DOT-VNTSC-OST-95-1

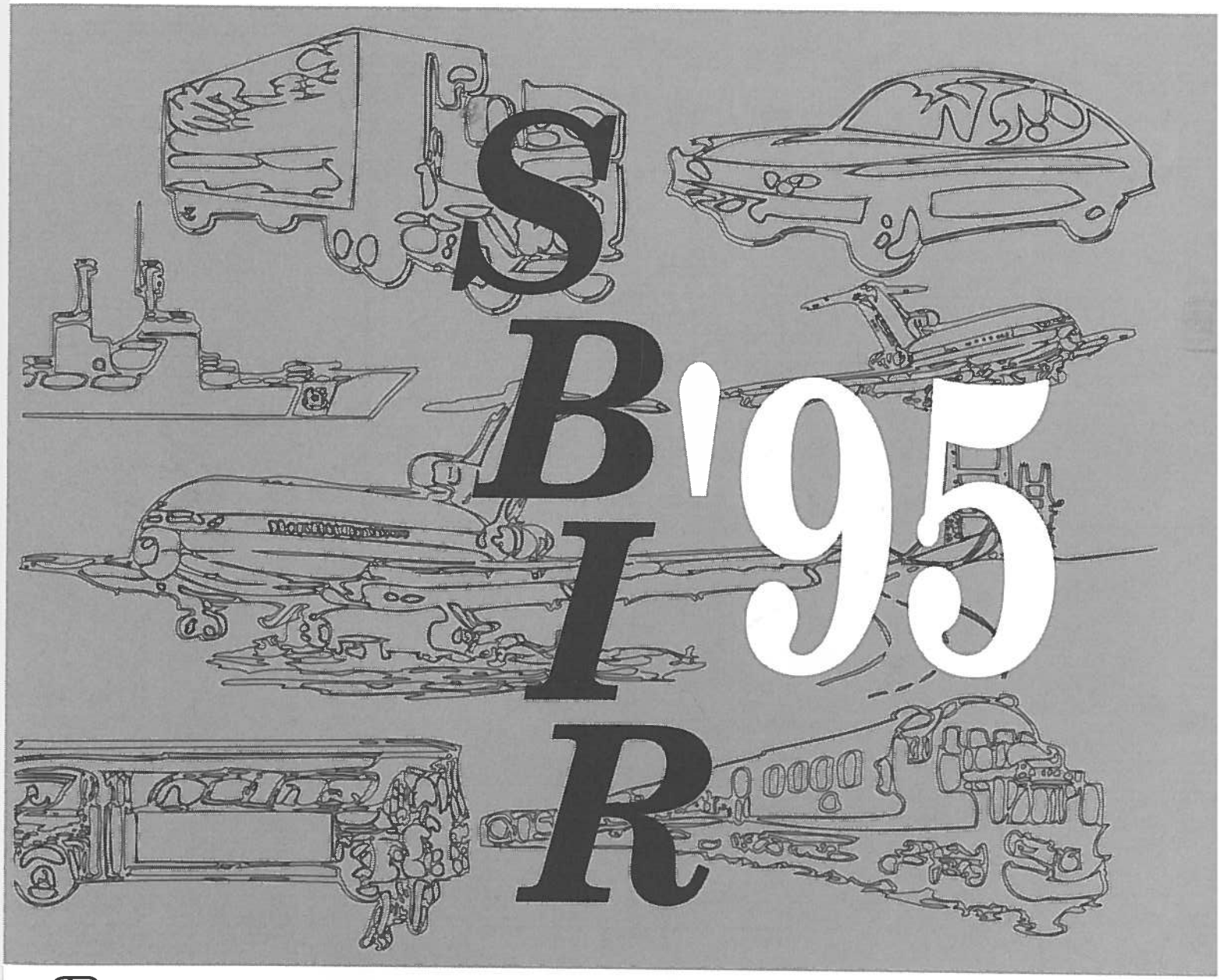
SBIR-95-1

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

Small Business Innovation Research

Program Solicitation

(Closing Date: May 2, 1995)



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

SBIR-95-1

PROGRAM SOLICITATION

Small Business Innovation

Research Program

Closing Date: May 2, 1995

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 $100,000 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 $750,000 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 10 point font size - single or double spaced, standard 8 1/2" 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 significant 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.

H. Prior SBIR Phase II Awards

If the small business concern has received more than 15 Phase II awards in the prior 5 fiscal years, submit name of awarding agency, date of award, funding agreement number, amount, topic or subtopic title, follow-on agreement amount, source and date of commitment and current commercialization status for each Phase II. (This required proposal information shall not be counted toward proposal pages count limitation.)

IV. METHOD OF SELECTION AND EVALUATION CRITERIA

A. General

All Phase I and Phase II proposals will be evaluated and judged on a competitive basis. Initially, all proposals will be screened to determine responsiveness to the solicitation. Proposals 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 comprising 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 2, 1995. 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, a debriefing comprised of the overall comments on the proposal may be provided to the proposer upon written request. The identity of the evaluators shall not be disclosed.

V. CONSIDERATIONS

A. Awards

It is estimated that during fiscal year 1995, 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 $100,000 unless otherwise noted. Phase II awards will be in the form of cost-plus-fixed-fee contracts with a value of up to $750,000 each unless otherwise noted. Phase II awardees will be required to have 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, Federal Transit Administration, Maritime Administration, and National Highway Traffic Safety Administration. 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 I a minimum of two-thirds of the research and/or analytical effort must be performed by the proposing firm unless otherwise approved in writing by the contracting officer.

2. For Phase II a minimum of one-half of the research and/or analytical effort must be performed by the proposing firm unless otherwise approved in writing by the contracting officer.

I. Contractor Commitments

Upon award of a contract, the awardee will be required to make certain legal commitments through acceptance of numerous contract clauses. The outline that follows is illustrative of the types of clauses to which the contractor would be committed. This list 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 2, 1995 to qualify for acceptance and consideration under the current DOT SBIR Program. Proposals postmarked later than May 2, 1995 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 2, 1995.

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 which appears on the back cover of this document.

3. **Confirmation.** The DOT SBIR Program Office will assign an identification number to each proposal received at the above address by May 2, 1995 or postmarked no later than May 2, 1995. 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:

Center for Technology Commercialization
Massachusetts Technology Park
100 North Drive
Westborough, MA 01581
(508) 870- 0042

Federal Information Exchange, Inc.
555 Quince Orchard Road, Suite 200
Gaithersburg, MD 20878
(301) 975-0103

Midcontinent Technology Transfer Center
Texas Engineering Experiment Station
The Texas A&M University System
237 Wisenbaker Engineering Research Center
College Station, TX 77843-3401
(409) 845-8762

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

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

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

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

University of Southern California
Technology Transfer Center
3716 South Hope Street
Los Angeles, CA 90007-4344
(213) 743-6132

VIII. RESEARCH TOPICS

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

DOT OPERATING ADMINISTRATION/TOPICS	POTENTIAL MAXIMUM FY95 PHASE I AWARDS

FEDERAL AVIATION ADMINISTRATION (FAA) . . . . . 12 Awards

Aircraft Safety

95-FA1	Turbine Engine Rotor System Failure Prediction and Condition Monitoring
95-FA2	Advanced Turbine Engine Containment Technology
95-FA3	Development of Low Power Transponders
95-FA4	NDI Methods for Composite Bonded Aircraft Structures
95-FA5	Aircraft System Probabilistic Risk Assessment
95-FA6	Determination of Widespread Fatigue Damage (WFD) Onset/Fitness for Service

Aviation Security

[1] 95-FA7	Concepts in Sampling Low Volatility Explosives from Surfaces
[1] 95-FA8	Automated Luggage Sampling Screener for Trace Explosives Detection
[1] 95-FA9	Photon Detector Materials

Human Factors

95-FA10	Development of a High-Resolution/Wide-Field-of-View Color Head Mounted Display
95-FA11	Development of a 2,048 x 2,048 Red, Green and Blue (RGB) Scan Converter
95-FA12	Development of Minimally-Obtrusive Display Glasses/Goggles
95-FA13	Alternate Pointing Devices

[1]See Note Section V.D.2

DOT OPERATING ADMINISTRATION/TOPICS		POTENTIAL MAXIMUM FY95 PHASE I AWARDS
Information Technology		
95-FA14	Aviation Safety Research Information Dissemination	
Air Traffic Control/Flight Services Technology		
95-FA15	Consolidated Model Interface Environment	
95-FA16	Data Consistency Among Analytical Models	
95-FA17	Optimization Models for Air Traffic Control	
95-FA18	Airport Congestion Detection and Resolution	
95-FA19	Spatial/Temporal Data Structures for Air Traffic Flow Management Models	
FEDERAL HIGHWAY ADMINISTRATION (FHWA) . . . . . 12 Awards		
Pavements		
95-FH1	Rolling Deflectometer	
Planning		
95-FH2	Use of GIS in Transportation Planning	
95-FH3	New Decision Support Concepts for Transportation Planning	
Structures		
95-FH4	Fatigue Crack Detection Using Remote Sensing	
95-FH5	Concrete Prestressing Strand Manufactured from Recycled Plastic	
95-FH6	Digital Waveform Recorder for Acoustic Emissions	
FEDERAL RAILROAD ADMINISTRATION (FRA) . . . . . 3 Awards		
95-FR1	Improved Nondestructive Inspection (NDI) for Rail	
95-FR2	Sensor Systems to Detect Hazardous Conditions in High Speed Rail Operations	

[2]Phase I may be up to $100,000 and Phase II may be up to $500,000
[3]Phase I may be up to $50,000 and Phase II may be up to $300,000
[4]Phase I may be up to $100,000 and Phase II may be up to $300,000

DOT OPERATING ADMINISTRATION/TOPICS		POTENTIAL MAXIMUM FY95 PHASE I AWARDS
MARITIME ADMINISTRATION (MARAD)		**1 Award**
[3] 95-MA1	Advanced Maritime Vessels and Intermodal Terminals	
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA)		**3 Awards**
[5] 95-NH1	Dynamic Intrusion Sensing System	
[5] 95-NH2	Safety Seat and Restraint System	
[5] 95-NH3	Crash Investigation Measurement Technology	
[5] 95-NH4	Traffic Enforcement Technology	

[3]Phase I may be up to $50,000 and Phase II may be up to $300,000
[5]Phase I may be up to $75,000 and Phase II may be up to $300,000

FEDERAL AVIATION ADMINISTRATION

AIRCRAFT SAFETY

95-FA1. TURBINE ENGINE ROTOR SYSTEM FAILURE PREDICTION 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 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.

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 monitoring would be undertaken.

95-FA2. ADVANCED TURBINE ENGINE CONTAINMENT TECHNOLOGY

Research is needed on advanced turbine engine containment technology to absorb hazardous energy levels due to turbine engine structural fragmentation failures of rotating components (including fan, compressor, turbine sides, blades, spacers, and seals). Proposed containment system designs should provide for absorption of high energy fragments at the engine casing, airframe nacelle, or fire wall structures. Solutions should have specific applications to engine case or airframe structures that may be applied at original design, major overhaul, or in-service retrofit. The concepts should include advanced lightweight energy absorption materials that are technically and economically feasible. They should also tolerate the operational ground/flight envelope. Basic design concepts should consider engine/airframe tradeoffs and be directed to both fixed wing aircraft and helicopters.

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 engine containment system would be undertaken.

95-FA3. DEVELOPMENT OF LOW POWER TRANSPONDERS

Because of the lack of electrical generation capability, only very limited electrical power is available for sailplane and light sport airplane operations. As a result, sailplanes have been exempted from some Mode C transponder requirements. As TCAS use increases and the airspace becomes more controlled, transponder capability is a desirable option for safety. Low power transponders with limited capability, available at an affordable cost, and ATC procedures to accommodate these transponders offer one solution. This need also applies to classics and amateur-built aircraft that have lower power, or no, electrical systems. The volume of aircraft covered is significant, especially those aircraft that typically fly near the perimeter of major cities.

Since most modern gliders are composite structures, they may be invisible to ATC radar. Glider activity is radioed or phoned in to ATC with the area, time, and altitude block estimated to be used. They are also at a loss as to what altitude the gliders are flying. Gliders can reach altitudes of 25-35,000 feet. Classic and amateur-built aircraft without transponder/radio are required to stay clear of controlled airspace. They may fly low to go under airspace, which is hazardous, or fly around the area expending additional fuel and time. The innovation required would result in prototype low power transponder(s) for flight test.

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 low power transponder(s) would be undertaken.

95-FA4. NDI METHODS FOR COMPOSITE BONDED AIRCRAFT STRUCTURES

Wide-spread acceptance of bonded composite structures is hampered by lack of confidence in current NDI techniques. Although such structures are in-service the certification costs almost negate the demonstrated benefits of such construction. There is a need to develop reliable NDI method(s) that in addition to being able to detect voids or delaminations would detect weak bonds. Weak bonds are characterized as intact bonds that, however, do not have the required strength or stiffness. The developed NDI method(s) must be substantiated using destructive tests such as sectioning or strength tests. The specimens must represent several weak bond mechanisms and large programmed weak bond areas to accommodate multiple destructive test correlations.

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 NDI method(s) would be undertaken.

95-FA5. AIRCRAFT SYSTEM PROBABILISTIC RISK ASSESSMENT

As aircraft systems and designs become more complex, the need arises to determine the effects and risks of each system towards catastrophic failures. Although manufacturers perform extensive deterministic risk analyses, probabilistic methods have shown potential of reliably improving risk calculations without deterministic tests. Innovation is required to develop a quantitative and qualitative approach to determine the risk of an aircraft catastrophe. The methodology should be capable of but not limited to considering aspects from material properties, system layout, and operating environments.

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 methodology would be undertaken.

95-FA6. DETERMINATION OF WIDESPREAD FATIGUE DAMAGE (WFD) ONSET/FITNESS FOR SERVICE

The present priority of the Aging Aircraft Program's Inspection Program Area remains the detection of small cracks indicating the onset of multi-site damage (MSD) in fuselage lap splices. This requires both enhanced crack detection sensitivity and the determination and characterization of flaw profiles. While laboratory and possibly commercial inspection systems with sufficient sensitivity exist, their application for the purpose of determining the flaw profile is not practical.

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Proposals should identify an airframe area with acknowledged susceptibility to widespread fatigue damage:

- o the aircraft pressure vessel (cracks at rivet sites - especially at skin splices/bulkhead web splices, cracks near window and door surround structure, cracks at run out of large doubler, disbonding of aluminum skins, hidden corrosion in skins and stringers.)
- o aircraft wings and empennage structure (wing spar integrity, cracks in cordwise fastener rows, cracks at stringer run out at tank end ribs.)
- o aircraft mechanical components (landing gear and wheels, door hinges and latches, bushings, and other mechanical parts.)

Proposals should also identify innovative technology with potential sensitivity sufficient to detect flaws with the indicated profile. Candidate technologies need not be capable of precise individual flaw location or sizing, but must be capable of determining the existence and extent of the flaw profile specified. Capability for precise individual flaw location and sizing will, of course, be considered advantageous. Proposals must address the detection of individual flaws and discuss the flaw profile. The profile should include a description of the probable crack locations, the probable number of cracks in the selected application area, and the size of cracks. Proposals should also identify a system configuration with insensitivity to: 1) potential human errors caused by complicated procedures, 2) difficult interpretation tasks, and/or 3) lengthy, redundant procedures.

Proposed systems should indicate real potential for (1) an improved level of capability and reliability compared to inspection methods currently used for the same or similar applications, or (2) an equally effective capability and reliability level with a significant improvement in cost effectiveness. Proposed systems should minimize the required structural disassembly and human-and-environment-induced variability.

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 WFD system would be undertaken.

AVIATION SECURITY

95-FA7. CONCEPTS IN SAMPLING LOW VOLATILITY EXPLOSIVES FROM SURFACES

The FAA is interested in developing better samplers that can be used with available trace detection technology. The main detection techniques include ion mobility spectrometry, electron capture, chemiluminescence, and mass spectrometry. The problem to be solved is how to transfer explosive residue from the surface of articles or clothing to the detection device without destroying the molecule. The main substances of interest include plastic explosives containing RDX or PETN, and other low volatility explosives such as nitrates or perchlorates. The surfaces of interest include synthetic materials such as high impact plastic case materials, soft plastic materials, typical luggage materials, and clothing such as cotton and polyester. The desired sampler must show clear advantages over present sampling techniques and be amenable to automation. An optimum sampler would be one that could locate the highest area of concentration and sample that area.

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 sample would be undertaken.

[1]See Note Section V.D.2

FEDERAL AVIATION ADMINISTRATION

[1] **95-FA8. AUTOMATED LUGGAGE SAMPLING SCREENER FOR TRACE EXPLOSIVES DETECTION**

The FAA is interested in improving on-line screening of checked and carry-on bags by using trace methodologies to detect low velocity explosives and ammonium nitrate. There is a need for unique or innovative sample collection methodologies that lend themselves to automation. Trace explosive detection devices that are able to detect the high volatile components of these explosives include ion mobility spectrometry, mass spectrometry, and chemiluminescence. The signature vapors that need to be extracted for sampling include DNT, NG, EGDN, Diphenylamine, Sulfur, Ammonia, and Nitric Acid found in the low parts per billion (ppb) in a matrix of hydrocarbons and other organic emissions from the luggage. The signature substances can also be acquired by active sampling methodologies available for particulate on the luggage and aerosols. Any designs should be compatible with batch sampling, mechanical, and pneumatic constraints of off-the-shelf trace explosive detection devices. Another area of consideration is the practical implementation of the design in the screening area of an airport concourse with existing conveyor belts and enhanced X-Ray systems. Phase I of the effort would involve demonstration of the technique with a breadboard model.

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 screener would be undertaken.

[1] **95-FA9. PHOTON DETECTOR MATERIALS**

Innovative techniques for the detection of explosives in passenger luggage and air cargo that employ photon energies up to approximately 12 MeV are needed by the FAA. These techniques can be classed into two categories, X-ray (photon energies from 50-200 KeV) and nuclear (characteristic gamma radiation up to 12 MeV). To facilitate development of practical explosive detection systems, detectors with better operating characteristics than are currently available are needed.

Factors to be considered for scintillator design are energy resolution, intrinsic and photospeak efficiencies, stopping power, timing characteristics, and operating conditions. Also of interest are detector materials using direct photon to charge conversion and normal room temperature operation. Proposals may address either the X-ray or gamma ray region.

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 detector would be undertaken.

[1]See Note Section V.D.2

FEDERAL AVIATION ADMINISTRATION

HUMAN FACTORS

95-FA10. DEVELOPMENT OF A HIGH-RESOLUTION/WIDE-FIELD-OF-VIEW COLOR HEAD MOUNTED DISPLAY

A quality head mounted display (HMD) is a vital part of Virtual Reality. There is a tremendous need in the Simulation, Visualization and Virtual Environments Industries for the barrier to be broken in the trade-off between high-resolution and wide-field-of-view for HMDs. Development of a high-resolution/wide-field-of-view HMD is one of the few remaining hurdles that needs to be overcome before Virtual Reality becomes widely accepted and more usable in many areas. Once the technology can provide this kind of quality, many industries can begin to reap the benefits of Virtual Reality. The technology that Virtual Reality needs to succeed is definitely obtainable - it just needs the funding necessary to develop it.

There is an increasingly large, and immediate, market for such a product in the defense, aerospace, medical, computer, research, and entertainment industries. These industries are anxiously awaiting just such an obtainable technical breakthrough. Products such as "virtual cockpits" and the "Virtual Tower" are beginning to sweep the aeronautical marketplace for use as tools for research, simulation, and training. All of these vendors, and their users, have been anticipating this technological milestone and all the possibilities and potential that it will unleash for virtual reality. Innovations should exceed the capabilities of the existing CRT-based regarding: resolution; field-of-view; arc minutes per pixel; binocular overlap; weight; brightness; and exit pupil size. Current fiber optic head mounted displays have acceptable capabilities, but are extremely expensive.

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 HMD would be undertaken.

95-FA11. DEVELOPMENT OF A 2,048 X 2,048 RED, GREEN AND BLUE (RGB) SCAN CONVERTER

In order to facilitate development of the next generation air traffic control system, the FAA Technical Center conducts various evaluations and research & development efforts involving the Initial Sector Suite (ISSS) Common Consoles, or simulators of them. To perform this work more effectively, there is often a great need for the capability to project the information that is on the display, from a projection system. Currently there is no commercially available scan converter system capable of doing this. Therefore, there is a great need for innovation in the development of a red, green and blue (RGB) scan converter that will scan a 2,048 x 2,048 resolution display and reduce it so that the image can be displayed by a typical 1,024 x 1,280 resolution RGB projector system.

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 converter would be undertaken.

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95-FA12. DEVELOPMENT OF MINIMALLY-OBTRUSIVE DISPLAY GLASSES/GOGGLES

Virtual Reality (VR) is a concept for computer-human interfaces which are more natural and effective using new technologies and techniques. It allows users to dynamically interact with a three dimensional (3D) graphical representation of concepts, designs and data sets which might otherwise be too complex to visualize. This is a technology from which users throughout the government and industry will benefit. Likely uses of this technology are air traffic control; weather; security; aging aircraft; architectural design (of towers and other FAA facilities); ergonomic design of work spaces; low cost simulation, studies, and training for controllers and pilots; and maintenance of aircraft and FAA facilities.

There is a great need for the development of a display system that can be worn as a light-weight, convenient, minimally-obtrusive pair of glasses or goggles, that can display computer-generated images on the transparent medium so that the computer images, or information, are superimposed on the real world as seen by the wearer. This concept is being applied to situations where it is advantageous for a person to have a view of the real world which is augmented, or supplemented, by computer images or information. The current designs of this nature are worn as helmets and are too heavy and obtrusive to the wearer. Unlike head mounted displays (HMDs) used for fully-immersive VR applications, the display system for Augmented Reality applications may not need such a high resolution nor wide field of view. It is important for the design to be convenient and unobtrusive to the wearer while still offering at least an acceptable resolution and field of view.

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 minimally-obtrusive display glasses/goggles would be undertaken.

95-FA13. ALTERNATE POINTING DEVICES

The FAA has traditionally relied on graphic representations of the National Air Space System in the Form of Plan View Displays to depict the immediate status of the National Airspace System. As personal computer technology has evolved, windowed systems requiring the point select of an activity icon have invaded all facets of the FAA from Airway Facilities Maintenance to standard office tasks. This has resulted in an unacceptable increase in repetitive stress injuries.

This topic requests proposals for innovative pointing technologies (not mouse or trackball) that are unobtrusive in a typical office or Air Traffic Control (ATC) environment. It should be noted that a large percentage of the users are not touch typists, and that in many cases their primary function requires voice communications with pilots thereby excluding voice recognition from this subject area. It is anticipated that a significant reduction in repetitive stress injuries would significantly increase employee satisfaction and career longevity. Additionally, a successful candidate technology would reasonably expect wide commercial acceptance.

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 minimally-obtrusive display glasses/goggles would be undertaken.

FEDERAL AVIATION ADMINISTRATION

INFORMATION TECHNOLOGY

95-FA14. AVIATION SAFETY RESEARCH INFORMATION DISSEMINATION

Research, Engineering and Development (R,E&D) projects in aviation safety generate voluminous technical information upon completion. Historically, R,E&D results of Federally funded projects have been catalogued and managed in Computer Software Management and Information Center (COSMIC) libraries located at various sites across the nation. COSMIC libraries use 1970s and 80s technology and do not support intelligent, on-line browsing.

There exists considerable regulatory, job guide, training, and work program related information requiring widespread dissemination within the FAA. Most of this information is currently distributed either via paper or older generation technologies.

With the advent of the National Information Infrastructure (NII), multimedia technologies, and intelligent navigation and browsing agent technologies in the 1990s, R,E&D results and other technical and regulatory information can be made available on the NII. It is possible to establish a distributed network of servers and clients with a graphical user interface using the Hyper Text Transfer Protocol facilitating the composition and deployment of wide area information bases using Hyper Text Markup Language (HTML). Innovations are needed that explore the feasibility of applying distributed client/server network(s) and HTML technologies to information dissemination.

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 innovative information dissemination system would be undertaken.

AIR TRAFFIC CONTROL/FLIGHT SERVICES TECHNOLOGY

95-FA15. CONSOLIDATED MODEL INTERFACE ENVIRONMENT

Researchers use numerous scientific models to study problems with air traffic control in areas such as enroute traffic, airport congestion, traffic flow, and noise abatement. A need exists to unite existing models in a consolidated environment where each model is used to capture the processes to which they are best suited. The models should be distributed across multiple platforms to allow for differences in model operating environments and hardware requirements. The resulting interface will allow several scientific models to execute simultaneously, allowing the reuse of 30-years of valuable software modeling.

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 consolidated model interface environment would be undertaken.

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95-FA16. DATA CONSISTENCY AMONG ANALYTICAL MODELS

Many of the FAA's scientific models and simulations require an extensive amount of air traffic data. These analytical models will require additional data as more data becomes available (driven by the increased use of automated equipment on and off aircraft). Currently, however, data requirements often overlap; data sources and formats are inconsistent. There is a need, therefore, to provide a consistent format and source of data. This would greatly reduce the cost of fulfilling the data requirements for each model, increase the efficiency producing studies with current models, and better prepare the FAA for future modeling.

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 consistent data format would be undertaken.

95-FA17. OPTIMIZATION MODELS FOR AIR TRAFFIC CONTROL

The FAA needs optimization models for managing flight operations subject to airspace and airport capacity constraints. These models can be applied to the computation of ground delay programs, the rerouting of flights to avoid bad weather as well as other air traffic control problems. The successful application of these techniques will require that various practical issues are properly handled, such as incurring fairness among airlines, accommodating airline banking at hub airports, accommodating a dynamic decision making environment and accounting for uncertainty associated with weather conditions. The models must be consistent with Air Traffic Control System Command Center policies on flight cancellations and substitutions. A model might consist of an integer program formulated with commercial off the shelf optimization tools and implemented on an advanced work station. In addition, it is important that the models are able to operate within the context of the FAA communication systems. Innovation is needed which would lend to the successful integration of optimization models within the air traffic control infrastructure.

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 optimization model for air traffic control would be undertaken.

95-FA18. AIRPORT CONGESTION DETECTION AND RESOLUTION

Several FAA models study the implications of airport construction and renovations by evaluating the delays imposed on aircraft as they traverse taxiways. To calculate these delays, it is essential to accurately model the efforts of the ground controller. A need exists to more accurately represent the decisions made by the ground controller. This requires the development of new computerized techniques (such as rule base technology) to simulate the ground controller's ability to detect and resolve airport congestion. This accurate modeling will result in a better understanding of the impact of new runway construction and terminal expansion.

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 airport congestion model would be undertaken.

FEDERAL AVIATION ADMINISTRATION

95-FA19. SPATIAL/TEMPORAL DATA STRUCTURES FOR AIR TRAFFIC FLOW MANAGEMENT MODELS

The FAA is responsible for ensuring a safe and efficient flow of air traffic throughout the National Airspace System (NAS). FAA research and development efforts are building decision support systems for air traffic managers. These systems must respond quickly to requests for automatically generated strategies best suited to the current situation and short term forecast conditions. The mathematical models within the decision support systems must incorporate the vast geometry of the NAS and the stochastic nature of operations run by NAS users (airlines, general aviation, military, etc.).

Innovation is needed to adapt spatial indexing concepts found in Geographical Information Systems (GIS) and adding temporal features resulting in a design for data structures that allows for the fastest possible retrieval times of spatially and temporarily oriented information. Candidate designs must explicitly consider the relationships and mutual effects of various ATC procedures, NAS user operations, and Air Traffic Management strategies. The design must account for the probabilistic and deterministic aspects of the NAS, and must possess an adaptive capability for responding to NAS changes. The design must incorporate system performance metrics and measures of precision and accuracy.

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 spatial/temporal data structure would be undertaken.

FEDERAL HIGHWAY ADMINISTRATION

PAVEMENTS

95-FH1. ROLLING DEFLECTOMETER

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 requires all States to have a Pavement Management System (PMS) for all Federal-aid highways. One piece of critically needed data to thoroughly perform a PMS analysis is "structural" data. The automated equipment that collects this at highway speeds is commonly called a "rolling deflectometer." Rolling deflectometers have not been developed in the U.S. nor are they available in the U.S. They have been developed to some degree in other countries.

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 rolling deflectometer would be undertaken.

[2]Phase I may be up to $100,000 and Phase II may be up to $500,000

FEDERAL HIGHWAY ADMINISTRATION

PLANNING

[2] 95-FH2. USE OF GIS IN TRANSPORTATION PLANNING

Geographic Information Systems (GIS) are tools that can significantly assist disciplines in the transportation field. What they provide is a geographic based environment for data manipulation, analysis and display. There is definitely a place for them in transportation planning. Applications have tended to be cumbersome and complex. Innovation is needed to develop more effective and efficient ways of utilizing GIS within the Statewide and metropolitan transportation planning process.

The Phase I research effort would consist of a feasibility study and the investigation of promising techniques. Upon successful completion of Phase I, the actual development of the GIS system would be undertaken.

[2] 95-FH3. NEW DECISION SUPPORT CONCEPTS FOR TRANSPORTATION PLANNING

Transportation planning in urban areas requires a mix of technical analysis, presentation and consensus building. Several iterations of analysis and presentation are usually needed to reach a decision point. Current and emerging hardware and software technology, such as Geographic Information Systems (GIS), work group software, expert systems and computer visualization technologies, may have substantial potential to improve communication, convey information and enhance the decision making process. These and other technologies could be combined to create an integrated and interactive environment for decision makers and analysts to provide an innovative approach to shortening the planning cycle. Research is needed to evaluate information and analysis technologies and work group concepts for their application potential to the transportation decision making process.

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 new decision support system would be undertaken.

STRUCTURES

[2] 95-FH4. FATIGUE CRACK DETECTION USING REMOTE SENSING

One of the most important needs identified by the bridge inspection community is for a method to rapidly detect fatigue cracks in steel highway bridges, even though the cracks might be covered by paint. FHWA is currently developing hardware using ultrasonic and magnetic contact transducers to meet this need. This hardware requires the inspector to place transducers on the steel to detect and quantify cracks. An innovative, rapid, non-contact technology is needed.

Possible methodologies include but are not limited to: high sensitivity thermography which would detect the cracks by sensing the localized thermoelastic/thermoplastic heating of the steel at the tip of the fatigue crack; active thermography which would detect the cracks by their influence on heat flow such as that produced by a pulse of a heat lamp; laser interferometry or holography methods which could detect characteristic surface deformation patterns due to fatigue cracks; laser ultrasonic scanning which could eliminate the need for contact transducers; and computer vision methods, such as digital correlation techniques, which could detect characteristic surface deformation patterns.

[2]Phase I may be up to $100,000 and Phase II may be up to $500,000

FEDERAL HIGHWAY ADMINISTRATION

A portable device, based upon a rapid, non-contact, wide field, remote sensing methodology, to detect fatigue cracks in steel bridges is needed.

The device should be able to detect fatigue cracks when they are less than 10 mm in length and covered by paint. The device must be operated and interpreted by a single person. Ideally the device should be battery powered and ruggedized for field use.

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 fatigue crack detection system would be undertaken.

95-FH5. CONCRETE PRESTRESSING STRAND MANUFACTURED FROM RECYCLED PLASTIC

Prestressing strand made from steel has the major disadvantage of corroding over time, which destroys the concrete. A non-corroding alternative would be made from recycled plastic. A major supply of plastic is available in the form of high-density polyethylene flake from recycled beverage containers. This material by itself does not have the physical properties necessary to make strands. However, it can be strengthened and stiffened by the addition of fiberglass strands through the manufacturing process of expultrusion. Preliminary research has shown that this process is feasible.

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 new technique would be undertaken.

95-FH6. DIGITAL WAVEFORM RECORDER FOR ACOUSTIC EMISSIONS

To take full advantage of advanced acoustic emission sensors, a high-resolution digital waveform recording system is needed. This innovation would permit the recognition of different types of acoustic emission events by their waveform signatures. It would also provide very accurate location of the microcracks that are the source of the emissions. Specifications for such a device would include at least 16 bit digital conversion resolution and 100 megahertz bandwidth.

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 innovative recorder would be undertaken.

FEDERAL RAILROAD ADMINISTRATION

95-FR1. IMPROVED NONDESTRUCTIVE INSPECTION (NDI) FOR RAIL

On June 30, 1992, derailment of a freight train near Superior, Wisconsin resulted in a toxic chemical spill which polluted a town water reservoir. The National Transportation Safety Board investigated the accident and determined the cause to have been a rail failure, precipitated by a fracture which initiated at a transverse

[2]Phase I may be up to $100,000 and Phase II may be up to $500,000
[3]Phase I may be up to $50,000 and Phase II may be up to $300,000

internal crack in the rail head, when the rail was loaded by the approaching train. The internal crack was large enough to have been easily detected by existing NDI procedures, under normal circumstances.

In this case, however, the preceding inspection, 19 days before the accident, failed to detect the crack. The factor which prevented detection is believed to have been the deteriorated condition of the rail head. Most of the running surface and part of the gage corner were covered by head checks, a network of fine parallel cracks oriented across the running surface and progressing downward into the rail head at a shallow angle. The network thus presents an overlapping or layered aspect to typical NDI signal propagation paths, which are angled more steeply into the rail head.

Rail is generally inspected for internal cracks by means of either magnetic induction or pulsed ultrasonic equipment. Ultrasonic systems are the most widely used, and it was ultrasonic NDI which failed to detect the critical crack just before the Superior accident. Ultrasound frequencies for rail inspection are typically between 2 and 2.5 MHz. Frequencies in this range give an acceptable balance between resolution and minimization of attenuation losses in steel.

Innovation is needed to develop novel NDI equipment with the potential to detect transverse cracks in head checked rails and/or rails with surface contamination such as oxidation or grit-filled lubricants. The Phase I proposal should present a plan for a laboratory demonstration of capability to illuminate typical targets and obtain returns at high signal/noise ratio when inspecting through contaminated surfaces, with potential for coverage every 4 mm at a sweep rate of at least 5 m/s. The technical discussion should explain the physical principles(s) on which the proposed approach is based and calculations to support the projected capability.

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 improved NDI equipment would be undertaken.

95-FR2. SENSOR SYSTEMS TO DETECT HAZARDOUS CONDITIONS IN HIGH SPEED RAIL OPERATIONS

High speed operation of passenger trains places equipment in dynamic environments which can lead to undesirable and potentially unsafe dynamic phenomena. In one such condition, called "truck hunting," the wheelsets of a railroad vehicle enter a resonant condition which causes the wheels and often the entire vehicle to rapidly rock back-and-forth as it travels down the track. This condition results in very high force levels between the wheels and the track structure, and can lead to equipment damage and sometimes derailment.

Innovative sensor systems are needed to prevent and/or control the onset of the hunting phenomenon. While the railroad vehicles are actually in operation, innovative onboard sensor systems would detect the onset of the hunting condition and report it to operating personnel so that the train can be slowed or stopped to preclude hazardous conditions from occurring.

A second type of sensor system is needed to measure and detect mechanical conditions which are conducive to hunting, prior to operating the vehicle in a speed regime where hunting might actually occur. Sensors on this second level would provide an advanced diagnostic capability to screen fleets of vehicles to detect vehicles in conditions particularly susceptible to the hunting phenomenon. Early detection of such conditions would allow removal of cars from service and would assure that operating fleets of cars had no vehicles unreasonably susceptible to truck hunting.

[4]Phase I may be up to $100,000 and Phase II may be up to $300,000

FEDERAL RAILROAD ADMINISTRATION

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 sensor systems would be undertaken.

MARITIME ADMINISTRATION

95-MA1. ADVANCED MARITIME VESSELS AND INTERMODAL TERMINALS

Innovative research is sought to improve the efficiency, productivity, safety and environmental responsiveness of maritime vessel and intermodal terminal design, construction and operation in U.S. maritime and waterway transportation. Proposers must have maritime experience and a first-hand understanding of industry practices. Proposed projects are to have a sound and practical basis, and be appropriate for near-term implementation and commercialization. Proposed projects are to be related to the programs and near-term interests of the Maritime Administration. Proposals should include an assessment of the importance of the research to the maritime industry and plans for commercialization.

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 innovative techniques would be undertaken.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

95-NH1. DYNAMIC INTRUSION SENSING SYSTEM

NHTSA is evaluating an offset impact test as a possible future requirement for frontal protection, where only a portion of the vehicle's front structure is loaded. The most detrimental aspect of offset impacts is the compartment intrusion and violation of the occupant's survival space.

Intrusion is also a detrimental factor in side impacts, rollovers and other crash modes. It appears that the injury consequences are more related to the timing, location and velocity of intrusion relative to the affected body region than simply the degree of intrusion. Innovation is needed for development of systems which will achieve the objective of dynamic measurement of compartment intrusion during staged crash tests.

The system should have the versatility to be used in frontal, side, rollover and other crash modes. The resulting innovation must also be feasible for production at reasonable cost for the expected market. Direct applications for the device would be continuous measurement, or several discrete intrusion measurements of floor pan, instrument panel, steering assembly, side door, roof, pillars or other compartment surfaces. It would also be desirable to measure intrusion of more than one component during a single test, using one or more of the sensing systems. The system must operate during a severe crash environment without interfering with the vehicle structural integrity and with test surrogates restrained with belts and/or air bags or with no restraint. Cost analysis for the device should account for the potential destructive test environment. The direct market for a dynamic intrusion measurement device is vehicle crash test facilities in the U.S. and worldwide. The proposal should also consider other potential markets besides vehicle testing.

[3]Phase I may be up to $50,000 and Phase II may be up to $300,000
[5]Phase I may be up to $75,000 and Phase II may be up to $300,000

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 innovative sensing system would be undertaken.

[5] 95-NH2. SAFETY SEAT AND RESTRAINT SYSTEM

In 1992, more than 22,500 drivers were killed and 1,935,000 were injured in crashes on our highways. The right side front passenger position accounts for the second most common location of fatalities and injuries among car occupants. Innovation is needed to develop reasonable cost, practical front outboard seating systems that provide substantially improved protection for their occupants for all car crash modes (frontal, rear, side, and rollover). Several examples of the possible approaches for improved safety performance are: 1) transmit crash load forces to other load bearing/energy absorbing structural elements, 2) provide anchorage/support for belt/bag restraint systems, 3) provide information about the size, mass, location of seat occupant at the onset of a crash and/or during crash event for use by air bag control module, and 4) provide energy absorbing support path for human body elements during crash event.

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 innovative restraint system would be undertaken.

[5] 95-NH3. CRASH INVESTIGATION MEASUREMENT TECHNOLOGY

Motor vehicle crash investigations include: (1) the measurement of the amount of vehicle crush sustained in the crash and (2) the interpretation and documentation of physical evidence generated by the vehicle(s) pre-crash and post-crash movement (i.e., gouge marks, etc.). A system involving tape measures and a stringline depicting the undamaged vehicle's extreme dimensions has been used to measure the vehicle's crush. Measuring wheels, tape measures, and vehicle surrogates have been used to interpret and measure the vehicle generated scene evidence. New measurement technology is needed to enable field personnel to investigate more crashes by decreasing the required time spent documenting vehicles and scenes. This same technology should be usable during staged crash tests which would ensure that both field measurements and controlled crash tests have compatible measurements. A further goal would be to enable police officers with no special training to obtain data from crushed vehicles and scene generated evidence with minimal additional effort.

Innovation is needed to develop technologies for measuring vehicle contours (damaged and undamaged) and for measuring and documenting the scene of the crash with and without crash generated physical evidence (i.e., skid and gouge marks). The new technology should have the following characteristics: can be used by personnel with little or no training; uses inexpensive equipment; uses equipment that is small and light weight; requires less than 30 minutes for vehicles and less than 45 minutes for accident scenes to set up, make measurements, and take down; data should be retainable in a redundant form to prevent loss during a power failure; and the system should lend itself to follow up quality control procedures. Vehicle measurements should be taken in such a manner as to be easily correlated to similar measurements from an undamaged vehicle so that the crush can be determined, with the final data in machine readable form.

[5]Phase I may be up to $75,000 and Phase II may be up to $300,000

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 innovative technology would be undertaken.

95-NH4. TRAFFIC ENFORCEMENT TECHNOLOGY

Innovation is needed to maximize the effectiveness and efficiency of available traffic law enforcement personnel. New vehicle identification numbers use both barcoding and embossing; some states issue driver's licenses with magnetic strips or barcoding. The ability to quickly gather and record this information can be developed to increase both the efficiency and accuracy of traffic law enforcement. Simultaneously, this information could be used in existing systems to learn if the offender or vehicle is sought for any criminal violations. Research is needed to develop technology for an innovative approach to electronically capture information related to the driver and the vehicle on a laptop computer, upload the relevant information to state and Federal information networks to check for possible criminal information involving either the driver or vehicle, and report the results back to the officer in the field. It is desirable that the vehicle and driver information be reproduced on necessary law enforcement reports (e.g., crash reports, citations) as well. The technology must be cost effective and practical for use by officers in the field.

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 innovative technology would be undertaken.

[5]Phase I may be up to $75,000 and Phase II may be up to $300,000

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. 95-1

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 $100,000 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. 95-1

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. 95-1

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

☆ U.S. GOVERNMENT PRINTING OFFICE : 1983 O—380-498 (77)

STANDARD FORM 1411 (10-83)
Prescribed by GSA
FAR (48 CFR) 53.215-2(c)

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 this 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)