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OFFICE OF EARTH SCIENCE  
GUIDELINES FOR CONCEPT STUDY REPORT PREPARATION

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University Earth System Science Concept Study Report Guidelines



**Introduction**

As described in the University Earth System Science (UnESS) Project Announcement of Opportunity (AO 99-OES-02), NASA intends to select six proposals to conduct nine-month Concept Studies. At the end of this nine month period, NASA will conduct a Downselect Process to select nominally two of these mission concepts for implementation and flight. NASA's intent for these concept studies is to provide your mission team the funding and additional time you need to better define the proposed investigation and its implementation, requirements and risks. At the end of the nine-month study period, NASA requires that you submit a Concept Study Report and provide a briefing to the evaluation team. NASA will base the evaluation for the NASA Downselect Process on your report and briefing. If there are any discrepancies between the report and the briefing material, NASA will give precedence to the report.

This document, *Guidelines for Concept Study Report Preparation*, defines the requirements for your report. NASA will provide to the Principal Investigators selected for concept study funding any revisions or updates to these guidelines at notification of selection or before initiation of the concept studies at the Downselect Kickoff Meeting.

NASA is providing relevant documents and Internet links through the University Earth System Science (UnESS) Project Library, available at uniform resource locator (URL) <http://uness.larc.nasa.gov/uness/unesslib.html> on the World Wide Web. This document itself is item number 17 in the UnESS Library. The specific documents mentioned in these study guidelines, most of which are available through the Library, are:

- **University Earth System Science (UnESS) Project Announcement of Opportunity (AO-99-OES-02)**, URL <http://uness.larc.nasa.gov/uness/ao/index.htm> (also available in other file formats through URL <http://uness.larc.nasa.gov/uness/>)
- **1999 UNITED STATES DEPARTMENT OF EDUCATION ACCREDITED POSTSECONDARY MINORITY INSTITUTIONS**, Library item 51, URL <http://www.ed.gov/offices/OCR/99minin.html>
- **Fact Sheet - Statement on National Space Transportation Policy**, Not currently listed in the UnESS Library, URL <http://www.whitehouse.gov/WH/EOP/OSTP/other/launchstfs.html>
- **Earth Science Integrated Technology Strategy**, Library item 15, link not provided on library page (need to fix) but available in PDF at URL [http://www.earth.nasa.gov/visions/ese\\_tech.pdf](http://www.earth.nasa.gov/visions/ese_tech.pdf)
- **NASA Technology Plan**, Library item 2, URL <http://technologyplan.nasa.gov/>
- **Earth Explorers Program Mission Assurance Guidelines and Requirements**, Library item 56, URL [http://uness.larc.nasa.gov/uness/Earth\\_Exp\\_Mission\\_Assu.pdf](http://uness.larc.nasa.gov/uness/Earth_Exp_Mission_Assu.pdf)
- **Earth Explorers Program Flight & Ground Safety Requirements**, Library item 68, URL [http://uness.larc.nasa.gov/uness/Earth\\_Exp\\_Safety\\_Req.pdf](http://uness.larc.nasa.gov/uness/Earth_Exp_Safety_Req.pdf)
- **ESE Educational Strategy Plan**, Library item 23, URL <http://www.earth.nasa.gov/education/edstratplan/index.html>

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- *NASA's Mission Operations and Communications Services (SOMO)*, Library item 44, available in PDF at URL [http://essp.gsfc.nasa.gov/essplib/pdf/SOMO\\_Prices.essp.pdf](http://essp.gsfc.nasa.gov/essplib/pdf/SOMO_Prices.essp.pdf) (IS ANYONE OTHER THAN ME CONCERNED THAT THIS DOCUMENT IS FROM 1998 AND WAS ONLY INTENDED FOR THE ESSP AO?)
- *Mission Definition and Requirements Agreement - Example*, Library item 46, URL <http://uness.larc.nasa.gov/uness/appendixd.html>
- *Elements to be Included in Arrangements between U.S. Principal Investigators and Cooperating Foreign Parties Under the ESSP Program*, Library item 47, URL <http://uness.larc.nasa.gov/uness/appendixf.html>

NASA will use the same evaluation criteria to evaluate the Concept Study Reports for the Downselect Process as was used for the initial proposal evaluation. Therefore, you should refer to the evaluation criteria in the AO to ensure that your report addresses all of the factors identified in the evaluation. In addition, the AO, particularly Appendices C and D, may provide additional insight and examples that may be useful to the your team. For a complete discussion of the Downselect Process and Considerations, see the AO.

For purposes of these guidelines, mission phases are defined as follows:

- Phase 1: Mission Concept Studies
- Phase 2: Mission Definition and Preliminary Design
- Phase 3: Mission Detailed Design
- Phase 4: Mission Development and Launch
- Phase 5: Mission Operations, Data Analysis, Archival, and Dissemination

The required uniform Concept Study Report formats and contents are summarized in the following sections. Failure to follow this outline may result in reduced ratings during the downselect evaluation process and could lead to the investigation not being selected for development and flight.

The Concept Study Report shall contain the following:

- A. Cover page
- B. Endorsements
- C. Table of Contents
- D. Section 1.0 Executive Summary (clearly identify changes from proposal and the resolution of weaknesses and issues identified in the proposal evaluation. Include the Investigation Summary Forms I and II from the AO);
- E. Section 2.0 Science/Applications Investigation (clearly identify changes from proposal);
- F. Section 3.0 Student Involvement Investigation Description (clearly identify changes from proposal);
- G. Section 4.0 Technical Implementation
- H. Section 5.0 Management;
- I. Section 6.0 Other Opportunities;
- J. Section 7.0 Mission Definition and Preliminary Design Study Plan;
- K. Section 8.0 Cost and Cost Estimating Methodology;
- L. Appendices.

If you have made changes to any data provided with the original proposal as a result of the concept study, you must clearly identify and explain these changes from the proposal in your study report. The subsequent paragraphs discuss the required content of each section

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in your report. Please note that all program requirements, constraints, and guidelines, given in the AO are still valid for the Concept Study Report and you should discuss them in your report. Pertinent portions of all other AO sections and appendices are also valid.

The Office of Earth Science is committed to meaningful participation of Historically Black Colleges and Universities (HBCU), Other Minority Universities (OMU) including Hispanic serving institutions and Tribal colleges and universities, and under-represented students in non-HBCUs/OMUs. This commitment includes participation in both the scientific and student involvement aspects of its programs and missions. The list of U.S. accredited post secondary minority institutions can be found at the Internet address.

**Table 1 – Page Limit Guidelines**

Section	Page Limit
Cover Page Endorsements Table of Contents	no page limit
1.0 Executive Summary (clearly identify changes from the proposal and the resolution of weaknesses and issues identified in the proposal evaluation. Include the Investigative Summary Forms I and II)	25 pages
2.0 Science/Application Investigation 3.0 Student Involvement Investigation Description 4.0 Technical Implementation 5.0 Management 6.0 Other Opportunities 7.0 Mission Definition and Preliminary Design Study Plan	100 pages
8.0 Cost and Cost Estimating Methodology	No page limit, but data presented in formats described must be included
Appendices (No other appendices permitted) A. Resumes B. Letters of Endorsement C. Mission Definition and Requirements Agreement D. Certifications E. Statement(s) of Work for Each Contract Option F. Incentive Plan(s) G. Relevant Experience and Past Performance H. International Agreement(s) I. Mission Assurance Plan J. Flight and Ground Safety Plan K. Compliance Matrix L. Office of Equal Opportunity Programs Minority University Research and Education Programs Funding Accomplishments (required only if NASA provided this funding) M. Additional Cost Data (Optional) N. Reference List (Optional) O. Acronyms List (Optional)	No page limit, but small size encouraged

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NASA has limited the number of pages for the main sections of the report to 125 pages, with a maximum of seven foldout pages (28 x 43 cm; i.e., 11 x 17 inches). Table 1 identifies the sections to which these page limits apply. Any pages in excess of these limits may be discarded without review.

Provide to NASA ten copies of the report bound in loose-leaf binders. Also provide one set of diskettes containing electronic versions of your report on DOS-compatible (version 5.0 or higher), high density (1.44 megabytes) 3-1/2" diskettes or 100 megabyte Iomega ZIP disks formatted for IBM-compatibles. Provide all text portions of the report in Microsoft Word for Windows format (version 6.0 or earlier) and in ASCII (DOS) format on separate diskettes. Check the diskettes for computer viruses before submission. Provide a brief description explaining the diskette file structure, naming conventions, and other information that you feel may help NASA to use these files. Include the name and version of the software used to check the diskettes for computer viruses. This description does not count toward the report pages limits, and you need submit only one copy.

If you like, you need only provide the text portion plus table and figure portions on diskettes. You do not need to include material of an essentially graphic nature. If you find it necessary to segment your report on multiple diskettes either because of diskette space or other limitations, the files should be as large as possible and have a logical relationship to the report structure. Do not include information on the diskettes that you did not include in the paper volume of the report. If NASA finds that the diskettes include information that differs from the paper volume or if they are defective (e.g., non-readable) NASA will return the diskettes

### A COVER PAGE

NASA will not count the cover page against the page limit. The Principal Investigator and an official by title of the investigator's organization that is authorized to commit the organization must sign this page. Include the full names of the Principal Investigator and the authorizing official, their addresses with zip codes, telephone and fax numbers, and electronic mail addresses.

### B ENDORSEMENTS

Include endorsements for all co-investigators, lead team members, contributors, and non-U.S. participants. NASA will not count these pages against the page limit. Include with the endorsements the named individual's signature, full name, address with zip code, telephone and fax numbers, and electronic mail address.

You must document that the institutions and/or governments involved endorse any participation by non-U.S. individuals and/or institutions as team members or contributors to your investigation. NASA requires institutional endorsements for all contributions. If you require government support then you need a government endorsement specifying the support that is to be provided (this includes Civil Service labor, government laboratory and testing facilities, and government spacecraft command and communications facilities, etc.). The letters of endorsement (to be included as Appendix B) must provide evidence that the non-U.S. institution and/or government officials are aware and supportive of your investigation and will pursue funding for the investigation if selected by NASA. You must submit such endorsements per the schedule in the AO and in compliance with the provisions of the AO's International Participation Section.

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### C TABLE OF CONTENTS

Include a table of contents in the Concept Study Report, which NASA will not count against the page limit. Parallel the outlines provided in Table 1 and Sections D through M below in this table of contents.

### D EXECUTIVE SUMMARY

NASA has limited the executive summary (Section 1.0 of Concept Study Report) to 25 pages. Provide in this section an overview of the investigation, including its scientific/applications goals and theme; scientific/applications and student involvement discussion, technical implementation discussion; management plans; other opportunity plans; and, cost and cost estimating methodology. Clearly identify any changes to the mission, individual instruments or their performance since submission of the proposal. Also clearly address the resolution of weaknesses and issues identified in the proposal evaluation, either in the Executive Summary, or by clearly identifying where in the body of the report these weaknesses and issues are addressed. Include in this executive summary the Investigation Summary Forms I and II as provided in the proposal.

### E SCIENCE/ APPLICATIONS INVESTIGATION

Describe in this section (Section 2.0 of Concept Study Report) the science/application aspects of the investigation resulting from the concept study. Discuss and clearly identify (e.g., highlighted in bold or column marking for easy identification) any descopeing of, or changes to, the investigation defined in the original proposal, including the rationale for the changes. If there are no changes, repeat this section identically from the proposal.

Give special attention to assuring that both the planning and resources described in the report are adequate to analyze, interpret, archive and distribute all the data produced by the investigation to the scientific community. Specifically identify the resources you require including the costs, schedule, and man-hours for scientific interpretation of the results of the investigation and their publication. Modifications of Science Investigation Description and other applicable sections to assure adequacy of these requirements are both warranted and expected.

### F STUDENT INVOLVEMENT INVESTIGATION DESCRIPTION

Describe in this section (Section 3.0 of Concept Study Report) the student involvement aspects of the investigation resulting from the concept study. Discuss and clearly identify (e.g., highlighted in bold or column marking for easy identification) any descopeing of, or changes to, the investigation defined in the original proposal, including the rationale for the changes. If there are no changes, repeat this section identically from the proposal.

Give special attention to assuring that both the planning and resources identified in Concept Study are adequate to support significant and meaningful hands-on student involvement in all phases of your mission. Specifically identify the resources you require including costs, schedule, and man-hours. Modifications to the Student Involvement Investigation Description and other applicable sections to assure adequacy of these requirements are both warranted and expected. Discuss in detail all plans and required resources for the student involvement aspects of the investigation. *Mission teams should also comment on the concept of including non-*

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*science/engineering university schools (business, journalism, communications, education, graphic/fine art, law and etc.) in the mission and if this concept helps accomplish the goal of fostering the development of the next generation of Earth system scientists, engineers, managers, educators, and entrepreneurs.*

### G TECHNICAL IMPLEMENTATION

Detail in the Technical Implementation section (Section 4.0 of Concept Study Report) the method and procedures for investigation definition, design, development, integration, ground operations, and flight operations. Provide a discussion of all new technologies you will use for the investigation, including back-up plans with scheduled decision criteria for those technologies. Also detail the expected products and end items associated with each phase. Mission teams have the freedom to use their own processes, procedures, and methods. NASA encourages the use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives provided you can demonstrate in your report that they will result in cost, schedule, and technical improvements. Discuss the benefits of such processes and products. This section must be complete in itself without the need to request additional data, although you may avoid duplications by using references to other sections of the Concept Study Report if necessary. **Note that the definitions and specified parameters of technical data required below are defined as in the AO.**

#### *G.1 MISSION DESIGN*

Fully describe in this section the operational phase of the mission from launch to end of mission. Clearly identify any changes to the mission design since submission of the proposal. Include in this section information on the planned launch vehicle, trajectories, Delta-V requirements, and a preliminary mission timeline indicating periods of data acquisition, data downlink, etc. Describe in the mission design the communication networks you plan to use and the interface requirements, along with potential impacts or conflicts with other users of the selected communications resources. Describe any design trade studies conducted or planned.

Include a "traceability matrix" showing how your mission design complies with the stated objectives, requirements, and constraints of your investigation. Include the rationale for the selection of launch vehicle. Identify and discuss any innovative features of the mission design that minimize total mission costs.

#### *G.2 INSTRUMENT IMPLEMENTATION*

Describe in this section the science/ applications instrument (or instruments) for the investigation. Clearly describe any changes to the payload or individual instruments or their performance since submission of the proposal. Include information pertinent to the accommodation of the instrumentation on the spacecraft. Describe the subsystem characteristics and requirements including: mass, volume, and power requirements by subsystem; 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. Identify any design features incorporated to effect cost savings. Provide a summary of the resource elements of the instrument design concept, including key margins. Provide the rationale for margin allocation. Identify those design margins that are driving costs.

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### G.3 INSTRUMENT INTERFACE AND PAYLOAD INTEGRATION

Characterize in this section the interface between the instruments and the flight system. Clearly identify any changes to the payload integration interfaces and processes since submission of the proposal. These interface requirements 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 requirements, as well as the planned process for physically and analytically integrating them with the flight system. Discuss the testing strategy of the science/applications payload prior to integration with the spacecraft.

### G.4 SPACECRAFT

Describe in this section the spacecraft design approach, particularly as it relates to new versus existing hardware and redundant versus single-string hardware. Fully identify the spacecraft systems and describe their characteristics and requirements. Clearly identify any changes to the spacecraft or its performance since submission of the proposal. Include a description of the flight system design with a block diagram showing the flight element subsystems and their interfaces, 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. Describe the flight heritage or rationale you used to select the flight system and its subsystems, major assemblies, and interfaces. Address in your discussion of heritage two important issues: (1) prior flight experience or flight-qualified design of specific subsystem components, and; (2) overall subsystem design, whether new, modified, or exact repeat of a design flown previously. Discuss the design *process* you used: trade studies, simulations, technology development, engineering models, prototypes, etc. Quantify and explain in Section K (below) the cost savings that result from heritage you describe in this section, providing cross-references as needed.

Thoroughly describe the subsystem characteristics and requirements, including current best estimate and contingency for: mass, volume, and power requirements; pointing knowledge and accuracy; new developments needed; space qualification plan; and logistics support. These subsystems may include structural/mechanical, solar array/power supply (and batteries), electrical, thermal control, propulsion, communications, attitude control, command, and data handling, etc. Identify any design features incorporated to effect cost savings, specifying the benefits and identifying the enabling assumptions or risks. Provide a summary of the resource elements of the flight systems design concept including key margins. Provide the rationale for and derivation of margin allocations including mass, power, communication link, pointing accuracy, etc. Identify those design margins that are driving costs. Provide data in tables to show the current estimate of computer memory margin and computer processor utilization margin. Summarize in a Master Equipment List the component-level information for all hardware subsystems of the spacecraft, other hardware elements (e.g., probes, canisters, etc.), and instruments.

### G.5 LAUNCH SERVICE

Describe in this section your launch service selection. Identify the specific launch planned. If at the end of the Concept Study you cannot identify the specific launch, discuss the range of acceptable launch options, orbit parameters, and the likelihood that your mission will be able to find a ride in the timeframe identified in your

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report. If your investigation is a partial mission (that is, an instrument on another, host spacecraft), describe the plans for the host mission. Include information on the launch option margins and reserves (volume, mass, etc.).

The National Space Transportation Policy states: "For the foreseeable future, United States Government payloads will be launched on space launch vehicles manufactured in the United States, unless exempted by the President or his designated representative." The policy allows the exception: "This policy does not apply to use of foreign launch vehicles on a no-exchange-of-funds basis to support the following: flight of scientific instruments on foreign spacecraft, international scientific programs, or other cooperative government-to-government programs. Such use will be subject to interagency coordination procedures." This exemption may not apply to all contributions of foreign launch services, such as contributions from private or commercial entities that are not subject to interagency coordination procedures.

If your mission proposal requires NASA to consult with the Office of Science and Technology Policy regarding consistency with National Space Transportation Policy, the NASA Office of Earth Science will request that the NASA Office of Space Flight initiate formal coordination with the White House Office of Science and Technology Policy (OSTP) regarding the proposed mission concept. At the end of the study period, during the Downselect process evaluation, NASA will not select a mission without OSTP discussion being complete on or before the time of final selection. NASA cannot guarantee that OSTP concurrence will be provided for any given mission. In the event that a mission cannot be selected for implementation for this reason, the Government has no liability. The proposing team assumes the risk of submitting a proposal that is conditioned upon obtaining OSTP approval to use a foreign launch vehicle for NASA-funded payloads.

For more information on the National Space Transportation Policy, see the August 5, 1994 *Fact Sheet - Statement on National Space Transportation Policy*.

### *G.6 MANUFACTURING, INTEGRATION AND TEST*

Describe in this section the manufacturing strategy to produce, test, and verify the hardware/software necessary to accomplish the mission. Include a description of the main processes/procedures planned in the fabrication of flight hardware, software, production personnel resources, incorporation of new technology/materials, and the preliminary test and verification program. Clearly identify any changes to the manufacturing, integration and test processes or their performance since submission of the proposal. Discuss the planned environmental tests and specify the test margins and durations for the environmental test program. Define the part burn-in requirements that you will use for the program. Describe your approach for transitioning from design to manufacturing and specify the data products that you will use to assure producibility and adequate tooling availability.

Describe your planned approach, techniques, and facilities planned for integration, test and verification, and launch operations phases, consistent with your planned schedule and cost. Include a preliminary schedule for manufacturing, integration, and test activities. Include a description of the planned end items, including engineering and qualification hardware.

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### G.7 MISSION OPERATIONS, GROUND AND DATA SYSTEMS

Discuss in this section your requirements for mission operations and the ground operations support. Discuss the planned approach for managing mission operations and all flight operations support, including mission planning. Describe all inter-facility communications, computer security, tracking, or near real-time ground support requirements, and indicate any special equipment or skills required of ground personnel. Provide a staffing plan for both mission operations and payload operations. Clearly identify any changes to the mission operations, ground and data systems or their performance since submission of the proposal.

Describe your approach to developing the ground data system, including the use of existing facilities such as Government facilities. Explicitly describe all usage of the Tracking and Data Relay Satellite System (TDRSS). Adequately describe any mission-unique facilities. Include a block diagram of the Ground Data System (GDS) showing the end-to-end concept (acquisition through archiving) for operations and data flow to the subsystem level. Describe all communications, tracking, and ground support requirements. Describe the software design heritage and software development approach and its relationship to the flight system software development.

Identify any specific features incorporated into the flight and ground system design that lead to low-cost operation. Describe the use of any existing mission operations facilities and processes, as well as any new facilities that you require to meet the mission objectives.

### G.8 NEW TECHNOLOGIES AND OPEN TECHNICAL ISSUES

Identify and discuss in detail any new technology(s), technology development(s), or technology enhancement(s) that your investigation depends on, along with the risks involved and alternative approaches if the technologies are not ready for mission use. The scientific value of the mission can be intrinsic to the mission itself or based on the value of the technology demonstrated through the mission. However, you must discuss the value and justification to the four science questions. NASA encourages discussion of the plans for transferring these technologies to the private sector, including the non-aerospace sector. The *Office of Earth Science Integrated Technology Strategy* (<http://www.earth.nasa.gov/vision/index.html>) and the *NASA Technology Plan* (<http://actuva-www.larc.nasa.gov/techplan/>) describes the means by which NASA's Office of Earth Science plans to implement new technology.

## H MANAGEMENT

Set forth in this section (Section 5.0 of Concept Study Report) your approach for managing the work, identifying the essential management functions and the overall integration of these functions. Specifically discuss the decision-making process that the team will use, focusing particularly on the roles of the Principal Investigator and Project Manager in that process. Provide insight through your management plan into the organizations identified for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators. Identify the institutional commitment of all team members and the institutional roles and responsibilities. NASA encourages the use of innovative processes, techniques, and activities by mission teams in accomplishing their objectives; however, you should employ them only when you can demonstrate cost, schedule, or technical

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improvements and identify specific enabling assumptions. *In addition, each team should identify management processes and tools that may be useful to NASA in the management of its programs and projects.*

### *H.1 MANAGEMENT PROCESSES AND PLANS*

Describe in this section the management processes and plans that you need for the logical and timely pursuit of the work, and accompany this with a description of the work plan. Describe in this section your planned methods of hardware and software acquisition. Discuss your planned management processes, including the relationship between organizations and key personnel, 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. Include in this discussion 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. Clearly identify and discuss the benefits of unique tools, processes, or methods that will be used by the investigation team. Cover all project elements to assure a clear understanding of project-wide implementation. The team is strongly encouraged to make use of a project control tool, such as the JPL RecDel System, a low-cost, real-time, on-line management information system developed at the Jet Propulsion Laboratory for the Cassini Program. Such systems offer innovative, effective and low-cost approaches for project control utilizing Distributed Planning Processes. Details about the RecDel System are available at URL <https://RecDel.jpl.nasa.gov:2000/>

### *H.2 SCHEDULES*

Clearly define the schedule and workflow for the complete mission life cycle and discuss the method and tools you will use for internal review, control, and direction. Clearly identify the 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 procurements required before the start of mission detailed design, and mission development and launch phase).

### *H.3 TEAM ORGANIZATION, STRUCTURE, AND EXPERIENCE*

Describe in this section the roles, responsibilities, time commitment, and experience of all team member organizations and key personnel, placing particular emphasis on the responsibilities assigned to the Principal Investigator (PI), Co-Investigators (Co-Is), Project Manager, Systems Engineer, and other key personnel. In addition, indicate what percentage of time key personnel will devote to the mission, the duration of service, and how you will accommodate changes in personnel. Include the experience of the PI, Co-Is, and science team members as addressed in the original proposal.

- a. Organizational Structure. Describe the management organizational structure of the investigation team. Include the responsibilities of each team member organization and its contributions to the investigation. Describe each key position, including its roles and responsibilities, how each key position fits into the organization, and the basic qualifications required for each position. Include a discussion of the unique or proprietary capabilities that each member organization brings to the team, along with a description of the

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availability of personnel at each partner organization to meet staffing needs. Discuss the contractual and financial relationships between all team partners.

Summarize the relevant institutional experience in this section, and refer to supporting detail included in Appendix G: Relevant Experience and Past Performance. If experience for a partner is not equivalent to, or better than, the requirements for your mission, explain and justify your confidence that you can accomplish the mission 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. Discuss the role(s), responsibilities, and time commitment of the Principal Investigator. Provide a reference point of contact, including address and phone number.
  - ii. Co-Investigator(s). Discuss the role(s), responsibilities, and time commitment of the Co-Investigator(s). Co-Investigator(s) must have a defined and necessary role in the investigation that is covered in the funding plan. Provide a reference point of contact, including address and phone number.
  - iii. Project Manager. Discuss the role, responsibilities, time commitment, and experience of the Project Manager. Provide a reference point of contact, including address and phone number.
  - iv. Systems Engineer. Discuss the role, responsibilities, time commitment, and experience of the Systems Engineer. Provide a reference point of contact, including address and phone number.
  - v. Other Key Personnel. Describe the roles, responsibilities, time commitments, and experience of other key personnel in the investigation.

### *H.4 RISK MANAGEMENT*

Describe in this section the approach to and plans for risk management that the team will take, both in the overall mission design, technology development, and in the individual systems and subsystems. Place particular emphasis on describing how you will manage the various elements of risk, including new technologies used, to ensure successful accomplishment of the mission within cost and schedule constraints. If you do not describe adequate plans to ensure success of the investigation then NASA will penalize for risk investigations dependent on new technology. Discuss all risks rated as “medium” or higher and their mitigation plans.

Identify a summary of margins and reserves in cost and schedule by phase and project element and year. Discuss the rationale for the margins and reserves. Define the specific means by which integrated costs, schedule, and technical performance will be tracked and managed. Describe the specific reserves and the timing of their application. Discuss the management of the reserves and margins, including whom in the management organization manages the reserves and when and how the reserves are released. Include the strategy for maintaining reserves as a

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function of cost-to-completion. Identify all funded schedule margins, including that for launch delay. Fully discuss the relationship between the use of such reserves, margins, potential descope options, and their effect on cost, schedule, and performance. Discussions and rationale may be placed in Appendix M (Additional Cost Data), which is not counted against page count limitations.

### *H.5 MISSION ASSURANCE AND SAFETY*

For all NASA investigations, mission success starts with a safety program documented by quality management processes that control, assure and identify risks before any mission can proceed. Investigator teams should describe their plans to avoid loss of life, personal injury or illness, property loss or damage, or environmental harm from any of its activities, ensuring safe and healthful conditions for the public and persons working at or visiting their facilities

Compliance with NASA safety and mission assurance requirements is the responsibility of each Principle Investigator. Each investigator should describe their program to develop safety, health, reliability, and quality assurance requirements needed for mission success.

Occupational Safety and Health Administration (OSHA) requirements shall apply to NASA sponsored investigations. Some states have their own OSHA programs that must comply with Federal OSHA standards. Where NASA, state or federal requirements conflict, the most stringent requirement shall apply and a formal deviation/waiver process should be described to determine variances, deviations or waivers.

The investigator should describe a process ensuring information concerning safety, health, risks, or quality assurance problems and mishaps are timely reported to NASA.

Investigators should describe a quality management system to control and document processes assuring safety, quality and reliability of hardware, software, or service.

NASA has added to the on-line UnESS Library links to two documents, *Earth Explorers Program Mission Assurance Guidelines and Requirements* and *Earth Explorers Program Flight & Ground Safety Requirements*, for your reference and use in preparing your Concept Study Report.

### *H.6 FACILITIES AND EQUIPMENT*

Provide a description of any new, or modifications to existing, facilities, laboratory equipment, and ground support equipment (GSE), including those of the team's planned contractors and those of NASA and other U.S. Government agencies, that you require to execute the investigation. Indicate in the outline of new facilities and equipment the lead-time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

### *H.7 GOVERNMENT FURNISHED EQUIPMENT, AND SERVICES*

Clearly delineate in this section the Government-furnished equipment, and services you require to accomplish all phases of the mission.

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### *H.8 REPORTING AND REVIEWS*

Clearly describe in this section your approach to reporting progress to the Government and the reviews you will invite the Government to attend to provide independent insight. Show how you have integrated the four required Government reviews into the process. Discuss the process, including the individual or organization responsible for reporting integrated cost, schedule, and technical performance. Identify the information you will present for each report and review.

### **I OTHER OPPORTUNITIES**

Describe in this section (Section 6.0 of Concept Study Report) the small disadvantaged business plan, education and public outreach plans, and plans for commercialization, if any. Summarize the benefits offered by the mission beyond the scientific/applications and student involvement benefits brought by obtaining and analyzing the desired scientific data. Clearly identify any changes to the plans since submission of the proposal.

#### *I.1 EDUCATION AND PUBLIC OUTREACH*

Summarize the benefits offered by the mission beyond the scientific and education participation benefits described in section 5.0 above. Reflect in this section your commitment to achieving the goals of the OES educational and public outreach programs. Include any innovative approaches to enhancing the level of Earth science/applications understanding and public awareness. Discuss any planned K-16 educational activities that the mission will perform and include any educational outreach to students and faculty at Historically Black Colleges and Universities and Other Minority Colleges and Universities.

You can find further information on the OES broad approach to education and outreach in the *ESE Educational Strategy Plan* .

#### *I.2 SMALL, SMALL DISADVANTAGED, AND MINORITY INSTITUTIONS*

Summarize the subcontracting plans for Small, Small Disadvantaged and Women-Owned Small Businesses, and Minority Institutions involvement in the implementation of the investigation. Discuss the subcontracting approach and state the subcontracting goals for small disadvantaged, women-owned, Historically Black Colleges and Universities, and Other Minority Colleges and Universities.

NASA contracts resulting from this project which offer subcontracting possibilities, exceed \$500,000, and are with entities other than small business concerns, will contain the clause at FAR 52.219-9. Offerors who are selected under the Downselect Process, and meet the foregoing conditions, will be required to negotiate appropriate subcontracting plans. A proposed subcontracting plan shall be provided in this section and will be evaluated as part of the Down select Process.

#### *I.3 COMMERCIALIZATION*

Discuss in this section the social benefits and enhanced U.S. economic and technical competitiveness achieved through partnerships between the public sector programs and the private sector. Provide any specific examples of commercialization.

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### J MISSION DEFINITION AND PRELIMINARY DESIGN STUDY PLAN

Describe in this section (Section 7.0 of Concept Study Report) the means by which you will perform the mission definition and preliminary design study. Identify the key mission tradeoffs and options you will investigate during the mission definition and preliminary design studies and identify those issues, technologies, and decision points critical to the mission success. Define the products of each phase and the schedule for their delivery to the team and/or Government.

### K COST AND COST ESTIMATING METHODOLOGY

Provide in the cost section (Section 8.0 of Concept Study Report) information on the anticipated costs for all phases of the mission (mission phases defined in the Introduction to this document). NASA requires a detailed cost estimate for the mission definition and preliminary design activities. NASA requires cost estimates for the follow-on phases, including a description of the estimating methodologies you used to develop the cost estimates. Provide a discussion of the basis of the estimate with a description of heritage and commonality with other programs. Quantify and explain the cost savings that result from heritage. Include all costs, including all contributions to the investigation. Complete and provide a summary of total mission cost by fiscal year as shown in Table L-1. The purpose of Table L-1 (Total Mission Cost Funding Profile) is to present all costs *on one page for the entire project* by project phase, by participating organization, and by fiscal year. Show all cost items in Table L-1 in Real Year dollars. **If obligation authority in excess of identified costs is required, the report must also indicate the authority needed by year.**

In addition, complete for each phase of the investigation a Time Phased Cost Breakdown for each Work Breakdown Structure (WBS) element, as shown in Table L-2. Use only the line items shown in Table L-2 that are relevant for each phase of the project. The purpose of this set of Figures is to provide NASA detailed insight into how you have allocated your project funding during each phase of work.

Summarize on one page and present in the format shown in Table L-3 the cost in Real Year dollars of the entire project. The purpose of Table L-3 is to: (1) provide NASA detailed insight into project costs by cost element, and; (2) provide a basis for comparison of the project team's reported cost with the evaluation team's independent cost estimate. Identify each reserve amount to the lowest level consistent with your planned reserve management strategy. For example, if each subsystem manager will have spending authority over a reserve for the subsystem, you should identify each such amount separately. If more convenient, you may show the reserve details in a separate table, with totals reported as shown in Table L-3. Finally, show costs for all development elements by recurring and non-recurring components in the format of Table L-4. Teams are to provide all tabular cost data in electronic spreadsheets using Microsoft Office 95/Excel 5.0 or compatible format on the floppy disks or ZIP disks discussed in submittal instructions on Page 4 above.

NASA plans to implement full cost accounting for NASA Centers or other Government laboratories during the period of performance of your mission. To plan for this, document all contributions provided by NASA Centers, including Civil Servant services, as well as the cost for the use of Government facilities and equipment. Fully cost and account for all direct and indirect costs associated with the work performed at NASA Centers. Teams should work with the Office of the

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Chief Financial Officer at the respective NASA Centers to develop estimates for these costs.

Use the inflation index provided in the AO Appendix to calculate all real-year dollar amounts, unless you use a government-approved industry forward pricing rate. If something other than the provided inflation index is used, document the rates used.

Include in all costs all burdens and profit/fee in real-year dollars by fiscal year, assuming the inflation rates used by NASA or specifically identified industry forward pricing rates.

### *K.1 MISSION DEFINITION AND PRELIMINARY DESIGN COST ESTIMATE*

Provide in this section a detailed cost estimate for performing the mission definition and preliminary design study. Describe the detailed plans for the study, but you may reference the Mission Implementation and Management sections of the report, as appropriate.

- a. Work Breakdown Structure. Include a Work Breakdown Structure (WBS) for the study phase of the mission. Develop this WBS at a level equivalent to hardware subsystems, or lower. Make the structure of the WBS consistent with the plans set forth in the Mission Implementation and Management sections of your report and with the Statement of Work you provide in Appendix E of the study report. A single all-encompassing WBS may be used for all phases, if desired, indicating elements that are not applicable to a specific phase.
- b. Workforce Staffing Plan. Provide a workforce-staffing plan that is consistent with the Work Breakdown Structure. Include in this workforce-staffing plan all team member organizations, including NASA Civil Service and on-site support contractor workforce, and cover all management, technical (scientific and engineering), and support staff. Phase by month the workforce-staffing plan. Clearly show the time commitments for the Principal Investigator, Co-Investigator(s), Project Manager, Systems Engineer, and other key personnel.
- c. Mission Cost and Cost Estimating Methodology. Describe the process and methodologies you used to develop the costs for the mission definition and preliminary design, and mission detailed design phases. Provide a description of the cost-estimating model(s) and methodologies used in the cost estimate. Discuss the heritage of the models and/or methodologies applied to this estimate, including any known differences between missions contained in the model's data base and key attributes of your mission. Include the assumptions used as the basis for the 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 plan and will be managed by the investigation team. Provide mass and power estimates by WBS element. Provide data rate and on-board memory estimates.
- d. Mission Definition and Preliminary Design, and Mission Detailed Design Time-Phased Cost Summary. Provide a summary of the total mission definition and preliminary design, and mission detailed design phase costs

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consistent with Table L-2. These costs also appear in Table L-3, and, if development work is planned during mission detailed design, in Table L-4. Develop the cost summary consistent with the Work Breakdown Structure and include all costs to NASA along with all contributed costs. Phase by fiscal year the time phased cost summary. Note: It is anticipated that phases mission definition and preliminary design, and mission detailed design will be on the order of approximately 9 months each.

- e. Cost Elements Breakdown. NASA requires costs and supporting evidence stating the basis for your reported costs to effectively evaluate your mission definition and preliminary design, and mission detailed design phase cost estimates. The Concept Study Report 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 estimate. Discuss the basis for developing the estimated 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 report purposes for each labor classification for the planned performance period.
    - (5) You must consider all Civil Servant labor in support of the mission definition and preliminary design that is not charged directly to the investigation as a contribution by a domestic partner, subject to the same restrictions as other contributions by domestic or foreign partners. Identify and discuss the source of funding for these Civil Servant contributions.
  - 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) that you will subcontract, and list the selected or potential subcontractors, locations, amount budgeted/estimated and types of contracts. Explain the adjustments, if any, and the indirect rates (or burdens) applied to the subcontractors' estimated amounts anticipated. Describe fully the cost analysis or price analysis and the negotiations conducted regarding the planned subcontracts. Explain any differences between values in the Table estimates and values included in commitment letters.
  - iv. Other Direct Costs.

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- (1) Travel, Relocation, and Related Costs. Provide a summary of the travel and relocation costs including the number of trips, destinations, duration, and purpose of the trips, by fiscal year.
  - (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 planned 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 mission definition and preliminary design estimate 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 the AO) include labor overhead, material overhead, general and administrative (G&A) expenses, and any other costs as an allocation to the estimated direct costs.
  - (2) If the study 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 planned 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.

### *K.2 MISSION DETAILED DESIGN, AND MISSION DEVELOPMENT AND LAUNCH COST ESTIMATE*

Provide in this section a cost estimate for performing the mission-detailed design, and mission development and launch portion of the mission. Correlate the cost estimate with the plans set forth in the Science/Applications and Student Involvement Investigation Discussion, Mission Implementation, and Management sections of the study. Apply the following guidelines in completing this section:

- a. Work Breakdown Structure. Include a Work Breakdown Structure (WBS) for the mission-detailed design, and mission development and launch phases of the mission. Describe the WBS to the subsystem level (i.e., Attitude Control System, Propulsion System, Structure and Mechanisms, etc.) for the spacecraft and to the instrument subsystem level for the payload. Show all

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other elements of the WBS to the major task level (Project Management, Systems Engineering, Ground Support Equipment, etc.).

- b. Cost Estimating Methodology. Describe the process and methodologies you used to develop the mission detailed design, and mission development and launch phase cost estimates. Provide a description of the cost-estimating model(s) and methodologies you used in the mission detailed design, and mission development and launch phase cost estimates. 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 your mission. Include the assumptions you used as the basis for the mission-detailed design, mission development and launch phase cost, and identify those which 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. Provide mass and power estimates by WBS element. Provide data rate and on-board memory estimates.
- c. Workforce Staffing Plan. Provide a workforce-staffing plan (including civil service) that is consistent with Work Breakdown Structure. Include in this workforce-staffing plan all team member organizations and cover all management, manufacturing, technical (scientific and engineering), and support staff. Phase the workforce-staffing plan by fiscal year. Clearly show the time commitments for the Principal Investigator, Co-Investigator(s), Project Manager, Systems Engineer, and other key personnel.
- d. Mission Detailed Design, and Mission Development and Launch Time-Phased Cost Summary. Provide a summary of the total costs consistent with Table L-2. Develop the cost summary consistent with the Work Breakdown Structure and include all costs to NASA, along with all contributed costs. Phase the time phased cost summary by fiscal year. Also report costs in Tables L-3 and L-4.

### *K.3 MISSION OPERATIONS AND DATA ANALYSIS, ARCHIVAL, AND DISSEMINATION*

Provide in this section a cost estimate for performing the mission operations and data analysis, archival, and dissemination. If you plan to use NASA mission operations and communications systems then you may refer to the information provided in *NASA's Mission Operations and Communications Services* document in the UnESS Program Library for the relevant costs. Consult the contacts listed in the subject document to assure accuracy as well as credibility, and to provide the best possible cost estimates.

### *K.4 TOTAL MISSION COST (TMC) ESTIMATE*

Summarize in this section the estimated costs your mission will incur in all phases of the mission, including: Mission Definition and Preliminary Design, Mission Detailed Design, Mission Development and Launch, Mission Operations and Data Analysis, Archival, and Dissemination; launch vehicle, upper stages, and launch services; ground system costs; student involvement costs and cost of activities

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associated for social or educational benefits (if not incorporated in any of the other phases). Develop the total mission cost estimate consistent with the Work Breakdown Structure.

Include in this section:

Detailed plans for all aspects of the mission not discussed elsewhere in the report, including: the launch vehicle, upper stages, and launch services; ground system; student involvement; and activities associated with social or educational benefits. If planned early-year obligations will exceed costs (e.g., for long-lead procurements), identify these obligation requirements and show or describe them separately from the cost profile. Apply the following guidelines in completing this section:

- a. Total Mission Cost. Include a summary of the Total Mission Cost time-phased by fiscal year in the format shown in Table L-1. Show dollar amounts in real-year dollars. Summarize Total Mission Costs in real-year dollars in the last column of this table. Represent in this summary the optimum funding profile for the mission. Include and clearly identify as separate line items any assets provided as contributions by international or other partners.

### L APPENDICES

NASA requires the following additional information with the Concept Study Report. You may include this information as Appendices to the Report, and, as such, NASA will not count these pages against the specified page limit.

- A. Resumes. Provide resumes for all key personnel identified in the Management section. Include resume data on experience that relates to the job these personnel will be doing for the planned investigation.
- B. Letters of Endorsement. Provide letters of endorsement from all organizations participating in and critical to the investigation. Make sure these letters of endorsement are signed by both the lead representative from each organization represented on the team, and by institutional and Government officials authorized to commit their organizations to participation in the planned investigation.
- C. Mission Definition and Requirements Agreement. Provide a draft Mission Definition and Requirements Agreement. NASA has provided an example of a Mission Definition and Requirements Agreement in the UnESS Program Library.
- D. Certifications. The same certifications that NASA required in the AO are again required.
- E. Statement(s) of Work for each Contract Option. Provide draft Statement(s) of Work for all potential contracts with NASA. Provide these Statement(s) of Work should (as a minimum) be for each contract option, clearly defining all planned deliverables (including science data) for each option, potential requirements for Government equipment and/or Government services, and a planned schedule for the entire mission.

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- F. Incentive Plan. Include a draft Incentive Plan should with the Concept Study Report. Outline in this Incentive Plan the contractual incentive features for all major team members. Include in the Incentive Plans both performance and cost incentives, as appropriate.
- G. Relevant Experience and Past Performance. Discuss the 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 ten years. Provide a description of each project, its relevance to the planned investigation, cost and schedule performance, and points of contact (including addresses and phone numbers).
- H. International Agreement(s). NASA requires Draft International Agreement(s) for all nondomestic partners in the investigation. See the UnESS Project Library for the elements you need to include in the draft agreement.
- I. Mission Assurance Plan. Provide a plan that addresses the guidelines and requirements in the reference document, *Earth Explorers Program Mission Assurance Guidelines and Requirements*.
- J. Flight and Ground Safety Plan. Provide a plan that addresses the guidelines and requirements in the reference document, *Earth Explorers Program Flight and Ground Safety Requirements*.
- K. Compliance Matrix. Provide a Compliance Matrix that includes, for each requirement in this guideline document, a summary of the requirement, the section and page number from this document, and where in your Concept Study Report you document compliance with the requirement (or your rationale if the requirement does not apply).

NASA requires the following information only if NASA provided Office of Equal Opportunity Programs Minority University Research and Education Programs funding in conjunction with the Concept Study funding.

- L. Office of Equal Opportunity Programs Minority University Research And Education Funding Accomplishments. This funding source was only available during the Concept Study Phase. If you received this funding, summarize the significant and meaningful participation and accomplishments of the certified HBCUs/OMUs during the Concept Study Phase. Describe how this funding was used to increase the capabilities of these institutions to participate in Earth science/applications missions and carry out more significant roles and responsibilities in the future. *The mission team should comment on the usefulness of this type of funding and make comments and recommendations how it may be used more effectively in the future.*

NASA does not require the following information, but you may provide it.

- M. Additional Cost Data. You may provide any additional, relevant cost data not included in Section 8.0.
- N. References List. You may provide in your Concept Study Report a list of reference documents and materials used in the study. Do not submit the documents and materials themselves, except as a part of the study, unless the reference is in publication and therefore not generally available.

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- O. Acronyms List. NASA encourages you to include a complete acronym list.

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## Table L-1 Total Mission Cost Funding Profile Template

### TOTAL MISSION COST FUNDING PROFILE TEMPLATE

(FY costs\* in Real Year Dollars, Totals in Real Year Dollars)

Cost Element**	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	...	FYn	Total (Real Yr.)
Phase Mission Definition and Preliminary Design	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
- Organization B									
- etc.									
Phase Mission Detailed Design, & Mission Development and Launch	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Phase Mission Operations and Data Analysis, Archival, and Dissemination	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Shuttle/ELV and services	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Other Tracking Support	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Other (specify)	\$	\$	\$	\$	\$	\$	\$	\$	\$
<b>Total Cost to NASA</b>	\$	\$	\$	\$	\$	\$	\$	\$	\$
Additional Contributions by Organization (Foreign or Domestic) to:									
Total Phase Mission Definition and Preliminary Design	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Total Phase Mission Detailed Design, & Mission Development and Launch	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Total Phase Mission Operations and Data Analysis, Archival, and Dissemination	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Shuttle/ELV Costs	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Tracking Support	\$	\$	\$	\$	\$	\$	\$	\$	\$
- Organization A									
Other	\$	\$	\$	\$	\$	\$	\$	\$	\$
<b>Contributed Costs (Total)</b>	\$	\$	\$	\$	\$	\$	\$	\$	\$
<b>Mission Totals</b>									\$

Costs should include all costs including fee

\*\* See Program Cost Elements in UnESS Program Library

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### Table L-2 Phase Cost Breakdown by WBS and Major Cost Category Template

PHASE _____ COST BREAKDOWN BY WBS AND MAJOR COST CATEGORY					
(Phased costs in Real Year Dollars, Totals in Real Year Dollars)					
WBS/Cost Category Description*	FY2000	FY2001	•••	Total (RYS)	Leave this column blank
<b>Total Direct Labor Cost</b>	\$	\$	\$	\$	
WBS 1.0 Management					
WBS 2.0 Spacecraft					
WBS 2.1 Structures & Mechanisms					
WBS 2.2 Propulsion					
Etc.					
<b>Total Direct Material and Equipment Costs</b>	\$	\$	\$	\$	
WBS # and Description					
:					
<b>Total Other Direct Costs</b>	\$	\$	\$	\$	
WBS # and Description					
:					
<b>Total Subcontracts</b>	\$	\$	\$	\$	
WBS # and Description					
:					
<b>Total Indirect Costs</b>	\$	\$	\$	\$	
WBS # and Description					
:					
<b>Total Reserves</b>	\$	\$	\$	\$	
WBS # and Description					
:					
Fee					
Other (Specify)					
<b>Total Contract Cost</b>	\$	\$	\$	\$	
<b>Total Other Costs to NASA</b>	\$	\$	\$	\$	
Shuttle/ELV and Launch Services					
Tracking Support					
Other (Specify)					
<b>Total Contributions (Foreign or Domestic)</b>	\$	\$	\$	\$	
Organization A:					
WBS # and Description					
etc.					
Organization B:					
WBS # and Description					
etc.					
<b>TOTAL COST FOR PHASE</b>	\$	\$	\$	\$	

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**Table L-3 Cost of Entire Project in Real Year Dollars Template**  
**FY Costs in Real Year Dollars (to nearest thousand)**

						<b>TOTALS</b>
<b>Cost Element **</b>	FY2000	FY2001	FY2002	...	FYn	RY \$
Phase Mission Definition (if required)						
Reserves						
<b>Total Phase Mission Definition</b>						
Phase Preliminary Design						
Reserves						
<b>Total Phase Preliminary Design</b>						
Phase Mission Detailed Design, & Mission Development and Launch	Enter each cost element					
Proj. Mgmt/Misn. Analysis/Sys. Eng.						
Instrument A						
Instrument B						
Instrument ...						
Instr. Integr., Assy. & Test						
<i>Subtotal - Instruments</i>						
Spacecraft bus						
Spacecraft Integr., Assy. & Test						
Other Hardware Elements (1)						
Launch Ops (Launch +30 days)						
<i>Subtotal - Spacecraft</i>						
Science Team Support						
Pre-Launch GDS/MOS Development						
Other (2)						
<i>Subtotal Phase before Reserves</i>						
Instrument Reserves						
Spacecraft Reserves						
Other Reserves						
<b>Total Phase Mission Detailed Design, &amp; Mission Development and Launch</b>						
Phase Mission Operations and Data Analysis, Archival, and Dissemination	Enter each cost element					
MO & DA						
DSN/Tracking						
Other (2)						
<i>Subtotal Phase before Reserves</i>						
Reserves						
<b>Total Phase Mission Operations and Data Analysis, Archival, and Dissemination</b>						
Launch Services						
<b>Total NASA Cost</b>						
Contributions (2)						
Total Contributions						
<b>Total Mission Cost =</b>						→

\*\* Refer to definition of Program Cost Elements

(1) Other Hardware Elements: Probes, Sample Return Canister, Etc.

(2) Specify each item on a separate line; include Education & Public Outreach, facilities, etc.

See *Program Cost Elements* document in UnESS Program Library.

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**Table L-4 Costs for all Development Elements by Recurring and non-recurring Components Template  
Development Costs in Real Year Dollars (to nearest thousand)**

	<b>TOTALS</b>		
<b>Cost Element **</b>	Non-Recurring (RYS)	Recurring (RYS)	RY \$
Instrument A (1)			
Instrument B (1)			
:			
Instrument n (1)			
<i>Subtotal - Instruments</i>			
Structure & Mechanisms			
Propulsion			
Power			
:			
Each Subsystem			
<i>Subtotal - Spacecraft Bus</i>			
Instrument Software			
Spacecraft Bus Software			
Ground Systems Software			
<i>Subtotal - Software</i>			
Other Elements (2)			
<i>Subtotal - Element</i>			
:			
:			
:			
<b>Total Development</b>			