

BAA 06-06

Proposer Information Pamphlet (PIP)

for

**DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (DARPA)
DEFENSE SCIENCES OFFICE (DSO)**

Nano Air Vehicle (NAV) PROGRAM

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NOTE: BAA 06-06 will be published in www.fedbizopps.gov and www.fedgrants.gov. To be considered for award during first selections, proposals must be received no later than **3:00 pm local time on 12 December 2005**.

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1. INTRODUCTION

The Defense Advanced Research Projects Agency (DARPA) Defense Sciences Office (DSO) is soliciting proposals under this BAA for the performance of research, development, design, and testing to support Phase 1 of the Nano Air Vehicle (NAV) Program. Phase 1 of the Program is focused on developing a system that can integrate power, navigation, communication and mechanisms to provide lift, thrust, and hover capabilities in UAVs in the range of <7.5 cm with a GTOW of <10 grams while carrying a notional payload of 2 grams. The form factor of the payload is 10 mm in diameter by 5 mm in depth with a uniform density. The Government is soliciting proposals as specified herein.

1.1. APPROACH

This BAA affords proposers the choice of submitting proposals for the award of a Grant, Cooperative Agreement, Procurement Contract, Technology Investment Agreement, or such other appropriate award instrument. The Government reserves the right to negotiate the type of award instrument determined appropriate under the circumstances.

1.2. PROPOSERS

The Government encourages proposals from non-traditional defense contractors, nonprofit organizations, educational institutions, small businesses, small disadvantaged business concerns, and Historically Black Colleges and Universities (HBCU), Minority Institutions (MI), large businesses, and Government laboratories (*to include teaming arrangements between and among these groups*). However, no portion of this BAA will be set aside for HBCU and/or MI participation due to the impracticality of preserving discrete or severable areas of research in the technologies sought. Government/national laboratory proposals may be subject to applicable direct competition limitations, though certain Federally Funded Research and Development Centers are exempt per P.L. 103-337 § 217 and P.L 105-261 § 3136. Any responsible and otherwise qualified proposer is encouraged to respond. For this BAA, proposers should note that the Government anticipates the proposed research will be unclassified.

1.3. PROGRAM SCOPE AND FUNDING

The Government anticipates one or more awards. The Government desires to make an award and/or awards that offer the best overall value to the Government. The Government reserves the right to fund some, all, or none of the proposals submitted under this BAA. Further, the Government may choose to select and fund an entire proposal, or selected portions thereof. Proposals may be selected and/or award decisions made without discussions or negotiations. Additionally, awards may be made without discussions or negotiations.

1.4. PERIOD OF PERFORMANCE

While the earliest anticipated award is planned to occur in March 2006, the Government may make awards after that timeframe. Phase 1 will last for eighteen (18) months. An optional Phase II will have period of performance of eighteen (18) months. Proposers, therefore, should submit proposals segregated in this fashion. The Government may incrementally fund any awards under this BAA. Any structure and period for exercise of options (if any) shall be negotiated as part of the award process.

1.5. TECHNICAL SUPPORT

All proprietary information should be marked on the full proposal. It is the policy of DARPA to treat all proposals as competitive information and to disclose their contents only for the purpose of evaluation. Standard proprietary disclaimers notwithstanding, proposals may be reviewed by non-Government technical experts who have signed a nondisclosure agreement with DARPA, unless the specific phrase "TO BE REVIEWED BY GOVERNMENT EMPLOYEES ONLY" appears on the cover sheet. In any case, personnel under exclusive contract with DARPA who have completed the appropriate nondisclosure agreements will handle the proposals for administrative purposes.

1.6. INSTRUCTIONS AND POINTS OF CONTACT

Technical questions pertaining to this BAA may be submitted to the following website address: <http://teaming.sysplan.com/NAV/>. DARPA may post updates to questions/comments periodically at that same website.

For Contractual/Administrative questions, please contact the following:

Contractual: A. Tate, e-mail: algeria.tate@darpa.mil

Administrative: J. Bunch, email: Joan.Bunch@wg.srs.com

2. OVERVIEW OF NAV PROGRAM

2.1. Program Overview

The Defense Advanced Research Projects Agency (DARPA) is soliciting innovative proposals for the research and development of a nano air vehicle (NAV) system. DARPA envisions that a NAV system may be based on either conventional or non-conventional air vehicle designs, or potentially a combination of both. NAVs of interest to DARPA are defined as airborne vehicles no larger than 7.5 cm in length, width or height, capable of performing a useful military mission at an affordable cost and gross takeoff weight (GTOW) of less than or equal to 10 grams. While systems that minimize acoustic and visual signatures, and offer some form of natural stealth (by mimicry) are highly desired, no such requirements will be defined as part of this solicitation. Nano air vehicles are envisioned as fully functional, militarily capable, fully integrated, very small flight vehicles.

The NAV Program is an exploratory development program with the following overall goal: Develop and demonstrate flight and operation of affordable NAV System with the potential to perform useful indoor and outdoor military missions, and develop and demonstrate flight-enabling technologies for advanced NAV systems, including: a) aerodynamic design tools, b) lightweight efficient propulsion and power, c) navigation, communications and control, and d) advanced manufacturing and packaging.

The military forces of the United States and its allies have an ever present need for improved capabilities enabling the timely collection of comprehensive intelligence information, particularly on the ground in the urban terrain. Information gathered and transmitted by unattended ground sensors of various types may be critical to the successful execution of many military missions, including various special operations. For many scenarios, the effectiveness of such sensors is strongly dependent on their precise location. Achieving optimal performance with respect to both monitoring designated areas and the ability to reliably communicate useful collected information often requires that the sensors be placed in locations that are not readily accessible: on buildings, walls (exterior or interior, e.g., in tunnels), windows, bridges, caves, tunnels, towers, rocks, and other vertical or steeply angled surfaces. Emplacing unobtrusive reconnaissance/surveillance sensors in remote or special high-security areas also demands sophisticated means for delivery. Nano air vehicles (NAVs)—small, recoverable aircraft no larger than 7.5 cm in length, height or width, and gross takeoff weight less than or equal to 10 grams—may provide an effective means for precision delivery and emplacement of small, multi-element sensor packages to locations of interest.

Notional Mission Requirements

The mission performance requirements for the nano air vehicle include, but are not limited to: a) maximum GTOW of 10 grams (with a reserved payload fraction of 2 grams); b) maximum dimension in any direction of 7.5 cm; c) a fast forward speed of 5 to 10 meters/sec; d) a slow forward speed of 0.5 meter/sec; e) range greater than 1000 meters at 5 to 10 meters/sec forward velocity; f) the ability to transition to the slow forward speed of 0.5 meter/sec after completing the 1000 meter high speed ingress and maintain the slow speed for >60 seconds; and g) the ability to hover in place for >60 seconds after completing a high speed 1000 meter ingress and the 60 second low speed ingress; and h) the ability to land from hover in a controlled manner. The vehicle must be able to navigate within a 0.5 m mean square residual error-(MSRE) and drop/release a payload at the end of the high and low speed ingress and return to the operator.

To carry out the aforementioned notional mission requirements, the program will be executed into two phases: 1) Subsystem Design & Evaluation and Preliminary Integrated Design, and 2) Comprehensive Detail Design, Integration, Test, and Evaluation.

Fortunately, biology offers some hints, e.g., insects and hummingbirds have evolved the ability to fly at this scale. In addition, recent advances in our understanding of low Reynolds number physics may permit human-made flight at this scale. Thus, in order to accomplish the goal of developing a nano air vehicle system capability for military operations, this program will pursue radical and quantifiable innovations in four technical areas each with distinct objectives:

Technical Area 1) Computational Aerodynamic Modeling and Wing Design/Manufacture Tools will involve the use of fundamental physics models at Low Reynolds number to design highly efficient (high lift to drag) airfoil geometries that can be used to manufacture and build monolithic 1 to 7.5 cm wings or rotors. The modeling tool should clearly demonstrate how it will be used to design and develop appropriately-scaled, very lightweight wings that can be seamlessly integrated into a nano air vehicle design. For this capability, the ability to design, simulate, and optimize the aerodynamic performance over an arbitrary articulation path of motion on this small scale would be necessary. In addition, a clear process for how these wings or rotors will be manufactured and integrated to other subsystems must be demonstrated. The design tools may include the ability to simultaneously analyze structural loads while possibly incorporating some level of multi-functionality to improve overall system performance.

Technical Area 2) Propulsion and Power will involve the integration of a reliable power source with sufficient energy and power density to carry out the notional mission objectives discussed above. In addition, the propulsion system must be capable of demonstrating highly efficient conversion of stored energy to mechanical work or thrust to propel the air vehicle system in both hover and forward flight modes of operation. Thus, highly efficient transduction actuators are required for nano air vehicle designs. Such actuators may include servos, integrated smart material elements or nanoscale or MEMs engineered actuators. System must be sized to deliver power to the communication and navigation sub-system over a range of 1 km for approximately 20 minutes. It is envisioned that this technical area may require a high degree of multifunctionality that may have close interaction with the other technical areas in this BAA.

Technical Area 3) Navigation, Guidance, Communication and, Command and Control of a nano-air vehicle system will involve the development of reliable avionics including necessary sensors (gyros, accelerometers, optics, etc.), actuators, electronics, software algorithms, communication system and ground control elements for guiding a vehicle from point A to point B and return in the presence of 5 knot wind gusts in an urban environment. While autonomous operation is desired, line of sight (LOS) and non-line-of-sight (NLOS) teleoperation strategies that achieve minimal on-board processing but enable both flight external and internal to building structures is acceptable. The system must be capable of operating in GPS denied environments and enable the operator to avoid obstacles of 0.5 meter diameter in size or larger. The communication link must be capable of providing a data link over a range of 1 km. It is important to note that the avionics software and hardware are not considered as part of the payload of the NAV system. The NAV system must be able guide itself along a path within a 0.5 m (1-sigma) mean squared residual error (MSRE).

Technical Area 4) Preliminary Integrated System Design will involve evaluation of the integrated nano air vehicle system that incorporates enabling technologies from Technical Areas 1 thru 3. The system must achieve nominal forward flight speeds of both 0.5 m/s and 5 to 10 m/sec over a 1 km range and be capable of hovering for >1 minute. The NAV system must also include all the necessary ground control station for LOS command and control electronics and software for communicating to air vehicle, as well as the necessary hardware and software interfaces for launching and retrieving nano air vehicles. System elements must demonstrate a sufficient level of performance and risk reduction at a preliminary design review level to ensure ability to conduct flight missions in Phase II.

Preliminary Design Review (PDR) or equivalent criteria, is included for definition to assure phase I exit criteria are fulfilled. The design maturity confirms that the design approach satisfies NAV Demonstration System (NDS) requirements and the total system is ready for detailed design. PDR confirms that the process completely defines NDS requirements for design, including

- a. The NAV Demonstration System-(NDS) physical architecture is an integrated detailed design approach to satisfy requirements, including interoperability and interfaces;
- b. An audit trail from systems requirements review-(SRR) is established with changes substantiated;
- c. Available developmental test results support the NDS design approach;
- d. The product performance requirements are defined;
- e. Sufficient detailed design has been accomplished to verify the completeness and achievability of defined requirements and quantification of cost, schedule, and risk; and
- f. Product and process improvement and evolutionary acquisition requirements planning necessary for NDS Demo Phase and the NAV Operational System (NOS) have been refined.

The Nano Air Vehicle Program will be executed using a multi phase approach. The base period, Phase I, will have a period of performance of 18-months and include trade analysis and subsystem risk reduction demo, and conceptual and preliminary design reviews encompassing efforts under all four technical areas defined above. Phase 1 will be awarded with a baseline and negotiated option to be separated by a technical Go/No-Go to be suggested by the contractor for use as a "DARPA HARD" metric to graduate to completing phase 1. The Go/No-Go metric will be related to the figures of merit defined in the table below. Actuation of a subsequent phase will be at the Government's discretion and based on evaluation of performance and results realized during the first phase. If executed, there would be an additional phase (Phase II) that will include an 18-month period of performance in which a completely integrated nano air vehicle system is flight demonstrated. The Phase II proposed efforts should be based on a critical design review, assembly plan for integrating the components of the nano air vehicle system, and a series of end to end flight demonstrations against the notional mission requirements to confirm the performance of the NAV system. Proposals in response to this solicitation should be structured for an initial period of performance of 18-months with an 18-month follow-on option. Proposals should identify clear and unambiguous milestones at which the Government can accurately define the metrics of performance and determine if efforts are or are not progressing towards achieving or exceeding the objectives of the program.

2.2. TECHNICAL APPROACH

Responders to this solicitation will be expected to have and demonstrate distinct core competencies in each of the four technical areas defined above. Technical Area 1 requires an understanding and expertise in computational aerodynamic modeling and wing design and manufacture for low Reynolds number operation. Technical Area 2 requires an understanding and expertise for small-scale power systems for robotic systems. In addition, there must be expertise in the design and construction of tiny mechanical actuators capable of providing highly efficient mechanical work while paying very close attention to size, weight, and power requirement issues. Technical Area 3 requires a detailed knowledge of small-scale avionics, navigation methodologies and command and control procedures for non-GPS guidance via LOS or NLOS links. Technical Area 4 requires an understanding of integrated system design principles to provide a path toward seamless subsystem integration to achieve overall notional mission goals.

In order for the Government to evaluate the effectiveness of a proposed solution in achieving the stated program objectives and thus base its decisions on whether subsequent phases should be funded, proposers should note that the Government hereby promulgates the following program metric decision criteria points, which may serve as the basis for determining whether satisfactory progress is being made to warrant continued funding of the program. Although the following program metrics are specified, proposers should note that the Government has identified these goals with the intention of bounding the scope of effort, while affording the maximum flexibility, creativity, and innovation in proposing solutions to the stated problem.

At the end of Phase I, it is expected that all four technical area objectives shall be satisfactorily addressed. These objectives are identified in the table below:

Phase I Go/No Go Milestones/Metrics

Technical Area	Figures of Merit
1. Aerodynamic Performance and Airfoil/Wing/Rotor Design and Manufacture	<ul style="list-style-type: none"> • Develop computational aerodynamic modeling tools to design a high performance airfoil at low Reynolds number. • Demonstrate reliable wing manufacturing principles and achieve Wing Loading of > 0.1 kg/m². • Demonstrate airfoil section steady lift to drag capability > 8 at low Reynolds number (Re < 15,000).
2. Propulsion and Power	<ul style="list-style-type: none"> • Demonstrate system electrical power to mechanical transduction conversion efficiency of at least 20 percent. • Demonstrate an ability to meet power requirements for a notional mission of 1 km with a total hover time of >1 minute.
3. Navigation Algorithm Design and Development for Precision Time, Position and Attitude Determination	<ul style="list-style-type: none"> • Develop LOS navigation capability that ensures delivery of nano air vehicle within 0.5 m of target location over a range of 1 km in 5 knot wind gusts. • Develop LOS navigation capability that enables robust guidance inside of enclosed buildings without GPS. • Demonstrate simulated navigation of NAV system inside a building.
4. Integrated System Design	<ul style="list-style-type: none"> • Achieve preliminary design review level of integrated nano air vehicle system with command and control. • Integrated nano air vehicle system must be able to hover for greater than 1 minute, translate at a forward speeds of both 0.5 and 5 to 10 m/sec, and support command and control over a 1 km distance for approximately 20 minutes. • Demonstrate measured thrust to weight ratio of greater than 1 at NAV GTOW. • Integrated nano air vehicle systems must achieve a GTOW of less than 10 grams and a minimum payload mass of at least 2 grams with dimensions of 10 mm in diameter by 5 mm in depth with a uniform density. • All this must be capable between 0-5000 ft MSL • System must be capable of being teleoperated from a ground control station over a range of 1 km.

The proposal must clearly demonstrate the proposer's ability to comply with the required core competencies defined in the BAA for the appropriate technical area(s) to which the bidder is responding. The proposed solution meets the letter and intent of the stated goals and all elements within the proposal exhibit a comprehensive understanding of the problem. The offeror clearly addresses how the proposed effort will meet and progressively demonstrate the goals of the NAV Program. Specifically, the offeror should address the Notional System Concept (NSC) and the Technical Approach to meet the objectives of the solicitation.

Notional System Concept

The offeror should describe their top-level vision of a NAV system architecture and Notional System Concept (NSC). The top-level vision should be substantiated with first order or higher analysis tools. This is meant to be an initial look that demonstrates the offeror's understanding of the program objectives, performance goals and operational issues. The offeror will not only describe their top-level vision, but will parameterize their concept, subsystems and major technologies utilized. The offeror's NSC will serve as a point of departure for Phase I development plan. The Government does not expect the NSC to be defined to high fidelity but rather will use this information to gauge the offeror's initial thoughts on how to best meet program vision and objectives.

Technical Approach

The Technical Approach should identify the top level metrics, processes, and system level performance and affordability trades the offeror intends to use to identify the critical and enabling technologies, processes and system attributes that must be validated and/or demonstrated to achieve acceptable risk entry into an advanced technology demonstration (ATD) program. A major objective of Phase I is to examine and assess the range of competing technologies and CONOPS that could enable the NAV System. The plan should describe the offeror's process that will be implemented for identifying and evaluating competing technologies available from other Government and industry R&D programs. The Technical Approach should include details on planned risk mitigation efforts including notional Phase II risk reduction efforts. It should include (but is not limited to) subsystem and component verification, vehicle check-out and flight safety assessments, critical technology evaluation and assessments, and flight demonstration of the ATD vehicle. The Technical Approach includes the Trade Study and Analysis Plan, SOW, and the Integrated Master Schedule (IMS). It is the risk mitigation plan for the entire program (at least through the end of Phase II), and will act as a living document, refined based on Phase I activities and findings.

(a) Trade Study and Analysis Plan (TSAP)

The proposal should clearly substantiate the proposer's technical approach with scientific principal, obtainable resources, and achievable milestones. The technical approach should represent trade studies to be conducted, risk reduction test, and a detailed risk management approach that will effectively identify decision points to avoid cost overruns and mitigate schedule impacts. The proposal should include clear and unambiguous milestones to define metrics of performance by which progress can be measured as it relates to program objectives

The Trade Study and Analysis Plan should describe the offeror's approach to progressively refining their NSC into a final demonstration design. Those refinements will be based on a series of concurrent system requirements, design and affordability trades.

(b) Statement of Work (SOW)

The SOW should describe the work effort necessary to meet the milestones and objectives for Phase I. The SOW should include the offeror's plans for trade studies and analyses, NAV concept development, analysis tool development and technology assessment. The SOW should structure tasks consistent with a Work Outline (Work Breakdown Structure) as stated in cost and integrated master schedule formats. The offeror may choose to define work at lower levels to better explain their approach. This section is not part of the technical 35 page count limit.

A notional Phase II toward meeting overall program goals and objectives should be provided, and will be updated during the refinement of the technical approach to reflect Phase II demonstration and risk reduction objectives and activities if the follow on phase is continued.

(c) Integrated Master Schedule (IMS)

The respondent should clearly address how the proposed effort will meet and progressively demonstrate the goals of the NAV Program. The proposed schedule is complete and achievable. The proposal indicates that the offeror has fully analyzed the project's critical path and has addressed the resulting schedule risks.

The IMS should outline the detailed tasks and the amount of time expressed in calendar schedules necessary to achieve the milestones and significant functional accomplishments in program. It is a tiered scheduling system corresponding to the work outline (Work Breakdown Structure) as stated in cost and SOW formats. The first iteration of the IMS should be to level 3 of the offeror's SOW or lower as determined by the offeror. Definitions and characteristics of the key elements of the IMS are given below. The IMS is not part of the technical 35 page count limit.

Detailed Tasks: Detailed work effort to be completed in support of a specific significant milestone or functional accomplishment.

Calendar Schedule: Detailed schedule (dates) of the period of performance for each work effort.

An initial IMS should be delivered with the Phase I proposal in Microsoft Project format or similar software. It will be updated throughout Phase I as part of the Technical Approach refinement, and ultimately used for the Phase II execution of the Technical Approach.

All NAV systems developed under this Program must be capable of high risk/high pay-off approaches or radical innovations to achieve or exceed the objectives of the program. However, risk management procedures must be included in the management approach. The Government is interested in developing this technology to provide the warfighter with a unique air vehicle that fly from exterior to interior environments. While there are no specific requirements on visual or acoustic stealth, offerors are encouraged to offer innovative solutions that can provide a natural form of stealth for vehicles at this scale.

3. GENERAL INFORMATION

3.1. Eligibility

Participation is limited to U.S. firms and universities, but proposers may include foreign personnel as part of their proposed resources as long as these personnel qualify technically. The proposed effort is unclassified, and such foreign personnel must sign any and all appropriate non-disclosure agreements prior to participating in the research effort, and all applicable export control laws or other such United States statutes, policies, procedures, regulations, or other such applicable directives or authoritative guidance is followed and adhered to.

3.2. INTELLECTUAL PROPERTY

3.2.1. Noncommercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS, shall identify all noncommercial technical data, and noncommercial computer software that it plans to generate, develop, and/or deliver under any proposed award instrument in which the Government will acquire less than unlimited rights, and to assert specific restrictions on those deliverables. Proposers shall follow the format under DFARS 252.227-7017 for this stated purpose. In the event that proposers do not submit the list, the Government will assume that it automatically has “unlimited rights” to all noncommercial technical data and noncommercial computer software generated, developed, and/or delivered under any award instrument, unless it is substantiated that development of the noncommercial technical data and noncommercial computer software occurred with mixed funding. If mixed funding is anticipated in the development of noncommercial technical data, and noncommercial computer software generated, developed, and/or delivered under any award instrument, then proposers should identify the data and software in question, as subject to Government Purpose Rights (GPR). In accordance with DFARS 252.227-7013 Rights in Technical Data - Noncommercial Items, and DFARS 252.227-7014 Rights in Noncommercial Computer Software and Noncommercial Computer Software Documentation, the Government will automatically assume that any such GPR restriction is limited to a period of five (5) years in accordance with the applicable DFARS clauses, at which time the Government will acquire “unlimited rights” unless the parties agree otherwise. The performer will require preapproval prior to spending any internal funds on any part of the NAV program. Proposers are admonished that the Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer’s assertions. If no restrictions are intended, then the proposer should state “NONE.”

A sample list for complying with this request is as follows:

Technical Data or Computer Software to be Delivered With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(List)	(List)	(List)	(List)

3.2.2 Commercial Items (Technical Data and Computer Software)

Proposers responding to this BAA requesting a procurement contract to be issued under the FAR/DFARS, shall identify all commercial technical data, and commercial computer software that may be embedded in any noncommercial deliverables contemplated under the research effort, along with any applicable restrictions on the Government’s use of such commercial technical data and/or commercial computer software. In the event that proposers do not submit the list, the Government will assume that there are no restrictions on the Government’s use of such commercial items. The Government may use the list during the source selection evaluation process to evaluate the impact of any identified restrictions, and may request additional information from the proposer, as may be necessary, to evaluate the proposer’s assertions. If no restrictions are intended, then the proposer should state “NONE.”

A sample list for complying with this request is as follows:

COMMERCIAL			
Technical Data Computer Software To be Furnished With Restrictions	Basis for Assertion	Asserted Rights Category	Name of Person Asserting Restrictions
(LIST)	(LIST)	(LIST)	(LIST)

3.3. Report Requirements

The number, types, and frequency of reports will be specified in the award document. In addition, any award document incorporating a respondent's proposal by reference, requires the proposer to submit those reports contemplated as part of a respondent's proposal. The reports shall be prepared and submitted in accordance with the procedures contained in the award document, or respondent's proposal. Monthly and technical status reports with projections and plans with any deviations of metrics greater than 10% will be discussed. A Final Report that summarizes the technical results of the research project at the end of each phase, and summarizes costs associated with the research effort will be required at the conclusion of the performance period for the award, or such other time after conclusion of the performance period for the award as may be mutually agreed to between the parties. In the event of a conflict between the actual award instrument and a respondent's proposal, the award instrument takes precedence.

3.4. Required Reviews, Demonstrations and Interchange Meetings

It is anticipated that awardees under this BAA will be required to present an overview of their proposed work and any updates at the program kick-off meeting. In addition, it is anticipated that program reviews will be conducted every 16 weeks. The purpose of these meetings is to facilitate an open exchange among all program participants, including advisors from industry and Government. DARPA believes that this open interchange will result in a higher probability of success in achieving the overall program objectives. For costing purposes anticipate the first year to include a program kick-off meeting to be held in Arlington, Virginia, and the other program reviews to be held at the contractor's (prime or one of its team members, whichever is more feasible) facility. It is anticipated that the duration of each meeting shall be approximately two days. Review materials will be submitted or posted on a mutually agreed program web site three days prior to any requirements, specification, design or general program reviews. The handout prints will be in notes form and annotated. Any sub Phase I Go/No-Go milestone demonstrations will be conducted at contractor's facilities.

4. PROPOSAL PREPARATION

This section is intended to provide information needed by the offeror preparing a proposal for submission. Organizations or individuals interested in submitting research proposals are encouraged to make preliminary inquiries on the general need for the type of research effort contemplated before expending extensive time and effort in preparing a detailed research proposal.

4.1. General Guidance

All proposals submitted must follow the instructions in this Proposer Information Pamphlet (PIP) and include only the information requested to avoid delays in evaluation or disqualification. It is anticipated that within approximately 45 days of proposal due date, proposers will be notified that: 1) proposal has been accepted for negotiation, or 2) proposal has not been accepted. No proposals will be returned. The original proposal or one original copy of such proposal will be retained at DARPA and all other copies destroyed.

4.1.1. Restrictive Markings on Proposals

All proposals should clearly indicate limitations on the disclosure of their contents. They must be marked with an appropriate legend. Markings like "Company Confidential" or other phrases that may be confused with national security classifications shall be avoided.

4.1.2. Proposal Format

A complete proposal shall consist of two volumes—a Technical and Management Proposal (Volume 1) and a Cost Proposal (Volume II). Proposals must be in English. Six (6) copies of Volume 1 and Volume II in hardcopy plus two (2) sets in electronic format shall be submitted to DARPA, including any graphics and tables. Respondents need only submit one (1) original signed copy with the other sets of proposal as copies of the original submittal. Each submittal shall reference BAA 06-06. These proposals shall be on single-sided pages, font no smaller than 12 point, and 1-inch margins left/right/top/bottom. A page is defined as being no larger than 8.5" x 11.0"; accordion-style fold-outs will be counted as multiple pages equivalent to the expanded size. With respect to information presented in tables/graphs and accordion-style fold-outs, respondents may submit such information in a type font smaller than 12 point as necessary to display such information, however respondents are cautioned that excessive use of tables/graphs and accordion-style fold-outs that include a type font smaller than 12 point, will not be viewed favorably, and may slow down Government, and such authorized non-Government evaluators, ability to evaluate such information in a timely fashion. Graphic material shall be embedded in the Word document and/or in PowerPoint, Excel, or GIF format. Proposals shall be stapled or submitted in loose-leaf binder, not bound. Electronic copy shall be on IBM PC-formatted CD-ROM in a format readable with Microsoft XP Office.

4.1.3. Confidentiality

It is the policy of DARPA to treat all proposals as competitive information and to disclose their contents only for the purpose of evaluation.

4.1.4. Proposal Submission

Proposals must be received by DARPA/DSO no later than **3:00pm local time, Arlington, on 12 December 2005** to be considered in the selection phase. Proposals must be submitted to the DARPA/DSO mailing address identified in this BAA. Proposals must be submitted in hard copy, with one signed original and one copy, plus two electronic copies on CD-ROM. Classified proposals will be accepted in accordance with Section 6.1 for this solicitation. Facsimile or electronic submissions will not be accepted.

Proposals submitted under this BAA may either be mailed or hand-delivered.

Mailing address: DARPA/DSO
ATTN: BAA 06-06
3701 North Fairfax Drive
Arlington, VA 22203-1714
Attn: Dr. Darryll Pines

For hand deliveries, the courier shall deliver the package to the DARPA Visitor Control Center at the address specified above. The outer package, as well as the cover page of the proposal, must be marked "BAA 06-06".

Proposers are responsible for submitting proposals so as to reach DARPA by **3:00pm local time, Arlington, VA, on 12 December 2005.**

Any proposal received at DARPA after the exact time specified for receipt of offers will be treated as "late" and will not be considered, unless there is acceptable evidence to establish that it was received at DARPA and was under the Government's control prior to the time set for receipt of offers.

Acceptable evidence to establish the time of receipt at DARPA includes the time/date stamp of that agency on the proposal wrapper, other documentary evidence of receipt maintained by the agency, or oral testimony or statements of Government personnel.

If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at DARPA by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to 3:00 PM Arlington, VA, local time, on the first work day on which normal Government processes resume.

Proposals may be withdrawn by written notice received at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

The Government anticipates multiple awards for Phase I—including all four technical areas. Successful Phase I development efforts and available funding will be included as decision factors for actuating subsequent phases. Technologies developed in this program will be evaluated and tested in the respondent's facilities. To facilitate further information exchange between potential bidders and program objectives, a Proposer's Day was held on Thursday, September 29, 2005, at Executive Conference Center, 3601 Wilson Blvd, Arlington, VA 22201. Briefings were provided on Government requirements including potential customers. Interested organizations can retrieve briefings from this proposer day at <http://teaming.sysplan.com/NAV/>. In order to insure that all technically relevant aspects of DoD requirements for nano air vehicle are fully addressed, teaming of companies, Government laboratories and academic institutions with complementary areas of expertise or core competence is encouraged. A teaming website is provided to facilitate these interactions and can be found at <http://teaming.sysplan.com/NAV/>.

4.2. Volume I - Technical and Management Proposal

The cover page of this volume shall clearly state and include the following information of the prime contractor: names, telephone and fax numbers and e-mail addresses for both a technical point of contact and a contract administrative point of contact. The cover page shall also include the BAA number; type of business, selected among the following categories: Large business, Small Disadvantage Business, Other Small Business, HBCU, MI, Other Educational or Other Nonprofit; and contractor's reference number (if any).

The technical portion shall include a five-page Executive Summary (not included in page count of technical section), a Notional System Concept (NSC), Technical Approach, and constructive plan for accomplishments of technical goals in support of innovative claims; and management portion describing: team makeup and key personnel, description of relevant prior work, a facilities and equipment description, list of deliverables associated with the research including documentation and reports; demonstrations; management plans; and a schedule, and milestones for the proposed research and optional phases. All paragraphs containing proprietary information must be clearly marked.

The balance of the Technical and Management Proposal shall be divided into the following two sections:

Section A--Technical (35 pages)

This section shall be the technical proposal, limited to thirty-five pages written in English which includes a description of the NSC, 1st order substantiations of NSC specification and capabilities, and technical approach should describe path to achieve the Government's objectives, scientific and expected significance of the work. The key elements of the project should be clearly identified and related to each other. The methods or approaches to be used should be described in detailed, and integrated into a master schedule and work package breakouts. The anticipated results should be identified and their relation to the proposal's stated objectives and the objectives of the NAV Program should be discussed, paying specific attention to performance milestones, risk mitigation and management, program and demonstration plans.

Products, transferable technology, and deliverables associated with the proposed research should be described. Well thought-out gates and milestones that define a clear path toward program system solution are strongly encouraged as the Government anticipates that this will be a very important element of the proposal. Describe proposed approach to intellectual property rights, together with supporting rationale of why this approach offers the best value to the Government. This section should list technical data, computer software, or computer software documentation associated with this research effort in which the Government will acquire less than unlimited rights. See Sections 3.2.1, 3.2.2, and 3.2.3 for additional information and specific instructions. A Statement of Work (SOW) outlining the scope of the effort (not part of page count) and citing specific tasks to be performed and specific proposer requirements will also be provided.

Section B--Management (15 pages)

The Management section should define both the organizations and the individuals within those organizations that make up the team, including expected duties, core competencies, relevant experience and task responsibilities of team members, and expected relationships among members. Expected levels of effort (percentage time or fraction of an FTE) for all key personnel should be clearly noted. A description of the technical, administrative, and business structure of the team and the internal communications plan should be included. Management construct to include descriptions of project/function/subcontractor relationships; Government research interfaces; and planning, scheduling, and control practices should be described. The team leadership structure should be clearly defined with resumes of key individuals that should not exceed two pages each.

Detailed support enhancing this section including formal teaming arrangements required to execute both Phase 1 and 2 of this program should be provided (not included in page count).

Indicate if the team organization has had prior Governmental contracting experience, and the extent of that experience. Description of corporate capabilities such as cost or schedule performance tracking, system engineering process, analysis tools developed and owned, infrastructure tools and procedures for configuration management, International Traffic in Arms Regulations protocol handling, software development, and any certified International Organization for Standardization (ISO) standards.

Discussion shall include the offeror's previous accomplishments and work in this or closely related research areas. The proposer shall describe the facilities that would be used for the proposed effort for the work area (including computational and experimental resources).

The type of support, if any, the proposer might request from the Government, such as facilities, equipment, or materials, or any such resources the proposer is willing to provide at no additional cost to the Government to support the research effort.

The names of other federal, state, or local agencies or other parties where the proposal is being submitted, and/or the proposed effort has received funding. If none, so state.

A statement regarding possible impact, if any, of the proposal's effect on the environment IAW applicable statutory and regulatory guidance.

4.3. Volume II – COST PROPOSAL

4.3.1. Cover sheet

A cover sheet to include:

- (1) Name and address of proposer (*include zip code*).
- (2) Name, title, telephone number, fax number, email of proposer's point of contact.
- (3) Award instrument proposed – grant, cooperative agreement, procurement contract and type (i.e. firm fixed price, cost-plus-fixed-fee (CPFF) contract, or other contract type), technology investment agreement, or other (*specify*).
- (4) Place(s) and period(s) of performance.
- (5) Total proposed cost separated by basic award and option(s).
- (6) Name, address, telephone number, fax number, email of the proposer's cognizant Defense Contract Management Agency (DCMA) or other administration office (i.e. Office of Naval Research).
- (7) Name, address, telephone number, fax number, email of the proposer's cognizant Defense Contract Audit Agency (DCAA) or other audit office (i.e. Dept of Health and Human Services).
- (8) Contractor and Government Entity (Cage) Code.
- (10) Dun and Bradstreet (DUN) number.
- (11) North American Industrial Classification System (NAICS) Number.
- (12) Taxpayer Identification Number.
- (13) Verification that the proposer is registered in the Central Contractor Registration (CCR) System in order to do business with the Federal Government (*as required*)

4.3.2. Detailed Cost Breakdown:

A detailed cost breakdown to include:

- 1) Total program cost broken down by Government fiscal year (GFY) [Note: Government fiscal year runs from October 1 to September 30] and program cost broken down by the base effort and proposed options. These costs should be further broken down by major cost element (i.e. WBS level 4, direct labor, subcontracts, materials, travel, other direct costs, overhead charges, etc.).
- 2) Costs of major program tasks by phase and by fiscal year;
- 3) An itemization of major subcontracts (labor, travel, materials and other direct costs) and equipment purchases;
- 4) A summary of projected funding requirements by month; and
- 5) The source, nature, and amount of any industry cost sharing, if applicable. Where the effort consists of multiple phases that could reasonably be partitioned for purposes of funding, these should be identified as options with separate cost estimates for each.

Supporting cost and pricing information in sufficient detail to substantiate the summary cost estimates above. Include a description of the method used to estimate costs and supporting documentation. Provide the basis of estimate for all proposed labor rates, indirect costs, overhead costs, other direct costs and materials, and escalation charges as applicable. Key personnel must be listed by name for the prime and all subcontractors. The following tables are provided as template to help formulate format of cost summaries.

4.3.2.1 Cost Tables and Format

The lead page of the Cost section shall have a Cost Summary Sheet, including all the information shown in Table 1, as applicable. It shall be a one-page summary of program costs in tabular format. The prime offeror/team lead, team members, funding to federal laboratories and agencies, and cost of major facility utilization (such as wind tunnels) shall all be addressed as applicable. The Summary Sheet shall only contain summary data; the lower-level detail can be addressed as part of the other recommended break-outs discussed in these instructions. The second page of the cost response should include a summary table that includes the base program and prioritized options (if proposed) with associated costs for each. Each prioritized option should be associated with a unique work outline number so that they can clearly be tracked throughout the cost response.

Table 1. Cost Summary Sheet

Phase I	
PoP: Start xx/xx/xx to End xx/xx/xx	
Prime Contractor Labor	
Labor Hours	
Total Labor \$	
Prime Contractor Direct Materials	
Direct Material \$	
Major Subcontractors / Team Members	
Team Member A	
Labor Hrs	
Total Labor \$	
Direct Material \$	
Other Direct Costs (ODC)	
Total Team Member A \$	
(Repeat above for Other Team Members)	
Other Direct Costs (ODC)	
Travel \$	
Lab/Test Facilities Usage \$ (if not GFE/GFI)	
Purchased Services / Consultants	
Other \$	
Government Furnished Equipment / Information (GFE/GFI)	
Item 1: ...Description of & Date Needed	
Item 2: ...Description & Date Needed	
(Repeat for additional GFE/GFI Items)	
Total Proposed Costs	

General Instructions

The Cost Response shall include a complete summary of all costs by work outline by month as highlighted in

Table 2. The offeror should use the same work outline as in the SOW and IMS. If a teaming arrangement is proposed, the desired cost information shall be provided for all team members. Cost information is desired down to work outline level 4.

In order for the Government to assess program risk and determine the reasonableness, realism, and completeness of the cost proposal, the data regarding labor, direct materials, major subcontracts / team members, other direct costs (ODC), and government furnished equipment or information (GFE/GFI) must be provided for each team member and in a cumulative summary. Each item and category must be broken out. The costs shown in the various breakouts and discussed in the following sections should equal those summarized in Table 1.

Table 2. Phase I Monthly Summary

	WO Task Title	Month 1	Month 2	.....	Month N	Total \$
	WO x.					
	WO x.x					
	WO x.x.x					
	WO x.x.x.x					
					
					
					
	Total \$					
	Cumulative \$					

Labor

Total labor includes direct labor and all indirect expenses associated with labor for Phase I. Labor hours and costs shall be allocated to each work outline element contained in the SOW and segmented by team member. Table 3 provides an example of this breakout. Table 4 shows a breakdown of labor hours and rates for each category of personnel to be used on this project.

Table 3. Labor Summary

	WO Task Title	Prime Contractor	Team Member A	Team Member B	.....	Total
	WO x.					
	WO x.x					
	WO x.x.x					
	WO x.x.x .x					
					
					
					
	Total					

Table 4. Labor Rate Summary

	FY04	FY05	FY06	FY07	FY08
	Hrs / Rate	Hrs / Rate	Hrs / Rate	Hrs / Rate	Hrs / Rate
<u>Prime Contractor</u>					
Labor Category 1					
Labor Category 2					
Labor Category 3*					
<u>Team Member A**</u>					
Labor Category 1					
Labor Category 2					
Labor Category 3*					
* Repeat for other Labor Categories as needed					
** Repeat for other Subcontractors/Team Members as needed					

Direct Materials

Total direct material includes that which will be acquired and/or consumed in the Phase I period of performance. List only major items of material (>\$100,000). As Table 5 illustrates, material costs shall be assigned to specific work outline elements as described in the SOW.

Table 5. Material Summary

	WO Task Title	Description	Prime Contractor	Team Member A	Team Member B	.....	Total
	WO x.						
	WO x.x						
	WO x.x.x						
	WO x.x.x.x						
						
						
						
	Total						

Subcontracts

List efforts to be subcontracted, the source, and estimated cost and the basis for this estimate. Major subcontractors and team members are defined as total effort for Phase I that is greater than \$250,000. Table 6 provides an example of a cost breakout. As with the Prime Contractor, break out the subcontract costs by labor (amount and hours), material, and other direct charges.

Table 6. Major Subcontractor Summary *

	WO Task Title	Labor Hours	Labor \$	Material \$	ODC \$	.....	Total \$
	WO x.						
	WO x.x						
	WO x.x.x						
	WO x.x.x.x						
						
						
						
	Total						
* Provide a separate table for each major subcontractor / team member in Phase I.							

Other Direct Costs (ODCs)

This section contains any direct costs not included above. As shown in Table 7, ODCs shall be broken out by categories, such as travel, facility costs, purchases services, and consultants. Major facility requirements such as wind tunnel testing or flight research vehicles, Government or commercial shall all be included, as should estimates of total facility occupancy and test time. Offerors are expected to include the costs of using any Government testing facilities in their cost proposals, but they can use Government rates instead of industry rates. At its discretion, DARPA may choose to directly procure services from Government test facilities.

Table 7. ODC Summary

	WO Task Title	Description	Travel \$	Purchased Services \$	Facilities Usage \$	Other \$	.....	Total \$
	WO x.							
	WO x.x							
	WO x.x.x							
	WO x.x.x.x							
							
							
							
	Total							

Government Furnished Equipment or Information

In Table 8, the offeror shall explicitly list all assumed GFE and GFI and the assumed delivery schedule for both. List only major items of GFE/GFI (>\$50,000) separately; however, the total for all GFE/GFI shall be included in Table 8. This information should be in sufficient detail for the Government to assess the realism and costs of providing such information or equipment.

Table 8. GFE/GFI Summary

	WO Task Title	GFE Description	Source	Date Needed	Total \$
	WO x.				
	WO x.x				
	WO x.x.x				
	WO x.x.x.x				
				
				
				
	Total				

5. PROPOSAL EVALUATION

5.1. EVALUATION CRITERIA

The criteria to be used to evaluate and select proposals for this project are described in the following paragraphs. Each proposal will be evaluated on the merit and relevance of the specific proposal as it relates to the program rather than against other proposals for research in the same general area as no common work statement exists. Agency evaluators will consider scientific and technical merit, value to defense, capability and key personnel to carry out proposed research, and cost realism. In accordance with FAR 35.016(e) the primary basis for selecting proposals for award shall be technical, importance to agency programs, and funds availability.

5.1.1. Scientific and Technical Merit

Proposers must demonstrate that their proposal is innovative and unique, that the technical approach is sound, that they have an understanding of critical technical issues and risk and that they have a plan for mitigation of those risks. A significant improvement in capability or understanding above the state of the art must be demonstrated. All milestones must be clearly and quantitatively described.

The proposal must clearly demonstrate the proposer’s ability to comply with the required core competencies defined in the BAA for the appropriate technical area(s) to which the bidder is responding. The proposed solution meets the letter and intent of the stated goals and all elements within the proposal exhibit a comprehensive understanding of the problem. The offeror clearly addresses how the proposed effort will meet and progressively demonstrate the goals of the NAV Program. Specifically, the offeror should address the Notional System Concept (NSC) and the Technical Approach to meet the objectives of the solicitation.

5.1.2 Value to Defense

This section of the proposal provides the offeror with the opportunity to explain and substantiate the significant novel and unique features of their NSC, and how it may radically change the capability of UAVs at small scale for the military. Offeror should discuss in detail missions, concepts of operation and concepts of employment that their design enables for the military. A critical part of this evaluation criteria, is the approach used to ensure that there is a clear transition path for this technology by the military for notional outdoor to indoor missions.

5.1.3. Capability of the Personnel and Facilities to Perform the Proposed Effort

5.1.3.1. Management Construct/Corporate Capabilities

The offeror should describe their program management process, based on the concepts of an Integrated Product and Process Development. A series of tracking tools should be used and updated monthly. They should include:

- Integrated Master Schedule (IMS): The offeror will establish and maintain a master scheduling system that provides continuous status of program accomplishments against time. This tiered system will provide visibility to Level 3 and Level 4 items as appropriate.
- Management Tools: The offeror will provide a management system that allows the Government visibility into the program budget and spend plan and is tied to their work outline. The offeror will provide regular cost reports to the Government, at least monthly, in an offeror-preferred format. Required tracking numbers include, but are not limited to, Estimate at Completion (EAC), Schedule Performance Index (SPI), Cost Performance Index (CPI), and explanations of significant variance from budget to actual cost.

These management and technical tools should be the same tools used internally to manage and technically conduct the program. No additional unique information for the Government is desired or required.

5.1.3.2. Key Personnel and Program Team

The roles of the prime and other participants required are clearly distinguished and pre-coordination with all participants (including Government facilities) fully documented.

Short two page maximum resumes should be provided for the top members of the development team. The entire team will be represented by these key personnel. The Government does not desire or require resumes of the personnel from each company, subcontractor or organization within the team. Key personnel should be the leaders of the team and represent the capability and strength of the team. They can be from a single company or distributed across various team members. The Government wishes to understand the strength of the team through its acknowledged leaders and their qualifications.

The offeror will describe the proposed program team and demonstrate the team's capability and experience to perform **ALL PHASES** of the NAV program.

5.1.3.3. Facilities

The proposal clearly defines the proposer's facilities and or the proposer's plan to access required facilities and resources to effectively and efficiently execute all phases of the NAV Program requirements.

5.1.3.4. Past Performance

The proposer's prior experience in similar efforts must clearly demonstrate an ability to deliver products that meet the proposed technical performance within the proposed budget and schedule. The proposed team has the expertise to manage the cost and schedule and has the relevant experience to achieve the desired performance. Similar efforts completed/ongoing by the offeror in this area are fully described including identification of other Government sponsors.

The offeror should describe relevant experience in each of the related subsystem areas to the NAV program. The offeror should identify what the offeror did, assess its performance, and identify how it relates to the NAV program on the contract identified. Program name, agency, and POC information must be provided for experience claimed.

5.1.4 Cost Realism

The proposed costs are complete, reasonable, realistic, and affordable for the work proposed. Estimates are "realistic" when they are neither excessive nor insufficient for the effort to be accomplished. The proposal documents all anticipated costs including those of associate, participating organizations. The proposal demonstrates that the respondent has fully analyzed budget requirements and addressed resulting cost risks. Other sponsors who have funded or are funding this offeror for the same or similar efforts are identified. The Government shall evaluate how well all cost data is traceable and reconcilable.

6.0 SECURITY INFORMATION

6.1 Proposal Submission Information

NOTE: The Government anticipates that proposals submitted under this BAA will be unclassified. In the event that a proposer chooses to submit a classified proposal or submit any documentation that may be classified, the following information is applicable.

If you choose to submit a classified proposal, you must first receive permission of the Original Classification Authority (OCA) to use their information in replying to this BAA and submit the applicable OCA classification guide(s) to ensure that the proposal is protected appropriately.

Classified submissions shall be in accordance with the following guidance:

Collateral Classified Data: Use classification and marking guidance provided by previously issued security classification guides, the Information Security Regulation (DoD 5200.1-R), and the National Industrial Security Program Operating Manual (DoD 5220.22-M) when marking and transmitting information previously classified by another original classification authority. Classified information at the Confidential and Secret level may only be mailed via U.S. Postal Service (USPS) Registered Mail or U.S. Postal Service Express Mail (USPS only; not DHL, UPS or FedEx). All classified information will be enclosed in opaque inner and outer covers and double wrapped. The inner envelope shall be sealed and plainly marked with the assigned classification and addresses of both sender and addressee. The inner envelope shall be addressed to:

Defense Advanced Research Projects Agency (DARPA)
ATTN: BAA 06-06, DARPA/ATO, Dr. Darryll Pines
3701 North Fairfax Drive, Suite 832
Arlington, VA 22203-1714

The outer envelope shall be sealed with no identification as to the classification of its contents and addressed to:

Defense Advanced Research Projects Agency (DARPA)
Security & Intelligence Directorate, Attn: CDR
3701 North Fairfax Drive, Suite 832
Arlington, VA 22203-1714

All Top Secret materials should be hand carried via an authorized, two-person courier team to the DARPA CDR.

Special Access Program (SAP) Information: Contact the DARPA Special Access Program Coordination Office (SAPCO) at (703)526-6708 for further guidance and instructions prior to transmitting to DARPA. All Top Secret SAP, must be transmitted via approved methods for such material. Consult the DoD Overprint to the National Industrial Security Program Operating Manual for further guidance. It is strongly recommended that you coordinate the transmission of SAP material and information with the DARPA SAPCO prior to transmission.

Sensitive Compartmented Information (SCI) Data: Contact the DARPA Special Security Contact Office (SSCO) at 703-812-1993/1994 for the correct SCI courier address and instructions. All SCI should be transmitted through your servicing Special Security Officer (SSO) / Special Security Contact Officer (SSCO). All SCI data must be transmitted through your servicing Special Security Officer (SSO) / Special Security Contact Officer (SSCO). All SCI data must be transmitted through SCI channels only (i.e., approved SCI Facility to SCI facility via secure fax).

Proposers must have existing and in-place prior to execution of an award, approved capabilities (personnel and facilities) to perform research and development at the classification level they propose.

***NOTE: PROPOSERS ARE CAUTIONED THAT EVALUATION SCORES MAY BE LOWERED AND/OR PROPOSALS REJECTED SHOULD SUBMITTAL INSTRUCTIONS NOT BE FOLLOWED.**