D.12 ASTROPHYSICS STRATEGIC MISSION CONCEPT STUDIES

1. Scope of Program

1.1 Overview

The Astrophysics Division of the Science Mission Directorate solicits concept studies for strategic space flight science missions that may be carried out in the next decade or for which technology development funding is sought in the next decade. These concept studies will be used for midterm and far-term forward planning of a diverse astrophysics mission portfolio and for obtaining a simultaneous and uniform assessment of future technology development needs for the Astrophysics Division. Study results and information related to the technical maturity of proposed mission components are expected to be provided as input to the panels convened by the National Research Council for the upcoming 2010 Astronomy and Astrophysics Decadal Survey.

Proposals should clearly describe the science goals and objectives, science investigation(s), measurements to be made, techniques used and capabilities required, and a viable implementation concept that fits the programmatic constraints discussed below. A current assessment of the technology maturity and the remaining technology development required for the proposed mission concept should also be provided.

Two cost classes of strategic mission concepts are being solicited: medium-class and large-class. A medium-class strategic mission is envisioned to have a total life-cycle (NASA phases A through E), full cost of approximately $600 million (in Fiscal Year 2008 dollars). A large-class strategic mission is envisioned to have a total life-cycle, full cost significantly greater than $600 million (in Fiscal Year 2008 dollars). Proposers should identify which funding category of strategic mission they intend to study: medium-class or large-class. For both categories, the total life-cycle funding includes the cost of any needed technology development. Proposals for concept studies may envision missions that include contributions from other agencies (national or international), industry, and universities. However, the value of those contributions may not be used to reduce the proposed mission's total life-cycle cost estimate; the value of the potential contributions must be included in the proposed mission total life-cycle cost estimate for the purpose of determining whether the mission is a medium-class or a large-class mission. NASA currently envisions funding several large-class mission concept studies and approximately twice as many medium-class mission concept studies.

This solicitation solicits only mission concept studies; it does not solicit technology development or flight instrumentation. NASA will issue future solicitations for specific technology development activities or for the flight instrumentation for these missions should they become part of NASA's Science Plan.

Proposals for mission concepts that can be realized within the existing Explorer Program will not be considered. Proposals for dark energy mission concepts will not be considered because they are already receiving funding from the Astrophysics Division following a

previous 2005 mission concept solicitation. Also, proposals for mission concepts for the following strategic missions currently in formulation will not be considered: Space Interferometry Mission-PlanetQuest (SIM-PlanetQuest), Constellation-X (Con-X), and Laser Interferometer Space Observatory (LISA). Proposers to earlier opportunities, such as the 2003 Einstein Probes studies (excepting the dark energy probe) and the 2004 Origins Probes studies, who wish to respond to this opportunity, are encouraged to update their concepts according to science or technology advances made in the interim.

1.2 Astrophysics Science Investigation Goals and Strategic Mission Management

This program solicits proposals for mission concept studies that address any of the science objectives of the Astrophysics Division. The science objectives of the Astrophysics Division are to discover the origin, structure, evolution, and destiny of the Universe and to search for Earth-like planets around other stars. These objectives are discussed in more detail in the 2007 *NASA Science Plan* (http://science.hq.nasa.gov/strategy/Science_Plan_07.pdf). A proposal should identify which of the following category of science it primarily addresses:

1. Physics of the cosmos (exploring the fundamental physics of the universe and the extremes of spacetime);
2. Cosmic origins (the origins and evolution of stars, galaxies, and cosmic structure); or
3. Exoplanet exploration (the search for and characterization of extra-solar planetary systems and potentially habitable environments around other stars).

If a proposal supports more than one category from the above list, the proposal should identify which categories it supports in priority order with a prime category identified.

Due to mission cost and complexity, it is envisioned that project management for both medium-class and large-class strategic missions will be led by a NASA Center. Therefore, proposers are encouraged to partner with a NASA Center prior to submission of the proposal to provide overall study management. A NASA Center will be assigned to selected proposals if no Center is identified in the proposal or if NASA determines that alternative management best serves this study opportunity. A series of preproposal conferences will be held to clarify the various NASA Center capabilities offered for this opportunity. Further information pertaining to the conference schedules and locations will be posted at http://science.hq.nasa.gov/research/research-opps.html (under “Related Links …” follow link to “Astrophysics Strategic Mission Concept Studies Conferences”).

NASA strongly encourages the submission of proposals for medium-class exoplanet exploration mission concepts. If resources for a medium-class exoplanet mission become available, NASA expects that mission management will be provided by the Jet Propulsion Laboratory (JPL); hence, for medium-class exoplanet mission concepts, proposers should engage JPL to provide overall study management. However, proposals for large-class mission concept studies may separately include more ambitious exoplanet exploration investigations; such studies may be managed by JPL or another suitable NASA Center.

In addition, proposers may incorporate technologies and capabilities to be developed as part of NASA's Exploration architecture (such as launch vehicles or other anticipated infrastructure within the manned space flight program) into their mission concepts, provided that realistic estimates of the full costs of utilizing such capabilities are included in the proposed study.

2. Programmatic Information

2.1 Programmatic Constraints

The future mission portfolio of NASA's Astrophysics Division will be constrained by available budgetary resources and the Division is making a concerted effort to control cost growth on future strategic missions through a combination of improved early cost estimation methodology, a more conservative posture of cost reserves, and a reinvigorated technology development program. The goal of the mission concept studies is to develop high-quality scientific, technical, and cost information to be used for future mission implementation and as input from the study teams to the Decadal Survey. The selection of mission concepts will hence be driven as much by technical feasibility and cost realism as by scientific merit, even in cases where the output is aimed at deriving a technology development roadmap for far-term major initiatives.

2.2 Evaluation Criteria

Evaluation criteria are given in Section C.2 of the *NASA Guidebook for Proposers*. These criteria are intrinsic merit, relevance, and cost realism/reasonableness. In addition to the factors for intrinsic merit given in the *NASA Guidebook for Proposers*, the intrinsic merit of a proposal shall include the following factors:

- The thoroughness and applicability of the technology assessments contained in the proposal, and
- The thoroughness of any proposed technology maturation plans.

In addition to the factors for relevance given in the *NASA Guidebook for Proposers*, the relevance of a proposal shall include the relevance of the proposed investigation to achieving the science objectives described in the *NASA Science Plan.*

2.3 Proposal Guidelines

The proposal must address the science objectives noted above in Section 1.2. If a proposed investigation can, without any additional cost or additions, address other science goals in the Science Plan, they may be briefly discussed as secondary science objectives.

As a modification to the material in Section 2.3.5 of the *NASA Guidebook for Proposers - 2007* (see reference further below), the Scientific/Technical/Management section of proposals for this program element must also include:

1) a clear statement of the scientific objectives and how these are met by the proposed science investigation(s), measurements, and capabilities supported by the mission concept;
2) a clear statement of the current readiness levels for mission critical technologies and a rationale supporting the stated readiness levels in the proposal, including, where possible, laboratory or field demonstrations of the technologies;
3) a description of the phased mission costs and cost estimation methodology and a description of the technical feasibility of the mission, or a description of the program required to mature mission critical technologies during the next decade; and
4) a detailed statement of work to be undertaken over the proposed period of performance (not to exceed twelve months), including the NASA Center's study management costs.

Proposals may request a very modest amount of funding for demonstration of science measurements or technology on current test beds that will be completed within the twelve month funding period. The relationship of the proposed science investigation to the present state of knowledge in the field, to the current readiness of needed technologies, and to any other relevant missions currently operating or under development must also be discussed.

If proposed mission concepts include contributions from other agencies, industry, or academia they must include at least one Co-Investigator from each institution or agency envisioned as making a contribution.

During the concept study's period of performance, study teams should plan to enlist the assistance of either the Jet Propulsion Laboratory's Advanced Projects Design Team (Team X) or Goddard Space Flight Center's Integrated Design Capability (IDC) office, even if the study is managed by another NASA Center. Team X and IDC will provide rapid space system analysis and development of conceptual designs, including:

- design of spacecraft and its interface to science instrument(s);
- full end-to-end studies of an entire mission concept, including its
- system/subsystem concepts, requirements, and possible trade-offs;
- focused studies of only part of a proposed mission;
- independent assessments of investigator-provided studies/concepts;
- preliminary cost estimates; and
- new technologies and risk assessments.

An anticipated cost of $200K for utilizing these facilities will be held by NASA (and will be paid by NASA as Team X or IDC services are employed); this amount should be itemized in the concept study budget as a fixed cost. Further information about the IDC can be found at http://idc.nasa.gov/. Further information about the Team X process can be found at http://trs-new.jpl.nasa.gov/dspace/bitstream/2014/38662/1/05-3162.pdf.

While study teams should plan to submit and/or present materials and results to the Decadal Survey for its consideration, the proposal should also include plans for

presenting findings at a workshop to be held sometime at the end of calendar year 2008 or early calendar year 2009 and for submitting the final report to NASA by March 2009 so that study results can be used in formulating NASA's next Science Plan. The final concept study reports will be made publicly available. In addition to presenting the resultant scientific case and mission concept, the final report should also include a technology roadmap that describes how enabling technologies should be developed (including estimated costs and schedules).

Proposals for supplemental Education/Public Outreach (E/PO) activities, as described in Section I(c) of the ROSES Summary of Solicitation, will not be solicited due to the short duration of these concept studies.

3. Summary of Key Information

Expected annual program budget for new awards	Up to ~ $8M
Number of new awards pending adequate proposals of merit	~ 6-8 medium-class mission concept studies ~ 3 large-class mission concept studies
Maximum duration of awards	12 months
Due date for Notice of Intent to propose (NOI)	September 20, 2007
Due date for proposals	November 20, 2007
NASA strategic objective(s) which proposals must state and demonstrate relevance to	Every proposal must address one or more Astrophysics Research Objectives from the NASA Science Plan Table 2.1
Detailed instructions for the preparation and submission of proposals	See the *Guidebook for Proposers Responding to a NASA Research Announcement – 2007* at http://www.hq.nasa.gov/office/procurement/nraguidebook/.
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the *NASA Guidebook for Proposers*
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the *Summary of Solicitation* of this NRA and Chapter 3 of the *NASA Guidebook for Proposers*.
Web site for submission of proposal via NSPIRES	http://nspires.nasaprs.com/ (help desk available at nspires-help@nasaprs.com or (202) 479-9376)
Web site for submission of proposal via Grants.gov	http://grants.gov (help desk available at support@grants.gov or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH07ZDA001N-ASMCS

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