NEW FRONTIERS

CRITERIA AND GUIDELINES FOR THE PHASE A CONCEPT STUDY

August 14, 2004

CRITERIA AND GUIDELINES
FOR THE PHASE A CONCEPT STUDY

INTRODUCTION

The Phase A Concept Study for each investigation will constitute the investigation's requirements definition phase (Phase A) of the formulation subprocess as outlined in NPG 7120.5B, *NASA Program and Project Management Processes and Requirements*. The purpose of a Phase A Concept Study is to better define the investigation, its implementation requirements, and its risks, as well as to describe the implementation plan for Education and Public Outreach (E/PO). The Phase A Concept Study period can also be utilized to mature the proposal concept presented in response to the AO by demonstrating proof of concept and/or conducting additional development testing to reduce/retire risks. In addition, it is expected that the proposer will utilize the Phase A Concept Study period to refine requirements and project interfaces with the New Frontiers Program Office (NFPO), the Kennedy Space Center (KSC) Expendable Launch Vehicle (ELV) office, the Jet Propulsion Laboratory (JPL) Interplanetary Network Directorate (formerly TMOD), and other critical support functions. Signed Letters of Endorsement from each of these critical support elements are mandatory to provide assurance that the project's requirements have been assessed and are supportable. Finally, and perhaps most importantly, the Phase A period should be utilized to finalize all cost estimates and develop the needed project funding profile necessary to implement the investigation with an acceptable level of risk ***- the project cost proposed at the completion of Phase A is the cost that a New Frontiers proposal team will be expected to meet for the entire life of the project***. Any subsequent increase in this cost without the full endorsement of the NFPO will be grounds for cancellation of the project.

Upon completion of their Phase A Concept Study, each proposer will submit a Concept Study Report (CSR) for NASA evaluation. The CSR is to be a self-contained document; that is, selected investigators should not assume that NASA evaluators will have reviewed or even have access to the original proposal. Please note that all program constraints, guidelines, definitions, and requirements given in the AO are still valid for the CSR except as noted herein. Likewise, specific guidelines and definitions for proposal preparation are still valid for the CSR except where specifically amended in this document (for example, page counts are amended herein to account for the added degree of expected maturity of the investigation's implementation).

Proposers should be aware that they are responsible for the content and quality of the entire CSR, including parts that may be prepared by any of their partners. All assumptions and calculations should be carefully documented in the CSR and reviewed by the Principal Investigator (PI) and his/her team to ensure that they are accurate and will satisfy the requirements of NASA and its supporting organizations.

In addition to the CSR, the evaluation process will also include a site visit by the evaluation team to hear oral briefings by each of the investigation teams. For planning purposes, these oral

briefings can be expected to last one full workday and will be conducted about 1 month after submittal of the CSR.

It is recognized that New Frontiers investigations are subject to three kinds of risks:

- inherent risks (including launch and space environments, mission durations, technology extensions, and unknowns);
- programmatic risks (those uncertainties imposed by the program such as Environmental Assessment approvals, budget uncertainties/changes, political impacts, and late/non-delivery of government-provided project elements);
- implementation risks (those elements under the control of the investigation team including such things as schedules, funding allocations, management structure, development approach, supporting organizations, and risk aversion/management approach including planning for known and unknown inherent and programmatic risks).

The primary purpose of the Phase A Concept Study is to develop detailed implementation plans for the proposed investigation so that the third kind of risk, implementation risk, can be judged. (At the same time, however, any special features of the proposed investigation that add unusual resiliency against either inherent or programmatic risk should be described.)

Part I of this document discusses the criteria to be used by NASA for the evaluation of the CSR. Part II provides guidance for preparation of the CSR. Guidelines for the project site visit will be presented at the Phase A Kickoff Meeting at NASA HQ, to be conducted approximately 1 month after selection.

As a result of the evaluation of the Concept Studies, the Associate Administrator for Science expects to confirm one New Frontiers mission investigation to proceed to Phase B. NASA will not continue funding for investigations that are not selected to proceed. All investigation teams will be offered a debriefing of all findings.

PART I - EVALUATION CRITERIA

The NASA evaluation process of the Phase A concept studies will be conducted in a manner similar to that used in the evaluation of proposals (see Section 7.0 of the AO). Since the selected investigations are those judged to have compelling science, it is expected that the science objectives will not change during the Phase A studies. If, however, there are changes to the science implementation that might affect these objectives, the science merit will be reevaluated. Assuming that there are no changes to the science objectives from those in the proposal, the Phase A evaluation will primarily be to evaluate all of the implementation planning for each investigation and consider in detail all factors related to the probability of mission success and to the realism of the proposed costs to NASA. This evaluation will also consider the investigation team's plans for E/PO.

Successful implementation of New Frontiers investigations demand, in addition to scientific merit, that the investigation be achievable within the established constraints on cost and schedule. The information requested in Part II of this document will enable NASA to determine how well each mission team understands the complexity of its proposed investigation, its technical risks, and any weaknesses that require specific action during Phase B.

The criteria to be used for evaluation of the CSR are as follows:

- The scientific merit of the investigation (will not be reevaluated unless it is determined that the science has changed from that described in the proposal)

- The technical merit and feasibility of the proposed investigation

- The feasibility of the proposed approach for mission implementation, including cost risk (i.e., realism and reasonableness of cost)

- The quality of plans for E/PO including implementation feasibility

Scientific Merit of the Investigation.

It is expected that the science objectives will not change from those given in the proposal. The scientific merit of each investigation as established by the peer review of the proposal will be, however, reexamined to determine if significant changes have occurred as a result of details provided in the Phase A CSR with regards to the implementation details of the science investigation. If a re-evaluation is judged to be necessary, the definitions and process for evaluating this criterion will be the same as those used for the proposal review. Given no change in the science, the peer review panel rating from the proposal will remain valid for the CSR.

Technical Merit and Feasibility of the Proposed Investigation

The information provided in response to Part II of this document will be used to evaluate each investigation in detail for its technical merit, scientific feasibility, resiliency, and probability of success. Although this criterion was evaluated during the proposal phase, it will be reevaluated during this Phase A Concept Study, which now will have science implementation details for evaluation. As a result, the evaluation of this AO criterion will be supplemented with the following considerations:

The scientific implementation of the investigation will be reevaluated from the data provided in the CSR and the site visit to look specifically at the level of implementation risk based on the feasibility of the investigation's technical approach, instrumentation provided to acquire the data, plans for science operations and data acquisition, plans for science descope, technical capabilities of the investigation team, and the plans for data analysis and archiving.

The evaluation results will be an assessment of science implementation risk (High, Medium, or Low).

Feasibility of the Proposed Approach for Mission Implementation, including Cost Risk

The information provided in response to Part II of this document will be used to evaluate each investigation in detail for the feasibility of mission implementation as reflected in the perceived risk of accomplishing the mission within proposed resources. The mission feasibility as a whole and as reflected in the subfactors (technical approach, management and organization, and cost) will be assessed, as well as each of these subfactors separately. This AO criterion will be supplemented with the following considerations:

The evaluation will consider the proposer's understanding of the processes, products, and activities required to accomplish development of all elements (e.g., mission design, launch systems, flight systems, communications systems, ground and data systems, etc.), the integration of all elements, and the adequacy of the proposed approach including reserves and margins. The mission operations approach will be evaluated to determine the adequacy of the plans and the resources for conducting the mission. The technical approach will be

examined in its entirety to ensure that: (1) all elements and processes are addressed, (2) weaknesses and design issues are understood and plans for resolution have been identified, (3) fundamental design trades have been identified and studies planned, and (4) primary performance parameters have been identified and minimum thresholds established. The overall technical approach (including a well-defined schedule), the specific design concepts, and the known hardware/software will be evaluated for soundness, achievability, and maturity. Resiliency and design performance margins will be factors in this evaluation. The advantages (e.g., higher performance and/or lower costs) and disadvantages (e.g., higher technical risk) of any new technology will be evaluated in the context of the overall feasibility of the proposed investigation. Investigations dependent on new technology will not be penalized for risk provided that adequate plans are described to provide a reasonable backup approach that will assure the success of the investigation within the proposed resources. See Section 5.7 of the AO for further details on technology requirements.

The experience and expertise of the development organizations will be important factors in assessing the probability of success. Innovative cost effective features, processes, or approaches will be rewarded if proven sound. The information provided in the Management section should demonstrate the proposer's plans, processes, tools, and organization for managing and controlling the development and operation of the mission, including performance measurement and reporting. The soundness and completeness of the implementation approach as defined in a Work Breakdown Structure (WBS), and the probability that the investigation team can assure mission success will be evaluated by reviewing the organizational structure (including roles, responsibilities, accountability, and decision making process) and the processes, plans, and strategies the team will use to manage the various mission elements. Factors in this evaluation will include: clear lines of authority, clean interfaces, prudent scheduling and cost control mechanisms, review processes, and demonstrated awareness of all necessary management processes. Additional factors in the evaluation of the probability of mission success will include the experience, expertise, and commitment of key personnel and the organizations to which they are attached, the adequacy of facilities and equipment proposed for the mission, the adequacy of the team’s approach to risk management, and the adequacy of the management and control mechanism. Innovative management processes and plans will be rewarded if proven to be sound.

The completeness of the Phase B plans will also be considered in determining the adequacy of the overall implementation approach. This will include an evaluation of the activities/products, the organizations responsible for those activities/products, and the detailed schedule to accomplish the activities/products.

The credibility and realism of the proposed cost estimates and the planned financial resiliency will be evaluated. The underlying rationales for the cost estimates, including cost reserves, technical reserves and margins, and the development schedule, including schedule margins, will be factors in this evaluation.

The subcontracting plan will be evaluated on whether the proposer provides maximum practicable opportunities for small business participation and on the extent of participation of small disadvantaged business concerns. The effect of the subcontracting plan on the technical, management, or cost feasibility of the proposed investigation will also be evaluated. See Section 5.8 and Appendix A, Section XII of the AO for details concerning small and small disadvantaged business requirements

The evaluation results will be an assessment of mission implementation risk (High, Medium, or Low).

Quality of Plans for E/PO including Implementation Feasibility

All proposed investigations must include an E/PO component that will be submitted in conjunction with their CSR. The criteria to be used to evaluate the E/PO component and a discussion of those criteria is given in the document *Explanatory Guide to the NASA Office of Space Science Education and Public Outreach Evaluation Criteria* (March 2004) which may be found by linking through the E/PO Web site at the URL http://spacescience.nasa.gov. See section 5.6 of the AO for further details on the E/PO requirements.

PART II
REQUIRED QUANTITIES, MEDIA, FORMAT, AND CONTENT

Sixty (60) paper copies of the CSR and 60 clearly labeled copies of a CD-ROM containing a single file, searchable PDF format version of the CSR are required. In addition, the Master Equipment List and cost and staffing data are required in Microsoft EXCEL format. A Microsoft Project version of the schedule is also to be provided. The required uniform format and contents are summarized below. Failure to follow this outline may result in reduced ratings during the evaluation process and could lead to the investigation not being confirmed for continuation.

When changes from the original proposal have been made to the science investigation (including science implementation) as a result of the Concept Study, ***these changes from the proposal must be clearly identified***. See sections E and F for information on highlighting changes.

The content of each requirement is discussed in the subsequent paragraphs. Note that all program constraints, guidelines, requirements, and definitions given in the AO are still valid for the CSR except as noted herein.

The CSR page limits are shown on the next page. Other guidelines are as follows:

- Three-ring binders should be used.
- The CSR is limited to no more than seven foldout pages (28 x 43 cm; i.e., 11 x 17 inches). A foldout page counts as one page.
- All pages other than foldout pages shall be 8.5 x 11 inches or A4 European Standard
- Each side of paper on which text or figures appears is counted as a page.
- Single- or double-column format is acceptable.
- In complying with the page limit, no page may contain more than 55 lines of text and the type font must not be smaller than 12-point except within figures and tables, where the type font may be smaller but must be easily readable without optical aid.

The following page limits apply:

Section	Page Limit
A. Cover Page and Investigation Summary	As needed
B. Table of Contents	2
C. Fact Sheet	2
D. Executive Summary	5
E. Science Investigation (changes highlighted)	42
F. Technical Approach G. Management Plan H. E/PO Plan I. Phase B Plan	130
J. Cost Information for Phase A through E: Cost Proposal for Phase B Cost Estimate for Phase C/D Cost Estimate for Phase E Cost Estimate for Any PSP/DAP/Phase F Cost Estimate for E/PO Cost Estimate for Total Mission	No page limit, but data must be presented in formats described; be brief
K. Appendices (No other appendices permitted) Letters of Endorsement Relevant Experience and Past Performance Resumes Statement(s) of Work for Each Contract Option Mission Definition and Requirements Agreement Radioactive Power Sources Plan (as applicable) Planetary Protection Approach Incentive Plan(s) NASA PI Proposing Team Technical Content of Any International Agreement(s) Discussion on Compliance with U.S. Export Laws and Regulations Communications Link Budget Design Data Cost and Pricing for Phase B Contract Additional Cost Data to Assist Validation Science Change Matrix Data Management Plan Approach Project Plan Approach Orbital Debris Analysis Reference List (Optional) Abbreviations/Acronyms List	No page limit, but small size encouraged

A. COVER PAGE AND INVESTIGATION SUMMARY

The guidelines in the AO, Appendix B, apply.

B. TABLE OF CONTENTS

The CSR shall contain a table of contents that parallel the outline provided in Sections C through K below.

C. FACT SHEET

A Fact Sheet that provides a brief summary of the proposed investigation must be included. The information conveyed on the Fact Sheet should include the following: science objectives (including the importance of the science to the NASA science themes), mission overview (including mission objectives and major mission characteristics), science payload, key spacecraft characteristics, anticipated ELV, launch date, major elements of the E/PO program, mission management (including teaming arrangement as known), schedule, and cost estimate. Other relevant information, including figures or drawings, may be included at the proposer's discretion. The Fact Sheet is restricted to two pages (preferably a double-sided single sheet).

D. EXECUTIVE SUMMARY

The Executive Summary is to be a summary of the contents of the CSR and is to include an overview of the proposed baseline investigation including its scientific objectives, the technical approach, management plan, cost estimate, and E/PO plans. The Executive Summary should be no more than 5 pages in length.

E. SCIENCE INVESTIGATION

This section shall describe the science investigation resulting from the Phase A Concept Study. Any descoping of, or changes to, the investigation from the baseline and minimum mission science defined in the proposal must be identified in this section. Changes should be highlighted in bold with column marking for easy identification. In addition, a change matrix giving the original (proposed) requirement, the new requirement, rationale for the change, and its location within the CSR is required as an appendix (see section K). If there are no changes, the science investigation section must be repeated identically from the proposal with a statement that there are no changes. Plans for any Participating Scientist Program (PSP) and/or Data Analysis Program (DAP) are to be included in this section.

F. TECHNICAL APPROACH

The Technical Approach section should detail the method and procedures for investigation definition, design, development, testing, integration, ground operations, and flight operations. Proposers must provide a sufficient level of detail to allow NASA to validate all aspects of the mission concept. Failure to provide sufficient detail could cause NASA to be unable to validate the concept, which could result in a High Risk rating. A discussion of all new technologies planned for the investigation should be provided and include backup plans with scheduled decision criteria if those technologies cannot be made ready. This section should also detail the expected products and end items (including hardware and software) associated with each phase. Mission teams have the freedom to use their own processes, procedures, and methods. The use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives is encouraged when cost, schedule, technical improvements, and risk containment can be demonstrated. The benefits and risks, if any, of any such processes and products should be discussed. This section must be complete in itself without the need to request additional data, although duplications may be avoided by reference to other sections of the CSR if necessary.

1. Technical Approach Overview. This section should provide a brief overview of the technical approach including its key challenges.

2. Mission Design. This section should fully describe the operational phase of the mission from launch to end of mission. It should include information on the proposed launch date (including any launch date flexibility), launch location and vehicle, trajectories, delta-V requirements, orbit characteristics, encounter geometry (orbiter, flyby, lander, etc.) and characteristics (flyby speed, orbital period, etc.), mission duration, and a preliminary mission timeline indicating periods of data acquisition, data downlink, etc. It should also include detailed analyses of all phases of the trajectory/orbit design including total delta-V, times of trajectory correction maneuvers and delta-V's, and contingency studies and details for major events on the trajectory. The mission design should also describe Deep Space Network (DSN) or other communications network to be used and interface requirements, along with potential impacts or conflicts with other users of the selected communications resources . Describe any design trade studies conducted or planned. Any trade studies involving ELV's must still require that NASA be the launch service provider unless it is to be a contribution. In such cases, the AO guidelines and constraints for both contributions and ELV's will be applicable.

   A "traceability matrix" showing how the proposed mission design complies with the stated objectives, requirements, and constraints of the proposed investigation, including planetary protection compliance, should be included. The rationale for the selection of the ELV should be included. The Concept Study should identify any innovative features of the mission design that minimize total mission costs.

3. Technology. This section should discuss how the subject technology relates to the proposed investigation, from which project(s) the technology comes and its current level of technology readiness, modifications necessary in order to utilize the technology for this investigation, and whether there are workarounds for the technology if plans for its usage on this investigation cannot be affirmed by Preliminary Design Review (PDR)/Confirmation. The functions that the new technology performs and how it will be demonstrated for the investigation should be described.

4. Spacecraft. This section should describe the spacecraft design/development approach, particularly as it relates to new versus existing hardware and software and redundant versus single-string hardware. It should fully identify the spacecraft systems and describe their characteristics and requirements. A description of the flight system design with a block diagram showing the flight subsystems and their interfaces should be included, along with a description of the flight software and the approach for its development, and a summary of the estimated performance of the flight system. The flight heritage or rationale used to select the flight system and its subsystems, major assemblies and software elements, and interfaces should be described. The discussion of heritage should address two important issues: (1) prior flight experience or flight-qualified design of specific subsystem hardware and software components, and (2) overall subsystem design, whether new, modified, or exact repeat of a design flown previously. Assumptions about potential cost savings that result from heritage will be quantified and explained in the Cost Proposal section (Section J) below. This section should also discuss the design *process* used: trade studies, simulations, technology development, engineering models, prototypes, etc.

   Subsystem characteristics, requirements, and expected performance should be described to the greatest extent possible. Such characteristics include current best estimate and contingency for: mass, volume, and power requirements; CPU, buffer, memory, databus utilization and timing; performance; pointing knowledge and accuracy; new developments needed; space qualification plan; logistics support; and expected degradation/losses. These subsystems include: structural/mechanical, solar array/power supply (and batteries), electrical, thermal control, propulsion, communications, attitude control, command, software, and data handling, etc. Include block diagrams with sufficient detail to allow NASA to determine the adequacy of the proposed subsystem.

   Any design features incorporated to effect cost savings should be identified; however, benefits should be specified and enabling assumptions or risks should be identified. A summary of the resource elements of the flight systems design concept, including key margins, should be provided. The rationale for, and derivation of, margin allocations including mass, power, communication link performance (data and carrier), pointing accuracy, etc., should be provided. Those design margins that are driving costs should be identified. Provide data in tables to show the current

estimate of data storage margin and computer processor utilization margin. A Master Equipment List should summarize component-level information for all hardware subsystems of the spacecraft, any other hardware elements (e.g., probes, canisters, and individual instruments). The quantity, unit current best estimate mass, estimated contingency mass percentage and value, and the current best estimate mass plus contingency mass value should be provided for each component. Component-level mass estimates should be presented individually and summed at the subsystem and system level. Heritage, design status, level of modification planned, and new development should also be provided for each component.

Show how the characteristics of and requirements on the spacecraft are traceable to the objectives, requirements, and constraints of the investigation.

5. Science Implementation. This section should describe the science implementation for the investigation, including the sample acquisition and processing system. Highlight any changes to the payload or individual instruments or their performance since submission of the proposal and provide a summary in the Science Change Matrix (see section K). Information pertinent to the accommodation of the instrumentation on the spacecraft should also be included. Subsystem characteristics and requirements should be described. Such characteristics include: mass, volume, and power requirements; computing and data resource requirements; pointing requirements; new developments needed; and a space qualification plan. Include where appropriate: block diagrams, layouts, calibration plans, operational and control considerations, and software development. Any design features incorporated to effect cost savings should be identified. A summary of the resource elements of the instrument design concept, including key margins, should be provided. The rationale for margin allocation should be provided. Those design margins that are driving costs should be identified. The Master Equipment List should summarize component-level information for each instrument, including payload common elements.

   Special attention should be given to assuring that both the planning and resources are adequate to analyze, interpret, and archive all the data produced by the investigation in the appropriate data archive (Planetary Data System or other, as justified). Include a discussion of the software system that will be used, the amount of new development, the team structure and staffing concept and location, and interfaces for the instrument processing system(s). The approach for science algorithm development (if appropriate) and the integration of the algorithms into the processing system should also be discussed. Resources include cost, schedule, and work-hours for scientific interpretation of results and publication.

   Show how the characteristics and requirements of the science implementation are traceable to the objectives, requirements, and constraints of the investigation.

6. Payload Integration. This section should characterize the interface between the instruments and the flight system. These include, but are not limited to: volumetric envelope, fields of view, weight, power requirements, thermal requirements, command and telemetry requirements, sensitivity to or generation of contamination (e.g., electromagnetic interference, gaseous effluents, etc.), data processing and storage requirements, as well as the planned process for physically and analytically integrating them with the flight system. The testing strategy of the science payload, prior to integration with the spacecraft, should be discussed.

7. Manufacturing, Integration, and Test. This section should describe the manufacturing strategy to produce, test, and verify the hardware/software necessary to accomplish the mission. It should include a description of the main processes/procedures planned in the fabrication of flight hardware and development of mission critical software, production personnel resources, incorporation of new technology/materials, and the preliminary test and verification program. The environmental tests planned should be discussed and proposed test margins and durations for the environmental test program specified. Part burn-in requirements that will be used for the program should also be defined. Describe the approach for transitioning from design to manufacturing and specify data products which will be used to assure producibility and adequate tooling availability.

   The approach, techniques, and facilities planned for integration, test and verification, and launch operations phases (including launch integration and processing), consistent with the proposed schedule and cost, should be described. A preliminary schedule and flow diagram for manufacturing, integration, and test activities - including system-level performance tests with the flight software - should be included. A description of the planned end items, including engineering and qualification hardware and software, should be included.

   If Radioisotope Power Systems (RPS's) are necessary for the investigation, the following requirements apply. The parallel Department of Energy (DOE) preparation of the RPS power source for the flight system poses specific development interface issues. The ground equipment, simulators, control documents, and schedule constraints required to support the parallel development and test of the flight system and the RPS shall be discussed. The unique requirements and procedures for integration of the power source at the launch site shall be presented. Any potential schedule issues associated with integration of the power system that are not within the contractor's control shall be identified, along with the expected impacts.

8. Mission Operations, Ground, and Data Systems. This section should discuss mission operations and the ground operations support required for the proposed investigation. The planned approach for managing mission operations and all flight operations support, including mission planning and scheduling, command sequence generation, uplink commanding, trajectory tracking, navigation, and telemetry

downlink and analysis should be discussed. Describe the approach for emergency communications during any phase of the mission. Describe all inter-facility communications, computer security, and near real-time ground support requirements, licenses and/or approvals required, and indicate any special equipment or skills required of ground personnel. Provide a staffing plan for both mission operations and science payload operations. Proposers planning to utilize the Deep Space Mission System's (DSMS's) facilities (DSN and Advanced Multi-Mission Operations System) are strongly advised to contact the DSMS Plans and Commitment Office during the Concept Study to better understand the options and associated costs for NASA-provided operations and communications services.

The approach to the development of the Ground Data System (GDS), including design heritage and the use, if any, of existing facilities including Government facilities, should be described. All usage of the DSN and of any existing non-DSN facilities should be explicitly described (see *NASA's Mission Operations and Communications Services* document in the New Frontiers Program Library (NFPL) for specific requirements and contacts) including plans for pre-launch compatibility testing. Any mission-unique facilities must be adequately described. Include a block diagram of the GDS showing the end-to-end concept (acquisition through archiving in the appropriate data archive) for operations and data flow to the subsystem level. Describe all communications, tracking, and ground support requirements; flight-ground trade studies; and integration and test plans. Describe the space/ground link spectrum requirements and the licensing approach. Proposers should contact an appropriate NASA Frequency Spectrum Management organization to ascertain licensing and frequency assignment requirements. An appropriate Spectrum Management organization is typically located in the organization providing Earth station or Tracking and Data Relay Satellite System (TDRSS) support. Describe the software heritage and software development approach and its relationship to the flight system software development.

Specific features incorporated into the flight and ground system design that leads to low-cost operation should be identified. The use of any existing mission operations facilities and processes should be described, as well as any new facilities required to meet mission objectives.

9. Facilities. Provide a description of any new, or modifications to existing, facilities, laboratory equipment, and ground support equipment (GSE) (including those of the team's proposed contractors and those of NASA and other U.S. Government agencies) required to execute the investigation. The outline of new facilities and equipment should also indicate the lead time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

10. Software Development Approach. Provide a Master Software List summarizing all major ground and flight software elements, characterizing function (including fault protection), estimated size, inheritance/heritage, operational platform, and

responsible team member for developing each element. Describe the investigation team's plan for acquiring, inheriting or developing, testing, validating and verifying flight and ground software over all mission phases. Provide assumptions on inheritance and describe the cost basis for the software. Provide a description of the test environment for the flight software, including the fidelity and availability of the proposed simulators used for testing.

11. Product Assurance, Mission Assurance and Safety. This section should describe the process by which the product quality is assured to meet the proposer's specifications, including identification of trade studies, the parts selection strategy, and the plans to incorporate new technology. This section should also describe the product assurance plan, including plans for problem/failure reporting, inspections, quality control, parts selection and control, reliability, safety assurance, and software validation. Describe the risk mitigation efforts that address designing for long life, dormant reliability, and cold environment and radiation effects that include the RPS. Describe the radio science link and any ultrastable oscillator requirements and how the project plans to meet these requirements. In addition, investigators should be aware of mission assurance topics of recent Agency-level special emphasis for all NASA missions. Such topics include Red Team Reviews, subsystem-level Failure Mode Effects Analysis, Probabilistic Risk Assessment with its subset of analysis tools, Continuous Risk Management, and Software Independent Verification and Validation (IV&V).

G. MANAGEMENT PLAN

This section sets forth the investigator's approach for managing the work, the recognition of essential management functions, and the overall integration of these functions. This section should specifically discuss the decision-making process to be used by the team, focusing particularly on the roles of the PI and Project Manager (PM) in that process. Include a discussion of the relationship among the investigation team, the NFPO, and NASA Headquarters. The management plan should give insight into the organizations proposed for the work, including the internal operations and lines of authority with delegations, external interfaces and relationships with NASA, major subcontractors and partners, and associated investigators. It also should identify the institutional commitment of all team members (including team members responsible for E/PO), and the institutional roles and responsibilities. The use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives is encouraged; however, they should be employed only when cost, schedule, or technical improvements can be demonstrated and specific enabling assumptions are identified.

1. Team Member Responsibilities. This section should describe the roles, responsibilities, time commitment, and experience of all team member organizations and key personnel, with particular emphasis placed on the responsibilities assigned to the PI, PM, Deputy PM, Project Systems Engineer, and other key personnel. In addition, information should be provided which indicates what percentage of time

key personnel will devote to the mission, the duration of service, and how changes in personnel will be accomplished. (Note: The experience of the PI and science team members does not need to be included in this section since that is addressed in the science investigation section.)

a. Organizational Structure. The management organizational structure of the investigation team must be described in the CSR. A WBS to at least level 3 must be provided. The CSR must describe the responsibilities of each team member organization and its contributions to the investigation. Each key position, including its roles and responsibilities, how each key position fits into the organization, and the basic qualifications required for each position, must be described. A discussion of the unique or proprietary capabilities that each member organization brings to the team, along with a description of the availability of personnel at each partner organization to meet staffing needs should be included. The contractual and financial relationships between team partners should be discussed. A summary plan, outlining the proposed investigation's approach and commitment to meet NASA's small business participation goals (as described in Appendix A, Section XIII, of the AO), should be provided. In addition, a subcontracting plan is needed with the CSR. This plan will be negotiated prior to any Phase B contract award.

   Summarize the relevant institutional experience in this section, and refer to supporting detail included in Section L, Relevant Experience and Past Performance. If experience for a partner is not equivalent to, or better than, the requirements for the proposed mission, explain how confidence can be gained that the mission requirements will be accomplished within cost and schedule constraints.

b. Experience and Commitment of Key Personnel. Provide a history of experience explaining the relationship of the previous experience to each key individual's role; include the complexity of the work and the results.

   i. Principal Investigator. The role(s), responsibilities, and time commitment of the PI should be discussed. Provide a reference point of contact, including address and phone number.
   ii. Project Manager, Deputy Project Manager, and Project Systems Engineer. The roles, responsibilities, time commitment, and experience of the PM, Deputy PM, and Project Systems Engineer should be discussed. Provide reference points of contact, including addresses and phone numbers.
   iii. Other Key Personnel. The roles, responsibilities, time commitments, and experience of other key personnel in the investigation including Co-Investigators (Co-I's) should be described.

2. Management Processes and Plans. This section should describe the management processes and plans necessary for the logical and timely pursuit of the work (including E/PO), accompanied by a description of the work plan. This section should also describe the proposed methods of hardware and software acquisition. The management processes which the investigator team proposes, including the relationship between organizations and key personnel should be discussed, including the following, as applicable: systems engineering and integration; requirements development; configuration management; schedule management; team member coordination and communication; progress reporting, both internal and to NASA; performance measurement; and resource management. This discussion should include all phases of the mission including preliminary analysis, technical definition, the design and development, and operations phases, along with the expected products and results from each phase. Describe the systems engineering approach that will be utilized in the definition, flowdown, tracking, and verification of design requirements, resource allocation and control, interface requirements and configuration and software configuration control. Unique tools, processes, or methods which will be used by the investigation team should be clearly identified and their benefits discussed. All project elements should be covered to assure a clear understanding of project-wide implementation.

3. NEPA Compliance and Approval. If an RPS is proposed, then two separate, yet related, processes of NEPA Compliance and Launch Approval shall be discussed. The requirement to launch a plutonium-fuel RPS shall be incorporated in this discussion. A clear understanding of each process shall be presented, including the necessary documents to be prepared, reviews to be conducted, timing of the key process milestones, and identification of responsible agencies and organizations. Any project-unique risks posed by the investigation's implementation approach (e.g., a new ELV, use of kick stages, etc.) must be identified. A proposed schedule, including all key milestones, shall be presented. Any exceptions to traditional NEPA/Launch Approval milestone scheduling required to match the schedules to the investigation's implementation constraints shall be noted.

4. Schedules. A detailed project schedule with the critical path(s) clearly delineated is required. The schedule and workflow for the complete mission life cycle must be clearly defined, and the method and tools to be used for internal review, control, and direction discussed. Schedules for all major activities, interdependencies between major items, deliveries of end items, critical paths, schedule margins, and long-lead procurement needs (defined as hardware and software procurements required before the start of Phase C/D) should be clearly identified and discussed. Any essential technology developments as well as major Engineering Test Units should be included. Provide a level 2 software build and delivery schedule that clearly indicates the relationship of the deliveries to the system integration and test activities from the start of test bed level testing all the way through final spacecraft level tests prior to launch. This should be accompanied by a listing of the functions contained in each build. Schedules are to be provided in MS Project format.

5. Risk Management. This section should describe the approach to, and plans for, risk management to be taken by the team, both in the overall mission design and in the individual systems and subsystems. Plans for using standard risk management tools for both hardware and software, especially fault tree analysis, probabilistic risk assessments, and failure modes and effects analyses, should be described. The role of the Project Systems Engineer in risk management should be discussed. Particular emphasis should be placed on describing how the various elements of risk, including new technologies used, will be managed to ensure successful accomplishment of the mission within cost and schedule constraints. Investigations dependent on new technology will be penalized for risk if adequate plans to ensure success of the investigation are not described. At least the top 3 risks and their mitigation plans should be discussed.

   A summary of reserves in cost and schedule should be identified by Phase and project element and year and the rationale for them discussed. The specific means by which integrated costs, schedule, and technical performance will be tracked and managed should be defined. Specific reserves and the timing of their application should be described. Management of the reserves and margins, including who in the management organization manages the reserves and when and how the reserves are released, should be discussed. This should include the strategy for maintaining reserves as a function of cost-to-completion. All funded schedule margins should be identified. The relationship between the use of such reserves, margins, potential descope options, and their effect on cost, schedule, and performance should be fully discussed. When considering potential descope options, consider the investigation as a total system including instrument(s), spacecraft, ground system, launch services, and operations.

6. Government Furnished Property, Services, Facilities, etc. This section should clearly delineate the Government-furnished property, services, facilities, etc. required to accomplish all phases of the mission.

7. Reviews. This section should list the major project reviews expected to be conducted during the project's life cycle and the approximate time frame of each. The objective of each review should be indicated. Allowance should also be made for government-initiated reviews including Confirmation Assessments, as well as Independent Assessment Reviews, to be conducted on an approximate annual basis. The NFPO will plan to conduct these reviews in conjunction with planned Project reviews (e.g., PDR, Critical Design Review (CDR), etc.). It should be noted that regular reviews of the progress of the E/PO component of the missions should be held in the same way that progress on the scientific and technical aspects are reviewed.

8. Reporting. This section should clearly describe the approach to reporting progress to the Government and indicate the progress reviews the Government should attend

to provide independent oversight. The process, including the individual or organization responsible for reporting integrated cost, schedule, and technical performance should be discussed. Planned project status reporting should include inputs to the monthly presentations to the governing Program Management Council (PMC), monthly status reporting to the NFPO, and, after the Project CDR, a brief weekly summary of progress via a web-based NASA Office of Science reporting site.

9. Software IV&V. This section should describe the plan to comply with NPG 7120.5B and NPD 8730.4 for software IV&V. Discussion of the plan to task the NASA IV&V Facility in Fairmont, West Virginia to manage the conduct of IV&V for appropriate project-produced flight and ground software is required.

H. EDUCATION/PUBLIC OUTREACH PLAN

This section should build upon and extend the discussion of E/PO activities given in the proposal. As noted earlier in these guidelines, the concept study E/PO plans are to be substantially refined and expanded beyond the level of detail contained in the original proposal.

The plan must describe how the project's E/PO activities will meet the requirements set forth in section 5.6 of the AO and be responsive to the E/PO evaluation criteria outlined in the Explanatory Guide to the NASA OSS E/PO Evaluation Criteria (March 2004). Particular attention should be directed to appropriate alignment with education standards and teacher professional development (http://stills.nap.edu/html/nses/4.html).

The E/PO Plan section shall also include:

- Phased schedule for execution of the E/PO program;
- A time phased E/PO budget including potential leveraging of other resources and cost sharing. The budget and supporting narrative justification should include a breakdown of individual personnel costs, associated time commitments and benefits, travel, equipment, supplies, subcontracts, consultants, facilities and administrative costs, and any other applicable costs.

Items are to be defined in sufficient detail that they can be evaluated at an appropriate level of depth. Where appropriate, references should be made to the Management Plan and other relevant sections for information on how the work is to be arranged, directed, implemented, reviewed, and reported. Letters of support/commitment from partners and subcontractors, and resumes from key E/PO personnel should be included as appendices to the CSR.

I. TECHNICAL DEFINITION (PHASE B) PLAN

This section should describe the plans and products for the technical definition phase (Phase B) of the Project. This section should identify the key mission tradeoffs and options to be investigated during Phase B and should identify those issues, technologies, and decision points critical to mission success – including acquisition of long-lead items and the associated funding requirements. These plans should include a detailed schedule and define the products (including a Project Plan) and the schedule for their delivery.

J. COST PLAN FOR MISSION PHASES A THROUGH F

The CSR cost proposal should provide information on the anticipated costs for all appropriate mission phases for the preferred baseline launch date. A detailed cost proposal is required for Phase B. Cost estimates are required for the follow-on phases (C/D, E, and, if applicable, Phase F), including a description of the estimating techniques used to develop the cost estimates. (Specific information that would better enable NASA to validate costs (e.g., WBS level 3 data) may be provided as an appendix - see Section K). A discussion of the basis of estimate should be provided with a discussion of heritage and commonality with other programs. Quantify and explain any cost savings that result from heritage. All

costs, including all contributions made to the investigation, should be included. Full cost accounting for NASA facilities and personnel proposed must be submitted as directed in section 5 of the AO. Proposers should complete a summary of total mission cost by fiscal year as shown in Figure 1**,** Total Mission Cost Funding Profile. The purpose of this summary is to (1) provide detailed insight into project costs by cost element and (2) provide a basis for comparison of the project proposed cost with the evaluation team's independent cost analysis. It presents all costs for the project *on one page*, by project phase (A through F), by participating organization, and by fiscal year. If obligation authority in excess of identified costs is required, the proposal must also indicate the authority needed by year.

In addition, for each phase of the investigation (A, B, C/D, E, and F) a Time-Phased Cost Breakdown for each WBS element, as shown in Figure 2, should be completed. Use only the line items shown in Figure 2 that are relevant for each phase of the project. The purpose of this set of Figures is to provide detailed insight into how the project allocates funding during each phase of work.

Identify each reserve amount to the lowest level consistent with the proposed reserve management strategy. For example, if each subsystem manager will have spending authority over a reserve for the subsystem, each such amount should be identified separately. If more convenient, the reserve details may be shown in a separate table, with totals reported as shown in Figure 1. Show costs for all development elements by recurring and non-recurring components in the format of Figure 3. Show costs (NASA Office of Science and contributed) associated with each Co-I in the format of Figure 4.

Proposers should include all contributions provided by non-Office of Science NASA Centers, including Civil Servant services, as well as the cost for the use of Government facilities and equipment on a full-cost accounting basis. All direct and indirect costs associated with the work performed at NASA Centers should be fully costed and accounted for in the proposal and summarized using the template provided in Figure 5. The purpose of this data is twofold: 1) to determine those costs that are included in the NASA Office of Science cost but are not funded out of the New Frontiers program, and 2) to determine civil service contributions that are not included in the NASA Office of Science cost. Teams should work with their respective NASA Centers to develop estimates for these costs.

Note that the definitions for cost element terms shown in the cost figures are provided in the *Program Cost Elements* document in the NFPL.

The inflation index provided in Appendix B (Table B3) of the AO should be used to convert between real-year and fixed year dollar amounts, unless an industry forward pricing rate is used. If something other than the provided inflation index is used, the basis for the rate used must be described.

All costs shall include all burdens and profit/fee in real-year dollars by fiscal year, assuming the inflation rates used by NASA (provided above) or specifically identified industry forward pricing rates.

1. Cost Proposal for Phase B. This section provides a detailed cost proposal for performing the Phase B study. Detailed plans for the study should be described, but reference may be made to the Technical Approach and Management sections of the proposal, as appropriate.

    a. Contract Pricing Proposal. Cost or pricing data is required for Phase B. Completed cost or pricing data must be included with the CSR proposal for each organization participating in the Phase B study and must be signed by each organization's authorized representative. This requirement may be satisfied with one form provided that all institutions involved in the Phase B study are included with the appropriate signatures. The contract pricing proposal for Phase B may be provided as an appendix (see section K).

    b. Work Breakdown Structure. A WBS should be included for Phase B. The structure of the WBS should be consistent with the plans set forth in the Technical Approach and Management sections of the proposal and the Statement of Work provided as an Appendix to the proposal.

    c. Workforce Staffing Plan. Provide a workforce-staffing plan that is consistent with the WBS. This workforce-staffing plan should include all team member organizations and should cover all management, technical (scientific and engineering), and support staff. The workforce-staffing plan should be phased by month. Time commitments for the PI, PM, Deputy PM, and other key personnel should be clearly shown.

    d. Proposal Pricing Technique. Describe the process and techniques used to develop the Phase B cost proposal. Provide a description of the cost-estimating model(s) and techniques used in the Phase B cost estimate. Discuss the heritage of the models and/or techniques applied to this estimate, including any known differences between missions contained in the model's data base and key attributes of the proposed mission. Include the assumptions used as the basis for the Phase B cost and identify those which are critical to cost sensitivity in the investigation. Identify any "discounts" assumed in the cost estimates for business practice initiatives or streamlined technical approaches. Describe how these have been incorporated in the cost estimate and will be managed by the investigation team.

    e. Phase B Time-Phased Cost Summary. Provide a summary of the total Phase B costs consistent with Figure 2. Phase B costs also appear in Figure 1, and in Figure 3 if development work is planned during Phase B. The Phase B cost summary should be developed consistent with the WBS and should include all

costs to NASA along with all contributed costs. The Phase B time-phased cost summary should be phased by month.

f. Cost Elements Breakdown. To effectively evaluate the Phase B cost proposals, NASA requires costs and supporting evidence stating the basis for the estimated costs. The proposal will include, but is not limited to:

i. Direct Labor.

(1) Explain the basis of labor-hour estimates for each of the labor classifications.

(2) State the number of productive work-hours per month.

(3) Provide a schedule of the direct labor rates used in the proposal. Discuss the basis for developing the proposed direct labor rates for the team member organizations involved; the forward-pricing method (including midpoint, escalation factors, anticipated impact of future union contracts, etc.); and elements included in the rates, such as overtime, shift differential, incentives, allowances, etc.

(4) If available, submit evidence of Government approval of direct labor rates for proposal purposes for each labor classification for the proposed performance period.

ii. Direct Material. Submit a summary of material and parts costs for each element of the WBS.

iii. Subcontracts. Identify fully each effort (task, item, etc. by WBS element) to be subcontracted, and list the selected or potential subcontractors, locations, amount budgeted/proposed and types of contracts. Explain the adjustments, if any, and the indirect rates (or burdens) applied to the subcontractors' proposed amounts anticipated. Describe fully the cost analysis or price analysis and the negotiations conducted regarding the proposed subcontracts.

iv. Other Direct Costs.

(1) Travel, Relocation, and Related Costs. Provide a summary of the travel and relocation costs including the number of trips, duration, and purpose of the trips.

(2) Computer. Provide a summary of all unique computer-related costs.

(3) Consultants. Indicate the specific task area or problem requiring consultant services. Identify the proposed consultants, and state the quoted daily rate, the estimated number of days and associated costs (such as travel), if any. State whether the consultant has been compensated at the quoted rate for similar services performed in connection with Government contracts.

(4) Other. Explain and support any other direct costs included in the Phase B proposal in a manner similar to that described above.

v. Indirect Costs.

(1) List all indirect expense rates for the team member organizations. Indirect expense rates (in the context of this AO) include labor

overhead, material overhead, General and Administrative (G&A) expenses, and any other cost proposed as an allocation to the proposed direct costs.

(2) If the proposal includes support services for which off-site burden rates are used, provide a schedule of the off-site burden rates. Include a copy of the company policy regarding off-site vs. on-site effort.

(3) If available, submit evidence of Government approval of any/all projected indirect rates for the proposed period of performance. Indicate the status of rate negotiations with the cognizant Government agency, and provide a comparative listing of approved bidding rates and negotiated actual rates for the past five (5) fiscal years.

(4) Discuss the fee arrangements for the major team partners.

2. Cost Estimate for Phase C/D. This section provides a cost estimate for performing the Design/Development Phase (Phase C/D) portion of the mission. The Phase C/D cost estimates should correlate with the plans set forth in the Science, Technical Approach, and Management sections of the proposal. In completing this section, the following guidelines will apply:

   a. Work Breakdown Structure. A WBS should be included for Phase C/D. The WBS shall be described to the subsystem level (i.e., Attitude Control System, Propulsion System, Structure and Mechanisms, etc.) for the spacecraft and to the instrument level for the payload. All other elements of the WBS should be to the major task level (Project Management, Systems Engineering, Ground Support Equipment, E/PO, etc.).

   b. Cost Estimating Technique. Describe the process and techniques used to develop the Phase C/D cost estimate. Provide a description of the cost-estimating model(s) and techniques used in the Phase C/D cost estimate. Discuss the heritage of the models applied to this estimate including any known differences between missions contained in the model's data base and key attributes of the proposed mission. Include the assumptions used as the basis for the Phase C/D cost and identify those that are critical to the cost sensitivity in the investigation. Identify any "discounts" assumed in the cost estimates for business practice initiatives or streamlined technical approaches and the basis for these discounts. Describe how these have been incorporated in the cost estimate and will be managed by the investigation team.

   c. Workforce Staffing Plan. Provide a workforce-staffing plan (including civil service) which is consistent with WBS. This workforce-staffing plan should include all team member organizations and should cover all management, manufacturing, technical (scientific and engineering), E/PO, and support staff.

The workforce-staffing plan should be phased by fiscal year. Time commitments for the PI, PM, and other key personnel should be clearly shown.

d. Phase C/D Time-Phased Cost Summary. Provide a summary of the total Phase C/D costs consistent with Figure 2. The Phase C/D cost summary should be developed consistent with the WBS and should include all costs to NASA, along with all contributed costs. The Phase C/D time-phased cost summary should be phased by fiscal year. Also report Phase C/D costs in Figures 3 and 4. Phase C/D extends 30 days beyond launch so be sure to account for all costs for this period, including tracking support and mission operations.

3. Cost Estimate for Phase E. This section provides a cost estimate for performing the Mission Operations for Phase E including E/PO. In completing this section, the guidelines for Phase C/D apply. Proposers may refer to the information provided in *NASA's Mission Operations and Communications Services* document in the NFPL for mission operations and communications costs, if NASA systems are proposed. Since the best possible cost estimates are desired, the contacts listed in the subject document should be consulted to assure accuracy as well as credibility.

4. Cost Estimate for Any PSP/DAP/Phase F. Provide a cost estimate for any PSP, DAP, or Phase F in this section. Such costs are included within the cost cap.

5. Cost Estimate for E/PO. This section should summarize the estimated costs to be incurred in Phases A through E of the investigation for the E/PO component. This summary should be consistent with and relate directly to the top-level E/PO budget lines in Figures 1-6 as appropriate and describe how these costs relate to the activities, products, programs, partnership arrangements, etc., defined in Section H.

6. Cost Estimate for Total Mission. This section should summarize the estimated costs to be incurred in Phases A through E including: Concept Study (Phase A), Technical Definition (Phase B); Design and Development Phase (Phase C/D); Mission Operations and Data Analysis Phase (Phase E); ELV, upper stages, and launch services; DSN and other ground system costs; and cost of activities associated for social or educational benefits (if not incorporated in any of Phases A through E). Figure 1 should be used to summarize these costs. The total mission cost estimate should be developed consistent with the WBS. Detailed plans for any aspects of the mission not discussed elsewhere in the CSR should be discussed here. The funding profile should be optimized for the mission. Contributions not included in the NASA Office of Science cost should be clearly identified as separate line items.

Note that immediately following downselection, NASA will award a letter contract based upon the detailed estimated costs for Phase B and will request a formal cost proposal with detailed cost information for the subsequent mission phases. The contractor will be requested to submit a formal cost proposal based upon the Federal Acquisition Regulation

(FAR) Part 15. The instructions and format for submission of this proposal are found in FAR Part 15.403-5 and Table 15.2. It is essential that the cost elements proposed in the formal contract proposal for contract award be traceable to the cost proposal provided in the CSR. Any changes in costs from the Concept Study proposal should be described in detail. The definitized contract will include an option provision for Phase C/D and E with a not-to-exceed amount for each phase.

Figure 1
TOTAL MISSION COST FUNDING
FY Costs in Real Year Dollars (to Nearest Thousand), Totals in RY and Fixed Year '03 Dollars

			SUBTOTAL					SUBTOTAL		TOTAL	
	Formulation		*Formulation*[1]		*Implementation*			*Implementation*[1]		*Life Cycle*	
Cost Element[2]	FY1	FYx	RY $	FY04$	FY1	É	FYz	RY $	FY04$	RY $	FY03$
Start to Launch + 30 Days (Phases A/B/C/D)	**Enter each cost element**										
Phase A Concept Study											
Proj. Mgmt/Miss. Analysis/Sys. Eng.											
Instrument A											
Instrument B											
Instrument É											
Instr. Integration, Assembly and Test											
Subtotal - Instruments											
Spacecraft bus											
S/C Integration, Assembly and Test											
Other Hardware Elements[3]											
Launch Ops (Launch +30 days)											
Subtotal - Spacecraft											
Science Team Support											
Pre-Launch GDS/MOS Development											
DSN/Tracking											
Other[4]											
Subtotal Phases A-D before Reserves											
Instrument Reserves											
Spacecraft Reserves											
Other Reserves											
Total Phases A/B/C/D											
Launch + 30 Days to End of Mission (Phase E)	**Enter each cost element**										
Mission Operations & Data Analysis (including Project Management)											
DSN/Tracking											
Other[4]											
Subtotal Phase E before Reserves											
Phase E Reserves											
Total Phase E											
Launch Services											
Phase F (Extended Mission) if applicable											
Total NASA Office of Science Cost											
Contributions[4]											
Total Contributions											
Total Mission Cost = →											

1. Formulation = Phase A + B; Implementation = Phase C + D + E
2. See ***Program Cost Elements*** document in Program Library
3. Other Hardware Elements: Probes, Sample Return Canister, etc.
4. Specify each item on a separate line; include Education & Public Outreach, facilities, etc.

Figure 2

TIME PHASED COST BREAKDOWN BY WBS AND MAJOR COST CATEGORY (Phased Costs in Real Year Dollars, Totals in Real Year and FY 2003 Dollars)					
WBS/Cost Category Description	FY1	FY2	• • •	Total (RY$)	Total (FY 2003$)
Total Direct Labor Cost	$	$	$	$	$
WBS 1.0 Management					
WBS 2.0 Spacecraft					
WBS 2.1 Structures & Mechanisms					
WBS 2.2 Propulsion					
etc.					
Total Subcontract Costs	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Materials & Equipment Cost	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Reserves	$	$	$	$	$
WBS # and Description					
:					
etc.					
Total Other Costs	$	$	$	$	$
WBS # and Description					
:					
etc.					
Fee					
E/PO, Other (Specify)					
Total Contract Cost	$	$	$	$	$
Total Other Costs to NASA Office of Science	$	$	$	$	$
Launch Services					
Ground Segment					
E/PO, Other (Specify)					
Total Contributions (Non-U.S. or U.S.)	$	$	$	$	$
Organization A:					
WBS # and Description					
etc.					
Organization B:					
WBS # and Description					
etc.					
Total Cost for Phase	$	$	$	$	$

Figure 3

PHASE C/D DEVELOPMENT COSTS
(Real Year Dollars to Nearest Thousand)

Cost Element	Non-Recurring	Recurring	Total (RY$)	Total (FY 2003$)
Instrument A*				
Instrument B*				
Instrument n*				
Subtotal - Instruments				
Structure and Mechanisms				
Attitude Control				
Power				
Subsystem n				
Subtotal - Spacecraft Bus				
Any other elements (specify)*				
Subtotal - Other elements				
Total NASA Office of Science Development Cost				

*Other elements: probes, sample return canister, etc. Specify each instrument by subsystem/components where possible.

Figure 4

CO-INVESTIGATOR COMMITMENT AND COST FUNDING PROFILE TEMPLATE

(FY Costs in Real Year Dollars, Totals in Real Year and FY 2003 Dollars)

	Phase B	Phase C/D	Phase E	Total (Real Year)	Total (FY 2003)
NASA OSS Cost					
Co-I #1 Name/Organization					
Percent Time					
Cost					
Co-I #2 Name/Organization					
Percent Time					
Cost					
Co-I #n Name/Organization					
Percent Time					
Cost					
Total NASA Office of Science Co-I Cost					
Contributions					
Co-I #1 Name/Organization					
Percent Time					
Cost					
Co-I #2 Name/Organization					
Percent Time					
Cost					
Co-I #n Name/Organization					
Percent Time					
Cost					
Total Contributed Co-I Cost					

FIGURE 5

NASA CIVIL SERVICE COST FUNDING PROFILE TEMPLATE

(FY Costs in Real Year Dollars, Totals in Real Year and FY 2003 Dollars)

Item	FY1	FY2	FY3	FY4	FY5	FYn	...	Total (Real Yr.)	Total (FY 2003)
Workforce	$	$	$	$	$	$	$	$	$
- NASA Center A									
- NASA Center B									
- etc.									
Facilities	$	$	$	$	$	$	$	$	$
- NASA Center A									
E/PO, Other*	$	$	$	$	$	$	$	$	$
- NASA Center A									
NASA Civil Service Costs included in NASA Office of Science Cost	$	$	$	$	$	$	$	$	$
Contributions by NASA Centers									
Workforce	$	$	$	$	$	$	$	$	$
- NASA Center A									
- NASA Center B	$	$	$	$	$	$	$	$	$
- etc.	$	$	$	$	$	$	$	$	$
Facilities									
- NASA Center A									
E/PO, Other*									
- NASA Center A									
Contributed NASA Civil Service costs	$	$	$	$	$	$	$	$	$
						Mission Totals			$

*Specify each item on a separate line.

K. APPENDICES

The following additional information is required with the CSR. This information can be included as Appendices to the CSR, and, as such, will not be counted within the specified page limit.

1. Letters of Endorsement. Letters of endorsement must be provided from all U.S. and non-U.S. organizations offering critical facilities (*e.g.*, integration and test, thermal vacuum chambers, L-Tool, etc.), goods, hardware, software, and/or services (including those of Co-I's). This includes the JPL Interplanetary Network Directorate (for the DSN), the KSC ELV Support Office, subcontractors, and E/PO partners. These letters must provide evidence that the senior officials of the participating institutions and/or appropriate Government officials are aware and supportive of the proposed investigation, and will provide funding for their stated participation in the investigation if it is selected by NASA, and must be signed by officials authorized to commit those organizations as proposed. (See Section 5.9.3 of the AO for further details.)

2. Relevant Experience and Past Performance. Relevant experience and past performance (successes and failures) of the major team partners in meeting cost and schedule constraints in similar projects within the last 10 years should be discussed. A description of each project, its relevance to the proposed investigation, cost and schedule performance, and points of contact (including addresses and phone numbers) should be provided.

3. Resumes. Provide resumes for all key personnel identified in the Management section. Also provide resumes for key E/PO lead personnel. Include resume data on experience that relates to the job these personnel will be doing for the proposed investigation.

4. Statements of Work for each Contract Option. Provide draft Statement(s) of Work for all potential contracts with NASA. These Statement(s) of Work should (as a minimum) be for each contract option (i.e., Phase B, Phase C/D, and Phase E) and clearly define all proposed deliverables (including science data) for each option, potential requirements for Government facilities and/or Government services, and a proposed schedule for each option and the entire mission.

5. Mission Definition and Requirements Agreement. A Mission Definition and Requirements Agreement should be provided that defines the roles and responsibilities of the major implementing partners of the mission project. The agreement submitted must be signed by institutional officials who have the authority to make the institutional commitments defined. This multiparty agreement will be considered a draft that can be finalized with appropriate NASA signatures if the project is selected to proceed. The information contained in this document will be the primary source of top-level programmatic responsibilities and requirements (science requirements, mission/project requirements, schedule milestones, etc.) for the development of subsequent New

Frontiers program requirements documentation (e.g., Level I requirements, Project Plan, and Project Implementation Plan). An example of a Mission Definition and Requirements Agreement is provided in the NFPL.

6. Radioactive Power Sources Plan (as applicable). Use of radioactive sources of power will require additional environmental documentation [see National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq*.); Executive Order 12114 "Environmental Effects Abroad of Major Federal Actions"; Council on Environmental Quality Regulations (40 CFR Parts 1500-1508); and NASA policies and procedures at 14 CFR Subpart 1216.3]. In addition, documentation is required to support NASA's request for Nuclear Safety Launch Approval in accordance with Presidential Directive/National Security Council-25 (PD/NSC-25). Provide a detailed plan and schedule that outlines the approach for implementing these requirements.

7. Planetary Protection Approach. Early in the Phase A Concept Study, investigation teams are encouraged to work with NASA's Planetary Protection Officer to verify/determine the appropriate planetary protection category and any special considerations and/or study requirements that may exist. Provide an approach to planetary protection consistent with *NPG 8020.12B, Planetary Protection Provisions for Robotic Extraterrestrial Missions*, available through the NFPL. Outline any special requirements on personnel, instrumentation, spacecraft assembly, facilities, launch configuration, or mission operations.

8. Incentive Plan(s). Draft Incentive Plans (if applicable) should be included with the Concept Study. Incentive Plans should outline contractual incentive features for all major team members. Incentive Plans should include both performance and cost incentives, as appropriate.

9. NASA PI Proposing Teams (if applicable). The same guidelines as in AO Appendix B apply.

10. Technical Content of Any International Agreement(s). A brief description of the technical content of the contribution of each non-U.S. partner is required. This information should be of a form that will allow it to be easily incorporated into an International Agreement(s) by NASA.

11. Discussion on Compliance with U.S. Export Laws and Regulations. Provide an update to the discussion in the proposal. Investigations that include international participation, either through involvement of non-U.S. nationals and/or involvement of non-U.S. entities must include a section discussing compliance with U.S. export laws and regulations; e.g., 22 CFR 120-130, *et seq*. and 15 CFR 730-774, *et seq*., as applicable to the scenario surrounding the particular international participation. The discussion must describe in detail the proposed international participation and is to include, but not be limited to, whether or not the international participation may require the proposer to obtain the prior approval of the Department of State or the Department of Commerce

via a technical assistance agreement or an export license, or whether a license exemption/exception may apply. If prior approvals via licenses are necessary, discuss whether the license has been applied for or if not, the projected timing of the application and any implications for the schedule. Information regarding U.S. export regulations is available through Internet URLs http://www.pmdtc.org and http://www.bxa.doc.gov. Proposers are advised that under U.S. law and regulation, spacecraft and their specifically designed, modified or configured systems, components, parts, etc., such as the instrumentation being sought under this AO, are generally considered "Defense Articles" on the United States Munitions List and subject to the provisions of the International Traffic in Arms Regulations, 22 CFR 120-130, *et seq*.

12. Communications Link Budget Design Data. Include communications block diagram and link budget design control tables for all radio communications links (data and carrier) showing relevant spacecraft and earth station parameters and assumptions for the maximum distance and/or throughput at which each particular link could be used. With particularity, provide losses, loop bandwidths, coding, antenna gains, and such other parameters as are identified in the document *NASA's Mission Operations and Communication Services*, in the NFPL.

13. Cost and Pricing for Phase B Contract. To assure that the deliverables via the CSR facilitate a direct and easily implementable Phase B contract, proposers must provide cost and pricing data for Phase B which meet the requirements of the FAR Part 15 Table 15-2 (see the NFPL section on Directives and Procurement-related Information). This Phase B cost and pricing data is necessary and required to implement the contract. This data is ***in addition*** to the data provided in Cost figures 1-6 for evaluation purposes, allocates project costs per the cost categories defined in Table 15-2, but still align at the highest levels with the evaluation data. Also see Section J of Part II above for additional guidance.

14. Additional Cost Data to Assist Validation. In addition to the specific cost table data requested in the Cost Proposal, Section J, proposers should also provide any additional costing information/data which they feel will assist NASA to validate the project's proposed costs. Vendor quotes, cost estimates, rationale for design heritage cost savings, are all examples of data that can be included here. However, in specific, all costs to the lowest level of the proposer's WBS should be provided in Microsoft Excel format.

15. Science Change Matrix. Should the Phase A effort result in any science change (including a science implementation change) from that originally proposed, provide the new requirement, the old requirement, the rationale for the change, and the section/paragraph where the change occurs in the CSR.

16. Data Management Plan Approach. Although no Project Data Management Plan is required for delivery via the Concept Study, this plan will be required at PDR. In the CSR, however, proposers must discuss all plans (schedules, costs, and deliverables)

and their approach and commitment to delivering project data to the appropriate NASA data archives and indicate such in the plans and schedules for Phase B14. In addition, this discussion must provide assurance that that all activities (womb to tomb) have been considered and included with appropriate resources separately allocated and budgeted.

17. Project Plan Approach. Although the Project Plan is not required for delivery as part of the CSR, the CSR should indicate the approach to complete this activity prior to Confirmation to enter Phase C/D. The Project Plan, written according to NPG 7120.5B, is a required product for Confirmation.

18. Orbital Debris Analysis. No orbital debris analysis is required with the CSR, however, this analysis will be required for PDR and CDR per NPD 8710.3, NASA Policy for Limiting Orbital Debris Generation. This document can be found in the NODIS library via the NFPL.

19 References List (Optional). The Phase A CSR may provide, as an appendix, a list of reference documents and materials used in the Concept Study. The documents and materials themselves cannot be submitted, except as a part of the Concept Study.

20. Abbreviations/Acronyms List. To aid in the evaluation process, every abbreviation and acronym used in the CSR should be included in this table even if it has been defined at first usage in the Report.