

OMB Control No. # 0693-0033 – NIST Generic Clearance for Program Evaluation Data Collections

**Economic Impact of the Nation’s Precision Timing Infrastructure:
The Global Positioning System**

FOUR STANDARD SURVEY QUESTIONS

1. Explain who will be surveyed and why the group is appropriate to survey.

The purpose of this information collection is to acquire information from the Department of Defense, government laboratories, commercial manufacturers, trade associations, advocacy groups, and academics that will allow RTI International to answer the following research questions:

- What was the nature of the technology transfer activities between public, private, and academic entities/researchers that enabled the development and deployment of the Global Positioning System (GPS)?
- What would the commercial sector have pursued as an alternative to GPS to provide its precision timing needs if GPS had never been developed or available for commercial use, and what would be the economic impact?
- What would be the economic impact today if GPS were to unexpectedly fail for 30 days?

The data collection will acquire information and perspectives from experts involved in the development and use of GPS, as well as commercial firms that have developed and marketed commercial products enabled by the availability of the free and ubiquitous GPS signal. This diverse group will be able to provide the study with information on

- how GPS is used in eight application focus areas,
- the benefits GPS provides relative to a well-defined counterfactual,
- the specific positioning accuracy and timing precision needed for different GPS applications, and
- the backup systems currently available by sector/application should GPS fail.

We have reviewed the published literature to identify some of the needed data; however, much of the information necessary to conduct a rigorous analysis has not been collected. Thus, the interview guides and survey instruments contained in this request will be used to both verify the data that is available and collect new data where necessary. The published literature is especially lacking on information related to quantifying/valuing benefits.

Because of the diversity of the sectors using GPS, eight separate groups will be targeted using eight different (but similar in structure and length) interview guides. The sectors are

- agriculture,
- surveying,
- telematics,
- location-based services,
- resource extraction,
- telecommunications,
- electricity, and
- financial services.

Collecting information from these groups will allow us to:

- Quantify and monetize the benefits associated with GPS in the eight sectors of interest
- Evaluate the role of technology transfer within government agencies and between the public and private sectors

2. Explain how the survey was developed including consultation with interested parties, pretesting, and responses to suggestions for improvement.

We developed the interview guides following early unstructured discussions with potential interviewees; a review of the scientific, engineering, and industry literature related to the topics; consultations with industry associations and independent technical experts; and in-depth consultation between NIST technical experts and RTI International.

We pre-tested each of the eight interview guides with three to five GPS experts in the relevant sectors. As part of the pre-tests, we assessed the clarity of the questions and respondents' ability to provide accurate and credible information. An important component of the pre-test was an assessment of the respondents' ability to understand the counterfactual scenarios relative to which economic benefits will be estimated.

3. Explain how the survey will be conducted, how customers will be sampled if fewer than all customers will be surveyed, expected response rate, and actions your agency plans to take to improve the response rate.

Potential interviewees recommended interviews facilitated by semi-structured interview guides as the mode for data collection because they felt that many of the key questions are better suited to open-ended responses than pre-defined answer selections. Based on those recommendations, we will use the interview guides to conduct semi-structured interviews over the telephone or in person at conferences, meetings, and gatherings of professionals and researchers engaged in the technical areas of interest. We will share interview guides with respondents in advance, allowing them the opportunity to review the questions and burden estimate and to choose whether to participate in the information collection.

The development and applications of GPS cut across many sectors and standard industry classifications and can be limited to small groups of experts within a sector. Therefore, rather than sampling using lists of firms by North American Industry Classification codes, we are primarily sampling using lists of experts who belong to or participate in industry associations, consortia, professional associations, and other cross-industry thematic groups.

The groups from which our samples will be drawn include the following:

Agriculture

- Attendees of the InfoAg Precision Agriculture Conference
- Members of farm associations, including American Farm Bureau, American Soybean Association, and National Corn Growers Association

Surveying

- Attendees of North Carolina Society of Surveyors Conference
- Members of the National Society of Professional Surveyors

Telematics

- Attendees of Connected Cars USA Conference and the NAFA Fleet Management Association Annual Conference
- Members of NAFA Fleet Management Association, Commercial Vehicle Safety Association, Commercial Vehicle Research Council

Location-based services

- Attendees of the Conference on Location-Based Services and the ION GNSS+ Conference
- Members of ICA Commission on Location-Based Services and the Institute of Navigation,

Resource extraction

- Attendees of the Mines and Technology conferences and the Offshore Technology Conference
- Members of the National Mining Association, the American Exploration and Mining Association, the Marine Technology Society, Society of Exploration Geophysicists, Society of Petroleum Engineers, the Petroleum Equipment and Services Association, and the IEEE Oceanic and Engineering Society

Telecommunications

- Attendees of the ATIS-NIST Workshop on Synchronization and Timing Systems (WSTS)
- Members of the Alliance for Telecommunications Industry Solutions (ATIS), the Resilient Navigation and Timing Foundation (RNFTF), and the International Telecommunications Union (ITU)

Electricity

- Attendees of IEEE/NIST Timing Challenges in the Smart Grid Workshop (Oct 26, 2016), EEI's Transmission, Distribution, Metering & Mutual Assistance Conference (April 2018).
- Members of the Electric Power Research Institute (EPRI), North American Synchronphasor Initiative (NASPI), and Edison Electric Institute (EEI).

Financial services

- Attendees of IEEE/NIST Timing Challenges in the Smart Grid Workshop (Oct 26, 2016), EEI's Transmission, Distribution, Metering & Mutual Assistance Conference (April 2018), and ATIS' Time and Money II workshop (January 2018).
- Members of the Electric Power Research Institute (EPRI), North American Synchronphasor Initiative (NASPI), and Edison Electric Institute (EEI), and the Alliance for Telecommunications Industry Solutions (ATIS).

We will use primarily email invitations to invite 400 experts to participate in the information collection, representing approximately 50 experts from each sector. Because of the timeliness of the topic and the opportunity to participate in an evaluation of NIST's programmatic options, we anticipate that 50% will accept our invitation. We will issue one request to participate and one reminder.

Participating firms will receive copies of the analysis and all reports when they are approved for public release by the NIST Economic Analysis Office. These reports will provide an analysis of benefits of GPS that will be useful to participants.

4. Describe how the results of the survey will be analyzed and used to generalize the results to the entire customer population.

For the purposes of this evaluation, we do not require statistically significant results. Rather, we are seeking to conduct an overall evaluation of historical trends, benefits, and economic impacts under hypothetical scenarios.

We will analyze the data collected using NVivo, Stata, and Excel software tools. These tools permit efficient thematic analysis that will allow NIST to evaluate overall trends and benefits. The tools will also allow us to export data to an economic model that will help NIST understand how GPS and its potential failure would affect the U.S. economy. The results will be generalized to the overall population using capital, labor, energy, and material (KLEM), by sector, using macroeconomic databases built from government economic statistics.