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Interview Guide: NIST Economic Impact Assessment of GPS

Evaluating the Uses and Benefits of GPS to the Telematics Sector

RTI International is working with the National Institute of Standards and Technology (NIST) to conduct an economic impact assessment of the nation's precision, navigation, and timing (PNT) services provided through the Global Positioning System (GPS).

The study has two objectives:

- Quantify the economic impact of GPS.
- Quantify the economic impact of an unexpected 30-day failure of the current GPS system.

As part of this study, RTI identified an alternative scenario, or counterfactual, to describe what we expect might have happened in the absence of GPS being developed and leveraged for commercial applications. Preliminary research and expert interviews suggest that in the absence of GPS the terrestrial PNT system known as Loran-C would have likely evolved over time to meet some of the needs filled by GPS. Some background on the Loran-C and Enhanced Loran (eLoran) systems are provided in an attachment.

Your perspective will help us quantify the benefits of GPS to the telematics and fleet management sector. Your participation is voluntary and confidential; only aggregated information will be included in any deliverables or communications. Additionally, we do not wish to discuss any proprietary or confidential business information, but rather your professional opinion about the role of GPS in telematics and fleet management.

Our research products will be an economic analysis, final report, and presentation materials. All deliverables will be publicly available in early 2019 and these will be shared with you as soon as they are released.

If you have questions, please contact:

- Alan O'Connor, Principal Investigator, RTI, oconnor@rti.org
- Kathleen McTigue, Technology Partnerships Office, NIST, kathleen.mctigue@nist.gov

Interview Questions

SECTION I. Respondent Background

1. Please give a brief description of your background.

2. How familiar are you with the use of GPS in the telematics sector?

SECTION II. How GPS Is Used in Telematics

3. Prior to GPS being widely available, how did commercial fleet operators manage their fleet assets and track their usage?

4. When did the use of GPS devices begin for tracking fleets? At what point did specialized products for telematics and fleet tracking come available?

5. How widely adopted are telematics devices for fleet management?

6. How is GPS used by telematics devices and service providers?

7. How much does a typical telematics solution per vehicle?
    a. For the equipment itself?
    b. For any monthly service agreements with the provider?

8. Besides GPS, what other major sensors make up a telematics device (e.g., ODB interface, accelerometer)?

9. In general, what are the benefits of using telematics for fleet management?

10. A study by Fleetmatics estimated that implementing a telematics solution reduced labor costs by approximately 20% because more efficient operation allowed a crew to complete the same amount of work each day in less time.
    a. Do you agree or disagree with this estimate?
    b. If you disagree, could you provide your own estimate of the impact of a telematics solution on labor costs?

11. The same study by Fleetmatics estimates that a telematics solution, on average, saves $45 per vehicle per month of fuel through reduced idle time, better routing, and slower average speeds. At the time of the study, $45 equated to approximately 12 gallons of gasoline.
    a. Do you agree or disagree with this estimate?
    b. If you disagree, could you provide your own estimate of the impact of a telematics solution on fuel consumption?

SECTION III. If GPS Were Not Available

12. If GPS had not become available, would the telematics sector exist?

13. Would another system (such as Loran, as described in the attachment) with less accurate geolocation information be feasible?

SECTION IV. Unanticipated 30-Day Failure of GPS System

14. If GPS failed unexpectedly, what would the impact be on the functionality telematics services and devices?

15. In the event of a failure, how would companies using telematics services be affected?

16. How would companies manage operations in the absence of a telematics service?

17. Can you characterize and/or quantify the impact of a GPS system outage on:
    a. Ability to complete jobs
    b. Labor costs
    c. Fuel efficiency

SECTION V. Technology Transfer

18. Are you familiar with the technology development history of GPS and devices that use GPS as they relate to the telematics sector?

19. Outside of launching and maintaining the GPS constellation itself, did federally funded research support the development and commercialization of any key GPS components that are used in the telematics sector today?

Section VI. Concluding Questions

20. Who else should we contact for this study?

21. Would you like to share any other comments?

22. Would you be willing to participate in a brief follow-up discussion of your responses to this survey?

THANK YOU for contributing your time and insight to the study.

ATTACHMENT: *Loran as a Counterfactual in the Absence of GPS*

We hypothesize that in the absence of GPS a Loran-based system would have been available and would have evolved over time in performance. The following is a brief background on Loran.

The legacy Loran system, known as Loran-C, was introduced in 1957 and operates similarly to GPS in that its primary signal is a timing and frequency message. Up until GPS was available, Loran-C was the de facto standard for PNT services. In the late 1980s and early 1990s, investments were made to expand the coverage of Loran-C to cover the continental United States and improve the precision and accuracy. However, progress on further upgrades to Loran-C stalled as the costs exceeded available funds and as GPS was more widely adopted, eliminating the need for Loran-C in some applications.

In the late 1990s, interest in maintaining and modernizing Loran-C rekindled because GPS was recognized as a single point of failure for much of the nation's critical infrastructure. An evaluation conducted by the FAA determined that with some investment in upgrades the Loran-C system could indeed function as a suitable backup in the event of a GPS outage (Narins, 2004). Additionally, some research and development was being conducted to standardize an enhanced Loran (eLoran) system, which would have more capabilities and better precision and accuracy.

While eLoran would not be able to achieve the levels of precision and accuracy available from GPS, proponents claim it could perform sufficiently to support many critical applications. Table 1 provides a comparison of the frequency, timing, and positioning capabilities of the different systems.

Table 1. Precision and Accuracy Performance

	Loran-C	***eLoran***	***GPS***
Frequency	1×10^{-11} frequency stability	1×10^{-11} frequency stability	1×10^{-13} frequency stability
Timing	100 ns	10-50 ns	10 ns
Positioning (meters)	18–90 meters	8–20 meters	1.6–4 meters[a]

Sources: Narins et al. (2004); Curry (2014); FAA (2008)
[a] GPS positioning accuracy varies widely by type of receiver and augmentations being applied. The accuracy quoted here is from the GPS Wide Area Augmentation System (WAAS) 2008 Performance Standard.

References

Curry, C. (2014). *Delivering a national timescale using eLoran.* Lydbrook, UK: Chronos Technology.

Federal Aviation Administration [FAA]. (2008). GPS Wide Area Augmentation System (WAAS) 2008 Performance Standard. Retrieved from https://www.gps.gov/technical/ps/2008-WAAS-performance-standard.pdf

Narins, M. (2004). *Loran's capability to mitigate the impact of a GPS outage on GPS position, navigation, and time applications*. Prepared for the Federal Aviation Administration Vice President for Technical Operations Navigation Services Directorate.