U.S. Department of Transportation

6913G623QSBIR1
FY 2023

Small Business Innovation Research (SBIR) Program
PHASE I PROGRAM SOLICITATION

NAICS CODE: 541715

Issue Date: February 7, 2023

Closing Date: March 7, 2023, 3:00 p.m. ET

Small Business Innovation Research (SBIR) Program, V-331
U.S. Department of Transportation (U.S. DOT)
Office of the Assistant Secretary for Research and Technology
John A. Volpe National Transportation Systems Center (Volpe Center)
55 Broadway
Cambridge, MA 02142-1093

INFORMATION ABOUT IMPORTANT DATES

Date	Description
February 7, 2023	Solicitation Open Date with amended topics (see below)
	Pre-solicitation Questions & Answers (Q&A) available on the U.S. DOT SBIR website (see Section I.D)
February 8, 2023, 5:00 p.m. ET	Registration Deadline for Pre-Offer Webinar (see below)
February 9, 2023, 1:00 p.m. ET	Pre-Offer Webinar (see below)
March 1, 2023, 5:00 p.m. ET	Administrative and Contract Pricing Worksheet (Appendix C) Questions Due (see Section I.D)
March 7, 2023, 3:00 p.m. ET	Solicitation Closing Date (See Section V)
On or about May 8-11, 2023	Pitch Day (see Section III.D)

A. Solicitation Open with Amendments to Topics as Follows:

The proposed topic list shared during the pre-solicitation has been amended for the U.S. DOT FY23 Phase I Solicitation as follows:

- Topic PH2, Integrated RFID Trackers and Sensors for Hazardous Material Communication in Transportation, has been updated with clarifications.
- Topic PH4, Wearable PPE-integrated Sensors for First Responders, has been updated with clarifications.

B. Pre-Offer Webinar

The Pre-Offer Webinar will be held on Thursday, February 9, 2023, at 1:00 p.m. ET. The Government encourages all small businesses and persons that are interested in or considering submitting an offer to attend the pre-offer webinar. Small businesses may attend this webinar only virtually via a webinar conference. Come learn about the U.S. DOT's SBIR program, this year's topics, and Pitch Day. Administrative questions about the solicitation will be collected during the webinar, but no technical questions regarding the research topics will be accepted.

To register, visit:
https://usdot.zoomgov.com/webinar/register/WN_Yx6ex3mwSFWs0HFwE5kXBQ.

The deadline to register for the webinar is Wednesday, February 8, 2023, at 5:00 p.m. ET.

After the webinar, a recording will be posted to the U.S. DOT SBIR Program website (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research).

C. Closing Date

Offers must be received through the U.S. DOT's automated proposal website no later than **Tuesday, March 7, 2023, at 3:00 p.m. ET.** The U.S. DOT's automated proposal website is located at https://usg.valideval.com/teams/usdot_2023/signup.

D. Pitch Day

The most favorably rated offers for the respective research topics (per Section III.D) may have an opportunity to make a virtual oral presentation to the Government promoting its offer. Pitch Day is scheduled on or around May 8-11, 2023. For more information, see Section III.D.

CONTENTS

I. PROGRAM DESCRIPTION

A. Introduction

The United States Department of Transportation (U.S. DOT) welcomes small businesses to participate in the U.S. DOT's Small Business Innovation Research (SBIR) program. The purpose of this solicitation is to invite small businesses, with their valuable resources and creative capabilities, to submit innovative research ideas and solutions in response to the topics identified by the U.S. DOT as described in Section VIII. Under the SBIR Program, the U.S. DOT does not accept unsolicited proposals.

The goals and objectives of the SBIR Program are to:

- Stimulate technological innovation;
- Meet Federal research or research and development (R/R&D) needs;
- Foster and encourage participation in innovation and entrepreneurship by socially and economically disadvantaged persons; and
- Increase private sector commercialization of innovations derived from Federal R/R&D funding.

The SBIR Program encourages small businesses to engage in R/R&D that has the potential for commercialization and meets Federal R/R&D objectives. The Small Business Innovation Development Act of 1982 [Public Law (P.L.) 97-219 codified at 15 U.S.C. 638] established the SBIR Program. More information is available at https://www.sbir.gov/about/about-sbir.

B. Three-Phase Program

The U.S. DOT SBIR Program is a three-phase program.

THIS SOLICITATION IS FOR PHASE I OFFERS ONLY.

Phase I. Phase I is the conduct of feasibility-related experimental or theoretical research or R/R&D efforts on research topics described herein. For the U.S. DOT SBIR Program, Phase I offers can be funded up to $200,000 unless otherwise noted in Section VIII. The period of performance of the resulting contract shall be six months. The basis for award is the scientific and technical merit of the offer, its commercial potential, and its relevance to U.S. DOT requirements and current research priorities. The U.S. DOT intends to award Firm-Fixed-Price (FFP) purchase orders utilizing Federal Acquisition Regulation (FAR) Part 13 Simplified Acquisition Procedures. A purchase order is an offer by the Government to buy supplies or services, including research and development, upon specified terms and conditions (in this instance, this solicitation and the contractor's offer). The U.S. DOT will require written acceptance of the purchase order by the SBC at the time of award via the SBC signing the

purchase order, thus creating a binding contract between the SBC and the Government. Award of a bilaterally signed purchase order is subject to the availability of funding.

All U.S. DOT SBIR Phase I awardees who have successfully completed Phase I are eligible to submit a Phase II proposal for evaluation and possible selection for award.

Phase II. The objective of Phase II is to continue the R/R&D effort from the completed Phase I. Award of a contract for a Phase II effort is based on the results of Phase I, the scientific and technical merit of the Phase II proposal, and the commercial potential of the proposed Phase II project. Commercial potential includes the capability to transition the technology to private sector applications, Government applications, or Government contractor applications. For the U.S. DOT SBIR Program, contracts for Phase II proposals can be funded up to $1,500,000 (except where a lower ceiling is specifically identified) and can have a period of performance of up to 24 months from the date of contract award. The Government is not obligated to fund any specific Phase II proposal.

The U.S. DOT typically awards Firm-Fixed-Price (FFP), FFP-Level-of-Effort (FFPLOE), or Cost-Plus-Fixed-Fee (CPFF) negotiated contracts for Phase II efforts utilizing FAR Part 15 Contracting by Negotiation procedures. Approximately 30 days prior to the end of Phase I efforts, the U.S. DOT SBIR Program Office will provide Phase I contract awardees details on the due date, content, submission requirements, and evaluation criteria for Phase II proposals. A summary of Phase II proposal submission requirements can be found on the U.S. DOT's SBIR website at https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/submit-proposal.

If invited by the Government, a Phase II awardee may receive one additional, sequential Phase II award to continue the work of an initial Phase II award.

Phase III. SBIR Phase III refers to work that derives from, extends, or logically concludes effort(s) performed under a U.S. DOT or another Agency's Phase I and/or Phase II funding agreement. Phase III is funded by sources other than the set-aside funds dedicated to the SBIR Program. Phase III work is typically oriented toward commercialization of SBIR research or technology and may be for products, production, services, R/R&D, or a combination thereof. The following activities are some of the types of SBIR Phase III work:

- Commercial application of SBIR-funded R/R&D financed by non-Federal sources of capital.
- SBIR-derived products or services intended for use by the Federal Government, funded by non-SBIR sources of funding.
- Continuation of SBIR work, funded by non-SBIR sources of Federal funding including R/R&D.

C. Eligibility

Size Rule

Regulations governing size and eligibility requirements for the SBIR program are found at 13 C.F.R. Part 121. See SBA's Guide to SBIR/STTR (Small Business Technology Transfer) Program Eligibility at http://sbir.gov/sites/default/files/elig_size_compliance_guide.pdf for further details. 13 C.F.R. Part 121.702 includes a provision that allows agency discretion relating to the participation by firms that are majority-owned by multiple venture capital operating companies, private equity firms or hedge funds. **The U.S. DOT elects at this time not to use the authority that would allow venture capital operating companies (VCOCs), hedge funds or private equity firms to participate in the SBIR Program. Offers submitted by these parties will not be considered for award.**

Each SBC submitting an offer must qualify as a SBC at the time of award of Phase I and Phase II contracts (see Section I. E. for the definition of a SBC). A SBC, together with its affiliates, must not have more than 500 employees. In addition, the following requirements must be met:

- The primary employment of the principal investigator must be with the small business firm at the time of contract award and at all times during the conduct of the proposed research. "Primary employment" means that more than one-half of the principal investigator's employment time is spent working for the small business. This typically precludes full-time employment with another organization.

- For Phase I, a minimum of two-thirds of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 66.7% of total contract cost must be for other than subcontractor/consultant costs).

- For Phase II, a minimum of one-half of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 50% of total contract cost must be for other than subcontractor/consultant costs).

- For both Phase I and Phase II, the R/R&D work must be performed in the United States. "United States" means the 50 states, the territories and possessions of the Federal Government, the Commonwealth of Puerto Rico, the Republic of the Marshall Islands, the Federated States of Micronesia, the Republic of Palau, and the District of Columbia.

Performance Benchmark Requirements for Phase I Eligibility

Section 4(a)(3) of the SBIR Policy Directive requires each Federal agency participating in SBIR to set a Phase II transition rate benchmark per Section 5165 of the SBIR/STTR Reauthorization Act of 2011. General information on the Performance Benchmark requirements is available at https://www.sbir.gov/faqs/performance-benchmarks.

Before submitting an offer to this solicitation, all potential offerors should verify their Transition

Rate eligibility for Phase I awards on SBA's SBIR website at https://www.sbir.gov/. On June 1st of each year, Phase I applicants that meet the Phase I to Phase II transition rate identified below are eligible to submit an offer for a new Phase I award. General information on the Performance Benchmark requirements is available at https://www.sbir.gov/faqs/performance-benchmarks.

Phase I to Phase II Transition Rate: The U.S. DOT's Phase I to Phase II Transition Rate uses a five-year period and counts an offeror's total number of Phase I awards over the last five fiscal years, excluding the most recently completed fiscal year; and the total number of Phase II awards over the last five fiscal years, including the most recently completed fiscal year. The U.S. DOT SBIR Phase I to II Transition Benchmark is: at least 0.25.

Effective July 25, 2013, for all U.S. DOT SBIR Program Phase I offerors that have received 20 or more Phase I awards over the past 5-year period, the ratio of Phase II awards received to Phase I awards received must be at least 0.25.

Commercialization Benchmark:

The Commercialization Benchmark requirement applies only to SBIR and STTR Phase I applicants that have received more than 15 (16 or more) Phase II awards over the past 10 fiscal years, excluding the last two years. These companies must have achieved at least the minimum required levels of commercialization activity, resulting from their past Phase II work, in order to be eligible to submit a proposal for a new Phase I (or Direct-to-Phase II) award. The current Commercialization Benchmark requirement, agreed upon and established by all 11 SBIR agencies, was published for public comment in the Federal Register (FR) at 78 FR 48537 in August 2013 with a reopening of the comment period at 78 FR 59410 in September 2013. It requires that the awardee applicant must have received, to date, an average of at least $100,000.00 of sales and/or investments per Phase II award received, or have received a number of patents resulting from the SBIR work equal to or greater than 15% of the number of Phase II awards received during the period.

As of April 2021, the Small Business Administration is enforcing the Commercialization Benchmark and is compiling a list of companies that will be deemed ineligible to submit a proposal for a new Phase I (or Direct-to-Phase II) award due to failure to meet the Commercialization Benchmark requirement.

SBIR and STTR awardees are required to update and maintain their organization's Company Registry Commercialization Report, accessible when logged in to the Company Registry profile as an authorized user under the "My Dashboard" section. Commercialization information is required upon completion of the last deliverable under the funding agreement. SBIR and STTR awardees are requested to voluntarily update the information in the database annually thereafter for a minimum period of 5 years.

Foreign Disclosure Notice

The SBIR and STTR Extension Act of 2022 (P.L. 117-183), Section 4(c), requires each SBC submitting a proposal or application for a federally funded award to disclose information in the proposal or application regarding ties to the People's Republic of China or another foreign country. The Extension Act requires such SBC to submit a certain disclosure notice. The U.S. DOT SBIR Program administrator anticipates that implementation and requirement for such disclosure will be before U.S. DOT makes its FY23 Phase I awards. The U.S. DOT reserves the right to obtain such disclosure notice from all offerors who submitted a proposal (offer) or application for or under the DOT FY23 SBIR solicitation and/or offerors who may be recommended for an award under this solicitation. DOT will provide the disclosure form(s). When the SBC receives the form(s), the SBC must complete and submit the completed form(s) to U.S. DOT for potential award consideration. Details on the requirements of the act can be found at https://www.congress.gov/bill/117th-congress/senate-bill/4900/text.

D. Contact Information

If you have any administrative questions not listed on our Frequently Asked Questions (FAQs) web page (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs), or questions regarding this Solicitation's Appendix C: Contract Pricing Worksheet, please submit such questions via email to:

U.S. DOT SBIR Program Office
dotsbir@dot.gov

All administrative and Appendix C questions must be submitted **no later than 5:00 p.m. ET on Wednesday, March 1, 2023**. Questions received after 5:00 p.m. ET on March 1, 2023, may not be answered. The Government reserves the right to address a late question, if the Government determines an answer is in the best interests of the Government.

PLEASE NOTE:

- Technical questions pertaining to the research topics will not be answered during the solicitation period, as technical questions were only permitted during the pre-solicitation period. To review the technical questions and answers, visit https://usdot.uservoice.com/forums/950674.
- Inquiries regarding offer status will not be answered.

For general SBIR Program inquiries not pertaining to this solicitation, please contact:

U.S. DOT's SBIR Hotline
(617) 494 2051
dotsbir@dot.gov

In order to support full and open competition and comply with the Procurement Integrity Act, 41 U.S.C. Sections 2101-2107 requirements, during the Phase I submittal and evaluation period, offeror or potential offeror contact with U.S. DOT relative to this Solicitation is restricted to the officials identified in this Solicitation. During the open period of this Solicitation (from solicitation issuance until release of award recommendation list), contact with U.S. DOT officials (excluding certain offices and positions such as the DOT Office of the Inspector General (see herein) and the U.S. DOT/Office of the Secretary) from or at any U.S. DOT agency, other than those U.S. DOT officials identified in this Solicitation, may result in rejection of the offer attributable to such unauthorized contact.

E. Definitions

Funding Agreement

Any contract, grant, or cooperative agreement entered into between any Federal Agency and any SBC for the performance of experimental, developmental, or research work, including products or services, funded in whole or in part by the Federal Government.

NOTE: The U.S. DOT does not award grants or cooperative agreements under the SBIR Program.

Research or Research and Development (R/R&D)

Any activity that is:

- A systematic study directed toward greater knowledge or understanding of the subject studied;
- A systematic study directed specifically toward applying knowledge and innovation to meet a recognized but unmet need; or
- A systematic application of knowledge and innovation toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements.

Subcontract

Subcontract means any agreement, other than one involving an employer-employee relationship, entered into by an awardee of a funding agreement calling for supplies or services for the performance of the original funding agreement.

SBIR Data

All data developed or generated during the performance of an SBIR award, including Technical Data and Computer Software developed or generated in the performance of an SBIR award. The term does not include information incidental to contract administration, such as financial, administrative, cost or pricing or management information.

SBIR Data Rights

The Government's license rights in properly marked SBIR Data during the SBIR protection period as follows: SBIR Technical Data Rights in SBIR Data that are Technical Data or any other type of Data other than Computer Software and SBIR Computer Software Rights in SBIR Data that is Computer Software. Upon expiration of the protection period for SBIR Data, the Government has a royalty-free license to use, and to authorize others to use on its behalf, these Data for Government purposes, and is relieved of all disclosure prohibitions and assumes no liability for unauthorized use of these Data by third parties, except that any such Data that is also protected under a subsequent SBIR award shall remain protected through the protection period of that subsequent award. The Government receives unlimited rights in all Form, Fit, and Function Data, Operations, Maintenance, Installation, or Training Purposes (OMIT) Data, and unmarked SBIR Data.

Small Business Concern (SBC)

A concern that meets the SBIR program eligibility requirements set forth in 13 CFR § 121.702, which can be found here: https://www.law.cornell.edu/cfr/text/13/121.702.

Veteran-Owned SBC

A Veteran-owned SBC means an SBC:

1. Not less than 51% of which is owned by one or more veterans (as defined at 38 U.S.C. 101[2]) or, in the case of any publicly owned business, not less than 51% of the stock of which is owned by one or more veterans; and,

2. The management and daily business operations of which are controlled by one or more veterans.

Women-Owned SBC (WOSB)

A WOSB is an SBC that is at least 51% owned by one or more women; or, in the case of any publicly owned business, at least 51% of the stock is owned by women; and women control the management and daily business operations.

Socially and Economically Disadvantaged SBC (SDB)

For Eligibility, and Certification, Relating to Federal Small Disadvantaged Business Programs, See 13 CFR § 124, Subpart B at https://www.law.cornell.edu/cfr/text/13/part-124/subpart-B.

Historically Underutilized Business Zone (HUBZone)

A HUBZone SBC means an SBC that meets the requirements described in 13 CFR 126.200 (https://www.ecfr.gov/current/title-13/chapter-I/part-126/subpart-B/section-126.200), is certified by the SBA, and designated by SBA as a HUBZone SBC in the Dynamic Small Business Search (https://www.ecfr.gov/current/title-13/chapter-I/part-126/subpart-A/section-126.103).

F. Report SBIR Fraud, Waste, and Abuse

The U.S. DOT Office of Inspector General Hotline (Phone: 800-424-9071, Email: hotline@oig.dot.gov) accepts concerns and other tips from all sources about allegations of fraud, waste, abuse, and/or mismanagement in U.S. DOT programs. If an allegation of fraud, waste, abuse, and/or mismanagement pertains to the SBIR Program, then the reporting individual should indicate that the alleged fraud, waste, abuse, and/or mismanagement pertains to an SBIR solicitation or contract. Additionally, the U.S. DOT SBIR Program website contains information and links to report potential fraud, waste, abuse, and/or mismanagement: https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/report-fraud-waste-and-abuse.

G. Other Information

Executive Order (EO) 13329, Encouraging Innovation in Manufacturing, February 26, 2004

"Encouraging Innovation in Manufacturing" requires SBIR agencies, to the extent permitted by law and in a manner consistent with the mission of that department or agency, to give high priority within the SBIR Programs to manufacturing-related R&D. "Manufacturing-related" is defined as "relating to manufacturing processes, equipment and systems; or manufacturing workforce skills and protection."

The U.S. DOT SBIR Program solicits manufacturing-related projects through the call for topics distributed to each of the Department's SBIR participating agencies. Additionally, the SBA requires each agency with an SBIR program to develop a written policy on the implementation of EO 13329 as well as publish an annual report.

Energy Independence and Security Act of 2007, December 19, 2007

The Energy Independence and Security Act of 2007 (P.L. 110-140) amends the Small Business Act (15 U.S.C. Section 636(a)) to instruct the SBA Administrator to ensure that certain Federal Departments and agencies give priority to SBCs that participate in or conduct energy efficiency or renewable energy system research and development projects. U.S. DOT SBIR projects that focus on conducting R/R&D in energy efficiency and/or renewable energy are reported annually to SBA.

II. OFFER PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. Overview

This is a solicitation for Phase I R/R&D offers on advanced, innovative concepts from SBCs having strong capabilities in applied science or engineering. The Phase I R/R&D offers shall demonstrate a sound approach to the investigation of an important transportation related scientific or engineering problem categorized under one of the research topics listed in Section VIII.

An offer may respond to any of the research topics listed in Section VIII herein, but must be limited to one topic. No one offer may be accepted under more than one topic. An SBC may, however, submit separate offers on different topics, or different offers on the same topic under this solicitation. Where similar research is discussed under more than one topic, the SBC shall choose that topic which appears to be most relevant to the SBC's technical concept.

The proposed research must have relevance to the improvement of some aspect of the national transportation system or to the enhancement of the ability of an Operating Administration of the U.S. DOT to perform its mission. Offers shall be confined principally to scientific or engineering research, which may be carried out through construction and evaluation. Offers must be for R/R&D, particularly on advanced or innovative concepts.

Each offer shall be self-contained and checked carefully by the offeror to ensure compliance with all preparation instructions (see Appendix D, Offer Submission Checklist).

All offers must be submitted using U.S. DOT's SBIR online submittal page: https://usg.valideval.com/teams/usdot_2023/signup.

B. Solicitation Requirements

The following requirements must be met by the submission deadline for the offer to be evaluated for award:

1. **SBA Company Registry Confirmation** – Each SBC applying to the SBIR program is required to complete its registration in SBA's Company Registry (http://sbir.gov/registration) prior to submitting its application. At a minimum, registration requires Unique Entity ID (UEI) and employer identification (EIN) numbers. Completed registrations will receive a unique SBC Control ID and PDF file, which should be submitted as the first page in the Technical Section of the Offer.

2. **Submission of Offer** – Offers must be submitted using the U.S. DOT SBIR Program's electronic submission process during open solicitation periods only. Offers must be complete, accurate and submitted as four separate files.

    a. **Technical Section** – The technical section must be submitted in PDF format in accordance with the following requirements:

        i. The technical section shall not exceed 15 pages. Any information over the 15-page limit may not be considered and could adversely affect the offer evaluation. A Table of Contents, the SBA Company Registry Confirmation, and Prior Phase II Awards do not count toward the 15-page limit.

        ii. Font size shall be no smaller than 10-point.

        iii. Offers shall be on standard letter size pages (8.5" by 11").

        iv. All pages should be numbered consecutively.

    b. **Appendices A and B** – Appendix A: Signature Page and Appendix B: Project Summary must be submitted as a PDF file, which does not count toward the 15-page limit for the technical section.

    c. **Appendix C: Contract Pricing Worksheet** – The Contract Pricing Worksheet should be submitted as an Excel file. This section does not count toward the 15-page limit for the technical section. SBCs **must** use the template provided by the U.S. DOT SBIR Program Office in order to be considered responsive.

    d. **Contract Pricing Worksheet Supporting Documentation** – Supporting documentation for Appendix C: Contract Pricing Worksheet must be submitted as a PDF file, and include the required supporting information described on page 15 of this Solicitation and in Appendix C. This section does not count toward the 15-page limit for the technical section. There is no limit on the number of pages for the Contract Pricing Worksheet Supporting Documentation.

3. **Offer File Names** – Offer file names for each of the four separate files must include the following:

    a. The first three characters must be the topic number that the offer is associated with (e.g., FH2).

    b. The remaining characters must include an abbreviation of the company's name and a distinct character to designate each file (e.g., 1, 2, 3, and 4).

4. **Offer Submission Deadline** – Offers must be received no later than **3:00 p.m. ET on Tuesday, March 7, 2023,** through U.S. DOT's automated proposal website at https://usg.valideval.com/teams/usdot_2023/signup. Offers received after this time will be automatically rejected; no exceptions will be permitted. Please be aware that the submittal process requires answering several questions; be sure to allow ample time to complete the multi-step submittal process. Offers shall not be considered received by the Government until this multi-step process is complete. Offerors are encouraged to submit their offers as early as possible.

5. **Duplicate Offers** – Offers shall only be submitted through the U.S. DOT's automated proposal website. No duplicate offers shall be sent by any other means. An offer may respond to any of the research topics listed in Section VIII herein, but must be limited to one topic. No one offer may be accepted under more than one topic. An SBC may, however, submit separate offers on different topics, or multiple separate offers on the same topic under this solicitation. **Note: To submit more than one offer in the proposal website, please add the topic number at the end of the company name in the 'Team Name' field (e.g., Small Business, Inc. – FH1). This will create a new profile for each offer. If submitting two or more offers under the same topic, please add "a", "b", etc. respectively after the topic number to each Team Name. (e.g., Small Business, Inc. – FH2a).**

6. **Specific Instructions for the Four Separate Offer Files**

Technical Section (PDF)

Includes SBA Registry Confirmation, Technical Section, and Prior Phase II Awards.

SBA Company Registry Confirmation (does not count toward the 15-page limit) *Page 1 of PDF*	All SBIR applicants are required to be registered in SBA's company registry database. The confirmation page from registering in the database should be included as the first page of the Technical Section. It does not count towards the 15-page limit. See https://www.sbir.gov/registration to register or print your registration confirmation.
Technical Section (not to exceed 15 pages)	Submitted offers are encouraged to have a Table of Contents (which does not count toward the page limit). Offers must include the following headings in bold (in cases where a section does not apply, please state "Not Applicable"): 1. **Identification and Significance of the Problem or Opportunity.** State the specific technical problem or innovative research opportunity addressed and its potential benefit to the national

	transportation system. 2. **Phase I Technical Objectives.** State the specific objectives of the Phase I R/R&D effort; including the technical question(s) the research seeks to answer to determine the feasibility of the proposed approach. 3. **Phase I Work Plan.** Describe the Phase I R/R&D plan. The plan shall indicate what will be done, where it will be done, when it will be done, and how the R/R&D will be managed or directed and carried out. Phase I R/R&D shall address the objectives and the question(s) cited above in No. 2. Discuss in detail the methods planned to achieve each objective or task, including the level of effort associated with each task. 4. **Related Research or R&D.** Describe significant R/R&D that is directly related to the offer including any R/R&D conducted by the project manager/principal investigator or by the proposing firm. Describe how related research affects the proposed effort, and any planned coordination with outside sources. The SBC must persuade reviewers of its awareness of recent, key R/R&D conducted by others in the specific topic area. 5. **Key Personnel and Bibliography of Directly Related Work.** Identify key personnel involved in Phase I including related education, experience, and bibliographic information. Where vitae are extensive, summaries that focus on the most relevant experience or publications are desired and may be necessary to meet page limitation. 6. **Relationship with Future Research and Development.** State the anticipated results of the proposed approach if the project is successful (Phase I and Phase II). Discuss the significance of the Phase I effort in providing a foundation for a Phase II R/R&D effort. 7. **Facilities.** Provide a detailed description of the availability and location of instrumentation and physical facilities proposed for Phase I. 8. **Subcontractors/Consultants.** Involvement of consultants in the planning and research stages of the project is permitted. Describe any intended consultant involvement in detail. For Phase I, a maximum of one-third of the research or analytical effort, measured in total contract dollars using simple math, may be performed by subcontractors/consultants. 9. **Potential Post Applications.** Briefly describe whether and how the proposed project appears to have (1) potential commercial

	application; and (2) potential use by the Federal Government. 10. **Similar Offers and/or Awards.** While it is allowed, with notification, to submit identical offers or offers containing a significant amount of essentially equivalent work for consideration under numerous federal program solicitations, **it is unlawful to enter into funding agreements requiring essentially equivalent effort**. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award. If an SBC elects to submit similar or identical offers containing equivalent work under other Federal program solicitations, a statement must be included in each offer indicating: • The name and address of the agencies to which offers were submitted or from which awards were received; • Date of offer submission or date of award; • Title, number, and date of SBIR Program solicitations under which offers were submitted or awards received; • The applicable research topics for each SBIR offer submitted or award received; • Titles of research projects; • Name and Title of Principal Investigator or Program Manager for each offer submitted or award received. 11. **Human Factors**. Research that involves human subjects may be subject to additional regulations found in 49 C.F.R. Part 11 (Part 11) as well as other applicable federal and state laws and regulations. Research will be considered to involve human subjects under Part 11 if the research obtains (1) data through intervention or interaction with an individual(s), and/or (2) identifiable private information. Unless exempt under 49 C.F.R. §11.104, human subject research must adhere to the regulations of Part 11, which includes review and approval of the research by a federally approved Institutional Review Board (IRB). Due to the short timeframe associated with Phase I of the SBIR process, the DOT does not recommend the submission of Phase I offers that require the use of Human Subjects Testing. For more information, visit the FAQ at https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs.
Prior SBIR Phase II Awards *(does not count toward the 15-page limit)*	If the SBC has received more than a total of 15 Phase II awards in the prior five fiscal years, submit the name of the awarding agency, date of award, funding agreement number, dollar amount, topic or subtopic title, follow-on agreement dollar amount, source and date of commitment, and current commercialization status for each Phase II. Provide the name and

	title of the project manager or principal investigator for each offer submitted or award received.

Appendices A and B (PDF)

Signature Page (Appendix A – page 1 of PDF)	Complete the signature page in Appendix A. The "topic title" block is to list the topic name as shown in this solicitation. The "offer title" block should be the name given to the offeror's proposed solution and should differ from the topic title block. Sign and date in blocks where indicated; the date used should be the date the offer is submitted to the Government.
Project Summary (Appendix B - page 2 of PDF)	Complete the Project Summary Sheet in Appendix B. The Project Summary of successful offers may be published by U.S. DOT and, therefore, must not contain classified or proprietary information. The Project Summary must include at a minimum: 1. A technical abstract with a brief statement of the problem or opportunity, project objectives, and description of the effort. a. The technical abstract shall be prepared in accordance with the instructions on the Appendix B Project Summary sheet, e.g., word limit using space on form, no proprietary/classified information. 2. Anticipated results and potential applications of the proposed research.

Appendix C: Contract Pricing Worksheet (Excel)

The required Appendix C template is available on our website in Microsoft Excel format.	A Phase I Contract Pricing Worksheet must be submitted using the template provided. SBCs must use the template provided by DOT. Some cost breakdown items of Appendix C may not apply to the proposed project. If such is the case, there is no need to provide information for each and every item. When completing your cost offer, please consider the following: • It is important to provide enough information to allow the U.S. DOT to understand how the SBC plans to use the requested funds if an award is made. • Phase I contract awards may include profit. Note: FFP purchase orders are the type used for Phase I SBIR awards. • Travel is allowable, however, unusual, for Phase I projects.

	• The SBC must note its EIN and UEI numbers in Appendix C, in the Contract Pricing Worksheet Coversheet. The UEI is assigned through SAM.gov (See III (D) below). If you are not able to receive a UEI number before the solicitation deadline, please indicate "Pending" in the UEI field of Appendix C. • If you have any trouble accessing the Appendix C spreadsheet, please contact the U.S. DOT SBIR Program Office via email at dotsbir@dot.gov no later than March 1, 2023. • Offers that exceed the Phase I Estimated Award Amount listed in Section VIII will not be considered for award.

Contract Pricing Worksheet Supporting Documentation (PDF)

See the first two tabs of Appendix C for instructions and further examples of supporting documentation.	Supporting documentation for the costs and pricing proposed in Appendix C must be submitted as a separate file in PDF format. Supporting documentation is required for **all** costs proposed (e.g., material quotes, subcontractor proposals, indirect rate calculations, etc.).

7. Specific Instructions for Pitch Deck

PITCH DECK (FOR INVITED OFFERORS ONLY)
Not part of the initial offer submission.

Pitch Deck (not to exceed 15 slides)	Upon invitation only and separate from the initial submission, offerors invited to Pitch Day must submit a pitch deck in MS PowerPoint or PDF via email to the SBIR Program Office (dotsbir@dot.gov) no later than 3 business days prior to the event. There is no set format for the slide content. Pitch deck slides are not to be submitted with the initial offer and will not be considered.

C. Other Information

1. **Offer Handling.** Offers will be available only to Government employees in the U.S. DOT team of engineers and/or scientists responsible for evaluating the offer, the U.S. DOT SBIR Program Office, and/or Volpe Center staff pertinent to the SBIR program.

The Government reserves the right to have different evaluators participate in Pitch Day.

2. **Fraudulent Information**. Submitting plagiarized information and/or false information pertaining to the company, the principal investigator and/or work to be performed may result in:

    a. An offer being deemed non-responsive;

    b. A recommendation for Phase I award being rescinded;

    c. Termination of an award; or

    d. Possible referral to the Suspension and Debarment authority for review and action.

3. **Technical and Business Assistance (TABA).** The SBIR Program Policy Directive permits an agency to provide TABA to an SBIR awardee. For the U.S. DOT, this amount shall be up to and not exceed $6,500 for Phase I awards. This amount is in addition to the award amount for Phase I awards.

    The purpose of TABA, as defined by the SBA Policy Directive, is to assist SBIR awardees in: (1) making better technical decisions on SBIR projects; (2) solving technical problems that arise during SBIR projects; (3) minimizing technical risks associated with SBIR projects; and (4) commercializing the SBIR products or processes.

    A U.S. DOT SBIR awardee can receive support through TABA in one of two ways:

    a. The U.S. DOT SBIR Program Office has a Blanket Purchase Agreement (BPA) with Foresight Science & Technology Incorporated (34 Hayden Rowe St., Hopkinton, MA) that can provide support to Phase I and Phase II awardees. Once an offer is recommended for award, the prospective awardee will receive notification from the U.S. DOT SBIR Program Office identifying the services available and guidance on how to obtain these services at no cost to the small business.

        These services for Phase I include a kick-off meeting with the TABA vendor and an individualized Commercialization Readiness Assessment report to support the development of the Phase II proposal's commercialization strategy,

        OR

    b. Awardees can receive assistance in an amount not to exceed $6,500 not using the BPA of the SBIR Program Office. To do so, an awardee must, through its own efforts, obtain a vendor to provide TABA services.

If recommended for award, the SBIR Program will contact the awardee and require them to provide an outline of the specific services its proposed vendor will provide and the detailed qualifications and experience of the proposed vendor, as well as pricing information. This information should not be included in the initial offer, the pitch deck (if selected for pitch day), or the Appendix C contract pricing worksheet.

4. **National Institute of Standards and Technology (NIST)/Hollings Manufacturing Extension Partnership (MEP).** An SBC may wish to contact its local NIST Hollings MEP for manufacturing and other business-related support services. The MEP works with small and mid-sized companies to help them create and retain jobs, increase profits, and save time and money. The nationwide network provides a variety of services, from business development assistance to innovation strategies to process improvements and the identification of commercialization opportunities. MEP is a nationwide network of locally managed extension centers with over 1,400 technical experts, located in every state. To contact an MEP center, call 1-800-MEP-4-MFG (1-800-637-4634) or visit MEP's website at http://www.nist.gov/mep.

D. System for Award Management (SAM)

Any business that seeks to work with the Federal Government under a FAR-based contract is mandated to register in SAM before being awarded a contract. It is recommended that such business register in SAM before submitting an offer as some items in SAM are due at the time of or before offer submission. Additional information on SAM and the registration process is provided on the SAM website at: https://sam.gov/content/home. A UEI number is also provided through SAM. More information on the UEI can be found at: https://www.gsa.gov/about-us/organization/federal-acquisition-service/office-of-systems-management/integrated-award-environment-iae/iae-systems-information-kit/unique-entity-identifier-update.

III. METHOD OF SELECTION AND EVALUATION CRITERIA

A. Basis of Award

All Phase I offers will be evaluated and judged on a competitive basis. Initially, all offers will be screened to determine responsiveness to the solicitation. All non-responsive offers will be rejected by the Government and will not be further evaluated.

Each offer will be judged on its own merit. A Phase I contract award will be made to the responsive and responsible SBC(s) whose offer provides the best value to the Government, based on the technical and scientific merit of the offer. **The U.S. DOT is under no obligation to fund any offer or any specific number of offers on a given topic. For any given topic, the U.S. DOT reserves the right to award more or less than the anticipated quantity of awards stated in Section VIII, and to make no awards under a given topic.**

B. Phase I Evaluation Criteria

Offerors will be evaluated based on the criteria outlined below. Selections will be based on best value to the Government considering the following criteria, which are listed in descending order of importance. Details of what are considered within each criteria are included below.

Technical Merit & Feasibility	Demonstration of understanding of the problem and solution alignment with the topic description; innovative approach; scientific feasibility
Experience, Qualifications, and Facilities	Description of technical personnel; equipment and facilities; and partnerships/subcontracts (when applicable)
Effectiveness of Proposed Work Plan	Clarity of technical plan and timeline
Commercial Potential	Market understanding and awareness of regulatory, compliance, or legal issues
Offer Quality	Quality of narrative and supporting evidence

C. Offer Responsiveness Review

Each offer will be examined to determine if it is complete and contains adequate technical data. **An offer that does not meet the requirements of the solicitation as described in Section II.B may be excluded from further consideration.**

D. Evaluation and Selection of Awardees

Responsive offers will be evaluated in a two-step process in order to reduce the time from submission to selection and award.

1. Each responsive offer will be evaluated against the evaluation criteria described in Section III.B. After evaluations are complete, the most favorably rated offers within each topic may be invited by the Government to move on to the next evaluation step, Pitch Day, and have an opportunity to be considered for award. The Government reserves the right to not extend a Pitch Day invitation to Offerors recommended for award after this first step in the evaluation process, and instead proceed directly to award. At the time the Government identifies the offerors that will participate in Pitch Day, all offerors will be notified of their evaluation status. Offerors invited to Pitch Day will receive instructions on how to prepare a short (15-slide maximum) Pitch Deck to present at the event.

2. The most favorably rated offers from step 1 may be invited to attend a virtual Pitch Day event on or around May 8-11, 2023. At Pitch Day, offerors will have no more than 15 minutes (timed) to present their Pitch Decks to the team of Government evaluators, with an additional 15 minutes (timed) to respond to Government Q&A on the presented pitch.

   It is recommended that no more than three individuals attend Pitch Day, and no more than five shall be permitted. Further logistical information will be made available closer to the event.

   Pitches will be evaluated against the evaluation criteria described in Section III.B independently of the initial offer. Once Pitch Day evaluations are complete, all Pitch Day offerors will be notified of the offers that the Government is recommending for award. At this time, the U.S. DOT SBIR Program Office will also post a listing of all Phase I offers recommended for award on the U.S. DOT SBIR Program webpage: http://www.volpe.dot.gov/sbir.

E. Time to Award Requirements

The SBIR Program Policy Directive requires all SBIR agencies to make Phase I awards within 180 days after the close of the solicitation.

The U.S. DOT SBIR Program Office intends to make recommendations for SBIR Phase I awards no later than 90 days after the closing date of this solicitation. If circumstances are such that notification to each applicant cannot be met within 90 days after the solicitation closing date, the U.S. DOT SBIR Program shall notify each applicant as soon as practicable.

F. Debriefing Requests

Each offeror will have an opportunity to access a written debriefing regarding the evaluation of its offer. Debriefings will be available electronically via the offer submission website. Debriefing information will consist of a summary of ratings across all evaluation criteria and may include comments received by the Government evaluators. The identity of the evaluators will not be disclosed. Debriefings will be available as follows:

Offerors who do not advance on to Pitch Day may access its written debriefing within ten (10) calendar days from the notification from the Government. If there is no response from the SBC within these ten (10) calendar days, the debriefing shall close without further notice. Offerors who do advance on to Pitch Day may access feedback regarding its offer within ten (10) calendar days from the notification from the Government, and will also receive information regarding Pitch Day.

Within ten (10) calendar days after Pitch Day, Offerors who have participated in Pitch Day will be notified of its award recommendation status. Once notified, Offerors will have ten (10) calendar days to access the debriefing. If there is no response from the SBC within these ten (10) calendar days, the debriefing shall close without further notice.

IV. CONSIDERATIONS

A. Funding Awards

The Government anticipates awarding a total of ten Phase I awards among all the topics identified in this solicitation, but reserves the right to make fewer, more, or no awards if it is in the best interest of the Government. The actual number of contract awards is subject to the availability of funding and the responses from small business firms to the solicited research topics described in Section VIII.

1. **Dollar Value of Awards**. The U.S. DOT SBIR Program has set the maximum thresholds for Phase I and Phase II awards at $200,000 and $1,500,000, respectively.

    a. **Phase I Awards**. Phase I is the conduct of feasibility-related experimental or theoretical research or R/R&D efforts on research topics described herein. For the U.S. DOT SBIR Program, Phase I offers can be funded up to $200,000 unless otherwise noted in Section VIII. The period of performance of the resulting contract shall be six months. The basis for award is the scientific and technical merit of the offer, its commercial potential, and its relevance to U.S. DOT requirements and current research priorities. The U.S. DOT intends to award Firm-Fixed-Price (FFP) purchase orders utilizing FAR Part 13 Simplified Acquisition Procedures. A purchase order is an offer by the Government to buy supplies or services, including research and development, upon specified terms and conditions (in this instance, this solicitation and the contractor's offer). The U.S. DOT will require written acceptance of the purchase order by the SBC at the time of award via the SBC signing the purchase order thus creating a binding contract between the SBC and the Government. Award of a bilaterally signed purchase order is subject to the availability of funding.

    All U.S. DOT SBIR Phase I awardees who have successfully completed Phase I are eligible to submit a Phase II proposal for evaluation and possible selection for award.

    b. **Phase II Awards**. The objective of Phase II is to continue the R/R&D effort from the completed Phase I. Award of a contract for a Phase II effort is based on the results of Phase I, the scientific and technical merit of the Phase II proposal, and the commercial potential of the proposed Phase II project. Commercial potential includes the capability to transition the technology to private sector applications, Government applications, or Government contractor applications. For the U.S. DOT SBIR Program, contracts for Phase II proposals can be funded up to $1,500,000 (except where a lower ceiling is specifically identified) and can have a period of performance of up to 24 months from the date of contract award. The

Government is not obligated to fund any specific Phase II proposal.

The U.S. DOT typically awards Firm-Fixed-Price (FFP), FFP-Level-of-Effort (FFPLOE), or Cost-Plus-Fixed-Fee (CPFF) negotiated contracts for Phase II efforts utilizing FAR Part 15 Contracting by Negotiation procedures. Approximately 30 days prior to the end of Phase I efforts, the U.S. DOT SBIR Program Office will provide Phase I contract awardees details on the due date, content, submission requirements, and evaluation criteria for Phase II proposals. A summary of Phase II proposal submission requirements can be found on the U.S. DOT's SBIR website at: https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/submit-proposal.

If invited by the Government, a Phase II awardee may receive one additional, sequential Phase II award to continue the work of an initial Phase II award.

2. **Phase II Contract Type and Accounting System Audits.** The Contracting Officer will consider whether a FFPLOE, CPFF, or other contract type is appropriate for each Phase II award. Phase II awardees MUST have an accounting system that is adequate for determining costs applicable to the contract or order to receive a cost type contract.

B. Reports

Under Phase I SBIR efforts, three (3) reports will be required, consisting of two (2) interim narrative reports, and a comprehensive final report. These reports are due at two-month intervals starting at the end of month two. An acceptable report is one that is comprehensive and describes all efforts and progression made on the R&D from the start of the funding agreement through the report submitted time.

C. Payment Schedule

The SBC may invoice for three partial payments for Phase I awards based on the SBC's delivery of, and the Government's acceptance of, each report. The SBC must ensure invoices are submitted in accordance with instructions in the award document, in conjunction with or after the submission by the SBC of an acceptable report(s) as described in above Paragraph B. Invoices submitted before submission of a due report will be rejected until the Phase I awardee submits an acceptable report.

Contracts for Phase II, and/or III will allow for incremental payments to the successful SBC as work progresses dependent on the negotiated contract type, invoice/payment contract requirements, and/or payment schedule incorporated into the contract.

D. Innovations, Inventions, and Patents

1. **Proprietary Information.** Information contained in unsuccessful offers will remain the property of the SBC. The Government will, however, retain copies of all offers. Public release of information in any offer submitted will be subject to existing statutory and regulatory requirements.

   The U.S. DOT prefers that SBC offers avoid the inclusion of proprietary data. If the inclusion of proprietary data is considered essential for meaningful evaluation of an offer it must adhere to the terms explained in this paragraph IV.D.

   If proprietary information is provided by a SBC in an offer that constitutes a trade secret, or commercial or financial information, it will be treated in confidence, to the extent permitted by law, provided the offer is clearly marked by the SBC as follows:

   The following legend must appear on the title page of the offer:

   > "This offer contains information that shall not be disclosed outside the Federal Government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than evaluation of this offer, unless authorized by law. The Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract if award is made as a result of the submission of this offer. The information subject to these restrictions are contained on all pages of the offer except for pages [*insert page numbers or other identification of pages that contain no restricted information*.]
   >
   > (End of Legend)"; and,

   The following legend must appear on each page of the offer that contains information the SBC wishes to protect:

   > "Use or disclosure of information contained on this sheet is subject to the restriction on the title page of this offer."

2. **Rights in Data Developed under SBIR Funding Agreements.** Rights in technical data, including software developed under any award resulting from this solicitation, shall remain with the SBC except that the Government shall have the limited right to use such data for Government purposes and shall not release such data outside the Government without permission of the SBC for a period of twenty years from the award date of the Phase I project from which the data was generated. However, effective at the conclusion of the twenty-year period, the Government shall retain a royalty free license for Federal Government use of any technical data delivered under an SBIR contract whether patented or not.

3. **Copyrights**. With prior written permission of the Contracting Officer, the SBC may copyright and publish (subject to and consistent with appropriate national security considerations, if any) material developed with U.S. DOT support. The U.S. DOT receives a royalty free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.

4. **Patents/Invention Reporting**. SBCs may retain the principal worldwide patent rights to any invention developed with Government support. The Government receives a royalty free license for Federal Government use, reserves the right to require the patent holder to license others in certain circumstances, and requires that anyone exclusively licensed to sell the invention in the United States must manufacture it domestically. To the extent authorized by 35 U.S.C. 205, the Government will not make public any information disclosing a Government-supported invention for a two-year period to allow the SBC a reasonable time to pursue a patent.

5. **Invention Reporting Process**. Awardees shall report SBIR inventions to the U.S. DOT through the iEdison Invention Reporting System (http://www.iedison.gov/). Use of the iEdison System satisfies all invention reporting requirements mandated by any award.

E. Cost Sharing

The U.S. DOT permits cost sharing for its Phase II efforts under the topic areas identified in this solicitation; however, cost sharing is not required nor is it a factor in evaluation of offers. Cost Sharing is not applicable to Phase I offers or awards.

F. Profit

A profit is allowed on awards to SBCs under the U.S. DOT SBIR Program consistent with the Federal Acquisition Regulations.

G. Joint Ventures or Limited Partnerships

Joint venture (JV) and limited partnerships are permitted to submit offer(s) to this solicitation provided the entity created qualifies as a SBC in accordance with the Small Business Act, 15 U.S.C. 632, and the definition of SBC included in this solicitation (Paragraph I.E). JVs must be properly registered in SAM as a JV prior to receiving an award. As this can be a time-consuming process, if offering as a JV, working with SAM to get the registration done before offer submission is highly recommended.

H. Research and Analytical Work

1. For Phase I, a minimum of two-thirds of the research or analytical effort, measured in

total contract dollars using simple math, must be performed by the awardee (i.e., 66.7% of total contract cost must be for other than subcontractor/consultant costs).

2. For Phase II, a minimum of one-half of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 50% of total contract cost must be for other than subcontractor/consultant costs).

I. Awardee Commitments

Upon award of a U.S. DOT SBIR contract, the SBC will be required to make certain legal commitments through acceptance of FAR and Transportation Acquisition Regulation (TAR) clauses, and other Government requirements. The FAR and TAR may be found using the following links:

- FAR: https://www.acquisition.gov/browse/index/far
- TAR: https://www.acquisition.gov/tar

The Summary Statements that follow are illustrative of the types of clauses to which the SBC would be committed. This list does not represent a complete list of clauses to be included in Phase I awards and does not provide the specific wording of such clauses. A complete copy of the terms and conditions will be provided upon issuance of the contract for signature prior to award.

J. Summary Statements

1. **Standards of Work.** Work performed under all SBIR efforts must conform to high professional standards.

2. **Inspection.** Work performed under all SBIR efforts are subject to Government inspection and evaluation.

3. **Default.** The Government may terminate the funding agreement if the Contractor fails to adhere to its terms.

4. **Termination for Convenience.** The Government may terminate the funding agreement if the Government deems termination to be in the Government's best interest. In such case, the Contractor may submit its costs for work performed and for reasonable termination costs.

5. **Disputes.** Any dispute concerning the funding agreement which cannot be resolved by agreement shall be decided by the Contracting Officer with right of appeal in accordance with the Contracts Disputes Act of 1978, 41 U.S.C. 71.

6. **Certain Telecommunications and Video Surveillance Services or Equipment.** Work performed under all SBIR efforts will require certification by an Awardee as to its use of and/or delivery of covered telecommunications equipment/services and compliance with any restrictions/prohibitions based on that certification. The offeror shall review a list of excluded parties in SAM for entities excluded from receiving federal awards for "covered telecommunication equipment or services" as specifically prohibited by Section 889 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Pub. L. 115-232).

7. **Equal Opportunity.** The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin.

8. **Equal Opportunity for Veterans.** The Contractor shall not discriminate against any qualified employee or applicant for employment because he or she is a disabled veteran, recently separated veteran, active-duty wartime or campaign badge veteran, or Armed Forces service medal veteran.

9. **Equal Opportunity for Workers with Disabilities.** The Contractor shall not discriminate against any qualified employee or applicant for employment because he or she is physically or mentally disabled.

10. **Officials Not to Benefit.** No Government official must benefit personally from the SBIR funding agreement.

11. **Gratuities.** The Government may terminate the funding agreement if any gratuity is or was offered to any representative of the Government to secure the award.

12. **Patent/Copyright Infringement.** The Contractor shall report each notice or claim of patent or copyright infringement based on the performance of the funding agreement to the SBIR Program Contracting Officer.

13. **Procurement Integrity.** Submission of an offer under this solicitation subjects the Offeror to the "Restrictions on Obtaining and Disclosing Certain Information" (41 U.S.C. §2101-2107, commonly known as the Procurement Integrity Act). This statute, as implemented by FAR (48 C.F.R. §3.104), prohibits the following conduct during an agency procurement: prohibits federal employees and certain Government contractors involved in federal procurements from **disclosing** contractor bid or proposal information or source selection information (§2102); prohibits any individual from obtaining contractor bid or proposal information or source selection information prior to award (§2102); requires agency officials to **report employment contacts** regarding non-Federal employment (§2103); and bans for a definitive period certain personnel from accepting compensation from the vendor and the vendor from compensating such certain personnel

during this definitive period (§2104). Violations of the statute may result in criminal and/or civil penalties, and administrative actions (e.g., suspension and debarment, cancellation of the procurement, and/or rescission of the contract).

14. **Section 508 Access Board Standards**. All information and communication technology (ICT) deliverables rendered under this contract must comply with the Revised Section 508 Standards of the Rehabilitation Act and the Access Board Standards, available for viewing at https://section508.gov/. For purposes of Revised Section 508 compliance, the definition of ICT includes information technology and other equipment, systems, technologies, or processes, for which the principal function is the creation, manipulation, storage, display, receipt, or transmission of electronic data and information, as well as any associated content. ICT acquired by a contractor incidental to this contract shall not be required to conform to the Revised 508 Standards. Unless otherwise indicated, the contractor represents by signature on a contract or order that all deliverables will comply with the Access Board Standards.

15. **Government Property**. Materials, equipment, special tooling, and special test equipment either furnished by the Government or, in a cost type contract, acquired or fabricated by the contractor, is subject to FAR clause 52.245-1 Government Property and may also be subject to special clauses specific to certain items of property.

16. **American Made Equipment and Products**. When purchasing equipment or products under an SBIR funding agreement, purchase only American-made items whenever possible.

K. Additional Information

1. This solicitation reflects current planning. Although not expected, there may be inconsistencies between the information contained in the FY 2023 solicitation and the terms and conditions of any resulting SBIR contract. The terms and conditions of the contract once executed are controlling.

2. The SBC shall complete an Online Representations and Certifications Application at https://sam.gov/content/home. The SBC should be certified in the designated North American Industry Classification System (NAICS) code (541715) of this solicitation. The size standard of NAICS code 541715 for the SBIR program is 500 employees.

3. The Government may request the SBC to submit additional management, personnel, and financial information in order for the Government to consider and determine the responsibility of the SBC.

4. The Government is not responsible for any monies expended by the SBC before award of any contract.

5. This solicitation is not an offer by the Government and does not obligate the Government to make any specific number of awards. Also, awards under this program are contingent upon the availability of funds.

6. The U.S. DOT SBIR Program is not a substitute for existing unsolicited offer mechanisms. Unsolicited offers shall not be accepted under the U.S. DOT SBIR Program for either Phase I or Phase II efforts. For information pertaining to submission requirements for unsolicited offers please refer to the U.S. DOT's Guidelines for Unsolicited Proposal Submission at https://www.volpe.dot.gov/work-with-us/guidelines-unsolicited-proposal-submission.

V. SUBMISSION OF OFFERS

Offers must be received no later than **3:00 PM ET on Tuesday, March 7, 2023,** through the U.S. DOT's automated proposal website at https://usg.valideval.com/teams/usdot_2023/signup.

Offers received after that time will be automatically rejected; no exceptions will be permitted. Please be aware that the submittal process requires answering several questions; be sure to allow ample time to complete the multi-step submittal process. Offers will not be considered received by the Government until this multi-step process is complete. Offerors are encouraged to submit their offers as early as possible.

VI. SCIENTIFIC AND TECHNICAL INFORMATION SOURCES

The following publications and websites are referenced in the research topics found in Section VIII.

A. Federal Highway Administration (FHWA)

23-FH1: Addressing Stormwater Runoff with a Self-Contained Portable Treatment System

- FHWA's Resiliency Research & Technology Portfolio: https://highways.dot.gov/research/rtportfolio/environment-resiliency

23-FH2: Traffic Monitoring and In Situ Information Processing Using Edge Computing

- FHWA Traffic Monitoring Guide: https://www.fhwa.dot.gov/policyinformation/tmguide/tmg_2013/vehicle-types.cfm

B. Federal Railroad Administration (FRA)

23-FR1: Concrete Crosstie Inspection Technology

- International Concrete Crosstie and Fastening Systems Survey: https://railroads.dot.gov/elibrary/international-concrete-crosstie-and-fastening-system-survey
- Improved Concrete Crosstie and Fastening Systems for US High Speed Rail and Joint Corridors Volume I Project Summary Report: https://railroads.dot.gov/elibrary/improved-concrete-crosstie-and-fastening-systems-us-high-speed-passenger-rail-and-joint
- Understanding the Splitting and Bursting Failure of Concrete Crossties: https://railroads.dot.gov/elibrary/understanding-splitting-and-bursting-failure-concrete-crossties
- A Study of Environmental and Track Factors that Contribute to Abrasion Damage of Concrete Ties: https://railroads.dot.gov/elibrary/study-environmental-and-track-factors-contribute-abrasion-damage-concrete-ties

23-FR2: Novel Design for Passenger Railcar Glazing Securement

- 49CFR238.113: https://www.ecfr.gov/current/title-49/subtitle-B/chapter-II/part-238/subpart-B/section-238.113
- 49CFR238.114: https://www.ecfr.gov/current/title-49/subtitle-B/chapter-II/part-238/subpart-B/section-238.114

C. National Highway Traffic Safety Administration (NHTSA)

23-NH1: Reduction of Transit Bus Collisions with Other Vehicles

- Annual Modal Research Plan: National Transit Database (NTD) Data: https://www.transit.dot.gov/ntd/ntd-data

23-NH2: Immersive Virtual Reality Training on Impaired Driving for Law Enforcement

No references.

D. Pipeline and Hazardous Materials Safety Administration (PHMSA)

23-PH1: Bioremediation for Hazardous Material Spills

No references.

23-PH2: Integrated RFID Trackers and Sensors for Hazardous Material Communication in Transportation

- HMR; 49 CFR 172.300: https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-C/part-172/subpart-D/section-172.300
- HMR; 49 CFR 172.400: https://www.ecfr.gov/current/title-49/subtitle-B/chapter-I/subchapter-C/part-172/subpart-E/section-172.400

23-PH3: Portable State-of-Charge Sensor for Lithium Batteries

- SOC Monitoring: https://www.pnas.org/doi/full/10.1073/pnas.1917172117

23-PH4: Wearable PPE-integrated Sensors for First Responders

- Wearable Sensing Technology Applications in Construction Safety and Health: https://ascelibrary.org/doi/10.1061/%28ASCE%29CO.1943-7862.0001708
- Permissible Exposure Limits: https://www.osha.gov/annotated-pels/table-z-1

VII.SUBMISSION FORMS AND CERTIFICATION (APPENDICES)

A. Offer Signature Page (Appendix A)

PDF version of Appendix A (page 1 of PDF) is available on U.S. DOT's SBIR website. A sample is provided in this solicitation document.

B. Project Summary (Appendix B)

PDF Version of Appendix B (page 2 of PDF) is available on U.S. DOT's SBIR website. A sample is provided in this solicitation document.

C. Contract Pricing Worksheet (Appendix C)

MS Excel Version of Appendix C is available on U.S. DOT's SBIR website.

D. Offer Submission Checklist (Appendix D)

(Do not include with offer – for offeror's use only)

A. Offer Signature Page (Appendix A)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G623QSBIR1, FY 2023
SIGNATURE PAGE

Offer Information		
Topic No. (see Solicitation):	Solicitation No.: 6913G623QSBIR1	
Topic Title:		
Offer Title:		
Company Information		
Company:		
Address:		
City:	State:	Zip:

Offeror Certification	
By signing belowand submitting this offer in response to Solicitation No. 6913G623QSBIR1, Topic Number_, I(We) am(are) representing on my(our) own behalf, and on behalf of the SBIR applicant, that the information provided in this certification, the application, and all other information submitted in connection with this application, is true and correct as of the date of submission. I acknowledge that any intentional or negligent misrepresentation of the information contained in this certification may result in criminal, civil or administrative sanctions, including but not limited to: (1) fines, restitution and/or imprisonment under 18 U.S.C. § 1001; (2) treble damages and civil penalties under the False Claims Act (31 U.S.C. § 3729 *et seq.*); (3) double damages and civil penalties under the Program Fraud Civil Remedies Act (31 U.S.C. § 3801 *et seq.*); (4) civil recovery of award funds, (5) suspension and/or debarment from all Federal procurement and non-procurement transactions (FAR Subpart 9.4 or 2 C.F.R. part 180); and (6) other administrative penalties including termination of SBIR awards.	
Principal Investigator Name:	Corporate/Business Official Name:
Title:	Title:
Address:	Address:
Telephone Number:	Telephone Number:
Email:	Email:
Signature:	Signature:
Date:	Date:

B. Project Summary (Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G623QSBIR1 FY 2023
PROJECT SUMMARY

Project Summary
Abstract (Limited to two hundred words in this space only. The Project Summary of successful offers may be published by the U.S. DOT and, therefore, shall not contain classified or proprietary information.).
Anticipated Results/Potential Commercial Applications of Results.
Keywords

C. Contract Pricing Worksheet (Appendix C)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G623QSBIR1, FY 2023
CONTRACT PRICING WORKSHEET

Appendix C can be found on our website here in Microsoft Excel format. Please fill out the spreadsheets as directed in the instructions.

Additional information about the contract pricing worksheet and its requirements can be found in the Appendix C instructions in the first two tabs of the workbook and on our FAQ page (https://www.volpe.dot.gov/work-with-us/small-business-innovation-research/faqs).

If you have any questions regarding Appendix C not listed on our FAQ page, please submit such questions via email to:

U.S. DOT SBIR Program Office
dotsbir@dot.gov

All administrative and Appendix C questions must be submitted no later than 5:00 p.m. ET on Wednesday, March 1, 2023. Questions received after 5:00 p.m. ET on March 1, 2023, may not be answered. The Government reserves the right to address a late question, if the Government determines an answer is in the best interest of the Government.

D. Offer Submission Checklist (Appendix D)

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 6913G623QSBIR1, FY 2023
OFFER SUBMISSION CHECKLIST

This is a CHECKLIST OF REQUIREMENTS for your offer. Please review the checklist carefully to assure that your offer meets the U.S. DOT SBIR requirements. Failure to meet these requirements may result in your offer being returned without consideration. (See Section II.B of this Solicitation). **Do not include this checklist with your offer.**

____ 1. The offer reflects that for Phase I, a minimum of two-thirds of the research or analytical effort, measured in total contract dollars using simple math, must be performed by the awardee (i.e., 66.7% of total contract cost must be for other than subcontractor/consultant costs).

____ 2. The offer is submitted according to the requirements described in Section II.

____ 3. The offer is limited to only ONE of the research topics in Section VIII.

____ 4. The budget may be up to $200,000 *unless otherwise indicated in Section VIII of the solicitation* and duration does not exceed six months.

____ 5. The technical abstract contains no proprietary information, does not exceed 200 words, and is limited to the space provided on the Project Summary sheet (Appendix B).

____ 6. The offer contains no type smaller than ten-point font size.

____ 7. All Appendices (A, B, and C) have been completed.

____ 8. The Technical Section includes all items identified in Section II.B of the Solicitation and does not exceed 15 pages per II.B requirements.

____ 9. The additional information on prior Phase II awards, if required, in accordance with Section II.B, is included.

____ 10. The Contract Pricing Worksheet (Appendix C) has been completed and the Contract

Pricing Worksheet Supporting Documentation file provides the necessary supporting information.

____ 11. The offer must be submitted online and received by the U.S. DOT automated proposal website by **3:00 p.m. ET, March 7, 2023. Offers received via email or any other means will not be accepted. Do not send duplicate offers via email or by any other means.**

VIII. RESEARCH TOPICS

The FY 2023 Solicitation Phase I research topics for U.S. DOT Operating Administrations are listed on the following pages. These topics indicate the specific areas for which SBIR Phase I offers are to be considered for acceptance by U.S. DOT. The topics are not listed in any order of priority. Each offer submitted must respond to one (and only one) topic and/or focus area as described in this section. An offer may, however, indicate and describe its relevance to other topics. Offerors are encouraged to review Section VI of this solicitation for scientific and technical information sources that may be referenced in the respective topic descriptions.

U.S. DOT Operating Administration	Topic Number & Title	Estimated Award Amount Phase I*	Estimated Award Amount Phase II**
Federal Highway Administration (FHWA)	23-FH1: Addressing Stormwater Runoff with a Self-Contained Portable Treatment System	$150,000	$1,000,000
	23-FH2: Traffic Monitoring and In Situ Information Processing Using Edge Computing	$150,000	$1,000,000
Federal Railroad Administration (FRA)	23-FR1: Concrete Crosstie Inspection Technology	$150,000	$300,000
	23-FR2: Novel Design for Passenger Railcar Glazing Securement	$150,000	$300,000
National Highway Traffic Safety Administration (NHTSA)	23-NH1: Child Presence Detection CO2 Release Test Device	$150,000	$500,000
	23-NH2: Immersive Virtual Reality Training on Impaired Driving for Law Enforcement	$150,000	$350,000
Pipeline and Hazardous Materials Safety Administration (PHMSA)	23-PH1: Bioremediation for Hazardous Material Spills	$200,000	$1,000,000
	23-PH2: Integrated RFID Trackers and Sensors for Hazardous Material Communication in Transportation	$200,000	$1,500,000
	23-PH3: Portable State-of-Charge Sensor for Lithium Batteries	$200,000	$1,000,000
	23-PH4: Wearable PPE-integrated Sensors for First Responders	$200,000	$1,000,000

* Offers that exceed the Phase I Estimated Award Amount will not be considered for award.

**The Phase II funding level noted above is an estimate only, is subject to the availability of funds, and/or the technical requirements to accelerate the development of a commercial product and/or innovation. Any changes to the Phase II estimated funding level listed above will be communicated to the small business when instructions on the Phase II process are sent approximately 1 month prior to the end of the Phase I project.

Research topics are organized into four sections:

A. Federal Highway Administration (FHWA)

B. Federal Railroad Administration (FRA)

C. National Highway Traffic Safety Administration (NHTSA)

D. Pipeline and Hazardous Materials Safety Administration (PHMSA)

A. Federal Highway Administration (FHWA)

About Us: FHWA's Research, Technology, and Evaluation Program strives to generate new solutions, build more effective partnerships, and provide better information and tools for decision making, which will enable the nation to enhance and make the best investments in the U.S. transportation system.

23-FH1: Addressing Stormwater Runoff with a Self-Contained Portable Treatment System

Stormwater runoff emanating from our built environment has direct water quality consequences to our natural environment. Fifty years ago, the Clean Water Act established programs to manage stormwater runoff, however our nation's water resources are in poor condition with over half of our nation's assessed water ways listed as impaired or threatened. Increased urban runoff pollution coupled with aging systems earned stormwater infrastructure a letter grade of "D" on the 2021 American Society of Civil Engineers Infrastructure Report Card. Stormwater quality management is difficult and costly to address as State Departments of Transportation (DOTs) have limited right-of-way (ROW) to construct stormwater treatment controls. Cost and difficulty will only continue to become more challenging as our climate crisis evolves and produces more frequent and intense rain events.

This effort aims to develop an innovative practice within the ROW and support FHWA's Resiliency Research and Technology portfolio. Part of the Resiliency activity requires partnering with State DOTs and others to conduct research and develop demonstration projects to reduce impacts on streams, and other waters; recreation facilities, and habitat by addressing emerging stormwater pollutants. This proposal seeks to develop a mechanism to remove suspended and dissolved pollutants and other emerging stormwater pollutants from highway construction and urban stormwater runoff sources. Methods may be inspired and modeled after drinking water and wastewater treatment approaches that have been proven to be effective. The proposed technology will be developed for deployment at highway stormwater outfalls to provide treatment of pollutants just prior to discharging stormwater into receiving water bodies. The system will be developed to be safe to use, cost-effective, passive, or semi-passive, portable, easy to deploy and maintain, and self-contained. This tool may address stormwater "hotspots" of highly contaminated runoff or areas that generate pollutants of high concern such as 6ppd quinone, the tire by-product that is killing Coho salmon. The technology sought in this project aligns with the Department's research priority for Sustainable and Resilient Infrastructure. Its goal is to facilitate resilient and sustainable infrastructure development without compromising the beneficial and future uses of our water bodies.

Commercialization could lead to the development of a portable system or unit that could be easily retrofit into existing stormwater infrastructure (e.g., pipes, culverts, detention basins, etc.) to provide water quality benefits. Potential buyers may include state departments of transportations, airports, local municipalities, land developers, homeowner associations, agricultural producers, and other owners of stormwater infrastructure.

Expected Phase I Outcomes

At the conclusion of Phase I, a final report will be developed to summarize efforts in the development of the stormwater treatment technology. Phase I will culminate with a design for and/or a working scaled prototype as well as design details for a full-scale device. In addition, Phase I will be used to identify partnerships with testing/research organizations that can provide independent, third-party evaluations of the full-scale device in Phase II. A detailed SWOT analysis (looking at strengths, weaknesses,

opportunities, and threats), marketing strategy, and intellectual property protection plans, where applicable, will be developed. By the conclusion of Phase I, the developers will have a path towards a clear commercialization plan.

Expected Phase II Outcomes

Phase II may include the development of a full-scale prototype and evaluation using simulated runoff events in a controlled laboratory setting. The research and testing will determine effectiveness of the developed device using standard testing methods. Findings from testing may be used to seek inclusion in DOT approved / qualified product lists, which will create opportunities to deploy the device in highway stormwater management applications. In addition, results can be used toward marketing the performance of the device to potential buyers. This phase may also include fillings for intellectual property protection, where applicable.

23-FH2: Traffic Monitoring and In Situ Information Processing Using Edge Computing

Gaining real-time traffic monitoring information is critical to improving traffic safety and promoting economic growth through a safe and reliable transportation infrastructure system. Current traffic monitoring practices follow the FHWA Traffic Monitoring Guide and the AASHTO Guidelines for Traffic Data Programs.

Technologies deployed range from traditional pavement embedded sensors such as piezoelectric and electromagnetic loop material to above-ground sensing technologies such as video, radar, and lasers. The extensively deployed Transportation Management Centers rely on video, which is transmitted to the control center, where humans decipher information from the video. While these current technologies have enabled the monitoring of highway traffic flow conditions, additional challenges and opportunities are also revealed. The most significant challenges of the current technologies include two main issues. First, efficiently transmitting information captured by the sensor back to the control center is a significant hurdle, especially in rural areas. This challenge is especially true with video monitoring. Second, deciphering information from the data collected by various sensors with minimum human interference must be overcome. It is challenging for a single person to monitor half a dozen screens with live video feeds. These challenges present a golden opportunity to develop in situ data processing technologies using edge computing chip technologies. In other words, if data gathered by sensors were processed on-site per specifications, transmitting results back would be significantly more straightforward, and human interference would be significantly reduced.

The vision is to integrate the low-power consuming edge computing chip with the traditional traffic data sensors. Instead of sending the raw data back to control, the edge computing device will compute and analyze the raw data in situ. Once the raw data is deciphered, results will be transmitted back to control, significantly reducing the data transmission burden. In addition, it is anticipated that the edge computing chip can be coded/programmed with intelligence where human interference in the control can be significantly reduced.

The eventual deliverables are envisioned to include edge computing integrated traffic monitoring sensors and efficient in-site information extraction computer algorithm for the edge computing devices.
Shall this research endeavor be successful, it would transform the traffic monitoring practices with real commercialization. End users from the transportation industry may include Federal, State, and local highway agencies and any other industry and commerce where monitoring and information extraction are practiced.

Expected Phase I Outcomes

At the conclusion of Phase I, a final report will be developed to summarize efforts in the development of traffic monitoring and information processing. Phase I will culminate with design for and/or a working scaled prototype and as well as design details for a full-scale device. In addition, Phase I will be used to identify partnerships with testing/research organizations that can provide independent, third-party evaluations of the full-scale device in Phase II. By the conclusion of Phase I, developers should have a clear path towards commercialization.

Expected Phase II Outcomes

Phase II may include the development of a full-scale prototype outlining the highly efficient edge computing codes to decipher information. Such coding shall help to identify vehicle types, speed, crash/collision, roadway conditions such as pavement condition (dry, wet, snow, etc.) and environmental condition (fog, smoke, etc.). Continuous testing and improvements to the protype design hardware with outdoor conditions for its reliability and operability improvements will be completed as well. Such conditions should include time of day lighting differences, temperature differences, humidity differences, humidity (condensation) effects, inclement weather (wind, rain, snow, fog, icing, etc.), and device power consumption and supply needs.

At the conclusion of Phase II, a fully functional and practical integrated edge-computing and traffic sensing device with accompanying software should be ready to be fully commercialized and deployable in DOT approved / qualified product lists, which will create opportunities to deploy the device in highway stormwater management applications. In addition, results can be used toward marketing the performance of the device to potential buyers. This phase may also include fillings for intellectual property protection.

B. Federal Railroad Administration (FRA)

About Us: FRA's research, development, and technology (RD&T) mission is to ensure the safe, efficient, and reliable movement of people and goods by rail through basic and applied research, and development of innovations and solutions. Safety is U.S. DOT's primary strategic goal and thus, the principal driver of FRA's RD&T program. FRA's RD&T program also contributes to other U.S. DOT strategic goals because safety-focused projects typically yield solutions toward state of good repair, economic competitiveness, and environmental sustainability goals. The RD&T program also has an important role to play in workforce development.

FRA's RD&T program is founded on an understanding of safety risks in the industry. Hazard identification and risk analysis allows us to identify opportunities to reduce the likelihood of accidents and incidents, and to limit the consequences of hazardous events, should they occur. Key strategies include stakeholder engagement and partnerships with other researchers such as the Association of American Railroads, prioritization of projects, and conducting research through cost-effective procurement.

23-FR1: Concrete Crosstie Inspection Technology

The U.S. railroad system contains approximately 140,000 miles of track. Approximately 10% of all U.S. railroad ties are made from concrete and are used in heavy freight and passenger service tracks. These ties are typically found on higher speed passenger routes and in high tonnage lines in the freight rail industry. Many of these crossties have been in service for decades. Understanding the state of good repair of these essential track components is critical to efficiently maintaining track safety. Concrete ties can fail in many ways, including brittle fracture from overloading, a loss of pre-stressing force due to fatigue or cracks, rail seat deterioration from service, and loss of section due to abrasion from ballast. This topic seeks novel technology research and development to efficiently and effectively inspect concrete crossties installed in track.

The research challenge is to develop a non-destructive technology to assess the internal and external condition of concrete railroad crossties in track. This research supports DOT goals for improving the state of good repair, safety, and efficiency. When developed and tested, this technology will allow for quantitative assessment of the condition of these critical track components ensuring the safety of rail infrastructure and preventing the premature replacement of components.

Proposed solutions shall be non-destructive and shall provide quantitative inspection data to allow for informed decisions regarding tie condition replacement. Inspection of external tie features includes: identification of surface cracks located in the rail seat area, in the center of the tie, and at the tie ends; rail seat abrasion; identification of exposed reinforcements; presence and orientation of the rail seat pad; presence and orientation of rail insulators, rail clips, and fasteners; and, tie section depth (detection of the effects of tie abrasion in the ballast). Inspection of internal tie condition includes: assessment of the amount and location of internal cracking or voids and identification of other defects related to the bond condition between reinforcements and the concrete.

A complete solution will report external and internal crosstie feature conditions in an automated manner. FRA will consider partial solutions provided the offeror presents an approach to obtaining a more complete inspection. FRA envisions the inspection system(s) will be suitable for deployment track hy-rail vehicle operating at speeds up to 30 mph. Proposed systems must include referencing capabilities to geo-locate individual ties. Technical approaches may employ more than one technology, and FRA expects the system to complete an inspection in a single pass over each tie. These technical parameters are important to ensure the inspection technology is compatible with typical rail industry inspection methods.

The FRA e-library system contains many technical reports documenting research into concrete crosstie design, manufacturing, testing, and failure modes. A few of these reports are linked here for reference:

- International Concrete Crosstie and Fastening System Survey | FRA (dot.gov)
- Improved Concrete Crosstie and Fastening Systems for US High Speed Passenger Rail and Joint Corridors: Volume 1 – Project Summary Report | FRA (dot.gov)
- Understanding the Splitting and Bursting Failure of Concrete Crossties | FRA (dot.gov)
- A Study of Environmental and Track Factors that Contribute to Abrasion Damage of Concrete Ties | FRA (dot.gov)

Expected Phase I Outcomes

Phase I efforts shall include technology investigation, selection, and initial laboratory-level proof-of concept testing. The output from Phase 1 should be a technology development plan to progress the inspection system to a more mature level. The development plan shall include a scientifically determined rationale for the technical approach, supported by laboratory test results.

Expected Phase II Outcomes

Phase II shall progress the system development in alignment with the technology development plan. FRA expects Phase II to include field testing of a prototype system in a real or simulated environment to establish technical and operational efficacy. Phase II will produce detailed test reports and an updated technology development plan.

23-FR2: Novel Design for Passenger Railcar Glazing Securement

Glazing systems on passenger railcars serve several critical functions beyond offering passengers a view outside the car. They also serve certain safety functions: impact resistance, emergency egress, emergency access, fire resistance, and occupant containment. Rail passenger car glazing systems must perform satisfactorily under competing expectations. They must allow passengers to escape in an emergency scenario. They also must allow emergency personnel to enter the car if necessary. However, trying to boost performance for one aspect often reduces the effectiveness in another, making this a difficult engineering problem to solve.

Failures of glazing retention mechanisms on passenger trains have led to multiple injuries and fatalities due to train occupant ejection in rollover-type accidents over the last several decades. A review of recent accidents has underscored the key failure mode that contributed to passenger injuries and fatalities: the failure of the outer gaskets during rollover derailments after the cars have been dragged along the ground. Once the gasket has failed, the window is pushed into the car, leaving an opening through which occupants may be ejected.

FRA is seeking design concepts which do not rely on traditional glazing securement methods and which are compliant with FRA's safety regulations related to passenger equipment glazing (specifically, 49CFR238.113 (for emergency exit windows) and 49CFR238.114 (for emergency access windows). Emergency egress/access windows and "conventional" (non-emergency egress/access) are equally challenged in a rollover derailment during which a passenger car slides on its side. Therefore, alternative solutions may be proposed for securing emergency egress/access windows and "conventional" windows.

Expected Phase I Outcomes

Phase I efforts shall include conception of technology alternative(s), selection, and initial effectiveness assessment (though analysis or other means) of one or more alternatives. The output from Phase I should be a technology development plan to progress the proposed design solution(s) to a more mature level, including manufacturability. The development plan shall include a rationale for the technical approach, supported by preliminary analysis results.

Expected Phase II Outcomes

Phase II shall progress the design development in alignment with the technology development plan. FRA expects Phase II to include development of a prototype(s) which can be physically tested in accordance with methods acceptable to the Government and described in the research report to establish technical and operational efficacy.

C. National Highway Traffic Safety Administration (NHTSA)

About us: The National Highway Traffic Safety Administration's (NHSTA) mission is to save lives, prevent injuries and reduce economic costs due to road traffic crashes, through education, research, safety standards and enforcement activity.

23-NH1: Child Presence Detection CO2 Release Test Device

Leaving an unattended child in a parked automobile can lead to heat stroke and death, even if only left for a few minutes. Child deaths from automobile-related heat stroke occur with lower frequency than those that occur in traffic crashes, but the nature of these completely preventable deaths warrants special attention. A young child's inability to exit the vehicle on his/her own combined with a low tolerance for elevated temperatures requires that children never be left unattended in an automobile.
NHTSA supports a variety of research efforts aimed at the detection of children in vehicles to prevent heat stroke. This project aligns with NHTSA's Fiscal Year 2022 – 2026 (FY22 – FY26) Research, Development and Technology Strategic Plan (RD&T Strategic Plan) and the Fiscal Year 2022 (FY22) Annual Modal Research Plan (AMRP) priorities by directly addressing child presence detection system testing with the intent of reducing child heat stroke deaths and injuries.

In particular, the research will support the RD&T Strategic Plan's Vison Zero grand challenge by working to "eliminate all fatalities and serious injuries on the U.S. transportation system." In addition, the FY22 AMRP stated, "Sensor systems will be evaluated for the ability to detect unattended children and prevent heat stroke occurrence." Some Child Presence Detection Systems measure chest movement and/or generation of Carbon Dioxide (CO_2) to determine if a child is present in the vehicle cabin. In order for NHTSA to test and evaluate Child Presence Detection Systems that measure CO_2 levels, NHTSA needs test equipment that simulates a child breathing through the realistic and repeatable release of CO_2.
The Office of Vehicle Safety Research (VSR) is interested in understanding the amount of CO_2 humans generate in an enclosed or predominantly enclosed vehicle, with a particular emphasis on children. This project will aim to develop test equipment that simulates a human child breathing by releasing CO_2 inside a vehicle cabin. The awardee will have to develop the test equipment to release CO_2 and record various test parameters, like the amount of CO_2 released and the overall amount of CO_2 in the vehicle cabin.

Expected Phase I Outcomes

The Phase I outcome will include a working prototype that meets the technical and interface specifications paired with a final report. The report shall include comparisons between the CO_2 release test device and human CO_2 production in exemplar vehicles, in addition to a repeatability analysis, showing repeated test device performance against a separate NIST-traceable CO_2 ground-truth sensor.

Expected Phase II Outcomes

Phase II is expected to result in a final version of the CO_2 release test equipment that is ready for commercialization and includes a portable storage container. In addition, the Phase II final report shall include all the measurement and analysis required, including CO_2 release comparisons against human data and repeatability analysis against NIST-traceable ground-truth sensor.

23-NH2: Immersive Virtual Reality Training on Impaired Driving for Law Enforcement

NHTSA is interested in the development of new training tools that can support the agency's continuing efforts to provide law enforcement professionals the necessary training resources to identify and remove impaired drivers from our nations' roadways. Preliminary estimates show roadway deaths climbing to 42,915 in 2021, a 16 year high. Every day, about 32 people in the United States die in drunk-driving crashes — that's one person every 45 minutes. In 2020, 11,654 people died in alcohol-impaired driving traffic deaths — a 14% increase from 2019 (NHTSA Media, 2022).

The ability of law enforcement to identify impaired drivers is a critical component to reducing fatalities involving alcohol and/or drug impairment. Impaired driving is a human factor that must be addressed to overcome the vision zero challenge to eliminate all fatalities and serious injuries on our nations' roadways. This aligns with DOT's Strategic Goal of Safety. The effects of alcohol on an individual have been researched extensively and law enforcement are trained to identify signs and symptoms associated with alcohol impairment through the basic Standardized Field Sobriety Testing curriculum, often included in the basic police academy/certification course. Law enforcement officials may later receive advanced training in the identification of impairment through the 16-hour Advanced Roadside Impaired Driving Enforcement (ARIDE) curriculum provided through the Drug Evaluation and Classification Program (DECP). Due to the complexity that comes with drug use and impairment, ARIDE is designed to introduce law enforcement officers to the identification of signs and symptoms associated with impairment from drugs other than (or in addition to) alcohol. The ARIDE curriculum also identifies the practical use of a Drug Recognition Expert, post-arrest, in Driving Under the Influence of Drugs (DUID) cases.

There is a need to make impaired driving training as realistic as practical so law enforcement can ensure they are identifying and apprehending impaired drivers' roadside. There are limitations and legitimate concerns (such as liability and harm) with dosing live individuals with impairing substances for the purpose of curriculum development. This project aims to reduce unnecessary risks of harm to individuals. Additionally, we aim to reduce monetary costs and time involved in dosing individuals for the purpose of training.

This topic aims to develop a course structure and technological approach for the purposes of training law enforcement on the behaviors associated with impaired driving. To achieve this, it is expected that subject matter expertise in the areas of drug-impaired driving enforcement will inform the training approach and material. Ideally, these subject matter experts (SMEs) should be drug recognition experts (DRE); drug recognition expert instructors; or drug recognition expert state coordinators who are familiar with the content and application of the DECP. The proposal should explain when this expertise will be introduced into the project and, when possible, by whom.

Expected Phase I Outcomes

Expected outcomes for the conclusion of Phase I are a "Proof of Concept" Final Report which presents a course design for the interactive training technology and describes the technological approach and software and hardware requirements. The project should also produce a detailed plan for the development of the software files for a wide variety of virtual drivers (varying by age, gender, race, ethnicity) that can be displayed as under the influence of various impairing drugs, combinations of drugs, and control subjects. Finally, the project outcomes must include the identification of qualifications required (i.e., DRE Instructor) to proctor the use of the interactive training technology. A proctoring instructor should be well versed in the field of DUID and current DUID curricula used to train law enforcement nationwide.

Expected Phase II Outcomes

Conditional on the outcomes of Phase I, Phase II will begin development of a market ready device for use by law enforcement officers. This device will be tested using the development plan developed in Phase I for ensuring the input responses corroborate with current DUID curricula and determining how well the device works in conjunction with user inputs. The device will be a pilot. The device must be affordable for most public safety agencies and, allow for selected proctors to use with a minimal amount of training. The expected outcome is a demonstration of the market-ready device as well as a report that documents the testing results and contains a marketing plan.

D. Pipeline and Hazardous Materials Safety Administration (PHMSA)

About Us: The Pipeline and Hazardous Materials Safety Administration (PHMSA) operates in a dynamic and challenging environment where advances in technology, manufacturing, and energy production impact transportation safety. PHMSA's mission is to protect people and the environment by advancing the safe transportation of energy and other hazardous materials that are essential to our daily lives. PHMSA's Pipeline Safety Research Program sponsors research and development projects focused on providing near-term solutions for the U.S.'s pipeline transportation system that will improve safety, reduce environmental impact, and enhance reliability. This includes ensuring that PHMSA's R&D program implements the Administration's priorities through R&D investments that promote safety and environmental protection, climate change, economic recovery and rebuilding, and transportation as an engine for equity.

Recent R&D projects are focused on leak detection; detection of mechanical damage; damage prevention; improved pipeline system controls, monitoring, and operations; and improvements in pipeline materials. These projects are addressing technological solutions that can quickly be implemented to improve pipeline safety and limit environmental impact of PHMSA-regulated infrastructure. PHMSA's Office of Hazardous Material Safety regulates the transportation of hazardous materials by air, rail, highway, and water. Over 1.3 million hazardous material products are transported daily over the various transportation modes. Because of the ubiquity of hazardous material movements, supporting the safe transport of these products will have a positive impact on safety and performance. The Office of Hazardous Material Safety seeks to improve the safety and reliability of hazardous material transportation.

23-PH1: Bioremediation for Hazardous Material Spills

Over the past 10 years, there have been close to 200,000 hazardous material (HAZMAT) incidents. Such incidents can result in human injuries, fatalities, economic losses, and environmental damage. Environmental damage and human exposure risk are of particular concern after HAZMAT spills, where spilled HAZMAT can enter soils, groundwater, surface water, or volatilize into air. Existing emergency response protocols call for containment and cleanup from the environment. Nonetheless, current cleanup methods typically focus on immediate containment and physical removal (e.g., berms, soil caps, dispersants, etc.). Though containment and physical removal are critical responses, there is less focus on short- or long-term treatment and remediation once the HAZMAT spill is contained or removed. After removal, HAZMAT may be disposed, incinerated, or recycled. Alternative and novel containment, removal, and treatment methods could reduce the environmental and safety risks of HAZMAT and further DOT's strategic goals of safety and climate change and sustainability, notably advancing DOT's Vision Zero initiative

To satisfy this need, we invite the small business to develop bioremediation solutions and applications for first response and ongoing treatment of HAZMAT spills. Bioremediation is a technique that uses living organisms such as plants, algae, bacteria, or fungi to treat contaminants. Bioremediation can also include applications of enzymes or engineered enzymes. These remediation techniques can be effective removal methods for a multitude of hazardous materials, especially when the organism can break down contaminants into less harmful substances. There is strong evidence in the academic literature for efficacy of bioremediation for different contaminants, including polychlorinated biphenyls, petroleum products (e.g., benzene, toluene, ethylene, and xylene) and even explosives. Recent studies have also demonstrated novel bioremediation delivery mechanisms such as enzyme immobilization or bio amended carbon materials.

The solution must consider containment and treatment of spills of different sizes, short-term and long-term treatment of the contaminant, environmental impact of the solution, and cost. For environmental impact, solutions must not introduce invasive species into the environment. The solution should consider possibilities of regeneration/reuse of the remediation method or environmentally sustainable disposal or attenuation. The solution should also consider different possible spill locations (i.e., a spill in water, soil, or within a transport vessel or container). Parameters to consider would include sorption capacity of materials, time required for contaminant removal and treatment, and applicability to different contaminants.

Expected Phase I Outcomes

The expected Phase I outcome would be a proof-of-concept report that demonstrates technical feasibility of the solution (including preliminary data) and how the solution will address the specifications for this topic. Proof-of-concept could include a model for a prototype or a design report including a testing plan and mock-up for the technology.

Expected Phase II Outcomes

The expected Phase II outcomes should result in a demonstration of a working prototype of the bioremediation technology showing efficacy in HAZMAT spill test scenarios. The prototype should be developed to be close to market-ready and the deliverables would include any test data or modeling work.

23-PH2: Integrated RFID Trackers and Sensors for Hazardous Material Communication in Transportation

To transport hazardous materials (HAZMAT), packages must be appropriately labeled and marked as specified by the Hazardous Materials Regulations (HMR; 49 CFR 172.300 and 172.400). The safe transportation of hazardous materials hinges in part on the visibility of hazardous communication (HAZCOM) labels and markings. Physical labels and markings can be torn or destroyed during transit, hard to see on the package, or even obscured due to the addition of external packaging after the package is dispatched (e.g., wrapping added onto a labeled package.) Additionally, labels and markings can be inaccurate. One such example of the impact of incorrect marking is an incident where lithium batteries inaccurately labeled as "computer parts" caught on fire during shipment.[1] Visibility and accuracy issues increase risk of unknown hazards to HAZMAT transporters and incident response teams. One possible solution to visibility and accuracy issues in HAZCOM is radio frequency identification (RFID) tagging. RFIDs have unique identification and work by sending a radio frequency signal from a reader. RFID tags then respond with the identification information. RFIDs are highly popular in the retail sector for inventory management and theft prevention and have wide applicability to multiple industries. RFID is a well-developed technology, and emerging technology such as integrated sensors with RFID tagging further improves utility. Within the HAZMAT field, the Department of Energy collaborated with Argonne National Lab to develop ARG-US, an integrated RFID and sensor system that can be used to monitor radioactive waste drums in transit or at facilities.[2] ARG-US is an award-winning technology, but HAZMAT transporters have yet to widely adopt RFID technologies.

Given the success and commercialization of ARG-US for radioactive waste, we invite small businesses to further innovate and improve upon RFID and sensor technology for HAZMAT transportation outside of

[1] https://homeport.uscg.mil/Lists/Content/Attachments/77040/USCGSA_0122.pdf
[2] Argonne/DOE ARG-US Radio Frequency Identification (RFID) Technology for Tracking Nuclear Materials in Storage, Transportation (anl.gov)

radioactive materials. Specifically, we seek an integrated RFID and sensor system that provides accurate HAZCOM and detects packaging failure for a variety of HAZMAT and packaging types. Particularly, pairing RFID tagging with a sensor for packaging failure (e.g., puncture, orientation changes, or leak detection) would allow for communication of otherwise unknown incidents during transport. The overall solution being sought is an integrated RFID and sensor system for HAZMAT packages in transportation that allows for secure real time transport monitoring, clear communication of HAZMAT contents, package failure and alert, and an easy-to-use user interface.

The overall system must be modular and adaptable to the major types of HAZMAT packaging including but not limited to metal drums, plastic tanks, cargo tanks, and other bulk or non-bulk packaging. The RFID tag must be able to convey pertinent hazardous material information such as UN number, hazard class, proper shipping name, quantity, and packaging type. Size of the system should be scalable to different packages. The system must be durable to human abuse, weather (I.e., rain and heat), potential fire, and impact. The system should include an active RFID (powered system that can continually transmit data) while maintaining a low cost.

This topic supports two of the OST-R Grand Challenges: Resilient Supply Chains and Transportation System-of-Systems of the Future. This technology has the potential to enhance resiliency in supply chains by improving timely and accurate data on goods location and movement. It also targets the Transportation System-of-Systems of the Future Grand Challenge by developing integrated sensor and communication systems.

Expected Phase I Outcomes

The desired Phase I deliverable for the RFID trackers and sensors technology would include a research report to demonstrate technical feasibility of the RFID tracker and sensor system on HAZMAT packaging and show a path toward a prototype in Phase II.

Expected Phase II Outcomes

The expected Phase II outcomes would be a hardware/software demonstration, test results from different types of packaging and packaging failure, with delivery of a technology and/software package at the completion of the Phase II contract.

23-PH3: Portable State-of-Charge Sensor for Lithium Batteries

The use of lithium batteries continues to rise over recent years, especially as demand grows for electronic devices, vehicles, and scooters/bikes. As usage grows, so do concerns of lithium battery safety due to incidences of battery fires. To minimize or prevent occurrence of battery fires, there is a great need to monitor battery health and state-of-charge (SOC). Lithium batteries at lower SOC are less likely to enter thermal runaway and cause fires. However, current methods of measuring battery health and SOC are either proprietary (e.g., battery management systems produced by manufacturers), require destruction of the battery, or are not easy to implement. Thus, there is a need for a non-destructive sensor capability to effectively monitor SOC for lithium batteries during shipment.

There have been recent advances in non-destructive magnetic imaging techniques to measure SOC.[3] Such techniques can measure damage due to mechanical impact or overcharging in addition to SOC. Further

[3] Sensitive magnetometry reveals inhomogeneities in charge storage and weak transient internal currents in Li-ion cells | PNAS

advancement of such methods to reduce form factor of the sensor, scale up sensing capabilities to larger batteries, and maintain low costs would allow for effective SOC monitoring.

The goal should be to create a handheld device that allows the user to quickly test the state of charge or amount of energy within any size of lithium-ion battery.

This device will promote the use of Lithium Ion Batteries while reducing the likelihood of an accident, advancing the RD & T Grand Challenges of Vision Zero and Net Zero Emissions.

Expected Phase I Outcomes

The expected Phase I outcomes for the proposed technology would include a report detailing the research of the technology and describing the technical feasibility. The report would also have to show a path toward Phase II which would include a technology demonstration with delivery of a workable prototype of the technology at the completion of the Phase II contract.

Expected Phase II Outcomes

Phase II outcomes will include taking the research and knowledge from Phase I and to further research the technology resulting in the development of a prototype for user testing that would lead to a possible commercialization.

23-PH4: Wearable PPE-integrated Sensors for First Responders

First responders to hazardous material (HAZMAT) incidents face many safety risks daily. Some risks, such as exposure to hazardous chemicals and toxic gasses, can be difficult to detect. Without information on real-time exposures, first responders are at a higher risk of injury or harmful exposure. Current detection methods (e.g., portable photo-ionization detectors for gases) for hazardous material exposure can be costly, difficult to transport, and not effective at detecting multiple hazards. One promising research area is wearable sensors, including small form-factor badge sensors or clothing-integrated sensors. Wearable sensors have been developed for measuring physical exertion, heart rate, stress, and other variables. [4]

Though we have seen some advancements in wearable badge-type sensors for hazardous gases, sensor technology for HAZMAT incident response lags behind sensor technology advancement in biomedical and other fields. Though badge-type sensors and watch-type sensors can be easy to wear, they also have the risk of accidental removal or detachment from the user. The frontier of wearable sensors now includes studies on clothing-integrated sensors. Clothing-integrated wearable sensors could eliminate possibility of sensor detachment during incident response.

We are looking for a small business to develop novel sensor technologies for first responders to hazardous materials incidents that are wearable and integrated into clothing or personal protective equipment (PPE). The sensor should be able to monitor exposure to hazardous materials (environmental, contact with PPE, or breach in PPE) and provide notifications to the first responder in advance of dangerous exposure.

The sensor technology must be integrated into first responder PPE. The sensors must not impede mobility of the first responder. Sensor reading outputs or actuators must be in real-time or close to real-time. The sensor should be able to detect multiple kinds of hazardous materials (e.g., different flammable gases or

[4] Wearable Sensing Technology Applications in Construction Safety and Health | Journal of Construction Engineering and Management | Vol 145, No 11 (ascelibrary.org)

liquid hazardous chemicals). Sensitivity of the sensor should be high enough to notify the first responder prior to reaching OSHA exposure limit thresholds.[5] The clothing/PPE-integrated sensor should also be durable, reusable, and low cost. For durability, small businesses should consider regular wear and tear as well as unique conditions first responders could be exposed to (e.g., fire, heat, hazardous chemicals). This topic fits into two Grand Challenges from the Office of the Assistant Secretary for Research and Technology. The first relevant Grand Challenge is "Vision Zero"; this topic targets the desired outcome of "work zones operate safely, and the safety of our transportation workers and first responders is assured. "The second relevant Grand Challenge is "the Future Transportation System-of-Systems"; this transformative research topic touches on advanced materials and sensor technology to help inform rapid decision-making and first responder safety.

Expected Phase I Outcomes

The expected Phase I outcome would be a detailed proof-of-concept report detailing technical feasibility, description of proposed prototype design and functionalities, and how it can be integrated into first responder PPE. Technical parameters and specifications above should be fully addressed in the report.

Expected Phase II Outcomes

The expected Phase II outcomes include a demonstration of a working prototype, report including stakeholder input on prototype, technology results, and a marketing plan.

[5] Permissible Exposure Limits – OSHA Annotated Table Z-1 | Occupational Safety and Health Administration