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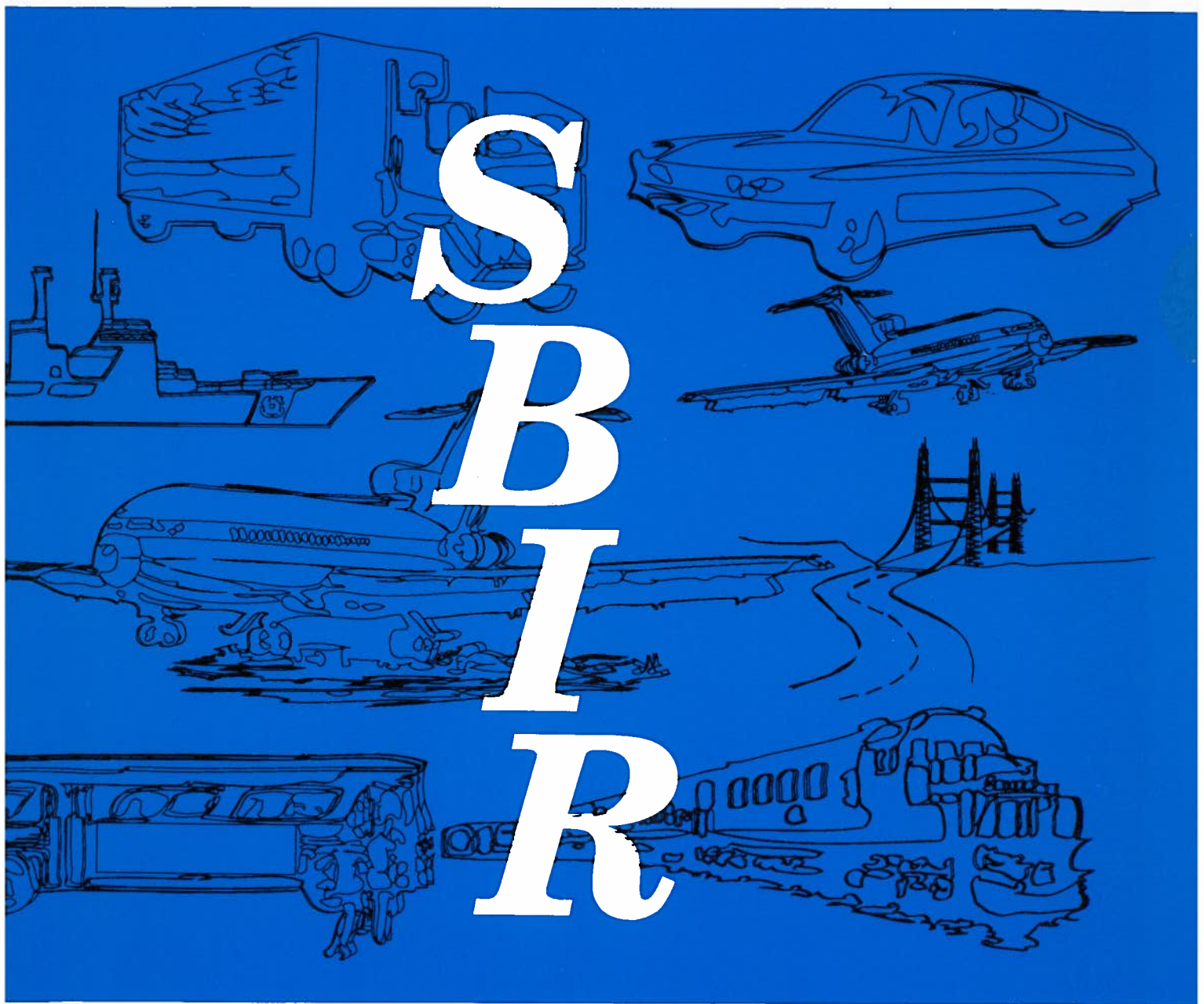


U.S. Department of
Transportation
Office of the Secretary
of Transportation

Small Business Innovation Research

Program Solicitation

(Closing Date: May 1, 1989)



Transportation Systems Center

SBIR - 89 - 1

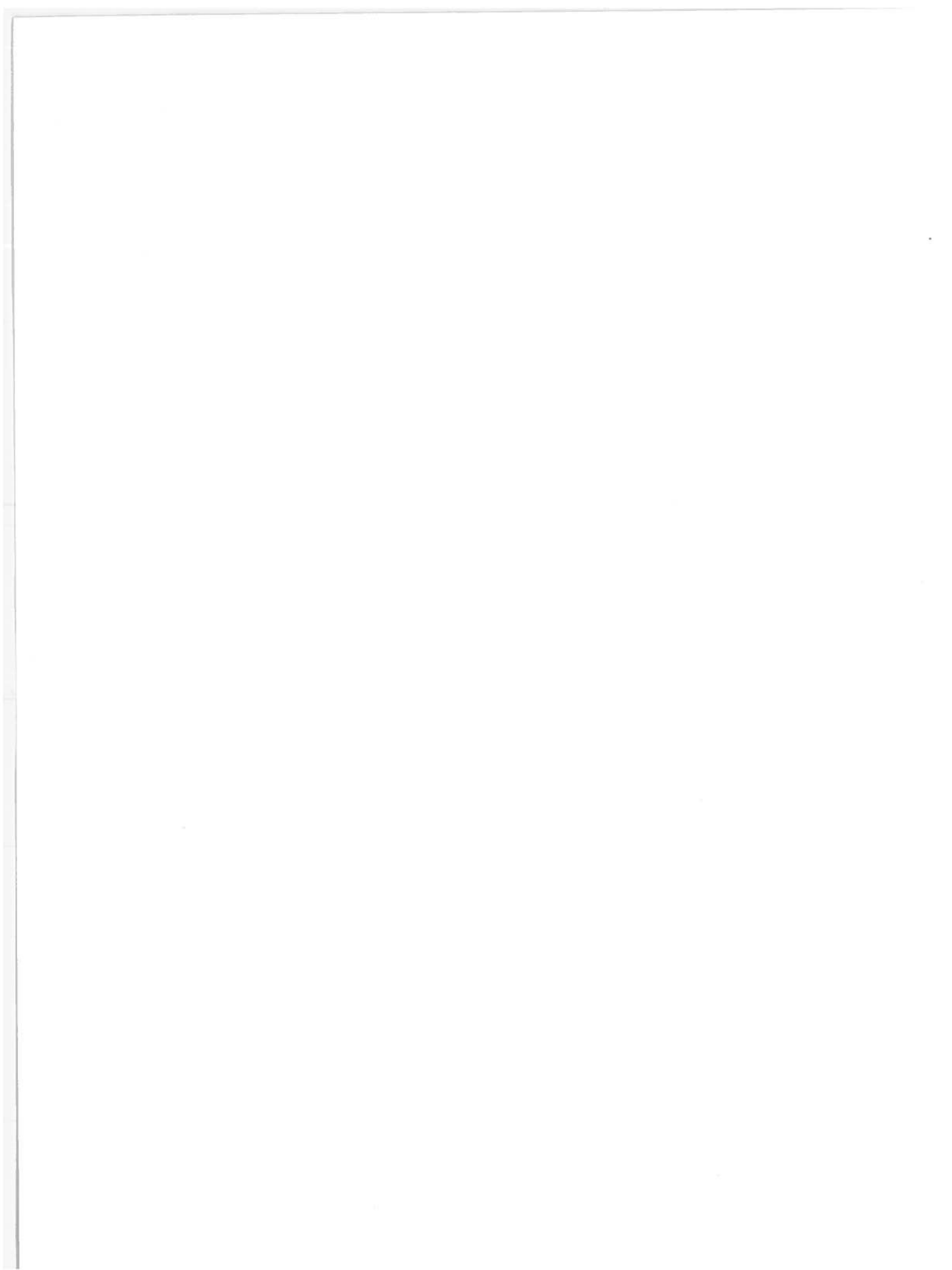
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PROGRAM SOLICITATION

**Small Business Innovation
Research Program**

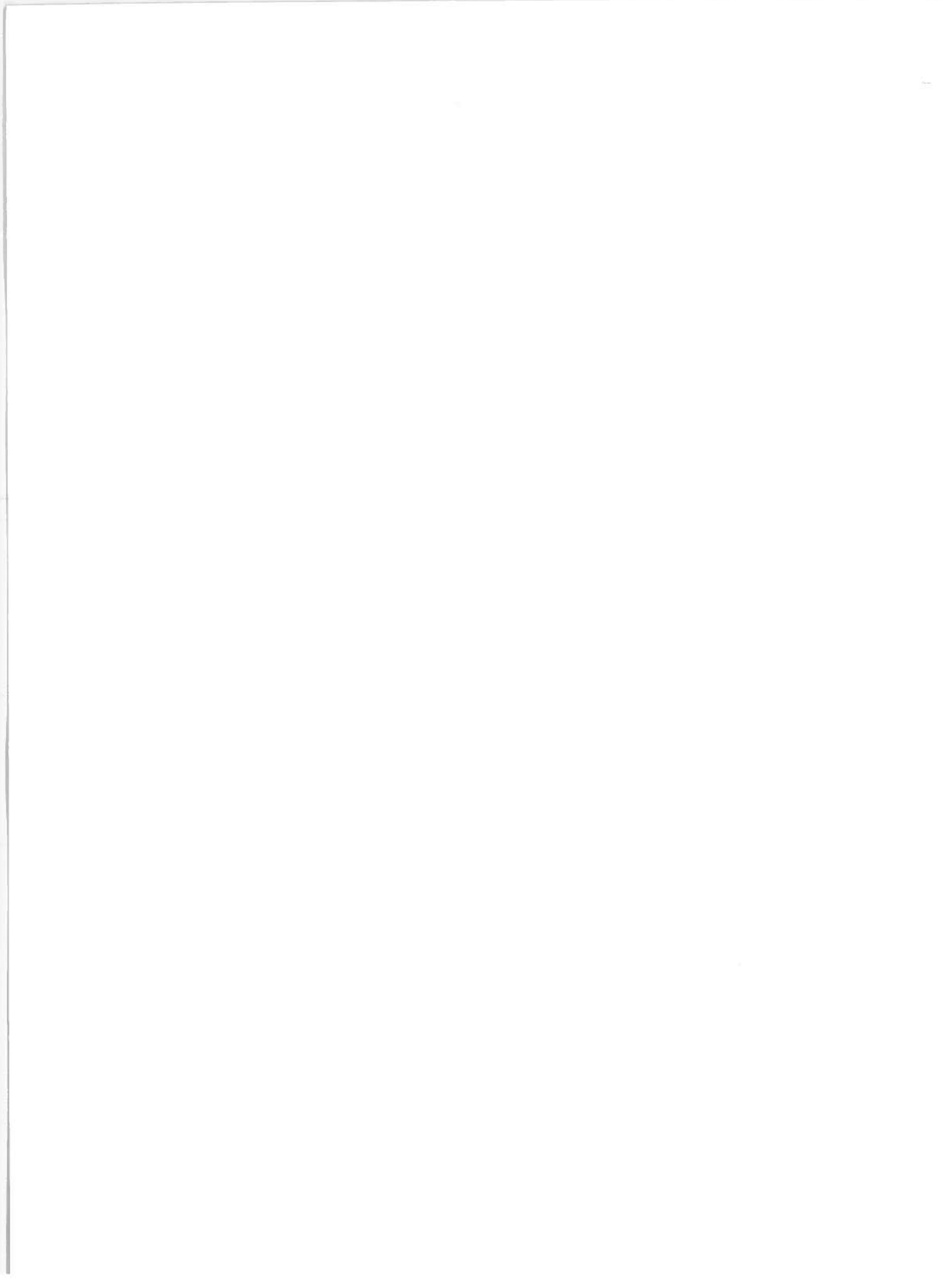
Closing Date: May 1, 1989

**DOT SBIR Program Office, DTS-23
U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142**



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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. 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 should not exceed \$50,000 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 \$300,000. Phase II proposals must be prepared in accordance with guidelines provided by DOT to all Phase I awardees. 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 non-Federal funds to pursue commercial applications of research or R&D funded in Phases I and II by the Department. Phase III may also involve follow-on 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, Appendix D).

Requests for additional information or questions relating to the DOT SBIR Program may be addressed to:

DOT SBIR Program Office, DTS-23
U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

Attn: Dr. George Kovatch
Telephone: (617) 494-2051

II. DEFINITIONS

A. Research or Research and Development

Research or research and development (R, R&D) means any activity which is:

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

B. Small Business

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 "affiliates" is defined in greater detail in 13 CFR 121.3-2(a). The term "number of employees" is defined in 13 CFR 121.3-2(t). 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) Asian-Indian Americans.

D. Women-Owned Small Business

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

E. Subcontract

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

III. PROPOSAL PREPARATION INSTRUCTIONS AND REQUIREMENTS

A. Limitation on Length of Proposal

Please note that:

- (1) SBIR Phase I proposals should not exceed a total of 25 pages (regular size type - no smaller than elite - single or double spaced, standard 8½" 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 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, R&D plan. The plan should indicate what will be done, where it will be done, and how the R, R&D will be managed or directed and carried out. Phase I R, R&D 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 detach and fill out the acknowledgement of receipt card on the back cover of this solicitation and include it with the proposal to DOT.

IV. METHOD OF SELECTION AND EVALUATION CRITERIA

A. General

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

B. Evaluation Criteria

The evaluation process involves the following factors:

- (1) The soundness of merit of the technical approach to assure successful demonstration of the feasibility of the Phase I R, or R&D project thereby enhancing prospects for an innovative solution to the research problem that is addressed and prospects for commercialization.
- (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.
- (5) In Phase II evaluations of proposals of equal technical and scientific merit the Department will give special consideration to proposals which demonstrate Phase III non-Federal capital commitments. Phase II proposals may be submitted only by Phase I contract awardees.

C. Prescreening

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

D. Schedule

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

E. Program Selection

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

F. Contact with DOT

Contact with DOT relative to this solicitation during the Phase I proposal preparation and evaluation period is restricted for reasons of competitive fairness. No information on proposal status will be available until formal notification of award or declination is made. For planning purposes this is expected to occur by October 2, 1989. Correspondence relating to proposals should reference the proposal identification number assigned on the acknowledgement of receipt card and be sent to the DOT SBIR Program Office.

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

V. CONSIDERATIONS

A. Awards

It is estimated that during fiscal year 1989, the Department of Transportation will award approximately 10 Phase I contracts with an anticipated potential maximum of 16 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 at a value of up to \$50,000 each. Phase II awards will be in the form of cost-plus-fixed fee contracts with a value of up to \$300,000 each. 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 following Operating Administrations: Federal Highway Administration, Federal Railroad Administration, National Highway Traffic Safety Administration, and the United States Coast Guard. Phase II awards for such research will depend on the actual funding available.

B. Reports

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

C. Payment Schedule

Payments will be made in three equal installments upon presentation of invoices by the contractor in

conjunction with the submission of the reports described above.

D. Innovations, Inventions and Patents

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

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

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

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

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

2. **Rights in Data Developed Under SBIR Funding Agreements.** Rights in technical data, including software developed under any contract resulting from this solicitation, shall remain with the contractor except that the government shall have the limited right to use such data for government purposes and shall not release such data outside the government without permission of the contractor for a period of two years from completion of the project from which the data were generated. However, effective at the conclusion of the two-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 89-FA11 through 89-FA14, 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 funding agreement officer.
2. For Phase II a minimum of one-half of the research and/or analytical effort must be performed by the proposing firm.

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.
- 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.

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:

DOT SBIR Program Office, DTS-23
U.S. Department of Transportation
Transportation Systems Center
Kendall Square
Cambridge, MA 02142

Attn: Dr. George Kovatch
Telephone: (617) 494-2051

Proposals must be postmarked NO LATER than May 1, 1989 to qualify for acceptance and consideration under the current DOT SBIR Program. Proposals postmarked later than May 1, 1989 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 1, 1989.

B. Additional Information

1. **Bindings.** Please do not use special bindings or covers. Staple the pages in the upper left corner of the cover sheet of the proposal with a single staple.
2. **Packaging.** All copies of the proposal should be sent in one package together with the acknowledgement of receipt card.
3. **Confirmation.** The DOT SBIR Program Office will assign an identification number to each proposal received at the above address postmarked no later than May 1, 1989. This number will appear on the acknowledgement of receipt card (see 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:

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

Aerospace Research Applications Center
611 North Capital
Indianapolis, IN 46204
(317) 262-5003

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

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

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

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

North Carolina Science and Technology
Research Center
P. O. Box 12235
Research Triangle Park, NC 27709
(919) 549-0671

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

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

VIII. RESEARCH TOPICS

Phase I research topics for each DOT Operating Administration 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 FY89 PHASE I AWARDS
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FEDERAL AVIATION ADMINISTRATION (FAA)	7 Awards
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Air Traffic Control/Flight Services

- 89-FA1. Air Traffic Controller/Automation Communication
- 89-FA2. Application of Artificial Intelligence to the Maintenance Control Center
- 89-FA3. PC-Based Airspace Design and Procedural Development Tool

Aircraft Safety

- 89-FA4. Advanced De-Icing Fluids for General Aviation Aircraft
- 89-FA5. Aging Aircraft Corrosion Indicator
- 89-FA6. Improvement of Eddy Current Nondestructive Testing Through Application of Automated Techniques and Artificial Intelligence
- 89-FA7. Certification/Safety Assessment of Flying Qualities and Pilot Workload for Advanced Digital Fly-By-Wire Transport Aircraft
- 89-FA8. Development of Low Heat Release Composites for Aircraft Interiors

Airport Technology

- 89-FA9. Airport Surface Traffic Automation
- 89-FA10. Video Image Processing of Airport Pavement Distress

Aviation Security

- 89-FA11. Explosives Vapor Sampling
- 89-FA12. Innovative Passenger Screening for Weapons
- 89-FA13. Security Checkpoint Optimization
- 89-FA14. Remote Identification Verification System

FEDERAL HIGHWAY ADMINISTRATION (FHWA)	3 Awards
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Structures

- 89-FH1. Shear Stress Gage for Hydraulic Laboratory Use

Safety

- 89-FH2. The Use of New Materials for Roadside Safety Hardware

Pavements

- 89-FH3. Field Evaluation of Equipment to Verify Steel Placement in Portland Cement Concrete
- 89-FH4. In Place Permeometer for Open-Graded Drainage Layers
- 89-FH5. Improved Larger Diameter Non-Corrodible Dowel
- 89-FH6. Alternative De-Icing Materials

DOT OPERATING ADMINISTRATION/TOPICS	POTENTIAL MAXIMUM FY89 PHASE I AWARDS
FEDERAL RAILROAD ADMINISTRATION	1 Award
<u>Rail Testing</u>	
89-FR1. Remote Detector Monitoring Device	
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION (NHTSA)	3 Awards
<u>Remote Vehicle Identification and Speed Monitoring</u>	
89-NH1. Application of High Performance Technology to Toll Road Speed Control and Vehicle Performance Monitoring	
<u>Safety Belt Applications</u>	
89-NH2. Safety Belt Buckle Device to Restrain Toddlers and Young Children	
89-NH3. Devices to Improve the Comfort and Convenience of Safety Belts	
89-NH4. "Buckle-Up" Education Program for Grammar School and Middle School Science Class Students	
<u>Medical Equipment Restraints</u>	
89-NH5. Crash Protection Accessories to Increase the Safety of Occupants with Special Medical Needs	
<u>Truck Driver Warning Systems</u>	
89-NH6. Vehicle/Object Detection Alongside Heavy Vehicles	
<u>Motorcycle Safety</u>	
89-NH7. Accessories to Increase the Safety of Motorcyclists	
<u>Glare Reduction Systems</u>	
89-NH8. Development of Headlamp Glare Reduction Devices	
UNITED STATES COAST GUARD (USCG)	2 Awards
<u>Law Enforcement Drug Detection</u>	
89-CG1. Cocaine/Heroin Drug Detection Technologies	
89-CG2. Passive Surveillance System for Law Enforcement	
<u>Materials</u>	
89-CG3. Alternate Construction Materials	
<u>Major Aid System Management</u>	
89-CG4. Remote Site Secondary Power Research	
89-CG5. Remote Site Power by Wave Energy	

FEDERAL AVIATION ADMINISTRATION

AIR TRAFFIC CONTROL/FLIGHT SERVICES

89-FA1. AIR TRAFFIC CONTROLLER/AUTOMATION COMMUNICATION

The FAA is engaged in developing advanced automation capabilities that will enable air traffic controllers to accommodate the projected levels of aviation activity. The automation systems, if they are to be beneficial to a busy controller under stressful conditions, must be able to both transmit information to the controller as well as receive information from the controller in a manner that is non-intrusive to the controller's primary job of monitoring and separating aircraft.

Current controller/automation communication techniques are primarily tabular displays on or near the radarscope and controller keyboard entries. While these may suffice in the existing environment, they will be inadequate for high demand and technology levels in the future. Research is needed to develop mechanisms, technologies, and techniques for enhancing the communications interface of the controllers and their supporting automation systems.

89-FA2. APPLICATION OF ARTIFICIAL INTELLIGENCE (AI) TO THE MAINTENANCE CONTROL CENTER (MCC)

Innovative research is required to explore and determine the cost as well as the operational and the technical feasibility of applying AI technology to the complex MCC environment. New technology is being introduced for remote maintenance monitoring (RMM), fault diagnosis, on-line certification, and restoration of systems in the field. The Airway Facilities work force is becoming more systems oriented; there is a need to investigate the feasibility of using expert systems to relieve the MCC operator of routine and mundane tasks as well as to provide training and simulation to expedite adaptation to the new RMM systems. Expert systems for intelligent fault isolation and analysis incorporating voice recognition and adaptive decision support are envisioned as fitting this need. The thrust of the proposed research should address initiatives to assist the MCC operators in performing more effectively in a complex, changing, and very demanding environment.

89-FA3. PC-BASED AIRSPACE DESIGN AND PROCEDURAL DEVELOPMENT TOOL

The FAA has a need to build more efficient airspace and to develop more effective procedures in the utilization of that airspace. A low-cost, PC-based air traffic simulation would allow individual facilities to experiment with various airspace designs, traffic scenarios, and procedures to enhance effectiveness of their facility.

AIRCRAFT SAFETY

89-FA4. ADVANCED DE-ICING FLUIDS FOR GENERAL AVIATION AIRCRAFT

Research is needed to develop advanced de-icing/anti-icing fluids for application to General Aviation (GA) aircraft with takeoff safety speeds (V_2) generally less than 85 knots. The current (Type I) glycol-based Newtonian fluids when applied to aircraft will afford the aircraft a limited safe period in which to become airborne during conditions of

FEDERAL AVIATION ADMINISTRATION

light freezing precipitation and snow. New advanced Type II thicken fluids with non-Newtonian viscosity behavior are currently being developed by industry for application primarily by large transport category aircraft with V_2 speeds in excess of 85 knots. Current Association of European Airlines (AEA) Type II fluids provide for longer holdover times during freezing/freezing precipitation conditions, than AEA Type I fluids. The effectiveness of new advanced fluids can be attributed to their base construction (typically long chain polymers) which provide special rheological and pseudoplastic behavior. Since recent advances in de-icing thicken fluid technology has been directed toward the large transport category aircraft with higher V_2 speeds, this added margin of aviation safety is not afforded smaller, lower speed GA type aircraft.

Some shortcomings of the current glycol-based fluids include hold over time limitations, toxicity, excessive aerodynamic shearing forces for removal of highly viscous fluids, difficulty of application, cost, etc. Basic fluid design/research should consider these and other concerns in light of the slower V_2 speeds of GA aircraft.

89-FA5. AGING AIRCRAFT CORROSION INDICATOR

Detailed inspections of large numbers of today's aging commercial fleet have uncovered various levels of subsurface corrosion. While surface corrosion is easily detected and removed, subsurface corrosion can neither be easily detected nor removed. This subsurface corrosion has the potential to significantly reduce the structural integrity of aircraft components. The level of subsurface corrosion may be a function of both aircraft calendar age and/or environmental conditions. Presently no direct measure of an aircraft's lifetime environmental resistance (or propensity to become corroded) exists. Research is needed to develop an on-board corrosion meter (indicator or other device) which would measure an aircraft's propensity to be corroded. Instrumentation (or other measurement technique) needs to be developed which can sense and quantify the cumulative corrosion factors (humidity, heat, salt air, etc.) and output a quantitative value which represents an aircraft's potential for significant subsurface corrosion due to its historical/geographical usage.

89-FA6. IMPROVEMENT OF EDDY CURRENT NONDESTRUCTIVE TESTING THROUGH APPLICATION OF AUTOMATED TECHNIQUES AND ARTIFICIAL INTELLIGENCE

Research is needed to develop a portable eddy current nondestructive testing system which allows rapid, personnel independent inspection of cracks in a rivet line. The device should require only one scan and should be capable of recognizing normally expected anomalies such as off-center probe or oversize rivet. Such capability is expected to be achieved using automated techniques and artificial intelligence to recognize impedance plane patterns. Due to the increased dependence of damage tolerant structure on such inspections, it is important that such a technique be developed to accurately detect and identify cracks in the rivet line while decreasing the inspection time by a factor of ten or more.

FEDERAL AVIATION ADMINISTRATION

89-FA7. CERTIFICATION/SAFETY ASSESSMENT OF FLYING QUALITIES AND PILOT WORKLOAD FOR ADVANCED DIGITAL FLY-BY-WIRE TRANSPORT AIRCRAFT

The introduction of new commercial aircraft that incorporate digital, high gain, full authority Fly-By-Wire (FBW) and Fly-By-Light (FBL) flight control systems present airworthiness/operational certification personnel in the agency with a new variety of safety assessment problems. The advent of these and other complementary technologies such as propulsion control, side arm controllers, flight envelop tailoring/limiting, and maneuver limiting will require a new approach to airworthiness, flight test pilot rating issues. Currently, little material exists for guidance in these areas. Research needs to target the following technical areas 1) full flight test pilot and flight test engineer assessment of advanced FBW and FBL control system flying qualities and aircrew workload, 2) development and incorporation of existing task oriented pilot workload rating systems, 3) critical analysis of the impact of pilot workload and flying qualities ratings as related to pilot error accidents where omission of critical aircrew functions is a cause or factor in accidents and incidents, and 4) analysis of candidate FBW/FBL failure modes and their impact on safety compliance and assessment of "failed mode" flight within the requirements for "minimum standards for a given level of safety."

89-FA8. DEVELOPMENT OF LOW HEAT RELEASE COMPOSITES FOR AIRCRAFT INTERIORS

Recent FAA rule making activity targeted a pass/fail level of 65 kilowatts per square meter and 65 kilowatt minutes per square meter as the peak heat release and total heat release, respectively, for burning aircraft cabin materials. Innovative materials or assemblies thereof are needed to achieve substantial further improvements in peak heat release and total heat release toward a research target of 10 kilowatts per square meter and 10 kilowatt minutes per square meter, respectively. A maximum smoke specific density of 200 has also been established, and research is needed to reduce this to 50. The difficulty lies in achievement of extremely low energy release composites within aircraft constraints such as weight, performance, aesthetics (decorative laminates), and reasonable fabrication technology. Target materials may be typically of honeycomb construction or thermoplastic moldings such as used in passenger service units.

AIRPORT TECHNOLOGY

89-FA9. AIRPORT SURFACE TRAFFIC AUTOMATION

The FAA's air traffic control (ATC) ground traffic management remains a highly manual (non-automated) function. Accidental runway incursions plus the increasing complexity of airport runway/taxiway configurations is fostering a heightened interest in exploring potential technology applications to the positive control of aircraft operating on the airport surface. The FAA's interest is broad and includes every aspect of ATC ground control of surface vehicles and aircraft.

FEDERAL AVIATION ADMINISTRATION

89-FA10. VIDEO IMAGE PROCESSING OF AIRPORT PAVEMENT DISTRESS

Innovative research is required to determine the incidence and extent of airport pavement surface distress manifestations. The product of this research will be an automated system for imaging and diagnostic interpretations to be used for pavement rehabilitation and repair. The system provided as a result of this research should also be capable of depth perception.

AVIATION SECURITY

*89-FA11. EXPLOSIVES VAPOR SAMPLING

The FAA requires that air travel passengers be screened for explosives prior to boarding commercial aircraft. This necessitates the development of a non-intrusive procedure for efficiently "scrubbing" a vapor sample, potentially containing explosive vapor emanating from passengers. Such a procedure would operate at flow rates of less than 300 liters/second and at temperatures non-offensive to humans. Design constraints for proposed sampling procedures shall take into account tolerable flow rate and temperatures, human engineering with respect to anticipated concept of intrusiveness, and characteristics of explosive molecules: high absorption affinity and frangibility. A feasible sampling procedure should be capable of sweeping vapor from less than one pound of plastic explosives concealed under one layer of typical clothing with great efficiency. It should also be capable of delivering a large number of unfragmented explosive molecules to a collector while posing no threat to the health or right to privacy of human subjects.

*89-FA12. INNOVATIVE PASSENGER SCREENING FOR WEAPONS

Research is needed to develop a system to detect threats (firearms, grenades, and explosive devices) on people. It must provide an image of the threat objects in two or three dimensions, be inexpensive, and be most informative. Medical approval is of greatest importance and should operate with a minimum of human intervention on the part of both the operators and the passenger.

*89-FA13. SECURITY CHECKPOINT OPTIMIZATION

Research is needed for optimization of concourse security screening points at airports. Typical checkpoints currently consist of both x-ray systems for hand-carried luggage items and walk-through metal detector portals for personnel screening. Improvements are needed to improve detections, reduce false alarms, and increase traffic flow rates. Primary considerations should be given to improvements in overall checkpoint efficiency and may include enhanced equipment and/or procedures.

*89-FA14. REMOTE IDENTIFICATION VERIFICATION SYSTEM

A need exists to automatically verify the identity of an individual carrying or presenting an identification card. Current systems require the physical contact and cooperation by the individual being verified (e.g., fingerprint, voiceprint, hand geometry), and do not lend themselves to remote verification. A system is required which can operate in real time at a distance and/or requires no cooperation by the user other than the possession of an ID card. A false reject rate and false accept rate of five percent may be acceptable.

*See Note Section V.D.2.

FEDERAL HIGHWAY ADMINISTRATION

STRUCTURES

89-FH1. SHEAR STRESS GAGE FOR HYDRAULIC LABORATORY USE

Design procedures for protective measures, such as riprap, and stability analyses of hydraulic problems of highways in a river environment often involve a so-called shear stress parameter which is a measure of boundary drag. In field situations this parameter is typically computed from formulas.

In laboratory situations, however, shear stresses need to be measured either directly or indirectly. Direct measurements usually involve measuring forces on a test section placed on the bed, but test sections are difficult to install and they do not work when there are significant vibrations. Indirect measurements usually involve sampling the velocity profile very close to the bed and computing the presumed shear stress based on the rate of change in velocity. One such device is the so-called Preston tube which is essentially a total pressure sensor that is placed on the bed of a flume. The Preston tube does not work well for rough boundaries or for unknown directions of flow such as might occur in scour holes. It is also cumbersome in that a pressure tube must be connected to a manometer or a transducer.

Research is needed to develop a velocity probe to be used in a small scale laboratory setting. Essential features include:

- Small size, < 1/4" diameter, to minimize disturbance to the flow field
- Designed to rest on the bed
- Capable of measuring two velocity components at a predetermined distance (say 1/4") from the bed
- Capable of operating in a somewhat contaminated water environment with suspended sand and clay particles, some entrained oil from pump lubrication, etc.
- Be reasonably inexpensive to fabricate

Consideration could include electromagnetic, laser and hot crystal techniques.

SAFETY

89-FH2. THE USE OF NEW MATERIALS FOR ROADSIDE SAFETY HARDWARE

Roadside safety devices (e.g., guardrail, bridge rails, breakaway supports, etc.) have typically been fabricated using traditional construction materials such as concrete, steel, aluminum, and wood. In recent years new materials such as plastics and composite materials have become viable alternatives to traditional materials in a number of industrial applications.

Research is needed to explore the feasibility of using non-traditional materials for the fabrication of roadside safety hardware. This research would involve an examination of current hardware systems to determine their material properties and performance characteristics. Alternative materials will then be identified that could be used in the fabrication of such hardware. Such materials will be examined to determine their potential for reducing the cost or enhancing the performance of existing hardware systems.

FEDERAL HIGHWAY ADMINISTRATION

PAVEMENTS

89-FH3. FIELD EVALUATION OF EQUIPMENT TO VERIFY STEEL PLACEMENT IN PORTLAND CEMENT CONCRETE

The proper placement of steel (epoxy-coated dowels, tie bars, reinforcing bars or mesh) is critical to the long term performance of Portland Cement concrete pavements. Currently, equipment allows for spot checks of steel placement on plastic concrete (such as Fisher M Scope Model M-100 Metal Probe and Rebar Locator) or in hardened concrete (Compass Corner Stake Locator). A Soil Test Cover-Meter can be used to determine exact dowel location. Various radar devices can also be used.

Research is needed to develop a fast, reliable system that can be used shortly after construction to verify steel placement and also be used as a basis for adjusting contract payments if specifications are not met. The equipment should rapidly determine and document accuracy of pavement steel location both in transverse and longitudinal directions, perfectly in one pass. Self-propelled, instant readout (including graphics) equipment is highly desirable.

89-FH4. IN PLACE PERMEOMETER FOR OPEN-GRADED DRAINAGE LAYERS

Research and evaluation of in-place pavement sections have shown that improved drainage extends pavement service life. A rapid field test device is needed to determine drainability of marginal subgrades and to measure permeability of open-graded bases to verify that design permeabilities are met or exceeded. A prototype field permeability test device was developed by FHWA in 1980 and field evaluations were made in Florida, West Virginia and several other states and reported on in 1982.

Research is needed to develop prototype equipment or innovative approaches to new equipment so that a commercial device suitable for routine use can be developed and marketed. The equipment and procedure should be capable of evaluating the permeability in ranges of 0-1000 ft/day, 1000-5000 ft/day and over 5000 ft/day. The accuracy required within these broad ranges can vary. Portability and easy setup and teardown of lab equipment is essential.

89-FH5. IMPROVED LARGER DIAMETER NON-CORRODIBLE DOWEL

Research has shown that larger diameter non-corrodible dowels can be expected to result in considerable performance improvement in jointed reinforced concrete pavement. Cost effective alternatives to 1-1/2 inch and greater diameter epoxy coated round solid steel dowels, 18 inches in length are needed. These alternatives could be reinforced plastic or perhaps ceramic materials, or even a stainless steel hollow pipe with a filler material.

Alternative devices should have shear strength, fatigue strength and other characteristics found with existing dowels. Laboratory and field tests should be proposed to verify the performance of the alternative designs.

FEDERAL HIGHWAY ADMINISTRATION

89-FH6. ALTERNATIVE DE-ICING MATERIALS

The search for effective alternative deicers to salt has been proceeding for several years. Recently, a new alternative, calcium magnesium acetate (CMA) has been discovered, its properties evaluated, and its production techniques developed. CMA is largely free from detrimental effects to the environment and is 3-10 times less corrosive than salt to bridges and automotive metals. However, it is slower than salt in its deicing action in the field and tends to roll off the roadway during field application or as a result of traffic. This limits the ability to obtain the maximum CMA deicing effect by applying it to the roadway before snow storms occur.

Research is needed to develop a deicing material that contains calcium, magnesium and acetate ions and whose aqueous solution has a lower eutectic point than that of commercial CMA now in use. This material should be faster and more effective at lower temperatures in melting ice and snow than that of commercial CMA both in the laboratory and in the field. This new product should have a flatter shape to limit the material rolling off the roadway during or after field application. Also, this material should contain no appreciable additives and should not be any more detrimental to the environment, highways, or bridge structures.

FEDERAL RAILROAD ADMINISTRATION

RAIL TESTING

89-FR1. REMOTE DETECTOR MONITORING DEVICE

As part of the FRA Office of Research and Development field studies on the variation in rail stress due to ambient temperature fluctuations, several long term measurement sites have been established on two railroads. The test sites must be visited often to collect data, which has become a very time consuming and costly process. The use of an automatic remote monitoring and data collection device would prove very cost effective for these research test projects. In addition, there is a distinct possibility that the device could be used at permanent rail stress and temperature measurement sites for evaluation of rail neutral temperature and train lubrication effectiveness.

Research is needed to develop the hardware and software to inexpensively monitor rail stress from strain gages located on the web of the rail and monitor rail head temperature from a thermocouple located on the field side of the rail head. A trigger circuit is required to take measurements both during and after train passage. The data must be transmitted either by hardwire or telemetry to a nearby monitoring station. The research should include, using new or existing systems, development of the monitoring station computer (i.e. data logger) and a modem or telemetry system to send data on command to a central location anywhere in the United States. The measurement gauges and the rail mounted computer chip and transducer should cost no more than \$500 to \$1000 per location, not including the off-track monitoring station.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

REMOTE VEHICLE IDENTIFICATION AND SPEED MONITORING

89-NH1. APPLICATION OF HIGH PERFORMANCE TECHNOLOGY TO TOLL ROAD SPEED CONTROL AND VEHICLE PERFORMANCE MONITORING

Research is needed to apply existing computer, bar code scanner, or other forms of electronic devices to enforce speed limit laws, reduce toll booth delays and accidents, and other traffic control situations. For example, speed control on toll roads might involve modification to the tickets issued to entering motorists, so that average travel speeds could be computed at the exit; tickets or fines could be imposed to a much greater extent, at lower cost to enforcement agencies than current roadside radar efforts. Alternatively, if moving vehicles could be identified (perhaps by a bar code scanner or unique electronic emission code detector), traffic law enforcement (e.g. going through a red light) might be monitored in a variety of settings or roadway tolls might be billed by mail, instead of requiring users be stopped to collect money. The proposals should show the engineering design and analysis as well as software and institutional considerations, expected produceability, marketability, cost/benefit, ethical or privacy issues, and tests planned to demonstrate the feasibility and consequences of the chosen high technology approach.

SAFETY BELT APPLICATIONS

89-NH2. SAFETY BELT BUCKLE DEVICE TO RESTRAIN TODDLERS AND YOUNG CHILDREN

Research is needed to improve devices intended to restrain toddlers and young children in child safety seats or safety belts. Current buckle or harness designs can often be released even by young toddlers, who are then able to travel unrestrained and unprotected. New buckles or cover-like safeguards are needed that are "child-proof", yet are easy for adults to fasten and unfasten, especially in emergencies. The devices must be inexpensive and simple to install if it is an after-market item rather than an improvement included by makers of cars or child safety seats. It should be suitable for use in a variety of car makes and models, with both active and passive belt systems. Proposals should show the engineering design and analysis, expected produceability, and cost/benefit, the tests to document the safety benefit or childproofing of the accessory, and steps needed to overcome concerns about liability issues.

89-NH3. DEVICES TO IMPROVE THE COMFORT AND CONVENIENCE OF SAFETY BELTS

Research is needed to address the most common complaints about safety belt discomfort and inconvenience, so that more occupants would be willing to use belts. Accessories are sought, for example to make belts easier to find and retrieve, permit the vehicle mounting of belts to be adjustable for optimal comfort of car occupants, or provide suitable soft padding near the neck or on the breast part of the belt. Comfort and convenience devices should be suited for new car manufacturers or owners of the existing vehicles. Proposals should show the engineering design and analysis, expected produceability, marketability, and cost/benefit, the tests to document the safety benefit of the accessory, and steps needed to overcome any concerns about liability issues.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

89-NH4. "BUCKLE-UP" EDUCATION PROGRAM FOR GRAMMAR SCHOOL AND MIDDLE SCHOOL SCIENCE CLASS STUDENTS

Research is needed to develop a marketable education program that science teachers can use to convey the importance of "Buckling-Up" to students through the use of materials that explain the laws of physics. The approach chosen should help enlighten students at an early pre-driving age to the value of "Buckling-Up," by using video as well as printed materials. Specifically, the students should learn the differences in crash consequences with and without protection by restraints. This project should result in a marketable prototype in such a manner as to form the basis for later products that would use interactive computer video as the medium to involve the students in learning the physics of crashes. The proposal should show the proposer's ability to develop and market such program materials including use of a focus group test plan and marketing plan.

MEDICAL EQUIPMENT RESTRAINTS

89-FH5. CRASH PROTECTION ACCESSORIES TO INCREASE THE SAFETY OF OCCUPANTS WITH SPECIAL MEDICAL NEEDS

Research is needed to develop restraint systems to secure life - supporting medical equipment when in transit by either emergency vehicle or passenger vehicle. People with special medical needs must often be transported in non-emergency conditions by passenger vehicle while connected to oxygen tanks, resuscitators, and other medical apparatus. In the event of a crash the medical equipment may not only be damaged or disconnected from the patient, but also may be a lethal flying object inside the vehicle. A problem also exists in emergency vehicles where specialized equipment such as incubators must routinely be transported.

The proposals should show the engineering design and analyses of the restraint systems and describe the testing which will be used to document the safety benefits of the proposed systems. Proposals should also indicate the feasibility of producing and marketing the product.

TRUCK DRIVER WARNING SYSTEMS

89-NH6. VEHICLE/OBJECT DETECTION ALONGSIDE HEAVY VEHICLES

Heavy truck and bus drivers face a difficult task when making lane changes or negotiating turns, especially to the right. Presently, they must rely on one or more mirrors to help them detect the presence of vehicles, pedestrians, or other objects before attempting to complete the maneuver.

In the case of articulated trucks, if the position of the tractor is angled or "jack knifed" relative to the trailer when this maneuver is attempted (either because the vehicle is part way through the turn or is backing up) the mirror system does not afford the driver a clear field of vision alongside the vehicle.

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Research is needed to identify and develop mature and novel technologies to help alert drivers to the presence of vehicles and other objects alongside their vehicle or more clearly see those objects compared to what they can presently see with conventional mirror systems.

Ideally, these systems should be self-contained on the truck or truck-tractor (as opposed to requiring an interface between tractors and trailers), should be durable enough to withstand the severe service environment typically encountered by many heavy vehicles, and be reasonably priced.

MOTORCYCLE SAFETY

89-NH7. ACCESSORIES TO INCREASE THE SAFETY OF MOTORCYCLISTS

Research is needed on accessories to increase the safety of motorcyclists. In 1986, 4,551 motorcyclists were killed in traffic accidents. Motorcycles, as a class, are the most dangerous vehicles to ride, and ways are needed to increase their safety. Proposals may include innovative use of products already built (at least in prototype). The proposal should show the engineering design and analysis, expected produceability, marketability, and cost/benefit, and the tests needed to document the safety benefits of the accessory.

GLARE REDUCTION SYSTEMS

89-NH8. DEVELOPMENT OF HEADLAMP GLARE REDUCTION DEVICES

The safety problem associated with nighttime driving has been recognized for many years by researchers who have sought to develop improved headlight systems. However, improvements have been very limited because of the difficulty of resolving the tradeoff between illuminating intensity versus glare intensity. Seeing distance in open-road driving can be increased with increased headlight intensity, but drivers exposed to this increased intensity will complain about glare and will have reduced seeing distance. A polarized headlight system had been proposed in the past as a solution to this problem. However, cost and implementation problems caused researchers to abandon this idea.

Research is needed on new technologies for reducing headlight glare while maintaining or improving seeing distance. Electro-optical systems for automatically lowering intensity in the direction of other drivers or improved polarized systems are the types of approaches needed. The proposals should show the benefits of improved safety and comfort in night driving and the potential market for a low-cost, practical, glare reduction system.

UNITED STATES COAST GUARD

LAW ENFORCEMENT DRUG DETECTION

89-CG1. COCAINE/HEROIN DRUG DETECTION TECHNOLOGIES

The United States Coast Guard is charged with interdiction of drugs, primarily marijuana, cocaine and heroin, entering the United States on marine vessels. Due to the high value of cocaine and heroin, these drugs are usually shipped in quantities easily concealed on pleasure craft, cargo tank vessels or in containers onboard container ships. The Coast Guard employs boarding parties to search suspected or suspicious craft in known drug trafficking areas. These boarding parties presently do not have equipment capable of detecting cocaine or heroin in the open environment or in concealed compartments. Given sufficient justification, the Coast Guard can have a suspicious compartment opened. Usually this results in destruction of an area of the vessel.

Studies are underway for evaluating cocaine/heroin detection equipment for use in the open environment aboard marine vessels. The Coast Guard is seeking a non-destructive technique for remote inspection of concealed compartments for cocaine or heroin. The barriers of these compartments could be wood, fiberglass, plastics, or steel.

89-CG2. PASSIVE SURVEILLANCE SYSTEM FOR LAW ENFORCEMENT

The Coast Guard is responsible for interdicting the waterborne smuggling of drugs into the United States. Since the coastline expanse is great and the Coast Guard's aircraft and vessel resources are limited, the problem of adequate surveillance to detect potential drug-carrying vessels exists. To improve the detection capability, research on a remote surveillance system is needed. The system would be passive and its receiver would detect and monitor aircraft, vessel and voice sounds. Such a system, analogous to remote microphones for monitoring football huddle conversations, would permit an outfitted AEROSTAT blimp to remain undetected and gather intelligence and/or detect movements of vessels involved in smuggling drugs. These data would be transmitted from the blimp to other operational aircraft/vessels that would interdict the suspect vessel.

MATERIALS

89-CG3. ALTERNATE CONSTRUCTION MATERIALS

Commercial U.S. vessels are required to meet certain design and construction standards or provide a level of safety that is equivalent to, or in excess of, that afforded by the required standard. One frequently encountered criteria is that a vessel must be constructed of steel or equivalent material. Steel is an excellent material from a structural fire protection viewpoint. It does not burn, retains most of its strength at elevated temperatures, resists passage of smoke and flame, and if covered with insulation will contain even the most severe fire. Aluminum, when properly insulated, can provide the same characteristics. Glass in itself does not have these characteristics; however, it provides an equivalent level of safety to personnel from fire if a water curtain is installed. Fiberglass or wood, in certain applications, may provide an equivalent level of personnel safety if used in conjunction with fire extinguishing and detection systems. However, they may also need to be contained within a steel

**U.S. DEPARTMENT OF TRANSPORTATION
 SMALL BUSINESS INNOVATION RESEARCH PROGRAM
 SOLICITATION NO. 89-1**

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 (Limit to 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. 89-1
CONTRACT PRICING PROPOSAL**

CONTRACT PRICING PROPOSAL COVER SHEET		1 SOLICITATION/CONTRACT MODIFICATION NO.	FORM APPROVED OMB NO. 3090-0118
<small>NOTE: This form is used in contract actions if submission of cost or pricing data is required. (See FAR 15.804-6(b))</small>			
2 NAME AND ADDRESS OF OFFEROR (Include ZIP Code)		3A NAME AND TITLE OF OFFEROR'S POINT OF CONTACT	3B TELEPHONE NO.
<small>4 TYPE OF CONTRACT ACTION (Check)</small>			
<input type="checkbox"/> NEW CONTRACT		<input type="checkbox"/> LETTER CONTRACT	
<input type="checkbox"/> CHANGE ORDER		<input type="checkbox"/> UNPRICED ORDER	
<input type="checkbox"/> PRICE REVISION/REDETERMINATION		<input type="checkbox"/> OTHER (Specify)	
5 TYPE OF CONTRACT (Check)		<small>6 PROPOSED COST (A-B+C)</small>	
<input type="checkbox"/> FFP <input type="checkbox"/> CPFF <input type="checkbox"/> CPIF <input type="checkbox"/> CPAF <input type="checkbox"/> FPI <input type="checkbox"/> OTHER (Specify)		A COST	B PROFIT FEE
7 PLACE(S) AND PERIOD(S) OF PERFORMANCE		\$	\$
		C TOTAL	\$
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
<small>9 PROVIDE NAME, ADDRESS, AND TELEPHONE NUMBER FOR THE FOLLOWING (if available)</small>			
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)		11A. DO YOU REQUIRE GOVERNMENT CONTRACT FINANCING TO PERFORM THIS PROPOSED CONTRACT? (If "Yes," complete Item 11B)	
<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> YES <input type="checkbox"/> NO	
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))		11B. TYPE OF FINANCING (if one)	
<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> ADVANCE PAYMENTS <input type="checkbox"/> PROGRESS PAYMENTS <input type="checkbox"/> GUARANTEED LOANS	
14. COST ACCOUNTING STANDARDS BOARD (CASB) DATA (Public Law 91-379 as amended and FAR PART 30)		13. IS THIS PROPOSAL CONSISTENT WITH YOUR ESTABLISHED ESTIMATING AND ACCOUNTING PRACTICES AND PROCEDURES AND FAR PART 31 COST PRINCIPLES? (If "No," explain)	
A. WILL THIS CONTRACT ACTION BE SUBJECT TO CASB REGULATIONS? (If "No," explain in proposal)		<input type="checkbox"/> YES <input type="checkbox"/> NO N/A	
<input type="checkbox"/> YES <input type="checkbox"/> 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)	
C. HAVE YOU BEEN NOTIFIED THAT YOU ARE OR MAY BE IN NON-COMPLIANCE WITH YOUR DISCLOSURE STATEMENT OR COST ACCOUNTING STANDARDS? (If "Yes," explain in proposal)		<input type="checkbox"/> YES <input type="checkbox"/> NO N/A	
<input type="checkbox"/> YES <input type="checkbox"/> 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)	
<input type="checkbox"/> YES <input type="checkbox"/> NO N/A		<input type="checkbox"/> YES <input type="checkbox"/> 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	

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1411-101

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

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

Background

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

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

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

13. Travel (if direct charge)
 - a. Transportation (detailed breakdown and dollars)
 - b. Per diem or subsistence (details and dollars)
 - c. Estimated total travel (dollars)
14. Consultants Service
 - a. Identify each consultant, including purpose and dollar rates
 - b. Total estimated consultant service costs (dollars)
15. Other direct costs (specify)
 - a. Total estimated direct cost and overhead (dollars)
16. General and administrative expense
 - a. Percentage rate applied
 - b. Total estimated cost of G&A expense (dollars)
17. Royalties (specify)
 - a. Estimated cost (dollars)
18. Fee or profit (dollars)
19. Total estimated cost and fee or profit (dollars)
20. The cost breakdown portion of a proposal must be signed by a responsible official of the firm (include typed name and title and date of signature).
21. Provide a yes or no answer to each of the following questions:
 - a. Has any executive agency of the United States Government performed any review of your accounts or records in connection with any other government prime contract or subcontract within the past twelve months? If yes, provide the name and address of the reviewing office, name of the individual and telephone/extension.
 - b. Will you require the use of any government property in the performance of this proposal? If yes, identify.
 - c. Do you require government contract financing to perform this proposed contract? If yes, specify type as advanced payments or progress payments.
22. Type of contract proposed, firm-fixed price.
23. DUNS number, if available _____
(See Section III.F)

**U.S. DEPARTMENT OF TRANSPORTATION
SMALL BUSINESS INNOVATION RESEARCH PROGRAM
SOLICITATION NO. 89-1
PROPOSAL CHECKLIST**

This is a CHECKLIST OF REQUIREMENTS for your proposal. Please review the checklist carefully to assure that your proposal meets the DOT SBIR requirements. Failure to meet these requirements may result in your proposal being returned without consideration. (See Sections III and IV.C. of this Solicitation).

- _____ 1. The proposal reflects the fact that for Phase I a minimum of two-thirds of the research and/or analytical effort will be performed by the proposing firm as required per Section V.H.1 and 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 as required per Section I.C.
- _____ 2. The proposal is 25 PAGES OR LESS in length.
- _____ 3. The proposal is limited to only ONE of the research topics in Section VIII.
- _____ 4. The proposal budget is for \$50,000 OR LESS and duration does not exceed six months.
- _____ 5. The technical abstract contains no proprietary information and does not exceed space provided on Project Summary sheet (Appendix B).
- _____ 6. The proposal contains only pages of 8 1/2" x 11" size.
- _____ 7. The proposal contains no type smaller than elite (except as legend on reduced drawings, but not tables).
- _____ 8. The COVER SHEET (Appendix A) has been completed and is PAGE 1 of the proposal.
- _____ 9. The PROJECT SUMMARY (Appendix B) has been completed and is PAGE 2 of the proposal.
- _____ 10. The TECHNICAL CONTENT of the proposal begins on PAGE 3 and includes the items identified in SECTION III.D of the Solicitation.
- _____ 11. The Contract Pricing Proposal (Appendix C) has been included as the last section of the proposal.
- _____ 12. The acknowledgement of proposal receipt card on the back cover of the solicitation has been detached, filled out and included with the proposal.
- _____ 13. An original and four copies of the proposal are submitted.
- _____ 14. The proposal must be postmarked or delivered no later than May 1, 1989 as required per Section VI.A.

