DOT-VNTSC-OST-93-1

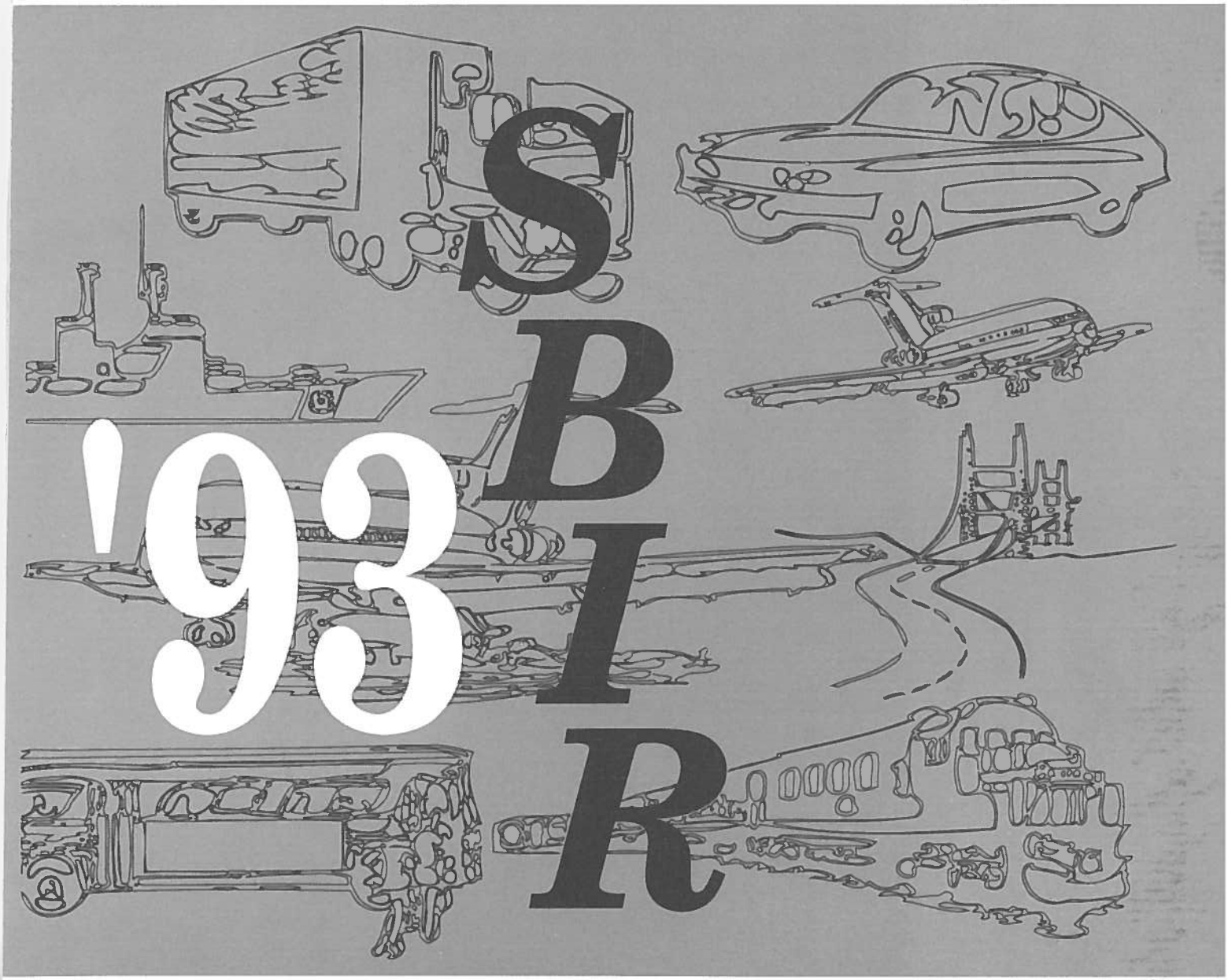
SBIR-93-1

U.S. Department of Transportation
Office of the Secretary of Transportation

Small Business Innovation Research

Program Solicitation

(Closing Date: May 3, 1993)



Research and Special Programs Administration
John A. Volpe National Transportation Systems Center

SBIR-93-1

PROGRAM SOLICITATION

Small Business Innovation

Research Program

Closing Date: May 3, 1993

DOT SBIR Program Office, DTS-22
U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
55 Broadway, Kendall Square
Cambridge, MA 02142-1093

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DOT PROGRAM SOLICITATION FOR SMALL BUSINESS INNOVATION RESEARCH

I. PROGRAM DESCRIPTION

A. Introduction

This solicitation for research proposals is issued by the Department of Transportation (DOT) pursuant to the Small Business Innovation Development Act of 1982, P.L. 97-219, as amended by P.L. 99-443, and P.L. 102-564, Small Business Research and Development Act of 1992, signed October 28, 1992. The law seeks to encourage the initiative of the private sector and to use small business as effectively as possible in meeting Federal research and development objectives.

The purposes of the Act are:

(1) To stimulate technological innovation;
(2) To use small business to meet Federal research and development needs;
(3) To increase private sector commercialization of innovations derived from Federal research and development; and
(4) To foster and encourage minority and disadvantaged participation in technological innovation.

In consonance with the statutory obligations of the Act, the U.S. Department of Transportation 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 Department.

B. Three-Phase Program

The SBIR Program is a three-phase process. **THIS SOLICITATION IS FOR PHASE I PROPOSALS ONLY.**

Phase I. Phase I is for the conduct of feasibility-related experimental or theoretical research or R&D efforts on research topics as described herein. The dollar value of the proposal may be up to $75,000 unless otherwise noted and the period of performance may be up to six months. The primary basis for award will be the scientific and technical merit of the proposal and its relevance to DOT requirements. Only awardees in Phase I are eligible to participate in Phase II.

Phase II. Phase II is the principal research or R&D effort having a period of performance of approximately two years with a dollar value of up to $500,000 unless otherwise noted. Phase II proposals must be prepared in accordance with guidelines provided by DOT to all Phase I awardees. DOT will accept Phase II proposals under the SBIR Program only from firms which have previously received a DOT Phase I award. Phase II awards will be based on 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. Phase III is to be conducted by the small business with either non-Federal funds to pursue commercial applications of research or R&D funded in Phases I and II, or non-SBIR funded contracts with components of DOT for products or processes intended for use by the United States Government.

C. Eligibility

Each concern submitting a proposal must qualify as a small business for research or R&D purposes. In addition, **the primary employment of the principal investigator must be with the small business firm at the time of 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 research or R&D work must be performed in the United States. "United States" means the several 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 research proposals on advanced, innovative concepts from small business firms having strong capabilities in applied science or engineering.

The Phase I research proposals should 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 VIII.

A proposal may respond to any of the research topics listed in Section VIII, 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 proposer should choose that topic which appears to be most relevant to the proposer'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 should be confined principally to scientific or engineering research which may be carried out through construction and evaluation. Proposals must be for research or R&D, particularly on advanced or innovative concepts, and should 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 should 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 should be self-contained and checked carefully by the applicant to ensure that all preparation instructions have been followed. (See proposal checklist, inside front cover.)
Requests for additional information or questions relating to the DOT SBIR Program may be addressed to:

Dr. George Kovatch
DOT SBIR Program Director, DTS-22
U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National
Transportation Systems Center
55 Broadway, Kendall Square
Cambridge, MA 02142-1093

Telephone: (617) 494-2051
Fax: (617) 494-2497

II. DEFINITIONS

A. Research or Research and Development

Research or research and development (R or 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

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

(1) Is independently owned and operated, is not dominant in the field of operation in which it is proposing, and has its principal place of business located in the United States and is organized for profit;

(2) Is at least 51 percent owned, or in the case of a publicly owned business, at least 51 percent of its voting stock is owned by United States citizens or lawfully admitted permanent resident aliens;

(3) Has, including its affiliates, a number of employees not exceeding 500, and meets the other regulatory requirements found in 13 CFR Part 121. Business concerns, other than investment companies licensed, or state development companies qualifying under the Small Business Investment Act of 1958, 15 U.S.C. 661, et seq., are affiliates of one another when either directly or indirectly (A) one concern controls or has the power to control the other; or (B) a third party or parties controls or has the power to control both. Control can be exercised through common ownership, common management, and contractual relationships. The term "affiliation" is defined in greater detail in 13 CFR 121.401. The term "number of employees" is defined in 13 CFR 121.407. Business concerns include, but are not limited to, any individual, partnership, corporation, joint venture, association or cooperative.

C. Minority and Disadvantaged Small Business

A minority and disadvantaged small business concern is one that is:

(1) At least 51 percent owned by one or more minority and disadvantaged individuals; or in the case of a publicly owned business, at least 51 percent of the voting stock of which is owned by minority and disadvantaged individuals; and

(2) Whose management and daily business operations are controlled by one or more such individuals.

A minority and disadvantaged individual is defined as a member of any of the following groups:

(1) Black Americans.

(2) Hispanic Americans.

(3) Native Americans.

(4) Asian-Pacific Americans.

(5) Subcontinent Asian Americans.

D. Women-Owned Small Business

A small business that is at least 51 percent owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

E. Subcontract

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.

III. PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. Limitation on Length of Proposal

Please note that:

(1) SBIR Phase I proposals should not exceed a total of 25 pages (regular size type - no smaller than elite - single or double spaced, standard 81/2" X 11" pages) including proposal cover sheet, budget and all enclosures or attachments.

(2) Attachments, appendices and references are included in the 25 page limitation. Proposals in excess of 25 pages shall not be considered for review or award.

B. Proposal Cover Sheet

Photocopy and complete the proposal cover sheet in Appendix A as page 1 of each copy of each proposal. All pages should be numbered consecutively, beginning with the proposal cover sheet. Do not add an overlay on the cover sheet.

C. Project Summary

Photocopy and complete the form in Appendix B as page 2 of your proposal. The Project Summary should 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 should also be summarized in the space provided. The Project Summary of successful proposals may be published by the DOT and, therefore, should not contain classified or proprietary information. The technical abstract must be limited to two hundred 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 Nation's transportation system should be clearly stated.

(2) **Phase I Technical Objectives.** State the specific objectives of the Phase I research or research and development 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 or R&D plan. The plan should indicate what will be done, where it will be done, and how the R or R&D will be managed or directed and carried out. Phase I R or R&D should address the objectives and the questions cited in (2) above. The methods planned to achieve each objective or task should be discussed in detail, including the level of effort associated with each task.

(4) **Related Research or R&D.** Describe sig-nificant research or 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 proposer must persuade reviewers of his or her awareness of key recent research or 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 limitation.

(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 research or research and development effort.

(7) **Facilities.** A detailed description, availability and location of instrumentation and physical facilities proposed for Phase I should be provided.

(8) **Consultants.** Involvement of consultants in the planning and research stages of the project is permitted.

(a) If such involvement is intended, it should 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.** A firm may elect to submit essentially equivalent work under other Federal Program Solicitations, or may have received other Federal awards for essentially equivalent work. In these cases, 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 (Standard Form 1411) must be submitted in detail as shown in Appendix C. Note: Firm Fixed Price (FFP) 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 proposer plans to use the requested funds if the contract is awarded. Phase I contract awards may include a profit or fee.

F. DUNS Identification Number

If available, a firm should note its DUNS identification number on Appendix C, Contract Pricing Proposal, Standard Form 1411. This number is assigned by Dun & Bradstreet, Inc., and is contained in that Company's Data Universal Numbering System (DUNS).

G. Acknowledgement of Proposal Receipt

Proposers should cut out and fill out the acknowledgement of receipt card on the inside back cover of this solicitation and include it with the proposal to DOT.

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 passing this screening will be evaluated to determine the most promising technical and scientific approaches. Each proposal will be judged on its own merit. The Department of Transportation 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.

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 second phase funding commitments from private sector or non-SBIR funding sources;

c) existence of third phase, follow-on commitments; and

d) 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 or 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 research or research and development.

C. Prescreening

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

D. Schedule

All DOT reviews should be completed and awards made within 5 months of the closing date for Phase I proposals.

E. Program Selection

A Proposal Review Panel, chaired by the Department's SBIR Program Director and comprised of senior management officials representing the Department's Operating Administrations and the Office of the Secretary, will arrange for review and evaluation by professionals, in their respective organizations, of all Phase I proposals that meet the requirements of this solicitation. The Proposal Review Panel will review the technical evaluations by the specialists and recommend to the Program Director the proposals for awards. The Program Director will announce the awards.

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. No information on proposal status will be available until formal notification of award or declination is made. For planning purposes this is expected to occur by October 1, 1993. Correspondence relating to proposals should reference the proposal identification number assigned on the acknowledgement of receipt card and be sent to the DOT SBIR Program Office.

After final award decisions have been announced the technical evaluator's comments on the proposal may be provided to the proposer in a verbal debriefing upon written request of the proposer. The identity of the evaluators shall not be disclosed.

V. CONSIDERATIONS

A. Awards

It is estimated that during fiscal year 1993, the Department of Transportation will award approximately 25 Phase I contracts with an anticipated potential maximum of 31 awards, depending on actual funding available and the responses from small business firms to the solicited research topics in Section VIII.

All Phase I awards will be firm fixed-price contracts and may be up to $75,000 unless otherwise noted. Phase II awards will be in the form of cost-plus-fixed fee contracts with a value of up to $500,000 each unless otherwise noted. Phase II awardees will be required to have acceptable accounting systems.

Only recipients of Phase I contracts will be eligible to compete for Phase II awards.

Under the Department of Transportation's implementation of the SBIR Act, the Department's Operating Administrations contribute to SBIR funding. Each Administration's contribution may be used only to support research of concern to that Operating Administration. For example, funds furnished by the Federal Aviation Administration may not support research solely of concern to the Federal Highway Administration. Based on anticipated funding levels, there may not be adequate funding within the SBIR program to support Phase II awards for research which is solely of concern to the Office of the Secretary and the following Operating Administrations: Federal Highway Administration, Federal Railroad Administration, Maritime Administration, National Highway Traffic Safety Administration, and the United States Coast Guard. Phase II awards for such research will depend on the actual funding available.

B. Reports

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

C. Payment Schedule

Payments will be made in three equal installments upon presentation of invoices by the contractor in conjunction with the submission of the reports described above.

D. Innovations, Inventions, and Patents

1. **Proprietary Information.** Information contained in unsuccessful proposals will remain the property of the proposer. 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 proposer in a proposal which constitutes a trade secret, proprietary commercial or financial information, confidential personal information or data affecting the national security, it will be treated in confidence, to the extent permitted by law, provided this information is clearly marked by the proposer 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, these data 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 proposer as a result of or in connection with the submission of these data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the contract. This restriction does not limit the Government's right to use information contained in the data if it is obtained from another source without restriction. The data subject to this restriction is contained in 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.

The Department of Transportation prefers that proposers 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 Funding Agreements.** 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.

(NOTE: With respect to topics listed under Aviation Security, information will not be released unless approved by the Director, Civil Aviation Security. The release of such information must comply with 14 CFR, part 191.)

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 Department of Transportation support. The Department of Transportation 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.

E. Cost-Sharing

Cost-sharing is permitted for proposals under 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 businesses 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 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 II 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 should 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. Copies of complete terms and conditions are available upon request.

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 Controller 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 forty 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, proscribes 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; 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.

Prior to award of an SBIR contract estimated to cost over $100,000 (normally a Phase II award), the competing contractor will be required to execute the Certificate of Procurement Integrity contained in FAR provision 52.203-8, "Requirement for Certificate of Procurement Integrity (SEP 1990)."

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 Government may request the proposer to submit certain organizational, management, personnel, and financial information to assure responsibility of the proposer.

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

4. 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.

5. The SBIR Program is not a substitute for existing unsolicited proposal mechanisms. Unsolicited proposals shall not be accepted under the SBIR Program in either Phase I or Phase II.

6. 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.

7. When purchasing equipment or a product with funds provided under the SBIR program, purchase only American made equipment and products, to the extent possible in keeping with the overall purposes of the program.

VI. SUBMISSION OF PROPOSALS

A. Submittal Instructions

An original and four copies of each proposal submitted under the DOT SBIR Program should be sent to:

Dr. George Kovatch
DOT SBIR Program Director, DTS-22
U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National
Transportation Systems Center
55 Broadway, Kendall Square
Cambridge, MA 02142-1093
Telephone: (617) 494-2051

Proposals must be postmarked NO LATER than May 3, 1993 to qualify for acceptance and consideration under the current DOT SBIR Program. Proposals postmarked later than May 3, 1993 will not be accepted.

Proposals delivered to the DOT SBIR Program Office by any means other than the U.S. Postal Service, must be received at the above address on or before May 3, 1993.

B. Additional Information

1. **Bindings.** Please do not use special bindings or covers. Staple the pages in the upper left corner of the cover sheet of the proposal with a single staple.

2. **Packaging.** All copies of the proposal should be sent in one package together with the acknowledgement of receipt card.

3. **Confirmation.** The DOT SBIR Program Office will assign an identification number to each proposal received at the above address by May 3, 1993 or postmarked no later than May 3, 1993. This number will appear on the acknowledgement of receipt card (see inside back cover) which will be sent to the proposer by return mail confirming receipt of the proposal.

VII. SCIENTIFIC AND TECHNICAL INFORMATION SOURCES

The following organizations may be sources for providing technology search and/or document services and may be contacted directly for service and cost information:

Aerospace Research Applications Center
611 North Capital
Indianapolis, IN 46204
(317) 274-4621

Central Industrial Applications Center
Southeastern Oklahoma State University
Durant, OK 74701
(405) 924-6822

NASA Industrial Applications Center
University of Southern California
3716 S. Hope Street #200
Los Angeles, CA 90007
(213) 743-6132

NASA Industrial Applications Center
823 William Pitt Union
University of Pittsburgh
Pittsburgh, PA 15260
(412) 648-7000

NASA/Southern Technology
Applications Center
University of Florida
One Progress Boulevard
Alachua, FL 32615
(904) 462-3913

NASA/UK Technology Applications Center
University of Kentucky
109 Kinkead Hall
Lexington, KY 40506
(606) 257-6322

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4600

NERAC, Inc.
One Technology Drive
Tolland, CT 06084
(203) 872-7000

VIII. RESEARCH TOPICS

Phase I research topics for the Office of the Secretary and 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.

OFFICE OF THE SECRETARY AND DOT OPERATING ADMINISTRATION/TOPICS	POTENTIAL MAXIMUM FY93 PHASE I AWARDS
OFFICE OF THE SECRETARY (OST)	1 Award

Space Transportation Safety

**	93-OS1	Launch Vehicle Technology

FEDERAL AVIATION ADMINISTRATION (FAA) . . . . . 15 Awards

Aircraft Safety

	93-FA1	Nondestructive Inspection (NDI) of Large Areas
	93-FA2	Assessment of Residual Life of Aging Aircraft
	93-FA3	Aircraft Structure Visual Inspection Enhancement
	93-FA4	Sensors for Detecting and Monitoring Corrosion in Aircraft
	93-FA5	Horizontal Stabilizer Buffet Loads Prediction
	93-FA6	Turbine Engine Rotor System Inspection and Condition Monitoring
	93-FA7	Cargo Compartment Fire Protection
	93-FA8	Cabin Smoke Control

Aviation Security

*	93-FA9	Operator's Perception of Images
*	93-FA10	Effects of Long-Term Exposure to Low-Level Radiation
*	93-FA11	A Luggage Simulation Tool

*See Note Section V.D.2
**Phase I may be up to $50,000 and Phase II may be up to $300,000.

OFFICE OF THE SECRETARY AND DOT OPERATING ADMINISTRATION/TOPICS		POTENTIAL MAXIMUM FY93 PHASE I AWARDS
* 93-FA12	Improved Radiation Detectors	
* 93-FA13	New Concepts in Bulk Explosives Detection	
* 93-FA14	Detection of Airborne Explosives	
Airport Technology		
93-FA15	Fiber Optic Transmission of High Energy Light in Approach Lighting Systems	
93-FA16	Direct Monitoring of Approach Lighting System Lamps	
93-FA17	Runway Incursion Prevention	
93-FA18	Alternative to Current Paints	
Air Traffic Control/Flight Services Technology		
93-FA19	GPS for CAT II/III Precision Approaches	
93-FA20	Development of a Low-Cost General Aviation Collision Avoidance System	
FEDERAL HIGHWAY ADMINISTRATION (FHWA)		5 Awards
Human Factors		
93-FH1	Automated Reduction of Video-Based Data	
Traffic		
93-FH2	Digital Signal Processor (DSP) Neural Net Based Vehicle Detector	
93-FH3	Development of Notebook Computer Software to Collect Rip Generation Data at Intermodal Passenger and Freight Terminal Facilities	
Transportation Enhancements		
93-FH4	Visual Database of Transportation Enhancements	
Hydraulics		
93-FH5	Mitigating Sediment Transport Problems through Flow Modification	
Pavements		
93-FH6	Computer-Based Pavement Distress Identification System	

*See Note Section V.D.2

OFFICE OF THE SECRETARY AND DOT OPERATING ADMINISTRATION/TOPICS		POTENTIAL MAXIMUM FY93 PHASE I AWARDS
FEDERAL RAILROAD ADMINISTRATION (FRA)		2 Awards
Safety		
93-FR1	Automated Rail-Based Wheel Gauge	
93-FR2	Train Detection	
MARITIME ADMINISTRATION (MARAD)		1 Award
Maritime Operations		
** 93-MA1	Ship and Terminal Operations	
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA)		3 Awards
Crashworthiness		
93-NH1	Advanced Glazing Materials	
93-NH2	Advanced Child Safety Seats	
Crash Avoidance		
93-NH3	Unobtrusive Psychophysiological Monitoring of Driver Alertness	
UNITED STATES COAST GUARD (USCG)		4 Awards
Navigation Systems		
93-CG1	Universal Junction Box for Navigation Sensors	
Marine Safety		
93-CG2	Plugging/Patching	
Exploratory Development		
93-CG3	Radar Detection of Search and Rescue Targets	
93-CG4	Development of Objective Analysis of Oceanic Data for the USCG Trajectory Models	
93-CG5	Fast Water Oil Containment	

**Phase I may be up to $50,000 and Phase II may be up to $300,000.

OFFICE OF THE SECRETARY

SPACE TRANSPORTATION SAFETY

** **93-OS1. LAUNCH VEHICLE TECHNOLOGY**

The Department of Defense (DoD) and the National Aeronautics and Space Administration (NASA) have initiated a number of programs to improve U.S. launch vehicle technology. Some of these programs seek to develop new vehicles (e.g., National Launch System, Single Stage Rocket Technology, National AeroSpace Plane, High-Speed Civil Transport). In contrast, the Component Technology Program seeks to develop improvements in existing U.S. expendable launch vehicles. All of these programs are focused on technologies to improve the Government's capability to launch Government payloads (military and/or civil) safely, reliably, and cost-effectively. The Office of Commercial Space Transportation (OCST) believes that the Government should also take account of commercial considerations in its decisions on launch vehicle technologies and that DOD and NASA should design in options for commercial versions of launch vehicle technologies from the very beginning of these developmental programs. Commercial launches of commercial payloads on vehicles identical with or similar to those developed for Government uses would benefit both the U.S. Government and the U.S. commercial space transportation industry through economies of scale. Such a policy would also contribute to the U.S. Government's policy of encouraging, promoting, and facilitating a viable, competitive U.S. commercial space transportation industry. Research is needed by OCST under this topic to examine the commercial applicability of launch vehicles to be developed as a result of current and proposed launch vehicle technology programs.

FEDERAL AVIATION ADMINISTRATION

AIRCRAFT SAFETY

93-FA1. NONDESTRUCTIVE INSPECTION (NDI) OF LARGE AREAS

Most currently available NDI equipment capable of detecting cracks on the order of 0.10 inches requires painstaking analysis of a series of very small areas. While the time and cost of such inspection is not insignificant, even more important is the possibility of inadequate inspection due a boredom-induced misapplication of the procedure at some point in the sequence of inspections. Research is needed to develop new and innovative NDI systems capable of inspecting quickly and reliably large areas of aircraft structure (for fatigue or corrosion damage). Comparison with existing techniques for the same application should project at least a doubling of inspection speed with no loss of inspection reliability. Proposals must specify a reliability analysis (e.g., probability of detection (POD) curves, false alarm rates, and minimum detectable flaw size estimates). Special consideration will be given to proposals whose product concept is deemed to be readily transferable to industry. Projected production and operation cost, anticipated ease of operation, and potential safety concerns are significant factors with respect to the transfer of new technologies to industry.

93-FA2. ASSESSMENT OF RESIDUAL LIFE OF AGING AIRCRAFT

The assessment of residual life of aging aircraft that are close to exceeding the original design objectives for flight hours and landing cycles is a subject of concern to airline operators, aircraft manufacturers, and the Federal Aviation Administration (FAA). The estimation of the status of damage (including probability of damage detection) and residual life of various structural elements is essential for the development and refinement of programs for inspections and maintenance. For the damage types seen in aging aircraft, the development of improved damage tolerant design criteria and inspection programs requires consideration of damage initiation and growth at multiple

**Phase I may be up to $50,000 and Phase II may be up to $300,000.

sites. Previous approaches based on determination of crack growth and residual strength of structures with isolated damages are no longer adequate. The new approach for maintaining damage tolerance of the structure needs to be investigated both for aging aircraft and for newly designed aircraft. An understanding of widespread fatigue damage and the synergistic effect on the damage is essential to advance the state-of-the-art. To achieve this goal, research is needed for the development of new, innovative methods/procedures for the estimation/prediction of residual life of aircraft structures subjected to multiple site damage (MSD) and multiple element damage (MED). This research should relate to the development of improved design criteria for damage tolerance for MSD and MED as well as to the probability of damage detection of various anticipated damage scenarios.

93-FA3. AIRCRAFT STRUCTURE VISUAL INSPECTION ENHANCEMENT

It is estimated that 80-90 percent of all aircraft inspections are performed visually by trained inspectors. Due to the inherent difficulties encountered during these inspections, the FAA requires research on innovative, low-cost ways of enhancing visual inspections for corrosion and cracks currently performed on commercial aircraft. State-of-the-art electronics, optics, and/or computerized software could be integrated into systems which enhance flaw visualization and data storage and retrieval. Proposed visual inspection enhancements should be low cost, user friendly, offer improved sensitivity and provide faster inspections than those performed now by the unaided eye. Enhancements to existing NDI equipment should be easily added and offer the same advantages as noted above. Proposals should demonstrate an ability to provide or acquire the necessary cracked and corroded aircraft specimens to complete a Phase I feasibility study.

93-FA4. SENSORS FOR DETECTING AND MONITORING CORROSION IN AIRCRAFT

Corrosion is perhaps the most significant issue affecting aging airplanes and is the cause of as much as 95 percent of all maintenance activity. Corrosion has been a contributing factor in several major catastrophic failures in civil aviation. Although manufacturers and operators address various forms of corrosion prevention through design practices and the use of protective coatings, corrosion can never be completely prevented. A successful corrosion control program must be based on early detection and repair. Research is required to develop a reliable, light-weight, low-cost corrosion sensor that could be placed in areas of the aircraft's structure which are highly susceptible to corrosion; e.g., galley, lavatory, cargo holds, and sump areas. Such a device should provide an early warning signal to indicate the locations and extent of corrosion. This research requires the development of new techniques and equipment. It also requires the evaluation of these techniques and equipment through the establishment of probability of detection (POD) curves, false alarm rates, and minimum detectable corrosion level. Cost, reliability, and ease of operation are also important to commercializing this technology.

93-FA5. HORIZONTAL STABILIZER BUFFET LOADS PREDICTION

Large amplitude antisymmetric rocking motion of a horizontal stabilizer can occur during some flight and ground conditions. This phenomenon occurs when the horizontal stabilizer enters the separated wake flow from the wing in conditions such as high angles of attack (flaps up or down), and landing rollout with ground spoilers deflected, and can affect both conventional and T-Tail configured aircraft. These load levels cannot be calculated directly; however, these levels, in some cases, represent design values. This has been demonstrated during flight tests of several commercial transports. More recently, empennage buffet was a significant design problem on the twin vertical tail F-15 and F-18 aircraft, and at that time considerable research was initiated to help predict buffet loads. However, this work did not address antisymmetric rocking loads due to buffet. Modern methods need to be developed which can predict, with known probability, horizontal stabilizer design antisymmetric buffet loads using airplane data available prior to a full-scale flight test. Equally important, flight and ground conditions under which horizontal stabilizer antisymmetric buffet loads can occur need to be identified.

FEDERAL AVIATION ADMINISTRATION

93-FA6. TURBINE ENGINE ROTOR SYSTEM INSPECTION AND CONDITION MONITORING

An innovative approach is needed to improve the current technical methodology used to predict, forecast and/or trend critical rotating component failures of turbine engines. Improved inspection and monitoring capabilities are required as well as methods of interpreting turbine engine operating parameters (vibration, acoustics, temperatures, pressures, etc.) to determine engine condition. Proposed technology should be easily adapted to engine hardware and proposed methodology should be easily adapted to current in-service operations. Concepts may include new sensor development, state-of-the-art computer hardware/software, and expert system technology. Solutions shall be capable of utilization in the engine production and in-service (ground and flight) environments. Basic design concepts should consider engine/airframe trade-off and be applicable to turboshaft, turboprop, turbojet or turbofan engines.

93-FA7. CARGO COMPARTMENT FIRE PROTECTION

A hybrid suppression system for cargo compartment fire protection is needed as an alternative to current halon 1301 fixed installations. It is anticipated that there is more than one system to meet these requirements. FAA is interested in as many alternative approaches as the proposer is willing and able to present, but as a minimum, at least four alternatives must be included in the proposal. The Phase I proposal should also contain a method to compare these alternatives with one another and with the existing halon 1301 type system.

93-FA8. CABIN SMOKE CONTROL

The FAA needs an innovative approach to develop an effective and practical means for preventing, controlling, or eliminating smoke accumulation in the aircraft passenger cabin as a result of an in-flight fire. The proposed concept should focus on performance, weight, flow and energy requirements, and overall parasitic effects. The proposal should also include a method for performing engineering analysis of the innovation.

AVIATION SECURITY

* 93-FA9. OPERATOR'S PERCEPTION OF IMAGES

Many devices used for the inspection of passengers, carry-on items and luggage use X-ray and other imaging techniques to provide an operator with an image for interpretation. These images inherently contain a certain amount of information. False colors are widely utilized to enhance these images. It is arguable whether this process adds any informational value to the image. The operator's perception of the image is actually what drives the entire process. There are numerous factors that affect this perception. It is important to study these and other factors and criteria to ensure the validity of decisions taken. Research is required in this general area to determine the effects various factors play in influencing the operator's perception. On the other hand, automation may eliminate the need for an operator. Artificial intelligence techniques can add to the accuracy and speed of the decision-making process. They can also lead to faulty decisions; hence, the need for the proposal to include a method for determining the limits of utility of artificial intelligence in aviation security.

* 93-FA10. EFFECTS OF LONG-TERM EXPOSURE TO LOW-LEVEL RADIATION

Aviation security systems or devices are generally designed for nondestructive unintrusive operation. Therefore, the majority of these systems include some type of a probe. Active probes normally employ electromagnetic or neutral particle radiation to interrogate the object under inspection. The entire electromagnetic spectrum and all

*See Note Section V.D.2

neutral particles are of interest. Within an airport environment, such systems can be deployed at various locations. As a rule, shielding is provided for in any such equipment. However, the possibility of low-level radiation cannot be totally dismissed. Effects of long-term exposure of humans, the environment and other equipment to such radiation are of concern.

* 93-FA11. A LUGGAGE SIMULATION TOOL

Many FAA development projects in "bulk" explosives detection involve use of a significant amount of modeling and simulation to help in optimizing design parameters and in predicting system performance. These simulations may involve complex Monte Carlo calculations for multidetector three-dimensional imaging explosives detection devices. However, while the characteristics of the detection system and the physical processes which take place within it may be readily calculable, one of the most important aspects of the simulation process is frequently oversimplified: the luggage itself. It would be useful to have the capability to interactively generate simulated luggage, in which bags or containers could be packed with a variety of materials and objects which have realistic and variable shapes and characteristics. Included in the luggage simulation would be the option to place explosive devices of various types and shapes in the luggage. A three-dimensional map of selected physical and chemical properties of each item of luggage would be generated which could be used in the simulation process or in directly evaluating actual imaging explosives detection devices, as a potential precursor to field testing with real luggage.

* 93-FA12. IMPROVED RADIATION DETECTORS

Most of the "bulk" explosives detection techniques being studied by the Federal Aviation Administration (FAA) are based on the inspection of luggage with various types of noncharged radiation, i.e., photons or neutrons. There is a wide spectrum of radiations which can, in principle, be applied to the problem of detecting explosives concealed in luggage. However, there may be limitations to any given technique imposed by the limited capabilities of the radiation detectors used, which are commonly taken from the commercial marketplace. It is possible that significant improvements in one or more characteristics of a given type of radiation detector may improve existing detection techniques or present new possibilities.

* 93-FA13. NEW CONCEPTS IN BULK EXPLOSIVES DETECTION

The FAA is involved in the development of various techniques for the detection of macroscopic ("bulk") quantities of explosives contained in luggage, air cargo, or air mail, or carried by persons boarding commercial aircraft. Most of the techniques investigated involve the interaction of various types of radiation with luggage and explosives, including neutrons and electromagnetic radiation ranging from millimeter wave (MMW) to X-rays and gamma rays. What these methods have in common is the ability to probe the interior of containers remotely and without the need to open them to determine the existence of potential danger. Research is needed to be able to perform this with high detection rate and low false identification rate as quickly as possible. While there are a number of promising technologies which have been identified, there may be techniques which have not been investigated that may be worthy of investigation. If a new technique is proven to be feasible, then further development is possible.

* 93-FA14. DETECTION OF AIRBORNE EXPLOSIVES

A major problem which must be solved if the requirements of FAA Aviation Security are to be met is the sensitivity and speed of alarm response to airborne forms of explosives. The sensitivity requirements can be approached either

*See Note Section V.D.2

by increasing the ability of the detection systems to "see" and respond to smaller concentrations of explosives in the air, or to capture and concentrate the explosives from larger volumes of air. Apparatus that can process great quantities of air quickly and deposit all of the microparticles from the entire quantity into a single very small volume either on a retainer or into a nonreactive fluid is needed. The time when particles are taken from the air must be identifiable, and the delay between that time and the time that the detection system acts on those particles must be constant. The capture efficiencies of the apparatus as a function of particle sizes must be determined. The apparatus must be safe to operate, must operate either intermittently or for up to days at a time without need for adjustment or maintenance. The apparatus must be rugged enough to stand shocks from rough handling and field test conditions. The entire apparatus and support accessories should not exceed a combined weight of 50 pounds, and should be compact enough to be transported by one person. The system should be easily decontaminated, cleaned and maintained. The system should be able to be put into full operation in less than 5 minutes, and should not require more power than a standard household iron for full operation. Numbers that it would be desirable to achieve include the following:

- Particle sizes captured with high efficiency: Aiken particle range and smaller. (<0.1 micrometers in largest cross-sectional dimension)
- Dwell Time in the apparatus: 30 seconds or less.
- Operating voltage and power: 110/220 vac, 50/60 Hz, 1500 watts maximum.
- Air flow: 1000 liters/minute.
- Capture volume: 1 milliliter/minute.
- Capture efficiencies over the microparticle range: >50 percent.

AIRPORT TECHNOLOGY

93-FA15. FIBER OPTIC TRANSMISSION OF HIGH ENERGY LIGHT IN APPROACH LIGHTING SYSTEMS

The current approach lighting systems of the Federal Aviation Administration (FAA) utilize large numbers of incandescent lamps operating in a lighting field distributed over several thousand feet of the runway's approach. Exposure to the environment--wind, rain, ice, salt spray, jet blast, and vandalism--is exceedingly stressful to the reliable operation of the equipment. Years of experience has optimized the configuration; however, significant maintenance workload exists and outages occur. Recent developments in fiber optic technology make it conceivable to use fiber optics for transmission and distribution of high energy light from more centralized and remote sources to eliminate the inherent weaknesses in existing approach lighting systems that use multiple incandescent lamps on elevated masts. The FAA needs to investigate available technology, identify options, and determine feasibility by conducting a breadboard concept demonstration.

93-FA16. DIRECT MONITORING OF APPROACH LIGHTING SYSTEM LAMPS

The FAA needs to determine whether recent advances in optical or thermal detectors and/or fiber optics can be applied to monitor individual lamps in an approach lighting system. The present monitoring system uses an indirect monitoring method that is subject to false indications caused by variances in loop current and lamp impedance, aging

effects, and by shorting devices which protect the system when a lamp fails. Only direct monitoring of each lamp will provide an absolute indication of the state of the lamps on the approach lighting system. If technological advances make it feasible to independently monitor each lamp, then the FAA will be able to accurately report when the system is safe.

93-FA17. RUNWAY INCURSION PREVENTION

A consistent issue in runway incursion prevention and movement of aircraft of the airport surface is the conspicuousness of taxiway markings. There are no criteria by which airport operators are required to repaint their markings. This is a judgement call left in many cases to the FAA airport certification and safety inspector under the requirements of FAR Part 139. The FAA needs to establish a threshold at which point repainting should be required in all weather conditions. Once the threshold is established, a method shall be established whereby the airport operator and the FAA inspector can survey the quality of the paint against a known reference and determine when repainting is required.

93-FA18. ALTERNATIVE TO CURRENT PAINTS

The FAA requires an alternative to current paints which will improve conspicuousness for runway and taxiway markings. These paints should be developed so they can be applied with less waste and with more reflectivity and durability than existing oil-based and acrylic pigments.

AIR TRAFFIC CONTROL/FLIGHT SERVICES TECHNOLOGY

93-FA19. GLOBAL POSITIONING SYSTEM (GPS) FOR CATEGORY II/III PRECISION APPROACHES

GPS is a satellite-based navigation system that eventually, with enhancements, may provide the accuracy and integrity required for Category II and III instrument landings. It is likely that if kinematic carrier phase techniques could be developed, differential GPS would be able to supplement and replace existing and planned instrument landing systems. The difficulty is to resolve tracking the carrier phase with a high degree of confidence. Research is needed to develop algorithms to resolve the carrier phase ambiguity. A simulation would be required to support the selection of the proposed algorithms.

93-FA20. DEVELOPMENT OF A LOW-COST GENERAL AVIATION COLLISION AVOIDANCE OR COLLISION WARNING SYSTEM

The FAA is supporting the installation of Traffic Collision Avoidance System I (TCAS) for commuter aircraft with 10-30 passenger seats and TCAS II for larger aircraft with more than 30 seats. Due to the increase in cost of the TCAS I system over the last few years, there is a need to develop a low-cost collision avoidance or collision warning system, for use by smaller General Aviation aircraft. The proposed system would not be mandated and would not necessarily be based on the existing Air Traffic Control Beacon System used by TCAS. Systems based on the Global Positioning System (GPS), Loran, beacon systems, optical techniques, and other approaches are of interest to the FAA and will be considered under this research topic. The proposal must contain a detailed analysis demonstrating the cost of implementing the proposed system.

FEDERAL HIGHWAY ADMINISTRATION

HUMAN FACTORS

93-FH1. AUTOMATED REDUCTION OF VIDEO-BASED DATA

The increasing sophistication and miniaturization of video equipment, coupled with its diminishing expense, make this technology an appealing method for collecting a wide variety of human factors-highway safety data easily and inexpensively. Unfortunately, manual frame-by-frame reduction of such data is time consuming and tedious, often counterbalancing any savings incurred during data collection. Lateral placement of a vehicle within its lane, for example, can be simply and inexpensively ascertained by using one or more properly positioned video cameras affixed to the vehicle. The camera(s) can be placed in such a way that the video always captures the edge- or lane-line and a reference point on the vehicle. Lateral placement data can be culled from this image by measuring the distance between these two points, then transforming this measurement to reflect real-world distances. Unfortunately, the labor intensity of frame-by-frame manual reduction detracts from the utility of this procedure. A simple and cost-effective method of automated reduction of video-based data in human factors-highway safety applications is needed. Current advances in image processing make development of such a system feasible, opportune, and practical. This Phase I research effort will focus on a feasibility and technology assessment of the proposed innovation. Following successful completion of the Phase I effort, Phase II design and development of a turnkey hardware-software system to perform the data reduction task would be undertaken. The final product will be simple to use, a PC-based system which efficiently reduces video-based lateral placement data into reconfigurable file-types to be exported into a variety of statistical software environments.

TRAFFIC

93-FH2. DIGITAL SIGNAL PROCESSOR (DSP)/NEURAL NET-BASED VEHICLE DETECTOR

Advanced Intelligent Vehicle Highway Systems (IVHS) applications will require additional information from vehicle detectors such as vehicle speed and classification. Most commercially available vehicle detectors provide only vehicle presence and passage. Research is needed to develop a DSP/Neural Network-based vehicle detector over several phases. During the Phase I research effort, a C/C++ computer program will be developed to accurately simulate vehicle detectors and allow trade-offs to be made to select the most feasible DSP/Neural Net based design and analyze the possibility of retro-fitting presently existing vehicle detection hardware with improved processing based on DSP/Neural Net techniques. A breadboard model should be developed to validate the selected designs. Following successful completion of Phase I research, development of field deployable hardware would be undertaken.

93-FH3. DEVELOPMENT OF NOTEBOOK COMPUTER SOFTWARE TO COLLECT TRIP GENERATION DATA AT INTERMODAL PASSENGER AND FREIGHT TERMINAL FACILITIES

In the past, emphasis was given to research and development of trip generation rates for hundreds of land uses. There is little current research being conducted in the area of intermodal passenger and freight terminal facilities. With the current interest in intermodal transportation facilities, there is a great need for this data, and more importantly, for software to collect this data using notebook computers. Notebook computer software is needed to collect trip generation data at intermodal facilities. The software will then be tested by collection, collation, and

establishment of trip generation and attraction rates and equations for sample intermodal facilities such as airports, seaports, and rail terminals. The resulting product and technology commercialization would include software which can be used in the field on a notebook computer to collect trip generation data.

TRANSPORTATION ENHANCEMENTS

93-FH4. VISUAL DATABASE OF TRANSPORTATION ENHANCEMENTS

The Congress has made available $2.8 billion to be used only for a limited number of activities, defined in the Intermodal Surface Transportation Efficiency Act of 1991 as transportation enhancement activities, which include bicycle and pedestrian projects, landscaping and scenic enhancement, historic preservation and mitigation of highway runoff impacts on water quality. Because this is a program area that is largely new to the State Departments of Transportation, there is a need for broad-based information sharing. Effective information sharing requires dissemination of visual images and narrative project descriptions. This innovativeapproach should capture and organize information from around the Nation into a computerized database that will enable rapid retrieval and universal dissemination of these visual images and narrative descriptions. It would use CD ROM, hypermedia, and multimedia technologies. In the future, this database may be tied into other hypermedia and Graphic Information Systems applications. The Phase I research effort would consist of a feasibility study and the investigation of possible techniques. Upon successful completion of Phase I, the actual development of the system would be undertaken.

HYDRAULICS

93-FH5. MITIGATING SEDIMENT TRANSPORT PROBLEMS THROUGH FLOW MODIFICATION

An innovative physical system is needed for local scour mitigation at highway bridges based upon the application of flow modification techniques. The problems associated with sediment transport, i.e., abutment scour, contraction scour, pier scour, channel migration, head cutting, and stream stability in general, can usually be attributed to areas of high fluid shear stress, turbulence and vorticity. If the flow patterns are modified to mitigate these factors then the accompanying sediment transport problems could be eliminated or at least reduced in severity. A complicating factor is the varying flow regime typical of bridges where, for example, the depth, velocity, and angle of attack of the flow at a pier will change throughout a flood. Any successful application of a flow modification approach would need to be designed in such a manner that it remains effective throughout the critical range of flow conditions typically experienced by the pier being protected.

PAVEMENTS

93-FH6. COMPUTER-BASED PAVEMENT DISTRESS IDENTIFICATION SYSTEM

Field surveys of pavement distresses are normally done with automated photographic equipment; otherwise they are done manually. Presently the manual distress survey method is a very tedious process involving detailed measurements, mapping and summation of data. Usually a distress identification manual, such as the Strategic Highway Research Program's (SHRP) "Distress Identification Manual for Long-Term Pavement Performance (LTPP) Studies," is used in this process. Distress identification manuals provide a uniform basis for collection of distress data. They normally contain a definition of each pavement distress, a description of the severity levels

(usually defined as low, moderate, or high) for each pavement distress and instructions on how to measure each pavement distress. Manual surveys must be used when automated photographic equipment is not available. There is a need for a computerized system which can be used in the field on a "Notebook" computer. This system would replace the manual surveys and eliminate some of the human error which is inherent in manually mapping pavement distresses and summarizing data from the map sheets. The system should be compatible with the automated and manual methods currently used by the SHRP LTPP program and must have the capability of mapping all distresses, and recording and summarizing all data. Deliverables would include an operating prototype system of hardware and software. This Pavement Distress Identification system has applications in both the private and public sector. Many engineering firms do pavement distress surveys for government agencies, airports and the military. This system could also be used by State and local highway agencies in their Pavement Management programs to perform condition surveys.

FEDERAL RAILROAD ADMINISTRATION

SAFETY

93-FR1. AUTOMATED RAIL-BASED WHEEL GAUGE

Defective railroad wheels still in service, including wheels worn past normal condemning limits, present a significant safety hazard to railroad employees and the public and are a major cause of maintenance cost in freight train operations. Current inspection methods for identifying worn and damaged wheels are inefficient. Car inspectors conduct "walk-by" inspections of the trains to visually inspect wheels. Mechanical "GO-NOGO" hand gauges are used to determine the status of suspect wheels. This method allows a percentage of defective wheels to be missed on in-bound yard inspections. This can lead to two potential problems: (1) the car is released to service with a defective wheel, or (2) the car is condemned on the outbound inspection; this results in expensive delays in the release of the car or a shortage of cars. A cost-effective automated rail-based wheel measurement system is needed which can reliably measure each wheel in a train and identify those that contain defects, including wear exceeding allowable condemning limits. Such a measurement system could require the integration of a variety of sophisticated technologies to identify the broad range of significant wheel defects (high flange, thin flange, broken flange, thin rim, rim and tread cracks, shells, tread flat spots, and tread buildup). For example, a rail-based method for detecting wheel cracking and shelling is currently being developed using electromagnetic-acoustic techniques. The feasibility, adequacy, and appropriateness of combining this technique with other techniques including laser, microwave, ultrasound, or other means to identify the other significant wheel defects should be addressed.

93-FR2. TRAIN DETECTION

An innovative train detection application with low cost and high reliability is needed by the FRA. Train detection using the wheel-axle to electrically short circuit or shunt a track circuit defined by a section of running rails has been used since 1872 when the track circuit was invented, and has been recognized as the safest way of determining the location of a train on the track for the purpose of preventing railroad operations that may be rendered unsafe by the proximity of another train. The concept is simple and effective. The running rails are partitioned into track circuits. Individual circuits are defined by electrically insulating sections of running rails to form two electrical conductors thus creating a closed circuit. Alternate current signals of different frequencies instead of direct current are also employed. This also allows track circuit definition without the need to physically insulate the track circuit section. In recent years loss of shunt (or inability to effectively short circuit the track circuit) has been experienced.

Many causes have been attributed to the loss of shunt problems. Among them are:

- Thin oxide layer covers the wheel and rail. The layer has a nonlinear electrical characteristic like that of a zener diode. A "zener" voltage can be present at the wheel-rail contact allowing a residual voltage at the track relay with a train present in the track circuit when the breakdown zener voltage is greater than the track circuit voltage.

- Debris on the rails, fallen leaves, etc. and manmade contaminants such as grease (used for better traction), rosin, or shavings from brake shoes create a film that could be frequency responsive and affect audio frequency as well as direct current track circuits.

The insulating and semiconducting films and oxide layers effect in loss of shunt is made worse by:

- Better tracking of newer railroad cars which prevents side scratching of rails by wheels which could otherwise scrape out insulating films or oxide layers.

- Lighter-weight cards that do not exert enough pressure to enhance the wheel-rail electrical contact.

In the past, several solutions to the train detection problem have been tried with varying degrees of success. High voltage pulses to punch through insulating films, conductive and inductive wheel-to-rail electric current injection, replacement of the track circuit by sensors, and others have been tried. Some of these solutions caused other problems as well, such as electromagnetic interference with the automatic train control. New and innovative approaches to the train detection problem are sought under this research topic.

MARITIME ADMINISTRATION (MARAD)

MARITIME OPERATIONS

** 93-MA1. SHIP AND TERMINAL OPERATIONS

Research is sought to improve the productivity, efficiency, safety, environmental quality, and management of maritime shipping systems in the commercial cargo or passenger sectors of the transocean or domestic waterway transportation service areas of the United States. Research topics can include but are not limited to intermodal/terminal/cargo operations, advanced navigation systems including application of electronic charts, multimedia technology applications to ship operations, ship design and technology improvements, ship structural and other ship system inspection, maintenance and reliability, man-machine systems integration, shiphandling simulation improvements, environmental protection, especially reduction of engine exhaust emissions, and casualty risk reduction primarily with respect to the Oil Pollution Act of 1990. Proposers must have maritime experience and a first-hand understanding of industry practices and developing technology for the application chosen. Proposals should include an assessment of the importance of the research to the maritime industry and potential impact on technology commercialization.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

CRASHWORTHINESS

93-NH1. ADVANCED GLAZING MATERIALS

Windshields, side, and rear windows for automobiles and trucks are almost exclusively made of glass. While the safety merits of plastic windows and windshields are well known, plastic materials with physical and mechanical

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properties adequate for these applications are lacking. NHTSA is seeking new materials to replace glass for increased crashworthiness. Improved materials are needed to protect vehicle occupants during a crash, while at the same time maintaining distortion-free optical clarity and light transmittance after repeated operation and/or washing, windshield wiper abrasion, weather/environmental action, and accidental scratching. Research is needed to develop advanced glazing materials meeting these requirements.

93-NH2. ADVANCED CHILD SAFETY SEATS

The use of child restraints is required in all 50 states and the District of Columbia. Despite these laws, about 2,300 children under the age of 12 were killed in 1990 in passenger cars involved in accidents; about half were in the 5 to 12 age category. Many of these fatalities could have been prevented if the child was properly restrained. Recent changes in vehicle interior dimensions and restraint system designs and the introduction of airbags make it desirable to reexamine the issue of providing increased safety and improved protection for children positioned in child restraint systems. New child restraint designs which are easier to install and use, and more difficult to misuse, would be desirable. An innovative technology is needed to provide improved protection for children in the changing automotive environment.

CRASH AVOIDANCE

93-NH3. UNOBTRUSIVE PSYCHOPHYSIOLOGICAL MONITORING OF DRIVER ALERTNESS

This effort will develop a highly accurate device for unobtrusive psychophysiological monitoring of motor vehicle driver eye closure and/or other eye activity associated with loss of alertness. Research has shown that eye closure and other eye activity such as eyelid "flutter" are reliable psychophysiological indices of driver drowsiness. In addition, since vision is the primary sense involved in driving, eye closure is a prima facie indication of impaired driver functioning. The envisioned device will be able to function as a stand-alone monitor for research and commercial applications, but will also have the capability to work cooperatively with vehicle-based systems that monitor driver performance parameters associated with drowsiness (e.g., steering movements, lane position) and with an integrated protocol for the presentation of warning displays. Research is needed on the development of a device to provide unobtrusive driver eye monitoring, and to transmit this data to a processing unit located on or in the instrument panel which will combine the eye activity data with performance data obtained from other sources (e.g., steering wheel movements). This research should lead to development, testing, and validation of a market-ready monitoring system with the following features:

- Validity--accurately measures eye activity demonstrated to be associated with driver drowsiness/loss of alertness.
- Reliable/robust--obtains valid measures for the broad population of drivers over a variety of operating conditions.
- Unobtrusive--causes minimal distraction and discomfort to drivers. Depending on how the device is installed/worn, miniaturization is likely to be a requirement.
- "Linkable"--features a communications link with vehicle-based driver drowsiness detection systems.
- Inexpensive--essential for marketability and positive cost-benefits, particularly since the device will likely be used as one component of a larger system.

UNITED STATES COAST GUARD

NAVIGATION SYSTEMS

93-CG1. UNIVERSAL JUNCTION BOX FOR NAVIGATION SENSORS

A low-cost, universal junction box to be used in conjunction with Electronic Chart Display and Information Systems (ECDIS) and shipboard Integrated Navigation Systems (INS) is needed. The junction box must be capable of receiving a number of National Maritime Electronics Association (NMEA) data streams in NMEA 0183 version 1.5/2.0 format. A minimum of six (6) data input and output ports are required. Sensor input data includes ship's gyrocompass, fathometer (depth sounder), speed log, and anemometer (wind speed/direction). Gyrocompass data may be either syncro or stepper. Fathometer and anemometer data could be analog or digital. Speed log data includes both pulse in, with speed out generated by GPS/ differential GPS. Data input/output ports must be configurable via a system manager port as to NMEA 0183 data sentence structure. Output data ports may include an interface to shipboard INS subsystems such as ECDIS, ship's autopilot, and a "black box recorder." The system must have an adequate battery backup to support the external navigation sensors for at least 30 minutes at 3 amps. The system must be capable of operating under 120 VAC or 12-24 VDC.

MARINE SAFETY

93-CG2. PLUGGING/PATCHING

Early versions of plugging/patching devices have been effective only in cases of relatively small areas of damage, and limited deployment. The Coast Guard needs to advance the state-of-the-art in plugging and patching technology. Research is needed to identify and develop plugging/patching devices and techniques to aid in preventing or reducing the discharge of oil and chemicals into the water from a damaged tanker vessel. The feasibility of developing and deploying plugging/patching devices on large tank vessels should be investigated. The research should focus on innovative systems that produce high benefits consistent with safe deployment methods.

EXPLORATORY DEVELOPMENT

93-CG3. RADAR DETECTION OF SEARCH AND RESCUE TARGETS

Innovative processing techniques for digital radar signals from the AN/APS-137 to separate very weak targets (life rafts) from noise and sea return are needed by the Coast Guard. Search and rescue targets provide very weak returns for radar and these returns are difficult for an operator to identify or separate from background signals and sea return. Target types of interest are life rafts, swamped and overturned small boats, and small recreational boats. The Coast Guard frequently uses a variety of radars to conduct offshore searches and is currently evaluating the detection performance of the HC-130 mounted AN/AFS-137 radar for search and rescue. There is a need to extract all available information from the radar signal. This Phase I research effort should explore the feasibility of separating, identifying, and displaying the radar response from very weak search and rescue type targets. The effort should emphasize the adaptation of existing filters and processing techniques which are available. Decision aids for the radar operator would be explored. Following successful completion of the Phase I effort, development of prototype modular search and rescue interface for the radar raster display would be undertaken. The potential commercial market for this type of processing would have application to improved radar display development. Application to the law enforcement field, where small contraband carrying boats are of interest, is also possible.

93-CG4. DEVELOPMENT OF THE OBJECTIVE ANALYSIS OF OCEANIC DATA FOR THE COAST GUARD'S TRAJECTORY MODELS

Computer modeling techniques that provide the optimal estimates of the surface velocity field by combining observed velocity data with the output of oceanic models and combining the outputs of two or more disparate oceanic models are needed by the Coast Guard. The Coast Guard uses the velocity fields outputs of a variety of ocean circulation numerical models to provide input into the Coast Guard's trajectory models of: search and rescue survivors and survivors' crafts, oil spills and hazardous chemicals containers, and icebergs. The Coast Guard also collects localized ocean current velocity data from a variety of sources: drifting buoys drogued at the surface and subsurface, satellite derived surface currents, fixed current meters, and other directly or remotely sensed sources of ocean currents. The Coast Guard requires the application of objective analysis techniques to the following two areas:

- The optimal jointing of the regularly grided velocity data from two or more ocean circulation models to produce a single optimally estimated velocity field.
- The optimal jointing of irregularly spaced and temporally observed ocean current velocity data with the optimally estimated velocity field.

This Phase I effort would explore the feasibility of applying the techniques of objective analysis to vector fields and then selecting the technique most appropriate for the Coast Guard's requirements. Following a successful Phase I effort, development of the machine independent computer model of objective analysis for oceanic data sets that the Coast Guard uses would be undertaken. The potential commercial market for objective analysis techniques are widely used for the data assimilation of scalar data into numerical models. The data assimilation of vector data by objective analysis into numerical models would have commercial applications for the geophysical models using vectors.

93-CG5. FAST WATER OIL CONTAINMENT

Historically, during oil spill recovery operations oil is contained with conventional booms. Booms typically fail in five modes of operation: (1) entrainment, (2) drainage, (3) splashover, (4) submergence, and (5) planing. Entrainment failure is inherent in fluid dynamics. Therefore, most conventional booms are not designed to operate in fast currents where entrainment would occur. Entrainment failure occurs in relative water speeds above 0.75 to 1 knot perpendicular to the boom, depending on the properties of the oil. This phenomenon was observed through extensive testing with oil containment barriers. Oil/water surface tensions and back pressures form a headwave in the oil upstream of the boom and turbulence occurs downstream of the headwave. This turbulence pulls oil droplets from the headwave into the water stream flowing under the boom. The Coast Guard is interested in innovative boom designs to overcome entrainment through the use of natural or directed flow fields. What is needed is an oil containment technology which effectively contains oil for recovery in water velocities up to 5 knots. The proposed boom should also overcome or minimize drainage, splashover, submergence, and planing. Little or no machinery is desired. Complete engineering analysis is required to support boom action during containment operations. A fluid dynamic analysis method is required to explain the proposed fluid flow and should be described in the proposal along with an approach to validate the effectiveness of the design and the development of a prototype for small-scale testing.

IX. SUBMISSION FORMS AND CERTIFICATIONS

1.	PROPOSAL COVER SHEET	Appendix A
2.	PROJECT SUMMARY	Appendix B
3.	CONTRACT PRICING PROPOSAL	Appendix C
4.	PROPOSAL CHECKLIST ON INSIDE FRONT COVER	
5.	PROPOSAL ACKNOWLEDGEMENT CARD ON INSIDE BACK COVER	

U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 93-1

PROPOSAL COVER SHEET

Project Title _____

Research Topic No. _____ Research Topic Title _____

Submitted by: Name _____

Address _____

City _____ State _____ Zip + 4 _____

Amount Requested (Phase I) $ _____ Proposed Duration _____
(May be up to $75,000 unless otherwise indicated) (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 11B; and that it meets the eligibility requirement in Section 1C. Yes_____ No_____

2. The above concern certifies it _____does_____does not qualify as a minority and disadvantaged small business as defined in IIC. (For statistical purposes only.)

3. The above concern certifies it_____does_____does not qualify as a women-owned small business as defined in IID. (For statistical purposes only.)

4. 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 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_____

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. 93-1

PROJECT SUMMARY

Name and Address of Proposer	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 (8 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. 93-1

CONTRACT PRICING PROPOSAL

CONTRACT PRICING PROPOSAL COVER SHEET

1. SOLICITATION/CONTRACT/MODIFICATION NO.

FORM APPROVED OMB NO. 3090-0116

NOTE: This form is used in contract actions if submission of cost or pricing data is required. *(See FAR 15.804-6(b))*

2. NAME AND ADDRESS OF OFFEROR *(Include ZIP Code)*

3A. NAME AND TITLE OF OFFEROR'S POINT OF CONTACT

3B. TELEPHONE NO.

4. TYPE OF CONTRACT ACTION *(Check)*

- ☐ A. NEW CONTRACT
- ☐ B. CHANGE ORDER
- ☐ C. PRICE REVISION/ REDETERMINATION
- ☐ D. LETTER CONTRACT
- ☐ E. UNPRICED ORDER
- ☐ F. OTHER *(Specify)*

5. TYPE OF CONTRACT *(Check)*

☐ FFP ☐ CPFF ☐ CPIF ☐ CPAF
☐ FPI ☐ OTHER *(Specify)*

6. PROPOSED COST *(A+B=C)*

A. COST	B. PROFIT/FEE	C. TOTAL
$	$	$

7. PLACE(S) AND PERIOD(S) OF PERFORMANCE

8. List and reference the identification, quantity and total price proposed for each contract line item. A line item cost breakdown supporting this recap is required unless otherwise specified by the Contracting Officer. *(Continue on reverse, and then on plain paper, if necessary. Use same headings.)*

A. LINE ITEM NO	B. IDENTIFICATION	C. QUANTITY	D. TOTAL PRICE	E. REF

9. PROVIDE NAME, ADDRESS, AND TELEPHONE NUMBER FOR THE FOLLOWING *(If available)*

A. CONTRACT ADMINISTRATION OFFICE

B. AUDIT OFFICE

10. WILL YOU REQUIRE THE USE OF ANY GOVERNMENT PROPERTY IN THE PERFORMANCE OF THIS WORK? *(If "Yes," identify)*

☐ YES ☐ NO

11A. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT? *(If "Yes," complete item 11B)*

☐ YES ☐ NO

11B. TYPE OF FINANCING *(If one)*

☐ ADVANCE PAYMENTS ☐ PROGRESS PAYMENTS
☐ GUARANTEED LOANS

12. HAVE YOU BEEN AWARDED ANY CONTRACTS OR SUBCONTRACTS FOR THE SAME OR SIMILAR ITEMS WITHIN THE PAST 3 YEARS? *(If "Yes," identify item(s), customer(s) and contract number(s))*

☐ YES ☐ NO

13. IS THIS PROPOSAL CONSISTENT WITH YOUR ESTABLISHED ESTIMATING AND ACCOUNTING PRACTICES AND PROCEDURES AND FAR PART 31 COST PRINCIPLES? *(If "No," explain)*

☐ YES ☐ NO

14. COST ACCOUNTING STANDARDS BOARD (CASB) DATA *(Public Law 91-379 as amended and FAR PART 30)*

A. WILL THIS CONTRACT ACTION BE SUBJECT TO CASB REGULATIONS? *(If "No," explain in proposal)*

☐ YES ☐ NO N/A

B. HAVE YOU SUBMITTED A CASB DISCLOSURE STATEMENT *(CASB DS-1 or 2)*? *(If "Yes," specify in proposal the office to which submitted and if determined to be adequate)*

☐ YES ☐ NO N/A

C. HAVE YOU BEEN NOTIFIED THAT YOU ARE OR MAY BE IN NONCOMPLIANCE WITH YOUR DISCLOSURE STATEMENT OR COST ACCOUNTING STANDARDS? *(If "Yes," explain in proposal)*

☐ YES ☐ NO N/A

D. IS ANY ASPECT OF THIS PROPOSAL INCONSISTENT WITH YOUR DISCLOSED PRACTICES OR APPLICABLE COST ACCOUNTING STANDARDS? *(If "Yes," explain in proposal)*

☐ YES ☐ NO N/A

This proposal is submitted in response to the RFP, contract, modification, etc. in Item 1 and reflects our best estimates and/or actual costs as of this date.

15. NAME AND TITLE *(Type)*

16. NAME OF FIRM

17. SIGNATURE

18. DATE OF SUBMISSION

NSN 7540-01-142-9845

1411-101

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

Background

The following items, as appropriate, should be included in proposals responsive to the DOT SBIR Program Solicitation.

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

1. Name of proposer
2. Address of proposer
3. Location where work will be performed
4. Proposer's Project Title
5. Research topic number and title from DOT SBIR Program Solicitation
6. Total dollar amount of the proposal (dollars)
7. Direct material costs
   a. Purchased parts (dollars)
   b. Subcontracted items (dollars)
   c. Other
      (1) Raw materials (dollars)
      (2) Standard commercial items (dollars)
   d. Total direct materials (dollars)
8. Material overhead rate _____ % x total direct material = dollars
9. Direct labor (specify)
   a. Type of labor, estimated hours, rate per hour and dollar cost for each type
   b. Total estimated direct labor (dollars)
10. Labor overhead
    a. Identify overhead rate, the hour base and dollar cost
    b. Total estimated labor overhead (dollars)
11. Special testing (include field work at Government installations)
    a. Specify each item of special testing, including estimated usage and unit cost
    b. Estimated total special testing (dollars)
12. Other special equipment
    a. If direct charge, specify each item of special equipment, including usage and unit cost
    b. Estimated total other special equipment (dollars)

13. Travel (if direct charge)
    a. Transportation (detailed breakdown and dollars)
    b. Per diem or subsistence (details and dollars)
    c. Estimated total travel (dollars)
14. Consultants Service
    a. Identify each consultant, including purpose and dollar rates
    b. Total estimated consultant service costs (dollars)
15. Other direct costs (specify)
    a. Total estimated direct cost and overhead (dollars)
16. General and administrative expense
    a. Percentage rate applied
    b. Total estimated cost of G&A expense (dollars)
17. Royalties (specify)
    a. Estimated cost (dollars)
18. Fee or profit (dollars)
19. Total estimated cost and fee or profit (dollars)
20. 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).
21. Provide a yes or no answer to each of the following questions:
    a. 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.
    b. Will you require the use of any government property in the performance of this proposal? If yes, identify.
    c. Do you require government contract financing to perform this proposed contract? If yes, specify type as advanced payments or progress payments.
22. Type of contract proposed, firm-fixed price.
23. DUNS number, if available_____
    (See Section III.F)