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Small Business Innovation Research (SBIR) Program

Federal Funding Opportunity (FFO)

ANNOUNCEMENT

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U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology

Opening Date: February 2, 2016

Closing Date: April 14, 2016

http://www.nist.gov/sbir

The NIST technical expert will be available for consultations and discussions to answer questions and clarify any other technical aspects of this effort.

References:
[1] DOE. Building Energy Data Book. 2011 [cited 2014; Available from: http://buildingsdatabook.eren.doe.gov/

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[3] Bomberg, M., Kisilewicz, T. and Nowak, K. “Is there an optimum range of airtightness for a building?”, Journal of Building Physics, 2015.

[4] IOM, “Damp Indoor Spaces and Health”, I.o. Medicine, Editor. 2004, The National Academies Press: Washington, D.C.

[5] ASTM, ASTM E779-10 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization. 2010, American Society of Testing and Materials: Philadelphia.

[6] Emmerich, S.J. and Persily, A.K. “Analysis of U. S. Commercial Building Envelope Air Leakage Database to Support Sustainable Building Design”, International Journal of Ventilation, 2014. 12(4): p. 331-343.

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[8] Hopfe, C.J. and Hensen, J.L.M. “Uncertainty analysis in building performance simulation for design support”, Energy and Buildings, 2011. 43(10): p. 2798-2805.

[9] Obama, B., “The President's Climate Action Plan”, 2013: Washington, D. C.

9.04.04 Single-Chip eLoran Receiver

The Global Positioning System (GPS) is used for a myriad of innovative—and now, essential—applications that were not envisioned when the system was first designed [1]. The Department of Homeland Security reports that of their 18 defined areas of U.S. critical infrastructure (e.g., communications, transportation, and energy), 16 of them rely on GPS for precision timing and synchronization in their system operations [2]. However, the GPS signal is exceedingly weak, and it is vulnerable to interference, both accidental and deliberate.

Programs have been proposed to provide resilience to the many modern cyber physical systems that rely on GPS for timing data. One that is often suggested is “eLoran,” which could augment GPS by providing a complementary data transmission channel for timing and more [3–8].

One of the developments that allowed GPS service to become so widely used was the development of application-specific integrated circuits (ASICs) that allowed engineers to incorporate GPS receivers into their products at very low cost (a few dollars or less). No such single-chip receivers currently exist for eLoran. Development and demonstration of ASICs for eLoran, or ASICs that integrate eLoran receiver functionality with that of other systems, would accelerate adoption and utilization of eLoran if and when it is deployed. While NIST has no operational responsibility for either GPS or eLoran, NIST seeks development of eLoran ASICs in order to help facilitate the broad dissemination of precise, accurate time standards and to provide robustness and resilience for critical cyber physical systems.

The goals of this project are to develop and demonstrate reference designs for single-chip eLoran receivers (ASICs). These designs could be for stand-alone eLoran receivers or—even better—integrated into ASICs that receive multiple time-dissemination signals (e.g., GPS, NIST’s WWVB). Designs must take care to capture all the timing precision available in these signals, and the designs must be amenable for eventual mass production at very low cost (commensurate in cost to today’s ASICs that provide precision time but which lack eLoran compatibility).

As of this writing, the only U.S. eLoran signal is broadcast from Wildwood, NJ, and on an intermittent, experimental basis. The signal has a coverage radius of a few hundred miles. Proposals under this subtopic (Phase I now, and perhaps a Phase II later) should make clear the extent to which access to this signal might be required, and what if any arrangements might have been made for access to this signal when needed. Neither the U.S. Government nor its CRADA partners [9] make any representation or commitment though this SBIR solicitation that this signal would be available or guaranteed. Open-air eLoran signals may also be available in the UK and other nations [10].

Phase I expected results:
Develop a feasibility study consisting, at a minimum, of a system design and supporting analysis for timing accuracy and volume manufacturing costs. The design should be based on published eLoran specifications (e.g., [3–7]) and the analysis should greatly benefit from experimental validation of elements in the design.

Phase II expected results:
Production of prototype integrated circuits. The prototype should be produced to the specifications to meet the needs for functionality testing and support the broad and rapid commercialization of eLoran technology.

NIST will not provide assistance on this project.

References:
[1] See http://www.dhs.gov/science-and-technology/cyber-physical-systems.

[2] See http://www.gps.gov/multimedia/presentations/2012/10/USTTI/graham.pdf.

[3] The eLoran definition document may be found at: http://www.loran.org/news/eLoran%20Definition%20Document%200%201%20Released.pdf.

[4] The Loran C signal specification may be found at: http://www.navcen.uscg.gov/?pageName=loranSignalSpec.

[5] The eLoran 9th pulse modulation technique is described in http://www-personal.umich.edu/~tmikulsk/loran/ref/eloran_ldc.pdf and http://www.dtic.mil/get-tr-doc/pdf?AD=ADA575171.

[6] See http://rntfnd.org/wp-content/uploads/Delivering-a-National-Timescale-Using-eLoran-Ver1-0.pdf and the references therein.

[7] See http://www-personal.umich.edu/~tmikulsk/loran/index_3.html and the references therein.

[8] Additional background information on eLoran and updates on its current status may be obtained by searching on that term with an Internet search engine.

[9] See http://www.exelisinc.com/news/pressreleases/Pages/Exelis,-UrsaNav,-DHS-and-the-U.S.-Coast-Guard-enter-agreement-to-trial-ground-based-position,-navigation-and-timing-signal.aspx.

[10] See http://www.gla-rrnav.org/radionavigation/eloran/index.html.

9.04.05 Smart Visualization of Smart Manufacturing

Today's manufacturing systems are able to collect vast amounts of data; however, much of that data is never used unless and until there is a known problem in the process. Sometimes the problem will not even be detected until the product is being used in the field, implying that the manufacturing problem may have persisted for several generations of the product. Advances in data visualization, which is a fundamental means of observing data and discovering problems, have come a long way for generalized applications. Data visualization still requires considerable effort to easily integrate with the systems generating data [1].

Current approaches (drag-and-drop dashboards, tableaus, etc.) to visualizing smart and