is research that:

- has the potential for yielding transformational results with wide-ranging implications;
- addresses an area of critical national need that supports, promotes, and accelerates innovation in the United States;
- is too novel or spans too diverse a range of disciplines to fare well in the traditional peer-review process; and
- fits within areas of technical competence of the National Institute of Standards and Technology (NIST).

White Paper Ideas: What are we looking for?

We encourage you to send TIP a white paper in which you describe the societal challenge associated with an area of critical national need that you have outlined. Explain how your suggested topic could lead to proposal submissions of high-risk, high-reward, transformational research that could meet the societal challenges identified in area(s) of critical national need. **We intend to share white papers broadly with the scientific community; therefore, white papers should contain only public domain information and must <u>not</u> contain proprietary information**. Submission of a white paper means that the author(s) agrees that all the information in the white paper can be made available to the public. In your white paper state as succinctly as possible how research results could meet the needs of a societal challenge within an area of critical national need. Specifically, provide an overview of the following:

- The research (technology(ies) and/or methods) to be developed;
- Expected new outcomes and capabilities; and
- Path to achieving your goals, matching your goals to all **three** critical national need selection criteria noted above.

A good white paper discusses broad problems to be addressed rather than a specific technical solution or project to solve the problem. Please do not submit a pre-proposal or letter of intent for a project that your organization would like to undertake. White papers should not focus on ideas for individual R&D projects, although you may include brief examples of project ideas to illustrate the kinds of research suitable for the Program. White papers should define a broader agenda in which many companies or academic institutions would want to participate, at a programmatic level. So, in writing a white paper, think in terms of your industry or broader technical

community as research performers rather than just your organization. As examples, we are currently hearing suggestions from the technical community in the areas of civil infrastructure, complex networks and complex systems, energy, future water supplies, healthcare, manufacturing, nanomaterials/nanotechnology, and sustainability. You can add to these discussions or suggest new challenge areas.

The most common deficiency in a white paper is that it is more of a project proposal instead of an outline of societal challenges (or problem areas) within an area of critical national need that could be addressed by a high-risk, high-reward research program. **Remember, do <u>not</u> include proprietary information.**

The following guidelines will help you address the criteria that TIP will use to analyze the ideas in your white paper. Please respond to the three major selection criteria and as many of their subparts as possible. The examples used below are for illustration only and cover selected issues. They do not reflect any preferences for or against the research or technologies mentioned.

A. Maps to Administration Guidance

An area of critical national need justifies government attention because the magnitude of the problem is large and the societal challenges that need to be overcome are not being addressed, but could be addressed through high-risk, high-reward research. Further, the societal challenges are problems or issues confronted by society that if not addressed could negatively affect the overall function and quality of life of the Nation, and as such justify government attention. Thus, TIP competitions will solicit high-risk, high-reward solutions to societal challenges for which *technological innovation* is needed.

How well do the identified societal challenges fit within the proposed area of critical national need? What existing efforts are addressing the problem? What is the significance of the challenges to the Nation's well being and how important are they in the national discussion? Are they identified within national science policy reports, technology roadmaps, special publications, or memos? What level of support (money, collaboration, or related research) currently exists to address this problem?

Some available resources include:
- National Objectives.
  - Administration guidance, such as stated in policy documents available from the White House Office of Science and Technology Policy. See http://www.ostp.gov/.
  - Various publications of the National Academy of Sciences. See http://www.nationalacademies.org/.
  - Various publicly available industry, university, government, or state reports, such as technology roadmaps, which indicate needs that science and technology may be able to address at a national level.

Example

If you were interested in defining an opportunity in civil infrastructure, you might consider the following:

> *Professional societies, as well as the Administration and Congress, have identified civil infrastructure issues as a national priority. It is currently one of the primary topics of a number of study groups and forms the basis of a number of reports.[1, 2]*

> *The National Academy of Engineering recently identified the restoration and improvement of urban infrastructure as one of their fourteen grand challenges in engineering. These challenges were selected by a committee of distinguished leaders in science and engineering. [3]*

> *The Office of Science and Technology Policy states: "Scientific discovery and technological innovation are major engines of increasing productivity and are indispensible for promoting economic growth, safeguarding the environment, improving the health of the population and safeguarding our national security in the technologically-driven 21st century." [4]*

B. Justification for Government Attention

What is the magnitude of the problem (an area of critical national need) addressed in the white paper? What are the specific societal challenges within the area? Does the research to meet those challenges have a strong potential for advancing the state-of-the-art and contributing significantly to the U.S. science and technology knowledge base? What are the negative impacts if the challenges go unmet or the consequences if solutions are delayed? Why is it important to the Nation for the Government to get involved?

Example

Continuing with the civil infrastructure example:

> *Civil infrastructure constitutes the basic fabric of the world in which we live and work. It is the combination of fundamental systems that support a community, region, or country. It plays a critical role in addressing the needs of civilization: improving the quality of life, promoting economic growth, and protecting people from threats of natural and human origin.*

> *Civil infrastructure systems in the United States are at a critical stage because many structures were built during a period of extensive construction activity in the 1960's. Since the design life of most civil infrastructure systems*

designed at that time typically ranges from 30 to 50 years, many of them are approaching if not in the end-stages of their intended life.

The 2005 Report Card for America's Infrastructure released by the American Society of Civil Engineers (ASCE) notes that the average grade for America's infrastructure is D, indicating an overall poor condition. The grade was assigned on the basis of condition and performance, capacity versus need, and funding versus need. Total funds needed to bring America's infrastructure back to good condition are estimated to be $1.6 trillion over a five-year period. Compared to the 2001 grade (D+) and necessary investment ($1.3 trillion), it is obvious that the condition of America's infrastructure is degrading, and the needed investment is increasing.

C. Essentials for TIP Funding

The identification and selection of areas of critical national need will shape TIP's collaborative outreach and competitions. An analysis of government (federal and state) funding will be used to assist in determining the unique TIP role within an area of critical national need, and will involve national entities and documents, such as the National Research Council of the National Academies of Science, the Science & Technology Policy Institute, industry groups, published industry roadmaps, and others. Thus, TIP competition topic areas will be based on the **needs**, and societal challenges within those needs, that can potentially be addressed by technological innovations (high-risk, high-reward research) with far reaching impacts (transformational results). **Societal challenges or portions of societal challenges, that are more appropriately addressed by non-scientific research efforts are not within the mission of TIP and cannot be considered for competition topic areas**.

We are interested in why these societal challenges currently are not being adequately addressed or sufficiently funded. What funding gaps exist (either private or public)? Why are current approaches believed to be inadequate or not sufficiently timely?

Example

Again, considering the civil infrastructure example:

State and local governments have significant knowledge gaps regarding quantitative assessment of infrastructure integrity, yet they do not have the funds and ability to develop more cost-effective advanced sensing tools that would eliminate the knowledge gaps. One Federal research program targeting advanced sensing for infrastructure is the National Science Foundation's "Sensor Innovation and Systems Program." Total funding for this program is $5 million per annum and innovation in sensing is only one of several categories of research supported under this program. Other programs were identified in which new sensing technologies might be funded, but none

of the programs are targeted specifically at new or early stage sensing technologies. The civil infrastructure grants that are provided by the National Science Foundation (NSF) are primarily targeted at academic fundamental research and are smaller than the program envisioned. The Exploratory Advanced Research Program of the Federal Highway Administration (FHWA) is currently targeted at "Intelligent Transportation" projects. The Remote Sensing and Spatial Information Program of the Research and Innovation Technology Administration (RITA) is a university-focused program that seeks applications of existing technologies in a transportation context. Transformational impacts on infrastructure sensing from these and other programs are therefore expected to be limited.

TIP is directed to fund research areas that are not currently being addressed by others. Given the scale and importance of the problem of our nation's infrastructure, it is not surprising there are other agencies that are working on challenges associated with infrastructure. In the civil infrastructure example, four Federal agencies were identified that operate twelve programs that might have shared commonalities with TIP's identified area of critical national need. Examination revealed that these programs do not currently have the scope, size, and potential impact that could be expected from a funding commitment by TIP to support innovative early-stage research in this area of critical national need.

How to Submit Your Idea

Your input will be invaluable in assisting TIP to identify areas of critical national need and the associated societal challenges. Here is how to make your ideas heard:

- Prepare a white paper (approximately 10 pages) describing the societal challenges associated with an area of critical national need.
    - o State clearly the types of high-risk, high-reward science and technology that could achieve transformational results by the end of the TIP funded research efforts.
    - o Discuss how the proposed idea meets the **three** selection criteria detailed above. Address as many of the points as possible.

- **White Papers must <u>not</u> contain proprietary information.**

- **White Papers must <u>not</u> be project specific requests for funding, or a pre-proposal.**

- Please include a Title Page that identifies the

    The Societal Challenge that you have outlined in your white paper. e.g., Civil Infrastructure: Advanced Sensing Technologies for the Infrastructure)

Submissions will only be accepted electronically via Email to tipwhitepaper@nist.gov with the subject: **TIP Critical National Needs Ideas**

Contact: To ask specific questions regarding white paper preparation, contact either Thomas Wiggins (301-975-5416) or Richard Spivack (301-975-5063).

TIP Mailing List: To have your name added to TIP's mailing list go to http://tipmailing.nist.gov/forms/mailing_list.cfm

End Notes

1. National Academy of Engineering, "Introduction to the Grand Challenges for Engineering," February 2008.
2. "Report Card for America's Infrastructure," American Society of Civil Engineers (ASCE), Washington, DC, 2005.
3. National Academy of Engineering, "Introduction to the Grand Challenges for Engineering," February 2008.
4. The White House, Memorandum for the Heads of Executive Departments and Agencies, August 4, 2009. http://www.ostp.gov/galleries/press_release_files/Final%20Signed%20OMB-OSTP%20Memo%20-%20ST%20Priorities.pdf