



**U. S. Department
of Transportation**

Office of the Secretary
of Transportation

PROGRAM SOLICITATION

Small Business Innovation Research Program (SBIR)

Issue Date: October 1, 2009

Closing Date: November 16, 2009

**Small Business Innovation Research (SBIR) Program Office, RVA-21
John A. Volpe National Transportation Systems Center
U.S. Department of Transportation
Research and Innovative Technology Administration
55 Broadway
Cambridge, MA 02142-1093**

CONTENTS

SECTION	PAGE
I. PROGRAM DESCRIPTION	1
II. DEFINITIONS	3
III. PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS	5
IV. METHOD OF SELECTION AND EVALUATION CRITERIA	7
V. CONSIDERATIONS	9
VI. RESEARCH TOPICS	13
VII. SUBMISSION FORMS AND CERTIFICATIONS	27
APPENDICES	
A. PROPOSAL COVER SHEET	28
B. PROJECT SUMMARY	29
C. CONTRACT PRICING PROPOSAL (Schedule 1)	30
D. PROPOSAL CHECKLIST	34

DOT PROGRAM SOLICITATION FOR SMALL BUSINESS INNOVATION RESEARCH

I. PROGRAM DESCRIPTION

A. Introduction

This solicitation for research proposals is issued by the U.S. Department of Transportation (DOT) pursuant to the Small Business Innovation Development Act of 1982, P.L. 97-219 (codified at 15 U.S.C. 638) as amended by the Small Business Innovation Research (SBIR) Program, Extension, P.L. 99-443 which extended the program through September 30, 1993. On October 28, 1992, through the Small Business Innovation Research and Development Act of 1992 (P.L. 102-564), Congress reauthorized and extended the SBIR program for another seven years (2000). Subsequently, on December 21, 2000, through the Small Business Reauthorization Act of 2000 (P.L. 106-554) Congress again reauthorized the SBIR program. The Program is currently operating under a continuing resolution.

The SBIR Program encourages small businesses to engage in research or research and development (R/R&D) that has the potential for commercialization to meet Federal research or research and development objectives.

The goals and objectives of the SBIR Program are:

- (1) To stimulate technological innovation;
- (2) To use small business to meet Federal R/R&D needs;
- (3) To increase private sector commercialization of innovations derived from Federal R/R&D; and
- (4) To foster and encourage participation by minority and disadvantaged persons in technological innovation.

In consonance with the statutory obligations of the Act, the DOT has established a Small Business Innovation Research Program —hereinafter referred to as the DOT SBIR Program.

The purpose of this solicitation is to invite small businesses with their valuable resources and creative capabilities to submit innovative research proposals that address high priority requirements of the DOT.

B. Three-Phase Program

The DOT SBIR Program is a three-phase process.

THIS SOLICITATION IS FOR PHASE I PROPOSALS ONLY.

Phase I. Phase I provides support for the conduct of feasibility-related experimental or theoretical research or R/R&D efforts on research topics as described herein. The dollar value of the proposal may be up to \$100,000 unless otherwise noted and the period of performance is generally six months. The basis for award will be the scientific and technical merit of the proposal and its relevance to DOT requirements and priorities. **Only awardees in Phase I are eligible to participate in Phase II which is by invitation only.**

Phase II. Phase II is the principal R/R&D effort having a period of performance of approximately two years with a dollar value of up to \$750,000 unless otherwise noted. DOT will accept Phase II proposals under the DOT SBIR Program only from firms which have previously received a DOT Phase I award. Phase II proposals must be prepared in accordance with guidelines provided by DOT to Phase I awardees receiving an invitation to submit a Phase II proposal. Phase II awards will be based on the results of Phase I efforts, technical merit, agency priority and commercial applications, and the availability of appropriated funds to support the Phase II effort. Special consideration may be given to proposals that have obtained commitments for follow-on funding from non-Federal sources for Phase III.

Phase III. SBIR Phase III award logically follows SBIR Phase II and may be a continuation of the work under Phase II or commercialization of the research under the previous SBIR phases. Like SBIR Phase II, the award process is exempted from FAR subpart 5.2 requirements. Only those vendors who were awarded both a SBIR Phase I and Phase II may receive a SBIR Phase III award. There is no limit on the performance period length or dollar value of a SBIR Phase III, and the small business size limits for Phase I and Phase II awards do not apply to SBIR Phase III awards.

Phase III is to be conducted by the small business with either:

- non-Federal funds to pursue commercial applications of R/R&D funded in Phases I and II, or

- non-SBIR Government funded contracts for continued research or products or processes intended for use by the U.S. Government.

C. Eligibility

Each concern submitting a proposal must qualify as a small business at the time of award of Phase I and Phase II contracts. In addition, **the primary employment of the principal investigator must be with the small business firm at the time of contract award and during the conduct of the proposed research** unless otherwise approved by the Contracting Officer. Primary employment means that more than one-half of the principal investigator's time is spent with the small business. Also 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 United States, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, the Trust Territory of the Pacific Islands, and the District of Columbia.

All types of small business organizations may submit proposals, including high technology, R&D, manufacturing, and service firms. Companies with outstanding scientific or engineering competence in highly specialized product, process or service areas may wish to apply their expertise to the research topics in this solicitation through a laboratory prototype. Ideally, the research should make a significant contribution to the solution of an important transportation problem and provide the small business concern with the basis for new products, processes, or services.

D. General Information

This is a solicitation for Phase I R/R&D proposals on advanced, innovative concepts from small business firms having strong capabilities in applied science or engineering.

The Phase I R/R&D proposals shall demonstrate a sound approach to the investigation of an important transportation-related scientific or engineering problem categorized under one of the topics listed in Section VI.

A proposal may respond to any of the research topics listed in Section VII, but must be limited to one topic. The same proposal may not be submitted under more than one topic. An organization may, however, submit separate proposals on different topics, or different proposals on the same topic, under this solicitation. Where similar research is discussed under more than one topic, the offeror shall choose that topic which appears to be most relevant to the offeror'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 element of the DOT to perform its mission.

Proposals shall be confined principally to scientific or engineering research, which may be carried out through construction and evaluation. Proposals must be for R/R&D, particularly on advanced or innovative concepts, and shall not be for incremental or scaled-up versions of existing equipment or the development of technically proven ideas. Proposals for the development of already proven concepts toward commercialization, or which offer approaches already developed to an advanced prototype stage or for market research shall not be submitted. Commercialization is the objective of Phase III, in which private capital or non-SBIR funds are to be used to continue the innovative research supported by DOT under Phase I and Phase II.

The proposal shall be self-contained and checked carefully by the offeror to ensure that all preparation instructions have been followed. (See Proposal Checklist, Appendix D).

Please address general inquiries on the U.S. DOT SBIR Program to:

Leisa Moniz
 DOT SBIR Program Director, RVA-21
 John A. Volpe National Transportation Systems Center
 U.S. Department of Transportation
 Research and Innovative Technology Administration
 55 Broadway
 Cambridge, MA 02142-1093
 Telephone: (617) 494-2051
 Fax: (617) 494-2370
 Email Address: Leisa.Moniz@dot.gov
 Volpe Center Website: <http://www.volpe.dot.gov/sbir>

II. DEFINITIONS

A. **Research or Research and Development (R/R&D)**

R/R&D means any activity which is:

- (1) A systematic, intensive study directed toward greater knowledge or understanding of the subject studied;
- (2) A systematic study directed specifically toward applying new knowledge to meet a recognized need; or
- (3) A systematic application of knowledge 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.

B. **Small Business Concern**

A small business concern is one that at the time of award of Phase I and Phase II contracts meets all of the following criteria:

- (1) Is organized for profit, with a place of business located in the United States, which operates primarily within the United States or which makes a significant contribution to the United States economy through payment of taxes or use of American products, materials or labor;
- (2) Is in the legal form of an individual proprietorship, partnership, limited liability company, corporation, joint venture, association, trust or cooperative, except that where the form is a joint venture, there can be no more than 49 percent participation by business entities in the joint venture;
- (3) Is (i) at least 51 percent owned and controlled by one or more individuals who are citizens of the United States or permanent resident aliens in the United States, (ii) at least 51% owned and controlled by another business concern that is itself at least 51% owned and controlled by individuals who are citizens of, or permanent resident aliens in the United States; or (iii) a joint venture in which each entity to the venture must meet the requirements of either (i) or (ii) of this section;
- (4) Has, including its affiliates, not more than 500 employees.

C. **Socially and Economically Disadvantaged Small Business Concern**

A socially and economically disadvantaged small business concern is one that is at least 51% owned and controlled by one or more socially and economically disadvantaged individuals, or an Indian tribe, including Alaska Native Corporations (ANCs), a Native Hawaiian Organization (NHO), or a Community Development Corporation (CDC). Control includes both strategic planning (as that exercised by boards of directors) and the day-to-day management and administration of business operations. See 13 CFR 124.109, 124.110, and 124.111 for special rules pertaining to concerns owned by Indian Tribes (including ANCs), NHOs, or CDCs, respectively.

D. **Women-Owned Small Business Concern**

A woman-owned small business concern is one that is at least 51% owned and controlled by a woman or women. Control includes both the strategic planning (as that exercised by boards of directors) and the day-to-day management and administration of business operations.

E. **Veteran Owned Small Business**

A veteran-owned small business concerns is one that is at least 51 percent owned and controlled 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 percent of the stock of which is owned by one or more veterans, and the management and daily business operations of which are controlled by one or more veterans.

F. **Subcontract**

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

G. **Historically Underutilized Business Zone (HUBZone)**

A HUBZone small business concern is one that meets the following criteria:

1. Located in “historically underutilized business zone” or HUBZone area located in one or more of the following:
 - a) A qualified census tract (as defined in Section 42(d)(5)(i)(I) of the Internal Revenue Code of 1986);
 - b) A qualified “non–metropolitan county” (as defined in Section 143(k)(2)(B) of the Internal Revenue Code of 1986) with a median household income of less than 80% of the state median household income or with an unemployment of not less than 140% of the statewide average based on U.S. Department of Labor recent data; or
 - c) Lands within the boundaries of Federally recognized Indian reservations.
2. Owned and controlled by one or more U.S. citizen(s).
3. At least 35% of its employees must reside in a HUBZone.

III. PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. Proposal Submission Requirements

- Each proposal shall not exceed 25 pages (regular size type – no smaller than 10 point font size – single or double spaced, standard 8 ½” by 11” pages) including proposal cover sheet, contract pricing proposal, and all enclosures or attachments.
- Proposals must be a PDF file and submitted online.
- No duplicate proposals shall be sent by any other means.
- Proposals may only be submitted online, a link to the web page can found here:
<http://www.volpe.dot.gov/sbir/current.html>
Instructions are included on the submission page.
- Proposals must be received no later than 11:59 P.M. EST on November 16, 2009.
- The proposal file name shall contain eight (8) characters; the first three shall be the topic number you are proposing to (i.e., FH3), and the remaining five characters shall be a unique abbreviation of your company’s name.

Proposals will be available to only the team of U.S. DOT engineers and/or scientists responsible for evaluating your proposal.

B. **Proposal Cover Sheet**

Complete the Proposal Cover Sheet in Appendix A as Page one of your proposal. All pages shall be numbered consecutively, beginning with the Proposal Cover Sheet.

C. **Project Summary**

Complete the form in Appendix B as Page two of your proposal. The Project Summary shall include a technical abstract with a brief statement of the problem or opportunity, project objectives, and description of the effort. Anticipated results and potential applications of the proposed research shall also be summarized in the space provided. The Project Summary of successful proposals may be published by the DOT and, therefore, shall not contain classified or proprietary information. The technical abstract must be limited to 200 words in the space provided on the Project Summary form.

D. **Technical Content**

Submitted proposals must include the following:

- (1) **Identification and Significance of the Problem or Opportunity.** The specific technical problem or innovative research opportunity addressed and its potential benefit to the national transportation system shall be clearly stated.
- (2) **Phase I Technical Objectives.** State the specific objectives of the Phase I R/R&D effort, including the technical questions it will try 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, 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 questions cited in (2) above. The methods planned to achieve each objective or task shall be discussed in detail, 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 proposal including any conducted by the project manager/principal investigator or by the proposing firm. Describe how it relates to the proposed effort, and any planned coordination with outside sources. The offeror must persuade reviewers of his or her awareness of key recent 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 their directly 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 proposal page limitations.
- (6) **Relationship with Future Research and Development.**

- (a) State the anticipated results of the proposed approach if the project is successful (Phase I and Phase II).
 - (b) Discuss the significance of the Phase I effort in providing a foundation for Phase II R/R&D effort.
- (7) **Facilities.** Provide a detailed description, availability and location of instrumentation and physical facilities proposed for Phase I.
- (8) **Consultants.** Involvement of consultants in the planning and research stages of the project is permitted. If such involvement is intended, it shall be described in detail.
- (9) **Potential Applications.** Briefly describe:
- (a) Whether and by what means the proposed project appears to have potential commercial application.
 - (b) Whether and by what means the proposed project appears to have potential use by the Federal Government.
- (10) **Similar Proposals or Awards.** Warning — while it is permissible, with proposal notification, to submit identical proposals or proposals containing a significant amount of essentially equivalent work for consideration under numerous Federal program solicitations, it is unlawful to enter into contracts or grants requiring essentially equivalent effort. If there is any question concerning this, it must be disclosed to the soliciting agency or agencies before award.

If a firm elects to submit identical proposals or proposals containing a significant amount of equivalent work under other Federal program solicitations, a statement must be included in each such proposal indicating:

- (a) The name and address of the agencies to which proposals were submitted or from which awards were received;
- (b) Date of proposal submission or date of award;
- (c) Title, number, and date of SBIR Program solicitations under which proposals were submitted or awards received;
- (d) The applicable research topics for each SBIR proposal submitted or award received;

- (e) Titles of research projects; and
- (f) Name and title of Project Manager or Principal Investigator for each proposal submitted or award received.

E. Contract Pricing Proposal

A firm fixed price Phase I Contract Pricing Proposal (Schedule 1) must be submitted in detail as shown in Appendix C. Note: firm fixed price is the type of contract to be used for Phase I SBIR awards. 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. It is important, however, to provide enough information to allow the DOT to understand how the offeror plans to use the requested funds if the contract is awarded. Phase I contract awards may include profit.

F. Central Contracting Registration (CCR) and Data Universal Numbering System (DUNS) Identification Number

Since October 1, 2003, it is federally mandated that any business wishing to do business with the Federal Government under a Federal Acquisition Regulation (FAR)-based contract must be registered in CCR before being awarded a contract. You can find more information on CCR and the registration process in their handbook, <http://www.ccr.gov/handbook.asp>. You can register online at <http://www.ccr.gov> by clicking on “Start New Registration” if you already have a DUNS number. If you need a DUNS number, you can find instructions at <http://fedgov.dnb.com/webform/displayHomePage.do>

A firm must note its DUNS identification number on Appendix C, Contract Pricing Proposal, Schedule 1. This number is assigned by Dun & Bradstreet, Inc.

G. Prior SBIR Phase II Awards

If the small business concern has received more than 15 Phase II awards in the prior five fiscal years, submit name of awarding agency, date of award, funding agreement number, amount, topic or subtopic title, follow-on agreement amount, source and date of commitment, and current commercialization status for each Phase II. (This required proposal information shall not be counted toward the proposal 25-page count limitation.)

IV. METHOD OF SELECTION AND EVALUATION CRITERIA

A. General

All Phase I and Phase II proposals will be evaluated and judged on a competitive basis. Initially, all proposals will be screened to determine responsiveness to the solicitation. Proposals that meet the solicitation requirements will be evaluated to determine the most promising technical and scientific approaches. Each proposal will be judged on its own merit. The DOT is under no obligation to fund any proposal or any specific number of proposals on a given topic or subtopic. It may elect to fund several or none of the proposed approaches to the same topic or subtopic.

A Phase II award will be made to the responsive and responsible Offerors whose offers provide the best value to the Government, based on the Technical Proposal and Cost Proposal. While it is the Government's intent to make Phase II awards based upon initial offers, the Government may, nevertheless, determine during the evaluation period that it is necessary to conduct discussions. In that case, the Contracting Officer will proceed to establish a competitive range and conduct negotiations with the firms in that range.

B. Evaluation Criteria

The evaluation process involves the following factors:

- (1) Scientific and technical merit and the feasibility of the proposal's commercial potential, as evidenced by:
 - a) Past record of successful commercialization of SBIR or other research;
 - b) Existence of Phase III funding commitments from private sector or non-SBIR funding sources; and
 - c) Presence of other indicators of the commercial potential of the idea.
- (2) The adequacy of the work plan and approach to achieve specified work tasks and stated objectives of the proposed effort within budgetary constraints and on a timely schedule.
- (3) Qualifications of the proposed principal/key investigator(s) including demonstrated expertise in a disciplinary field related to the

particular R/R&D topic that is proposed for investigation.

- (4) Adequacy of supporting staff and facilities, equipment, and data for the successful completion of the proposed R/R&D.

C. Prescreening

Each proposal submission will be examined to determine if it is complete and contains adequate technical and pricing data. Proposals that do not meet the basic requirements of the solicitation will be excluded from further consideration. Each offeror will be notified promptly by email of such action.

D. Schedule

All DOT evaluations shall be completed and recommendations for award will be submitted to the U.S. DOT SBIR Program Office within eight weeks of the closing date for Phase I proposals.

E. Program Selection

Each of the Department's Operating Administrations will establish technical evaluation teams comprised of federal staff, including engineers and/or scientists and provide written recommendations for award to the DOT SBIR Program Director. The DOT SBIR Program Office will post the listing of awards on the webpage: <http://www.volpe.dot.gov/sbir>.

F. Contact with DOT

Contact with DOT relative to this solicitation during the Phase I proposal preparation and evaluation period is restricted for reasons of competitive fairness. Technical questions pertaining to the FY10.1 DOT SBIR solicitation research topics must be submitted to the DOT SBIR Program Office by e-mail to: Linda.Duck@dot.gov. **Technical questions submitted after October 22, 2009 may not be answered before the solicitation closing date.**

No information on proposal status will be available until the complete list of FY10.1 Phase I Award Recommendations is posted on the DOT SBIR Program Webpage: <http://www.volpe.dot.gov/sbir>. For planning purposes the notification of FY10.1 Phase I Award Recommendations are expected to be posted on the DOT SBIR Program web page by 5 PM Eastern Time, February 16, 2010. **Phase I proposals which are not included in the list of FY10.1**

Phase I Award Recommendations will not receive an award. NO WRITTEN CORRESPONDENCE REGARDING PROPOSAL STATUS WILL BE ANSWERED.

After the FY10.1Phase I Award Recommendations are posted on the DOT SBIR Program webpage, a debriefing comprised of the overall comments on the proposal may be provided to the offeror upon request.

Debriefing requests should be submitted to the SBIR Program Contracting Officer by e-mail to:

Darren.Shaffer@dot.gov, and must include the offeror's name, address, research topic number, and the proposal identification number assigned on the acknowledgement of receipt card. The identity of the evaluators will not be disclosed.

V. CONSIDERATIONS

A. Awards

The Government anticipates awarding approximately 16 Phase I contracts with the potential for additional awards. The actual number of contract awards, depends on actual funding available and the responses from small business firms to the solicited research topics in Section VI.

All Phase I awards will be firm fixed price contracts and may be up to \$100,000 each unless otherwise noted. Phase II awards anticipate cost-plus-fixed-fee contracts with a value of up to \$750,000 each unless otherwise noted. Phase II awardees will be required to have an acceptable accounting system to receive a cost-plus-fixed-fee contract.

Only recipients of Phase I contracts will be eligible to receive a Phase II invitation.

DOT's Operating Administrations contribute to 2.5% of their Extramural Research Budget for SBIR funding. Each Operating Administration's contribution may be used only to support research of concern to that Operating Administration. For example, funds furnished by the Federal Highway Administration (FHWA) may not support research solely of concern to the National Highway Traffic Safety Administration (NHTSA). Based on anticipated funding levels, there may not be adequate funding within the DOT SBIR Program to support Phase I and/or Phase II awards for research which is solely of concern to the following Operating Administrations: Federal Aviation Administration (FAA), Federal Highway Administration (FHWA), Federal Motor Carrier Safety Administration (FMCSA), Federal Railroad Administration (FRA), Federal Transit Administration (FTA), National Highway Traffic Safety Administration (NHTSA), Research and Innovative Technology Administration (RITA), and Pipeline Hazardous Materials Safety Administration (PHMSA). Phase I and Phase II awards for such research will depend on the actual funding available.

B. Reports

Under Phase I SBIR contracts, 3 reports will be required, consisting of 2 interim letter reports, and a comprehensive final report.

C. Payment Schedule

Payments for Phase I contracts will be made in 3 equal installments upon submission of invoices by the contractor in conjunction with the submission of acceptable reports as described in Paragraph B above.

D. Innovations, Inventions, and Patents

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

If proprietary information is provided by a offeror in a proposal which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or information effecting national security, it will be treated in confidence, to the extent permitted by law, provided this information is clearly marked by the offeror with the term "confidential proprietary information" and provided the following legend appears on the title page of the proposal:

"For any purpose other than to evaluate the proposal, this proprietary information shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed in whole or in part, provided that if a contract is awarded to this offeror as a result of or in connection with the submission of this information, the Government shall have the right to duplicate, use, or disclose the information to the extent provided in the contract. This restriction does not limit the Government's right to use information contained in the document if obtained from another source without restriction. The information subject to this restriction is contained pages _____ of this proposal."

Any other legend may be unacceptable to the Government and may constitute grounds for return of the proposal without further consideration and without assuming any liability for inadvertent disclosure. The Government will limit dissemination of such information to within official channels.

DOT prefers that offerors avoid inclusion of proprietary data in their proposals. If the inclusion of proprietary data is considered essential for meaningful evaluation of a proposal submission, then such data should be provided on a separate page with a numbering system to key it to the appropriate place in the proposal.

2. **Rights in Data Developed under SBIR Contracts.** Rights in technical data, including software developed under any contract resulting from this solicitation, shall remain with the contractor 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 contractor for a period of four years from completion of the project from which the data were generated. However, effective at the conclusion of the four-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 contractor normally may copyright and publish (consistent with appropriate national security considerations, if any) material developed with DOT support. The DOT receives a royalty-free license for the Federal Government and requires that each publication contain an appropriate acknowledgement and disclaimer statement.
4. **Patents.** Small business firms normally 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 normally 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 contractor a reasonable time to pursue a patent.

Awardee may report inventions to the Department of Transportation (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

Cost-sharing is permitted for Phase II proposals under the topic areas identified in this solicitation; however, cost-sharing is not required nor will it be a factor in proposal evaluations.

F. Profit or Fee

A profit is allowed on awards to small business concerns under the DOT SBIR Program.

G. Joint Ventures or Limited Partnerships

Joint ventures and limited partnerships are permitted provided the entity created qualifies as a small business concern in accordance with the Small Business Act, 15 U.S.C. 631, and the definition included in this solicitation.

H. Research and Analytical Work

1. **For Phase I, a minimum of two-thirds of the research and/or analytical effort must be performed by the proposing firm** unless otherwise approved in writing by the Contracting Officer.
2. **For Phase II, a minimum of one-half of the research and/or analytical effort must be performed by the proposing firm** unless otherwise approved in writing by the Contracting Officer.

I. Contractor Commitments

Upon award of a contract, the awardee will be required to make certain legal commitments through acceptance of numerous contract clauses. The outline that follows is illustrative of the types of clauses to which the contractor would be committed. This list shall not be understood to represent a complete list of clauses to be included in Phase I contracts, nor to be the specific wording of such clauses. A complete copy of the terms and conditions will be provided upon issuance of the model contract for signature prior to award.

1. **Standards of Work.** Work performed under the contract must conform to high professional standards.
2. **Inspection.** Work performed under the contract is subject to Government inspection and evaluation at all times.
3. **Examination of Records.** The Comptroller General (or a duly authorized representative) shall have the right to examine any directly pertinent records of the contractor involving transactions related to this contract.
4. **Default.** The Government may terminate the contract if the contractor fails to perform the work contracted.
5. **Termination for Convenience.** The contract may be terminated at any time by the Government if it deems termination to be in its best interest, in which case the contractor will be compensated for work performed and for reasonable termination costs.

6. **Disputes.** Any dispute concerning the contract which cannot be resolved by agreement shall be decided by the Contracting Officer with right of appeal.
 7. **Contract Work Hours.** The contractor may not require an employee to work more than eight hours a day or 40 hours a week unless the employee is compensated accordingly (i.e., overtime pay).
 8. **Equal Opportunity.** The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin.
 9. **Affirmative Action for Veterans.** The contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era.
 10. **Affirmative Action for Handicapped.** The contractor will not discriminate against any employee or applicant for employment because he or she is physically or mentally handicapped.
 11. **Officials Not to Benefit.** No member of or delegate to Congress shall benefit from the contract.
 12. **Covenant Against Contingent Fees.** No person or agency has been employed to solicit or secure the contract upon an understanding for compensation except bonafide employees or commercial agencies maintained by the contractor for the purpose of securing business.
 13. **Gratuities.** The contract may be terminated by the Government if any gratuities have been offered to any representative of the Government to secure the contract.
 14. **Patent Infringement.** The contractor shall report each notice or claim of patent infringement based on the performance of the contract.
 15. **Procurement Integrity.** Submission of a proposal under this solicitation subjects the offeror to the procurement integrity provision (§27) of the Office of Federal Procurement Policy Act (41 U.S.C. 423). This statute, as implemented by Federal Acquisition Regulation (FAR, 48 CFR) §3.104, prescribes the following conduct by competing contractors during an agency procurement: offering or discussing future employment or business opportunities with an agency procurement official; promising or offering a gratuity to an agency procurement official; and/or soliciting or obtaining proprietary or source selection information regarding the procurement. Violations of the statute may result in criminal and/or civil penalties, disqualification of an offeror, cancellation of the procurement, or other appropriate remedy.
16. **Section 508 Access Board Standards.** All electronic and information technology deliverables rendered must comply with Section 508 of the Rehabilitation Act and the Access Board Standards available for viewing at <http://www.section508.gov>. Unless otherwise indicated, the contractor represents by signature on a contract that all deliverables will comply with the Access Board Standards.
 17. **Government Property.** Equipment either furnished or acquired under this contract is subject to Federal Acquisition Regulation 52.245-1 Government Property (June 2007) clause (and Small Business Innovation Research (SBIR) Program Policy Directive, Section 8 (c).

FAR: <http://acquisition.gov/comp/far/current/html/52>

SBIR Policy Directive: <http://www.sba.gov/aboutsba/sbaprograms/sbir/sbirstir/index.html>
- J. Additional Information**
1. This solicitation is intended for informational purposes and reflects current planning. If there is any inconsistency between the information contained herein and the terms of any resulting SBIR contract, the terms of the contract are controlling.
 2. Before award of an SBIR contract, the offeror shall complete Online Representations and Certifications Application: <https://orca.bpn.gov>
 3. The Government may request the offeror to submit additional management, personnel, and financial information to assure responsibility of the offeror.
 4. The Government is not responsible for any monies expended by the offeror 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 DOT SBIR Program is not a substitute for existing unsolicited proposal mechanisms. Unsolicited proposals shall not be accepted under the DOT SBIR Program in either Phase I or Phase II. For information pertaining to submission requirements for unsolicited proposals please go to the following web page <http://www.volpe.dot.gov/procure/unsolguide.html>.
7. If an award is made pursuant to a proposal submitted under this solicitation, the contractor will be required to certify that he or she has not previously been, nor is currently being paid for essentially equivalent work by any agency of the Federal Government.
8. When purchasing equipment or a product with funds provided under the DOT SBIR Program, purchase only American made equipment and products, to the extent possible in keeping with the overall purposes of the program.
9. In accordance with FAR 52.233-2, Service of Protest, the following Service of Protest procedures shall be followed. Protests, as defined in Section 33.101 of the FAR that are filed directly with an agency, and copies of any protests that are filed with the Government Accountability Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgement of receipt from: Orin Cook, DOT/RITA/Volpe Center, 55 Broadway, RVP-31, Cambridge, MA 02142-1093

VI. RESEARCH TOPICS

Phase I research topics for DOT Operating Administrations are listed below. These topics indicate the specific areas for which proposals are to be considered for acceptance by DOT. The topics are not listed in any order of priority. Each proposal must respond to one (and only one) topic as described in this section. A proposal may, however, indicate and describe its relevance to other topics.

<u>DOT OPERATING ADMINISTRATION/TOPIC</u>	<u>MAXIMUM PHASE I AWARDS</u>
FEDERAL AVIATION ADMINISTRATION	1 AWARD
10.1-FA1 NextGen Human Factors Transition Tool	
FEDERAL HIGHWAY ADMINISTRATION	3 AWARDS
10.1-FH1 Transportation System Performance Measurement Using Existing Loop Infrastructure	
10.1-FH2 Expert System Traffic Signal Analysis Tool	
10.1 FH3 Simulating Signal Phase and Timing with an Intersection Collision Avoidance Traffic Model	
FEDERAL RAILROAD ADMINISTRATION	6 AWARDS
10.1-FR1 Flangeway Gap Material or Device	
10.1 FR2 Low Cost Detection of Vehicle or Person in Grade Crossing	
10.1 FR3 Constant Warning Time Grade Crossing Activation System	
10.1 FR4 Advanced Rail Yard Inspection Vehicle	
10.1 FR5 Improvements to Continuous Welded Rail (CWR) using Innovative Field Welding Techniques	
10.1 FR6 Non-Contact Track Gage Measurement Device	
FEDERAL TRANSIT ADMINISTRATION	3 AWARDS
10.1 FT1 Safer, Greener, User-Friendly Bus and Rail Transit	
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION	2 AWARDS
10.1 NH1 Driver Behavior and Crash Avoidance Monitoring System for Vehicles	
10.1 NH2 Radio Frequency Identification Licensing System for Motor Vehicles	
PIPELINE AND HAZARDOUS MATERIALS SAFETY ADMINISTRATION	1 AWARD
10.1-PH1 In-service Testing of Composite Cylinders	

Federal Aviation Administration (FAA)

10.1-FA1 NextGen Human Factors Transition Tool

A human system integration (HSI) measurement tool is needed to model the human factors maturity and readiness of operational capabilities comprising the Next Generation Air Transportation System (NextGen) for transitioning from research and development to implementation. NextGen poses impressive transitions of new technologies, concepts, and automation needed to handle projected increased future traffic demand placed on the National Airspace System (NAS). These transitions will occur both in the aircraft and with air traffic control (ATC) and involve dramatic delegation for spacing and separating aircraft to pilots from controllers. The transitions will also challenge the architects of NextGen in determining how new sophisticated automation and associated procedures can efficiently handle more traffic while avoiding overload on the pilot and controller.

The HSI measurement tool would classify and model the portfolio of NextGen operational capabilities in order to measure the level of HSI maturity of a new technology or application during its development. Previous human factors research reported on a set of some 20 attributes used to assess human factors risk in development of air traffic management systems (see <http://www.hf.faa.gov/Portal/techrptdetails.aspx?id=1646>). The classification should demonstrate the mutual interdependencies and interactive constraints among a heterogeneous set of operational capabilities. The classification would identify research issues resulting from these constraints on the human operator and the implications for technology or automation maturity being developed.

Research is needed to develop and validate anchors by which to measure and model the maturity of human factors considerations associated with NextGen operational improvements. The model could start with Technology Readiness Levels, or Levels of Maturity as described in the FAA System Engineering Manual (see paragraph 4.2.6.2.3 on FAA System Engineering Milestones at http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/operations/sysengsaf/seman/SEM3.1/Section%204.2%20v3.pdf). This research would develop the tool for use in benchmarking and transitioning NextGen capabilities across all stages of development. The tool could also provide an important human factors technique in the evaluation during operational testing.

By defining a network of key HSI attributes, this research will provide a new framework for defining, assessing, and understanding the maturity of individual operational capabilities. The research will extend this perspective to examining the interoperability of capabilities as aircraft progress through different phases of flight, as described in the NextGen Implementation Plan in relation to technology, automation, and procedures (see <http://www.faa.gov/about/initiatives/nextgen/media/ngip.pdf>). This provides a unique nomological view on both major and subtle changes in the demands on pilot and controller situation awareness, workload, and communications in relation to the envelope of effective and efficient human performance.

This research aligns with OMB-OSTP memorandum M-09-27 and its General Science and Technology Program Guidance that "Agencies should develop 'science of science policy' tools that can improve management of their research and development portfolios and better assess the impact of their science and technology investments."

The output of the Phase I research effort is to spawn an innovative approach modeling the contribution of HSI in measuring the maturity of NextGen research capabilities for transition to implementation.

Federal Highway Administration (FHWA)

10.1-FH1 Transportation System Performance Measurement Using Existing Loop Infrastructure

Travel time and origin-destination data and characterization are key to System Performance Measurement. The objective of this project is to develop an inductive loop based technology for monitoring the travel time and origin-destination performance of vehicles that augments a Bluetooth based travel time system now under development.

This technology is intended to complement the Bluetooth based travel time and origin-destination technology¹ being developed under a separate SBIR project² and being independently explored by various universities and state DOTs. Inductive loop signature identification and re-identification has several advantages over and disadvantages under the Bluetooth based technology. To their advantage, loop signatures characterize almost 100% of the vehicles traveling over them while Bluetooth technology characterizes none of them. Bluetooth always correctly re-identifies vehicles while loops may mismatch or miss signature matches. Loop signature technology works best where there are already preexisting loops for either signal control, weigh in motion systems, permanent count stations or speed measurement with only minimal additional loops needed for completing the system performance measurement network while Bluetooth sensors can be deployed in any location with power access and many without power access. Loops give a very accurate estimate of total vehicle count while Bluetooth only gives a 5 to 10% sample. Because of this, the two systems are complementary rather than competitive. Together, they would allow a very accurate estimate of surface transportation system performance which is a key USDOT goal.

The objective of measuring travel time has several aspects. First, the vehicle signature must be accurately yet anonymously sensed at the first location. For the purposes of this SBIR "accurately sensed" includes providing an accurate classification of the vehicle according to the FHWA classes³ based on the vehicle signature. Second, the vehicle must be accurately yet anonymously sensed at a second location. Third, communications must make it possible to accurately match the two loop signatures and the elapsed time between the two identifications while providing anonymity to the driver. Fourth, it must be possible to assemble these identifications into travel time and origin-destination data for purposes of developing System Performance Measurement. This must be done in

¹ Wasson, Jason S.; Sturdevant, James R.; Bullock, Darcy M., "Real-Time Travel Time Estimates Using Media Access Control Address Matching", Institute of Transportation Engineers, ITE Journal, June 1, 2008.

² FHWA SBIR 08-FH2, "Research and Development of Anonymous Traffic Probes for Travel Time and Origin-Destination using Bluetooth IDs."

³ Traffic Monitoring Guide, FHWA-PL-01-021, <http://www.fhwa.gov/ohim/tmguide/index.htm>

near real time if the data is to be available for real time transportation systems developed with FHWA funding such as Adaptive Control System (ACS) and ACS-Lite.

The software for processing the unique signatures, tracking the travel time measurements from the unique signatures, and communicating them from location to location may be proprietary. However, to make the system useful to a wide variety of Transportation Management Centers and Real Time Control Systems such as ACS and ACS-Lite, there must be an open source software package which can take these signatures and corresponding vehicle classifications and calculate travel time and origin-destination data as well as providing information availability to the local Advanced Transportation Controllers. The open source requirement is to ensure full and continued evaluation of the algorithms. Communications should be encrypted with the GNU OpenPGP to facilitate data privacy and prevention of tampering.

<http://www.gnupg.org/>
<http://www.ietf.org/rfc/rfc4880.txt>

In Phase I, field tests must demonstrate that the technology can successfully sense and track vehicles between two points with vehicle classification. Statistical characterizations of the number of vehicles that can be successfully identified at the first location and then re-identified at the second location must be made. These should be compared to ground truth against the total vehicle population traveling between the two points. This will demonstrate the potential of the new technology. The loop signature sensor hardware may be a device previously developed by the SBIR proposer or one of its partners or may be developed or developed further under this project.

Phase II would develop the new or enhanced technology and then demonstrate the prototype at a sequence of intersections and freeway locations. The technology should be evaluated at a sequence of instrumented stations for establishment of a rigorous statistical measurement of the accuracy of the technology against "ground truth" in the real world during a variety of weather conditions. The University of California-Path, Virginia Tech, Purdue, and Texas A&M have sensor test facilities which might be suitable for such tests. A demonstration of the basic effectiveness of the concept would also be conducted at the TFHRC intelligent intersection. (note: The TFHRC intersection uses 2070 ATC units so use of another class such as regular ATC's or NEMA controllers might require demonstration of one of the alternative sites. Compatibility with one of 1) 2070 ATC, 2) ATC or 3) NEMA standard traffic signal controller would be part of the Phase II test.

NOTE: The specific technology(ies) for the communications have not been specified. Several traffic signal control companies and traffic sensor manufacturers already have communications systems which might be built upon or the proposer may develop their own.

Preferred strengths for the project team include experience with inductive loop signatures, vehicle classification, vehicle identification, communications of traffic data, system integration, traffic engineering, and experience on sensor applications, software development and system communications. Also preferred are experience with traffic data collection and analysis for systems validation. Inductive loop sensor manufacturing capability or partnership with an inductive loop sensor manufacturer would be preferred. Understanding of Bluetooth data collection systems and how they might work with or complement Inductive Loop Signature systems is needed.

Relationship to FHWA Strategic Objectives (from : FHWA STRATEGIC PLAN Publication No. FHWA-PL-08-027, October 2008, <http://www.fhwa.dot.gov/policy/fhplan.html>)

- System Performance - Objective 1 - Performance Indicators - Develop and use a nationally recognized, credible, balanced, and readily digestible suite of national highway system

performance indicators, focusing on the NHS, Strategic Highway Network, and other major arterials and intermodal connectors. (Strategic Plan Page 11)

- Strategy – 1.2 Develop a robust system for collecting, analyzing, and integrating the data necessary to calculate, forecast, and display the selected performance indicators and identify critical performance gaps.
- Strategy – 1.3 Develop methods for effectively communicating system performance information to partners, Congress, and the media..

Note: The outcome of this study will be a robust system for collecting, analyzing, and integrating and communicating system performance.

- Objective 2 – Performance Improvements: Make significant improvements to critical aspects of highway system performance (safety, congestion, reliability, infrastructure condition, air quality, user satisfaction, and emergency response). (Page 12 of Strategic Plan)
 - 2.2 Evaluate causes of congestion and develop deployable tools, options, and solutions that reduce congestion.
 - 2.4 Improve highway system reliability through operations, intermodal integration, and increased multijurisdictional institutional capacity and cooperation.

Note: Only Bluetooth and loop signature identification/re-identification systems have the current potential to evaluate causes of congestion. System performance measurement at a reasonable price point for deployment is a critical key to assist in creating solution strategies t. •Such systems would enable metropolitan areas with comprehensive, network level traffic signal management systems to monitor and maintain system performance. These systems would also allow urban and rural jurisdictions to provide access to real-time travel conditions information, such as 511 travel information systems and dynamic message signs where loop based systems currently exist.

These outcomes cannot be reached unless systems can reliably and accurately detect and characterize vehicle segment traffic travel times and road segment to road segment origin-destination movements in all weather and lighting conditions. Inductive loop signature technologies are fully all weather and software would allow them to emulate probe vehicle data with 100% sampling. The desired outcome of this study is hardware and software which will enable implementing these strategies.

- Relationship to fuel consumption and emissions – Improved highway system performance in safety, congestion, and reliability, directly caused reductions in fuel consumption, CO2 emissions and air quality for the same VMT.

Note: Providing real time travel time measurements and origin destination data to traffic control systems would allow construction of new kinds of algorithms for Adaptive Control Systems (ACS) and Traffic Responsive Control Systems that cannot exist with current technology.

10.1-FH2 Expert System Traffic Signal Analysis Tool

Problem Statement

Effective signal timing is a process that requires system-wide data collection and analysis, expertise with conventional timing theory, and localized signalization experience for best outcome.

Project Goal and Objectives

The goal of this project is to develop a comprehensive signal analysis tool, which has the capability to collect system-wide traffic data and localized expert knowledge, and to perform system-wide signal timing analysis for the diagnosis of any signal timing problem.

Objective #1

To develop a low-cost, wireless networked sensor group which can be easily deployed for temporary data collection. The data from sensors will be transmitted to a central computer through the wireless network.

Objective #2

To develop a data interface tool that can perform data fusion and data pre-processing for the analysis tool.

Objective #3

To develop a knowledge-based Expert System that can use conventional traffic signal timing theory, localized knowledge on signal networks and timing plans to perform signal system analysis.

These objectives are often not met in real world practice due to certain technical constraints and the optimal system-wide time is not achieved.

Major constraints include:

1. It is very difficult to collect synchronized, system-wide traffic and timing data. Without such data, it is very hard to figure out the problems of signal timing in a network.
2. It is very difficult to comprehend and analyze the whole dimension of system-wide data. For example, managing thousands, if not millions of data inputs are beyond what a human brain can do.
3. There is no effective analysis tool that can process system-wide, comprehensive data to identify systematic signal timing issues.

BACKGROUND

Here is an example of signal constraint:

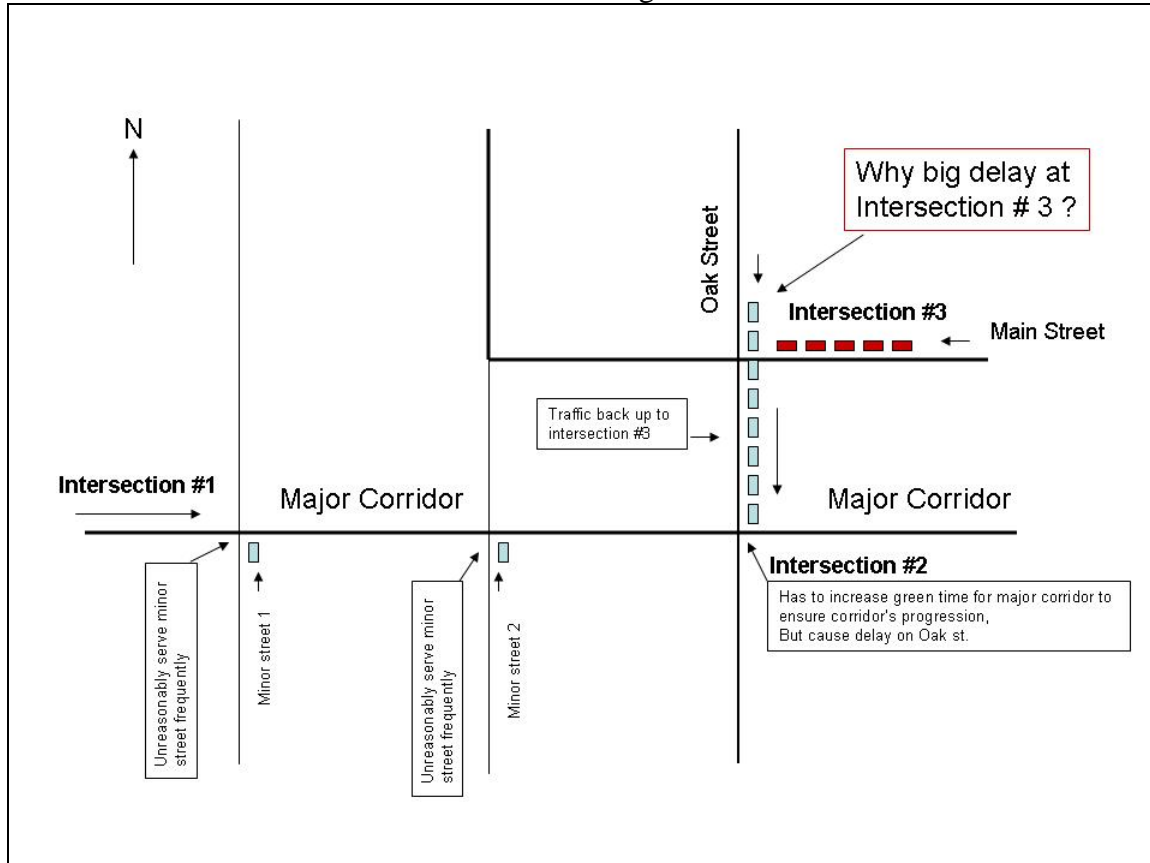
As shown in Figure 1, a major corridor runs E-W direction and needs guaranteed green time to maintain progression. There is a frequent delay at intersection #3 on this major corridor. But the reason for that delay is not initially clear – why is there such a long delay at Intersection #3?

Through a system-wide analysis it was found that the cause of this delay was due to the timing at intersection #1 – at this intersection a frequent, preferential service was given to the minor street, meaning vehicles at the minor street did not have to wait a long time to get green light. In this way, platoons of vehicles on a major corridor were stopped frequently causing wasted green light time at downstream intersection #2. In order to enhance progression, intersection #2 had to increase its green phase to compensate for the lost green time. Unfortunately, this increase caused delays on Oak Street

(see diagram below). Consequently, traffic queues on Oak Street would frequently extend into intersection #3 and then block Main Street traffic. This was the main reason for traffic delays on Main Street at the intersection #3.

This example shows that in order to figure out the problem in one intersection, system-wide, synchronized traffic and timing data is required, as well as conventional timing theory and localized knowledge. If a system-wide approach is not employed, unanticipated consequences may occur at other locations.

Figure 1



The Benefits of the Project

Every day, traffic delays and air pollution are caused by ineffective traffic signal timing. However, it is very hard for traffic agencies to expedite timing solutions due to lack of resources and effective tools.

The Intelligent Signal Analysis Tool, which will be developed in this project, will be a powerful tool to help the agencies address signal timing issues. This tool will provide effective diagnosis of timing problems and serve as a powerful evaluation tool. Using the tool, traffic agencies can save costs in data collection and achieve much better signal timing.

In summary, this tool will greatly improve signal timing –traffic delay and air pollution will be greatly reduced.

Phase I Tasks

Task I

To develop and test 20 low cost sensors (such as magnet sensors) in a network with wireless networking capability. Sensor data needs to be time stamped and transmitted to a central computer.

Task II

To develop and test a data interface which can receive data from sensors and controllers through a wireless network. This interface also performs data fusion and pre-processing for the knowledge base.

Task III

To develop a prototype knowledge based Expert System. The Expert System will be powered by rule-based knowledge from human experts. It will produce output using the knowledge base and pre-processed data, and it will also have capability to interact with human experts as well as simulation programs.

Task IV

1) To apply the developed sensors group to a small traffic network to demonstrate the data collection functions; 2) To input the collected data and collected localized expert knowledge into the data interface, and 3) To demo the data fusion and pre-processing functions.

Task V

To apply the Expert System with a simulated signal system using collected traffic and signal data. The task is to demonstrate the capability of the expert system.

The deliverable of Phase I is a functional prototype signal analysis tool.

The Phase II Expectations

After the proof-of-concept in Phase I, following steps are expected in Phase II:

- (1) The knowledge base will be populated to an applicable level for real-world use.
- (2) The sensor group will have the capacity to cover any size network.
- (3) An operational version of the product which will be fielding tested by a champion state DOT on a mid-size traffic network.

10.1-FH3 Simulating Signal Phase and Timing with an Intersection Collision Avoidance Traffic Model

OBJECTIVE

Use object-oriented structured programming and JAVA (a programming language developed by Sun Microsystems) to enable open source TEXAS (Texas Experimental and Analytic Simulation) intersection collision simulation to model Signal Phase and Timing data (SPAT) broadcasts and Geometric Intersection Description (GID) broadcasts to vehicles.

TECHNICAL DESCRIPTION

The TEXAS model is a high-quality single intersection simulation model. TEXAS analyzes in microscopic detail the behavior of vehicles as they go through intersections and mix with other traffic flows. Most simulation models discard this level of detail in favor of focusing on the surface street

network for congestion mitigation or planning purposes. TEXAS has path following, microscopic car following, visibility restriction features and surrogate safety measures allowing it to be used for intersection collision analysis. This makes it suitable for research into SPAT and GID modeling to facilitate research and design in the applications of these Intellidrive tools. Making SPAT and GID easy to model would encourage their use in the safety and operations design of intersections for Intellidrive that consider both traffic collision/safety potential and traffic operations enhancements.

The SPAT broadcast message consists of current state of signal phasing and time remaining in that phase. Under the broad category of DSRC, the Society of Automotive Engineers (SAE) is developing standards for SPAT messages. These draft standards are contained in SAE J2735. GID information is needed to accurately place the vehicle in the proper position within the intersection. The vehicle will have latitude and longitudinal information of its location through GPS. Intersection information is needed to place the vehicle in its lane as well as determine vehicle position relative to the stop line.

For the purposes of this study, it is envisioned that SPAT and GID will consist of a separate set of routines that have access to the signal state and timing of the controller. It will then “broadcast” by simulated messages over the “DSRC” to vehicles. A simulated vehicle on board application can then perform a number of functions consisting of an advisory to the simulated driver, partial vehicle control, or full vehicle control to prevent simulated crashes.

PROJECT ISSUES

This project will also use object-oriented structured programming techniques and JAVA to adapt the open source interactive graphical interface of the TEXAS intersection collision simulation for intersections (stop sign, pre-timed and actuated traffic signals) to handle SPAT, GID and Intellidrive applications. (Note- this interface is and would have to remain “Section 508 handicapped accessibility” compatible). TEXAS and its interface program and all of its code are copyrighted under the Free Software Foundation statement. The SPAT/GID enabled model would continue to be programmed in JAVA and Fortran 2000+ to continue their platform independence. It would continue to run on at least Windows XP, LINUX and MacOS and if possible, Windows 7.

PHASE I AND PHASE II DELIVERABLES

Phase I would develop a simple SPAT and simulate a simple Intellidrive application using the SPAT data.

Phase II would add configurable SPAT and GID features and additional Intellidrive applications such as those being worked on by UC Berkeley, Va. Tech and the University of Minnesota, and Bonneson’s red light running reduction system.

Phase II would also enable running of vendor PC-based emulators of real traffic signal controllers as well as SPAT enhanced hardware in loop simulation. Phase II will be staged with interim deliverables. For this reason, experience in traffic simulation modeling, JAVA, section 508 compatible data entry, CAD and traffic operations are critical.

Note: Although not required, it would be helpful if you provide in your proposal a working example to demonstrate your ability to work with Java and user interfaces.

For an overview of TSIS, CORISM and related materials see:

<http://ops.fhwa.dot.gov/trafficanalysistools/corsim.htm>

The following site explains the philosophy of the GPL. <http://www.gnu.org/philosophy/free-sw.html>

This site explains categories of software and copyright and the description of the license:

<http://www.gnu.org/copyleft/gpl.html>

Federal Railroad Administration (FRA)

10.1-FR1 Flangeway Gap Material or Device

The flangeway gap at grade crossings presents a hazard to people in wheelchairs and on bicycles. The narrow tires of wheelchairs and bicycles can get trapped in the flangeway gap and either trapping the person or throw the person from the wheelchair or bicycle. The purpose of this Phase I study is to develop a variety of materials or devices which will fill the gap under light loads of a wheelchair or bicycle but compress or retract when a train wheel flange passes over it. The material or device will be tested under heavy and light train loads for safety, effectiveness, durability, and cost.

10.1-FR2 Low Cost Detection of Vehicle or Person in Grade Crossing

The purpose of this research is to develop a low cost system to determine when a person or vehicle is in the grade crossing. The life cycle cost of the system must be less expensive than loop detectors. The system will be tested and compared to loop detectors in terms of installation, maintenance and operation costs, as well as safety, effectiveness, and reliability.

10.1-FR3 Constant Warning Time Grade Crossing Activation System

The purpose of this research is to develop and test a constant warning time grade crossing activation system which minimizes the use of track detectors and circuits through the use of Differential Global Positioning System (DGPS) and telecommunications. The system must be fail safe and be very reliable. The system will be tested and compared with current track circuit technology. The objective is to develop a system that performs better than current technology, is as safe or safer, and costs less.

10.1-FR4 Advanced Rail Yard Inspection Vehicle

It is necessary to increase employee safety during yard inspections and operations. The purpose of this research is to design, develop and test an advanced inspection vehicle which will not only enhance operation efficiency but most importantly, improve employee safety in rail yards. The system must have the ability to perform complex tasks and access small yet dangerous spaces in order to perform complete and comprehensive inspections procedures. This modular vehicle concept is intended to provide either remote operation or autonomous navigation in the rail yard. The advanced inspection vehicle will perform automated car inspections and have the ability to conduct various maintenance activities.

10.1-FR5 Improvements to Continuous Welded Rail (CWR) using Innovative Field Welding Techniques

FRA wishes to investigate the possibility of designing a portable Field Welding system that can improve the reliability and safety of railroad infrastructure. Failure of in field welds are a significant cause of rail separation that leads to track caused derailments. Through the testing and development of improved Continuous Welded Rail (CWR) field welding techniques, both track maintenance time and track derailments can be reduced. The system should generate welds that meet or exceed AREMA specifications and substantially reduce the current down time associated with field repair of CWR sections (allowing for minimal track/service interruption) and reduce costs associated with existing welding technologies (i.e., thermite & flash-butt) by use of the portable innovative welding system. The system should be of a scale that allows for ease of transportation to and from multiple track locations and be self contained allowing for repeat usage as needed

10.1-FR6 Non-Contact Track Gage Measurement Device

FRA wishes to investigate the possibility of designing a non-contact track gage measurement device. This system should be easily installed on any rail vehicle (locomotive, passenger or freight cars) and measure the track gage in accordance to FRA track safety standards. In addition the system should be able to operate in adverse weather conditions (rain, snow) and should not interfere with track components or vehicle operation. The system should be able to collect all the data in both the forward and the reverse move at all speeds up to 125 mph and report the data at one foot interval. The measurement range and accuracy for each channel are as follows: (Gage (inches): 55 1/2" to 58 1/2" Range, 0.0625" Precision). The current technologies (contact, optical, or eddy current) will not be considered.

Federal Transit Administration (FTA)

10.1-FT1 Safer, Greener, User-Friendly Bus and Rail Transit

Economical and durable technologies and devices for improving safety for riders and transit agency employees, reducing noise and energy consumption, or improving the rider experience. The innovations must be adaptable to existing bus and rail transit vehicles and systems.

National Highway Traffic Safety Administration (NHTSA)

10.1-NH1 Driver Behavior and Crash Avoidance Monitoring System for Vehicles

Human factors play a large role in crash causation. The extent to which human factors play a role has been quantified by the Large Truck Crash Causation Study, published by the FMCSA in 2006, where driver behavior was associated with 87% of the 141,000 truck crashes (fatal and injury) covered by the study. The vehicle itself was associated with 10% and the environment with just 3% of the crashes in the study. It is considered that the conclusions reached in the Large Truck Crash Causation Study above are similarly valid for passenger cars and light trucks.

In order to manage driver behavior more effectively, it is necessary to measure this variable directly, and ideally, in near real time.

For this technology to have maximum impact, it must be available for the existing national fleet, be generally independent of vehicle systems (except for power) and be relatively inexpensive, so that the adoption rate will be meaningful, and thus have a measurable effect on the national crash rate.

Although a number of after-market systems that monitor drivers exist (e.g., camera base technology), they do not integrate real-time data analysis and transmission of driver behavior to the driver and fleet operator. Such a system would provide both the driver and the fleet operator significant information. The driver could modify undesirable behavior and the fleet operator could determine driver's performance and have objective information of incidents that may occur in near real time.

Phase I will address five activities:

- 1) Develop a concept algorithm to monitor driver behavior which embeds in the firmware of an embedded system.
- 2) Develop communications software enabling an embedded module to transmit reports using GPRS over mobile phone networks to a remote web server

- 3) Develop communications software enabling an embedded system to transmit real time feedback to driver.
- 4) Create concept of a Web-based hosting environment comprising a database, and graphical user interface and digitized mapping.
- 5) Demonstrate the concept of an embedded system incorporating, microprocessor, non volatile memory, accelerometers, GPS and GSM (for transmission of reports in real time), software developed above and ports for downloading and connection with serial devices.

The outcome of Phase I will be a demonstration of a system for driver behavior and crash avoidance monitoring, incorporating the elements described above. The demonstration should be an advanced concept or prototype. A final report and presentation will be required also. It should include clear description of concepts for feedback that do not cause undue distraction to the driver.

A Phase II would be an effort to further develop, refine, and test the concept or demonstration of the Driver Behavior and Crash Avoidance System. Methods for manufacturing and commercialization of the product would be identified in Phase 2.

10.1-NH2 Radio Frequency Identification Licensing System for Motor Vehicles

In 2007, according to the National Highway Traffic Safety Administration's (NHTSA) National Center for Statistics and Analysis, 36% of all motorcycle riders involved in fatal crashes were speeding⁴, compared to 24% for passenger car drivers, 19% for light-truck drivers, and 8% for large-truck drivers. There are increasing reports in multiple State jurisdictions across the United States that motorcycle riders intentionally conceal motorcycle license plates and operate their vehicles in a reckless manner on public roadways knowing that (1) law enforcement personnel do not possess a tool with which to positively identify the motorcycle or the rider, and (2) law enforcement personnel are prohibited from engaging in high-speed pursuit in many jurisdictions. Therefore, the goal of this research study is to develop a radio frequency identification (RFID) system for motor vehicle (including motorcycle, passenger car, light-truck, etc.) license plates to assist law enforcement in highway safety activities. While the initial concept for this project is focused on improving motorcycle operator compliance with laws through increased technology for law enforcement agencies, there are other applicable roles for this technology (i.e., identification of stolen vehicles, etc.) that would benefit law enforcement agencies.

There is no one definitive "RFID technology". Rather, there is a wide range of technical solutions ranging from simple, inexpensive, and common to those with more functionality, performance, and cost. In its simplest form in common use today, an RFID system consists of four elements: a tag, antenna, reader, and host computer.

Phase I will address five activities: (1) conduct a literature review on existing RFID systems applicable to motor vehicles, toll collection, border crossings, and traffic flow monitoring; (2) develop the proof of concept for a RFID licensing system that law enforcement can utilize to accurately identify all motor vehicles within a 30' or greater radius of the RFID reader in a police cruiser and identify the direction/location of the RFID tag with respect to the location of the RFID reader in the

⁴ NHTSA considers a crash to be speeding related if the driver or motorcycle rider was charged with a speeding-related offense or if an officer indicated that racing, driving too fast for conditions, or exceeding the posted speed limit was a contributing factor in the crash.

police cruiser; (3) develop a mock-up of an RFID reader that would minimally impact a police cruiser's power supply, minimally impact available space in the passenger compartment and/or the exterior of the vehicle if equipment installation is required, and connect to existing law enforcement computer systems currently in use; (4) develop a mock-up for passive, read-only and read/write RFID tag/antenna that can be imbedded in (not affixed to) a motor vehicle license plate and can be programmed at the time of license plate manufacture or by a State agency at a later date with appropriate data, such as State name, license plate number, vehicle identification number (VIN), vehicle make, vehicle model, and vehicle model year; and (5) conduct a cost and methodology analysis for fully developing and field testing a prototype RFID licensing system developed under Phase I. The outcome of Phase I will be a final report on the proof of concept for a prototype RFID system for motor vehicle license plates, including a discussion on the technical aspects of the prototype RFID system, software packages, RF spectrum, accuracy and fall-off range, interference, tampering, cost, and methodology for conducting a field test or demonstration project.

If a prototype RFID licensing system for motor vehicles can be developed at a reasonable cost, the project would move to Phase II. Phase II would be an effort to fully develop, refine, and test the prototype RFID licensing system to include a small-scale field test or demonstration project. The objectives of Phase II are to (1) develop and refine the prototype RFID licensing system; (2) test the methodology and accuracy for storing, collecting, analyzing, and managing relevant data; (3) conduct a field test or demonstration project to test real world applicability of the prototype RFID licensing system. The outcomes of Phase II are to determine (1) if the prototype RFID licensing system is feasible; (2) the extent to which data can be stored, collected, analyzed, and managed; and (3) the extent to which jurisdictional law enforcement agencies volunteer to accept a new technology to enforce traffic laws. These outcomes would be included in a final report detailing the extent to which a full-scale study is feasible, and if feasible, describe the most efficient methodology for a full-scale study within a State jurisdiction.

Pipeline and Hazardous Materials Safety Administration (PHMSA)

10.1-PH1 In-service Testing of Composite Cylinders

Metallic lined composite cylinders have been used for many years under PHMSA's Special Permit Program. PHMSA has recently approved special permits for a composite cylinder with a non-load sharing liner. The failure modes of composite cylinders with non-load sharing liners are not well understood. DOT limits the life of composite cylinders to 15 years from the date of manufacture based upon work done by NASA and a desire to keep the possible failure rate below 1 in a million. There is a lack of information which can be used to predict the life expectancy of a composite cylinder in service. Research is needed into the development of a practical non destructive examination (NDE) method for conducting in-service testing of composite cylinders. The NDE method shall be capable of distinguishing the differences between normal fiber breakage and a critical crack which may cause cylinder failure prior to next requalification period (five years).

VII. SUBMISSION FORMS AND CERTIFICATIONS

1. PROPOSAL COVER SHEET Appendix A
2. PROJECT SUMMARY Appendix B
3. CONTRACT PRICING PROPOSAL Appendix C
4. PROPOSAL CHECKLIST Appendix D
(Do not include with your proposal – for your use only)

**U.S. DEPARTMENT OF TRANSPORTATION
 SMALL BUSINESS INNOVATION RESEARCH PROGRAM
 SOLICITATION NO. DTRT57-10-R-SBIR1
 FY10 . 1**

PROPOSAL COVER SHEET

Project Title _____

Research Topic No. _____ Research Topic Title _____

Submitted by: Name _____

Address _____

City _____ State _____ Zip + _____

Amount Requested (Phase I) \$ _____
 (May be up to \$100,000 unless otherwise indicated)

Proposed Duration _____
 (in months) (Not to exceed six months)

1. The above concern certifies it is a small business firm and meets the definition stated in Section II.B; and that it meets the eligibility requirement in Section I.C. Yes _____ No _____

2. The above concern certifies it _____ does _____ does not qualify as a socially or economically disadvantaged small business as defined in Section II.C. (For statistical purposes only.)

3. The above concern certifies it _____ does _____ does not qualify as a women-owned small business as defined in Section II.D. (For statistical purposes only.)

4. This firm and/or Principal Investigator has submitted proposals containing a significant amount of essentially equivalent work under other federal program solicitations, or has received other federal awards containing a significant amount of essentially equivalent work. (If yes, identify proposals in the Section III. D.10. "Similar Proposals or Awards".) Yes _____ No _____

5. Will you permit the Government to disclose the title and technical abstract of your proposed project, plus the name, address, and telephone number of the Corporate/Business Official and Principal Investigator of your firm, if your proposal does not result in an award, to any party that may be interested in contacting you for further information? Yes _____ No _____

6. Do you qualify as a HUBZone-owned and meet the definition as stated in this Section II. F (For statistical purposes only) Yes _____ No _____

Principal Investigator
 Name _____
 Title _____
 Signature _____ Date _____
 Telephone No. _____

Corporate/Business Official
 Name _____
 Title _____
 Signature _____ Date _____
 Telephone No. _____

PROPRIETARY NOTICE (IF APPLICABLE, SEE SECTION V.D.1)

**U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. DTRT57-10-R-SBIR1
FY10.1
PROJECT SUMMARY**

Name and Address of Offeror	FOR DOT USE ONLY
	Proposal No.

Name and Title of Principal Investigator

Project Title

Research Topic No.

Research Topic Title

Technical Abstract (Limited to two hundred words in this space only with no classified or proprietary information/data).

Anticipated Results/Potential Commercial Applications of Results.

Provide key words (eight maximum) description of the project useful in identifying the technology, research thrust, and/or potential commercial application.

**U.S. DEPARTMENT OF TRANSPORTATION
 SMALL BUSINESS INNOVATION RESEARCH PROGRAM
 SOLICITATION NO. DTRT57-10-R-SBIR1
 FY10.1**

**APPENDIX C
 (SCHEDULE 1)**

CONTRACT PRICING PROPOSAL

PROPOSAL COVER SHEET				1. SOLICITATION/CONTRACT/MODIFICATION NUMBER			
2a. NAME OF OFFEROR				3a. NAME OF OFFEROR'S POINT OF CONTACT			
2b. FIRST LINE ADDRESS				3b. TITLE OF OFFEROR'S POINT OF CONTACT			
2c. STREET ADDRESS				3c. TELEPHONE		3c. FACSMILIE	
2d. CITY	2e. STATE	2f. ZIP CODE	AREA CODE	NUMBER	AREA CODE	NUMBER	
4. TYPE OF CONTRACT OR SUBCONTRACT (<i>Check</i>)				5. <input type="checkbox"/> PRIME OFFEROR			
<input checked="" type="checkbox"/> FFP <input type="checkbox"/> CPFF <input type="checkbox"/> CPIF <input type="checkbox"/> CPAF <input type="checkbox"/> FPI <input type="checkbox"/> OTHER (<i>Specify</i>)				<input type="checkbox"/> SUBCONTRACTOR _____ PRIME OFFEROR'S NAME			
6. ESTIMATED COST, FEE, AND PROFIT INFORMATION							
A. ESTIMATED COST							
B. PROFIT							
C. TOTAL PRICE							
7. PROVIDE THE FOLLOWING							
NAME OF COGNIZANT CONTRACT ADMINISTRATIVE AGENCY				NAME OF COGNIZANT GOVERNMENT AUDIT AGENCY			
STREET ADDRESS				STREET ADDRESS			
CITY	STATE	ZIP CODE	CITY	STATE	ZIP CODE		
TELEPHONE	AREA CODE	NUMBER	TELEPHONE	AREA CODE	NUMBER		
FACSIMILE	AREA CODE	NUMBER	FACSIMILE	AREA CODE	NUMBER		
NAME OF CONTACT				NAME OF CONTACT			
PROPERTY SYSTEM				APPROXIMATE DATE OF LAST AUDIT			
<input type="checkbox"/> Reviewed by cognizant contract administrative agency and determined acceptable <input type="checkbox"/> Reviewed by cognizant contract administrative agency and determined not acceptable <input type="checkbox"/> Never reviewed				PURPOSE OF AUDIT			
PURCHASING SYSTEM				ACCOUNTING SYSTEM			
<input type="checkbox"/> Reviewed by cognizant contract administrative agency and determined acceptable <input type="checkbox"/> Reviewed by cognizant contract administrative agency and determined not acceptable <input type="checkbox"/> Never reviewed				<input type="checkbox"/> Audited and determined acceptable <input type="checkbox"/> Audited and determined not acceptable <input type="checkbox"/> Never audited			
8a. NAME OF OFFEROR (<i>Typed</i>)				9. NAME OF FIRM			
8b. TITLE OF OFFEROR (<i>Typed</i>)							
10. SIGNATURE					11. DATE OF SUBMISSION		

**U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
CONTRACT PRICING PROPOSAL
FY10.1**

Background

The following items, as appropriate, should be included in proposals responsive to this Solicitation.

Cost Breakdown Items (in this order, as appropriate) (See Section III.E)

1	Name of offeror				
2	Address of offeror				
3	Location where work will be performed				
4	Offeror's Project Title				
5	Research topic number and title from DOT SBIR Program Solicitation				
6.	Total Proposal Amount		\$ _____		
7.	Direct Material Costs				
	a.	Purchased Parts	\$ _____		
	b.	Subcontracted Items	\$ _____		
	c.	Other	\$ _____		
		(1) Raw Materials	\$ _____		
		(2) Standard Commercial Items	\$ _____		
		Total Direct Materials (TDM)	\$ _____		
8.	Material Overhead (TDM x Rate %)				
		Rate	Amount		
	Total Material Overhead (TMO)	_____ %	\$ _____		
9.	Total Materials (TDM + TMO)		\$ _____		
10	Direct Labor				
	Type / Personnel		Hours	Rate (\$ / Hr)	Cost
					\$ _____
					\$ _____
					\$ _____
	Total Direct Labor (TDL)			\$ _____	
11.	Labor Overhead (TDL x Overhead Rate)				
		Rate	Amount		
	Total Labor Overhead (TLO)	_____ %	\$ _____		
12.	Labor: Fringe Benefits (TDL x Benefit Rate)				
		Rate (% or \$ / Hr)	Amount		
	Fringe Benefits	_____ %	\$ _____		
13.	Total Labor (TDL + TLO + Fringe)		Amount \$ _____		
14	Direct Costs: Special Testing (Include field work at Government installations)				
	Item & Anticipated Use		Unit Cost	Estimated Cost	
				\$ _____	
				\$ _____	
			\$ _____		

					\$ _____
	Estimated Total Special Testing				\$ _____
15.	Direct Costs: Special Equipment				
	Item & Anticipated Use		Unit Cost	Amount	
				\$ _____	
				\$ _____	
				\$ _____	
	Estimated Total Special Equipment				\$ _____
16	Direct Costs: Travel				
	Travel Location	Mode of Travel	# of Trips	Per Diem	Amount
					\$ _____
					\$ _____
	Travel				\$ _____
17	Direct Costs: Consultant Services				
	Description of Service				Amount
					\$ _____
					\$ _____
	Total Consultant Services				\$ _____
18	Direct Costs: Other Direct Costs (ODC) not previously accounted for.				
	Item & Anticipated Use		Unit Cost if applicable	Amount	
				\$ _____	
				\$ _____	
				\$ _____	
	Total Other Direct Costs				\$ _____
19	Total Direct Costs (TDC) (Sum of Line No. 14 – 18)				Amount
					\$ _____
20	General & Administrative Expense ((Total Materials + Total Labor + Total ODC) x Rate)				
			Rate %	Amount	
				\$ _____	
21	Royalties				
	Description				Amount
					\$ _____
	Total				\$ _____
22	Total Cost (Sum of lines 9, 13, 19, 20 & 21)				Amount
					\$ _____
23	Profit (Total Cost x Profit Rate)				
			Rate %	Calculated Amount	
				\$ _____	
24	Total Firm Fixed Price Amount (Total Cost + Profit)		\$ _____		
25	THE COST BREAKDOWN PORTION OF A PROPOSAL MUST BE SIGNED BY A RESPONSIBLE OFFICIAL OF THE FIRM. (INCLUDE TYPED NAME AND TITLE AND DATE OF SIGNATURE IN THE SPACE PROVIDED ON THE COVERPAGE OF THIS PROPOSAL)				
26	Provide a <u>yes</u> or <u>no</u> answer to each of the following questions:				(Yes / No)
	Has any executive agency of the United States Government performed any review of your accounts or records in connection with any other Government prime contract or subcontract within the past twelve months? If yes, provide the name and address of the reviewing office, name of the individual and telephone/extension below				

	Will you require the use of any Government property in the performance of this proposal? If yes, identify. _____ _____	
	Do you require Government contract financing to perform this proposed contract? If yes, specify type as advanced payments or progress payments. _____ _____ _____	
27	Type of contract proposed is, <u>firm-fixed price</u>	
28	DUNS number, if available _____ (See Section III.F)	
29	Tax Identification Number, if available _____	

**U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. DTRT57-10-R-SBIR1
FY10.1
PROPOSAL CHECKLIST**

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

- ___ 1. The proposal reflects the fact that for Phase I a minimum of two-thirds (and for Phase II a minimum of one-half) of the research and/or analytical effort will be performed by the proposing firm as required (see Sections V.H.1 and V.H.2) and the primary employment of the principal investigator (for both Phase I and Phase II) must be with the small business firm at the time of award and during the conduct of the proposed research as required (see Section I.C).
- ___ 2. The proposal is 25 PAGES OR LESS in length. This limitation does not apply to the additional information required by Section III.G.
- ___ 3. The proposal is limited to only ONE of the research topics in Section VI.
- ___ 4. The proposal budget may be up to \$100,000 unless otherwise indicated 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 proposal contains no type smaller than ten point font size.
- ___ 7. The COVER SHEET (Appendix A) has been completed and is PAGE one of the proposal.
- ___ 8. The PROJECT SUMMARY (Appendix B) has been completed and is PAGE two of the proposal.
- ___ 9. The TECHNICAL CONTENT of the proposal begins on PAGE three and includes the items identified in SECTION III.D of the Solicitation.
- ___ 10. The Contract Pricing Proposal (Appendix C) has been included as the last section of the proposal.
- ___ 11. The additional information on prior Phase II awards, if required, in accordance with Section III.H.
- ___ 12. The proposal must be a PDF file and submitted online by 11:59 p.m., November 16, 2009. Proposals may only be submitted online, a link to the web form can be found here: <http://www.volpe.dot.gov/sbir/current.html>. Instructions are included on the submission page.