OMB Approval Number 2700-0087
Broad Agency Announcement NNM10ZDA001J

BROAD AGENCY ANNOUNCEMENT

Heavy Lift & Propulsion Technology Trade Study

PROPOSALS DUE
On or About July 2, 2010

Release Date: On or About June 2, 2010

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
George C. Marshall Space Flight Center
MSFC, AL 35812

DRAFT

Table of Contents

INTRODUCTION

1.0 This publication constitutes a Broad Agency Announcement (BAA) as contemplated by Federal Acquisition Regulation (FAR) Part 35 and NASA Federal Acquisition Regulation (NFS) Part 1835. A formal Request for Proposal (RFP), solicitation, and/or additional information regarding this announcement will not be issued. Request for same will be disregarded.

2.0 The National Aeronautics & Space Administration (NASA) will not issue paper copies of this announcement. NASA reserves the right to select for award all, some, or none of the proposals in response to this announcement. NASA provides no funding for direct reimbursement of proposal development costs. Technical and cost proposals (or any other material) submitted in response to this BAA will not be returned. It is the policy of NASA to treat all proposals as sensitive competitive information and to disclose their contents only for the purposes of evaluation.

3.0 Potential offerors may submit questions regarding this BAA in writing via e-mail to Melinda E. Dodson, Contracting Officer, at melinda.e.dodson@nasa.gov. Questions will be accepted by Ms. Dodson up to 7 days after BAA issuance.

4.0 NASA is seeking an innovative path for human space exploration which strengthens the capability to extend human and robotic presence throughout the solar system. NASA is laying the ground work to enable humans to safely reach multiple potential destinations, including the Moon, asteroids, Lagrange points, and Mars and its environs. The Exploration Systems Mission Directorate (ESMD) is leading the Nation on a course of discovery and innovation that will provide the technologies, capabilities and infrastructure required for sustainable, affordable human presence in space.

NASA is examining the trade space of potential heavy lift launch and space transfer vehicle concepts. The focus is on affordability, operability, reliability, and commonality with multiple end users (Department of Defense (DoD), commercial, science, international partners, etc.) at the system and subsystem levels. A major thrust of this activity is space launch propulsion technologies that will enable a more robust exploration program, support commercial ventures, and related national security needs.

5.0 The December 2009 NASA Heavy Lift Launch Vehicle (HLLV) study is contained within the government-provided technical package posted with this BAA. The model contract is also posted with this BAA and the Offeror is to submit a signed contract in response to the BAA.

6.0 This BAA is soliciting proposals for Heavy Lift and Propulsion Technology Trade study and seeks industry input on technical solutions in support of heavy lift system concepts studies. These studies will capture potential system architectures and identify propulsion technology gaps (to include propellant tanks, main propulsion elements, health management, etc.). This BAA request offerors to expand upon the initial NASA technical assessments provided in the technical data package included. This effort will include

architecture assessments of a variety of heavy lift launch vehicle and in-space vehicle architectures employing various propulsion combinations and how they can be employed to meet multiple mission objectives. A variety of in-space architectural elements, such as space transfer stages, space transfer vehicles, propellant depots may be included. The focus will be on developing system concepts that can be used by multiple entities (NASA, DoD, Commercial, International) with a strong emphasis on affordability.

7.0 NASA's policy prioritizes safety to protect: (1) the public, (2) astronauts and pilots, (3) the workforce (including contractor employees working on NASA contracts), and (4) high-value equipment and property. NASA FAR Supplement (NFS) 1852.223-70 defines safety as the freedom from those conditions that can cause death, injury, occupational illness, damage to or loss of equipment or property or damage to the environment.

8.0 Any additional future calls are anticipated to be issued under separate solicitation mechanisms.

I. GENERAL INFORMATION

1.0 Agency Name: National Aeronautics and Space Administration (NASA)

2.0 Research Opportunity Title: Heavy-Lift and Propulsion Technology Trade Study

3.0 Program Name: TBD

4.0 Response Date: Proposals are due on or about July 2, 2010 12:30 (Central Standard Time CST) (See paragraph IV.)

5.0 Point of Contact: All questions shall be directed to the cognizant NASA Contracting Officer as specified below. All questions shall be submitted in writing. Questions and responses will be posted on the web at http://nspires.nasaprs.com/, http://prod.nais.nasa.gov or http://www.fedbizopps.gov site. Inquiries by telephone or in person will not be accepted.

Contracting Point of Contact
NASA Marshall Space Flight Center (MSFC)
ATTN: Melinda E. Dodson, Mail Code PS40
Marshall Space Flight Center, AL 35812
Email: melinda.e.dodson@nasa.gov

6.0 Selection Official : Michael Hecker

7.0 Instrument Type(s): It is anticipated that multiple firm fixed price contracts will result from this BAA solicitation.

8.0 Additional Information: BAA and attachments may be obtained over the internet at http://nspires.nasaprs.com, http://prod.nais.nasa.gov or http://www.fedbizopps.gov.

II. ELIGIBILITY INFORMATION

1.0 Eligible Applicants: All categories of non-government U.S. institutions are eligible to submit one proposal per company in response to this BAA. NASA Centers (JPL is considered a NASA Center for the purposes of this BAA) cannot submit proposals to this BAA.

2.0 Guidelines for Foreign Participation: The NASA FAR clause 1835.016-70(a) foreign participation under broad agency announcements (BAAs) policy provides guidelines for this activity. NASA seeks the broadest participation in response to broad agency announcements, including foreign proposals or proposals including foreign participation. NASA's policy is to conduct research with foreign entities on a cooperative, no-exchange-of-funds basis (see NPD 1360.2, Initiation and Development of International Cooperation in Space and Aeronautics Programs). NASA does not normally fund foreign research proposals or foreign research efforts that are part of U.S. research proposals. Rather, cooperative research efforts are implemented via international agreements between NASA and the sponsoring foreign agency or funding/sponsoring institution under which the parties agree to each bear the cost of discharging their respective responsibilities. NASA funding may not be used for subcontracted foreign research efforts. The direct purchase of supplies and/or services, which do not constitute research, from non-U.S. sources by U.S. award recipients is permitted.

All foreign proposals must be typewritten in English and comply with other submission requirements stated in the BAA. All foreign proposals will undergo the same evaluation and selection process as those originating in the U.S. All proposals must be received before the established closing date. Those received after the closing date will be treated in accordance with Section VI of this BAA. Sponsoring foreign government agencies or funding institutions may, in exceptional situations, forward a proposal without endorsement if endorsement is not possible before the announced closing date. In such cases, the NASA sponsoring office should be advised when a decision on endorsement can be expected.

Should a foreign proposal or a U.S. proposal with foreign participation be selected, NASA's Office of External Relations will arrange with the foreign sponsor for the proposed participation on a no-exchange-of-funds basis, in which NASA and the non-U.S. sponsoring agency or funding institution will each bear the cost of discharging their respective responsibilities.

Depending on the nature and extent of the proposed cooperation, these arrangements may entail:

- An exchange of letters between NASA and the foreign sponsor**;** or
- A formal Agency-to-Agency Memorandum of Understanding (MOU).

3.0 Export Control: Performance of studies under this BAA will require access to data that is subject to export control regulations. Any entity proposing for a contract under this BAA in order to be considered for award shall comply with all U.S. export control laws and regulations, including the International Traffic in Arms Regulations (ITAR), 22 CFR Parts

120 through 130, and the Export Administration Regulations (EAR), 15 CFR Parts 730 through 799, and must demonstrate their compliance and process in the performance of this contract.

III. TECHNICAL OBJECTIVES

The technical objective of this study is the identification of the capabilities required to support an innovative evolutionary human space exploration activity, with possible destinations including the Moon, Mars and its environs, near-earth asteroids, and Lagrange points. The focus of this study is to determine the technology, and research and development required for a Heavy Lift System, defined as including a heavy lift launch vehicle and the in-space propulsion elements required to conduct those human space exploration activities. The study shall identify and analyze multiple alternative architectures (expendable, reusable, or some combination) on which a Heavy Lift System addressing the objectives can be based.

The study shall identify how alternative heavy lift system solutions address key decision attributes/figures of merit/measures of effectiveness, including:

- Provide a recommended list of key decision attributes and rationale associated with each.
    - As a point of reference, NASA's Heavy Lift Launch Vehicle study utilized the following list of system attributes: Life-cycle cost – DDT&E, fixed and recurring (production and operations); operability-support manifest launch rate; safety and reliability; performance (mass, delivery orbit); schedule – initial human flight; extensibility to support Modified Flex Path Missions.
- Provide a recommendation for the weighting of the recommended key decision attributes.
- Identify how changes to the weighting of key decision attributes affect the architectures.
- Identify how alternative ground rules and assumptions (Reference NASA HLLV Study) impact the identified alternative system solutions. For example, due to time and resource constraints, the NASA HLLV study could not address system alternatives associated with the number of launches, alternative LOX/RP 1st stage main engine characteristics, evolutionary vehicle development, the use of propellant transfer or depot, the incorporation of international partner participation, the use of multiple crew spacecraft options, and the effect of technology development.
- Identify how innovative or non-traditional processes or technologies can be applied to the Heavy Lift Systems to dramatically improve its affordability and sustainability.
- Identify how aspects of a Heavy Lift System (including stages, subsystems, and major components) could have commonality with other user applications, including NASA, DoD, commercial, and international partners.
- Identify how incremental development testing, including ground and flight testing, of Heavy Lift System elements can enhance the heavy lift system development.
- Identify capability gaps associated with the Heavy Lift System, and for each capability gap identify specific areas where technology development may be needed. Items identified as

requiring technology development shall be quantitatively evaluated using established metrics, i.e. NASA Technology Readiness Level (TRL), Capability Readiness Level (CRL), Manufacturing Readiness Level (MRL), Process Readiness Level (PRL), etc.

- Identify capability gaps associated with the first-stage main engine functional performance and programmatic characteristics required to support each Heavy Lift System studied. The minimum set of functional performance characteristics identified shall include engine thrust, specific impulse (I_{sp}), mixture ratio, mass, throttle range, and physical envelope. This assessment shall include, but is not limited to, LOX/RP main engine systems. The minimum set of programmatic characteristics identified shall include an estimated overall lifecycle cost (DDT&E and recurring per engine cost), development schedule, and production rate. Identify any impacts to overall life cycle costs of the Heavy Lift System based on the engine studied.
- Identify capability gaps associated with the upper-stage main engine functional performance and programmatic characteristics required to support each heavy lift system studied. The minimum set of functional performance characteristics identified shall include engine propellants, thrust, specific impulse (I_{sp}), mixture ratio, mass, throttle range, and physical envelope. The minimum set of programmatic characteristics identified shall include an estimated overall lifecycle cost (DDT&E and recurring per engine cost), development schedule, and production rate. Identify any impacts to overall life cycle costs of the Heavy Lift System based on the engine studied.
- Identify capability gaps associated with all other technical aspects of heavy lift system, i.e. tanks, propellant and pressurization systems, integrated system health management, auxiliary propulsion systems, avionics and control systems, structures, etc. Identify test and integrated demonstrations to mitigate risk associated with the gaps.
- Identify capability gaps associated with the in-space space propulsion elements functional performance and programmatic characteristics required to support each Heavy Lift System studied. This assessment shall include, but is not limited to, LOX/H2 and LOX/CH4 propulsion systems. The minimum set of functional performance characteristics identified shall include propellant definition, thrust, specific impulse (I_{sp}), mixture ratio, mass, throttle range (if any), and physical envelope. The minimum set of programmatic characteristics identified shall include an estimated overall lifecycle cost (DDT&E and recurring per engine cost), development schedule, and production rate. Identify any impacts to overall life cycle costs of the Heavy Lift System based on the engines studied.
- Identify capability gaps associated with all other technical aspects of the in-space space propulsion element, i.e. tanks, propellant and pressurization systems, cryogenic fluid management, integrated system health management, auxiliary propulsion systems, avionics and control systems, structures, autonomous rendezvous and docking, etc. Identify test and integrated demonstrations to mitigate risk associated with the gaps.
- Identify what in-space space propulsion elements, if any, which should be demonstrated via space flight experiments.

IV. PROPOSALS

1.0 Submission Instructions

1.1 Proposal submittal shall be prepared and submitted in accordance with the instructions included in this announcement.

1.2 One (1) original proposal package, plus two (2) paper copies, and three (3) digital copies shall be submitted to the Contracting Officer. Digital copies must be readable by Microsoft Office Word 2003 edition and Microsoft Office Excel 2003 edition. Proposals are to be clearly separated into three (3) parts:

- Technical Merit,
- Past Performance,
- Price.

All responses are to be unclassified and appropriately marked.

1.3 Proposals must be printed in English, using no smaller than 12-point font on standard 8½" x 11" white paper with 1-inch margins. Chart, tables, and graphs may utilize 8 point font size and spacing. Pages may be printed double-sided and presented in a standard portrait presentation. Pages printed double-sided will count as two (2) pages. Charts, diagrams, and similar representations will count towards the page count limitations and any page larger than 8½" x 11" will count as more than one (1) page. Proposals that exceed the page count limits will be reduced to the page limitation by removing every page in excess of the limit and removed pages will not be evaluated. Binding is not required; however, parts must be clearly separated. All pages minus the cover page must be numbered. Page limitations are outlined below. The model contract, to include the proposed Statement of Work, will not be included in the proposal submittal page limit. There are no other exclusions to the page limits.

1.4 The Government intends to evaluate proposals and issue contract awards without discussions with Offerors. Therefore, the Offeror's initial proposal should contain the Offeror's best terms from a price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. The Government may also elect to select an offer for negotiations leading to award of a contract.

2.0 Proposals shall include the following material, in this order:

Part 1 Technical Merit	Twenty (20) Page Maximum
Part 2 Past Performance Proposal	Five (5) Page limit
Part 3 Price Proposal	No Page Count Limit

2.1 Part 1: Technical Merit

2.1.1. Technical Approach

The Offeror shall clearly define the proposed technical and systems engineering approach for evaluating and analyzing Heavy Lift System concepts as outlined in the Section III Technical Objectives and the attached technical package which contains the HLLV study.

2.1.2. Statement of Work (SOW)

The Offeror shall propose a SOW, suitable for incorporation into a contract, for a six month period of performance and include their approach to completing the contract deliverables as stated in Section VIII, Paragraph 9.0. Offerors are cautioned to include only that information which is essential to a clear, concise and binding SOW.

2.1.3. Capabilities

The Offeror shall provide evidence of existing capabilities for designing and developing space-qualified systems applicable to a variety of heavy lift launch vehicle and in-space vehicle architectures employing various propulsion combinations and multiple mission objectives as described in Section III.

2.1.4. Data Rights/Export Control

The Offeror shall address their proposed data rights approach to meet the requirements under Section VIII, Part 8.0, Data Rights. The Offeror shall address their proposed approach to meet Export Control under Section II, Part 3.0, Export Control.

2.1.5. Small Business Utilization

The Offeror shall propose subcontracting goals for small businesses (SB), historically under-utilized business zone (HUBZone) SBs, small disadvantaged businesses (SDB), woman-owned small businesses (WOSB), veteran-owned small businesses (VOSB), service-disabled veteran owned (SDVO) SBs, Historically Black Colleges and Universities (HBCU) and Minority Institutions (MI). Proposers should indicate key small business subcontractors and their roles. The North American Industry Classification System (NAICS) code for this solicitation is 541710 with a small business size standard of 1,000 employees. Percentage goals shall be expressed as a percentage total contract value.

2.1.6. Deviations and Exceptions

The Offeror shall identify and justify deviations or exceptions to the model contract terms and conditions.

2.2 Part 2: Past Performance Proposal: (Maximum 5 Pages).

The Offeror should include a list and description of any experience in research and development of launch vehicle systems. The Offeror shall provide evidence of system analysis tool validation for systems of the class being investigated. The

Offeror shall provide a maximum of five (5) sources of past performance on similar studies. For each contract, the Offeror shall provide the following:

- Contract Number
- Name of Contracting Agency
- Program Manager and Telephone Number
- Contracting Officer and Telephone Number
- Synopsis of Work Performed
- Contract Type
- Total Contract Value
- Past Performance Rating

2.3 Part 3: Price Proposal. The price proposal shall include the overall firm fixed price. The offer shall not exceed $750,000. The offeror shall provide total direct labor hours by skill mix, travel and subcontracts. (Price volume has no page limits or formatting requirements.)

V. SUBMISSION OF LATE PROPOSALS

Proposals received by the Government after the specified date and time for receipt will not be evaluated.

VI. EVALUATION CRITERIA

Relative Importance:

- Technical merit is more important than past performance which is more important than price.
- Technical merit and past performance, when combined, are significantly more important than price.

1.0 **Factor 1 - Technical Merit**:

All subfactors are in descending order of importance within the Technical Merit factor.

Subfactor 1.1: Technical Approach

The Government will evaluate the extent to which the Offeror has demonstrated a logical methodology, including the technical and systems engineering approach, to achieve the technical objectives of this BAA on which the Offeror's proposal is based. The Government will evaluate how the Offeror proposes to accomplish trades and analysis by application of key decision attributes and alternative ground rules and assumptions. The Government will evaluate the extent to which the Offeror has demonstrated a thorough

knowledge of the technical objectives, including innovativeness, and critical issues through the proposed technical approach.

Subfactor 1.2: Statement of Work (SOW)

The Government will evaluate the extent to which the Offeror has demonstrated a thorough knowledge of the technical objectives and critical issues through the proposed SOW for research under this BAA. The Government will evaluate the completeness, quality, and thoroughness of the SOW.

Subfactor 1.3: Capabilities

The Government will evaluate the Offeror's evidence of existing capabilities for designing and developing space-qualified systems applicable to a variety of heavy lift launch vehicle and in-space vehicle architectures employing various propulsion combinations and multiple mission objectives.

Subfactor 1.4: Data Rights/Export Control

The Government will evaluate the Offeror's approach to data rights and how well they meet the objectives identified under Section VIII, Paragraph 8.0, Data Rights. The Government will evaluate the Offeror's proposed approach to Export Control compliance and how well the approach meets the requirements under Section II, Paragraph 3.0, Export Control.

Subfactor 1.5: Small Business Utilization

The socioeconomic merits of each proposal will be evaluated.

Subfactor 1.6: Deviations and Exceptions

The Government will evaluate any deviations or exceptions to the BAA and model contract. The Government, reserves the right to disqualify a proposal based on significant deviations or exceptions to the BAA or model contract.

2.0 **Factor 2 - Past Performance:** The Government will evaluate each Offeror's relevant past performance, including the record of any significant subcontractors or teaming partners. The Government will evaluate the relevancy and quality of past performance in the research and development of launch vehicle systems. Lack of relevant past performance will not be evaluated favorably or unfavorably.

3.0 **Factor 3 – Price**: The Government will evaluate the overall firm fixed price to the Government and the extent to which the Offeror complied with the specified dollar limits in the BAA. The Government will evaluate the total direct labor hours by skill mix, travel and subcontracts.

VII. EVALUATION PANEL AND BASIS OF AWARD

1.0 The selection of the source(s) for contract award(s) shall be based upon the quality and innovativeness of proposed studies, funding availability, and evaluation results.

2.0 Evaluation of the proposals received in response to this BAA shall be accomplished by government personnel only.

3.0 All government personnel participating in the evaluation shall be bound to protect proprietary and source selection information.

VIII. AWARD INFORMATION

1.0 Central Contractor Registration (CCR). Successful Offerors not already registered in the Central Contractor Registry (CCR) will be required to register prior to award of any contract. Information on CCR registration is available at http://www.ccr.gov.

2.0 Certifications: A completed package of representations and certifications will be required before the execution of any contract.

3.0 Multiple Awards: NASA anticipates multiple awards based on the evaluation criteria. The overall number of awards will be dependent upon the quality and innovativeness of proposed studies, funding availability, and evaluation results.

4.0 Period of Performance: Period of performance of the contracts will be for six months following the authorization to proceed effective date.

5.0 Award Date: Award is anticipated on or about August 13, 2010.

6.0 Funding Allocation: Individual award amounts shall not exceed $750,000. Contracts shall be firm fixed price. Offerors shall propose consistent with the BAA reporting requirements a milestone payment schedule as part of the signed model contract. No cost sharing is anticipated or sought in this solicitation. The Government's obligation to make award(s) is contingent upon the availability of appropriated funds from which payment can be made and the receipt of proposals that NASA determines are acceptable.

7.0 Certificate of Current Cost or Pricing Data (CCCPD). A CCCPD is not required on this BAA.

8.0 Data Rights: The objective of the contract is to obtain data for NASA's use in determining an approach for defining, deriving, and/or validating requirements. Any limitations to use of data, including pre-existing data, for these purposes are discouraged. The Government will not incorporate Contractor's specific design solutions for launch systems and architecture into future solicitations or disclose the cost data outside the Government (to include support contractors with non-disclosure agreements). The data associated with technology gaps and needs assessment is expected to be provided with unlimited data rights. Co-mingling of unlimited and limited rights data is not allowed. Both government and support contractor personnel (who have non-disclosure agreements with NASA) will be involved in reviewing the data during contract performance. All industry and government parties shall require unrestricted data access throughout the study

and requirements generation period. Contractors will be required to share data, other than limited rights, at both Technical Interchange Meetings with all study contractors.

9.0 Reporting Requirements: The resultant contract awards will include the following deliverable requirements:

Month	Deliverable
3	Technical Interchange Meeting 1 and Briefing Package
5	Technical Interchange Meeting 2 and Briefing Package
6	Final Study Report

9.1. Technical Interchange Meeting Briefing Package (s): Charts statusing accomplishments, planned work and issues per the Data Rights Restrictions in Paragraph 8.0.

9.2. Final Study Report (due six months from contract award effective date): one (1) hard copy and one (1) CD-ROM to be delivered to NASA.

9.3. **Electronic Submissions:** The Government encourages electronic submittal of all reports. All reports may be submitted by e-mail, or via the internet, or by some other electronic method, in lieu of a hardcopy. Dedicated websites, accessible via password and maintained by the Offeror, are acceptable reporting tools, if compatible with the current NASA hardware and software and authorized by the COTR. CD or disc submittals are acceptable reporting tools, if compatible with the current NASA hardware and software and authorized by the COTR.

(End of Solicitation)