

C.19 ASTROBIOLOGY SCIENCE AND TECHNOLOGY INSTRUMENT DEVELOPMENT,  
INCLUDING CONCEPT STUDIES FOR ASTROBIOLOGY SMALL PAYLOADS AND  
SATELLITES

**Appendix C.19 is amended on November 14, 2007. The Astrobiology Science and Technology Instrument Development (ASTID) program is soliciting proposals through ROSES-2007. Notices of Intent to propose (NOIs) are due December 14, 2007. Proposals are due February 15, 2008.**

**This amended text replaces in its entirety the text for Appendix C.19 that was released with ROSES-2007 on February 16, 2007, and updated on July 19, 2007.**

1. Scope of Program

1.1 Background

The Astrobiology Science and Technology Instrument Development (ASTID) program requests proposals to develop instrumentation capabilities to help meet Astrobiology science requirements on future space flight missions, as well as unique Astrobiology science objectives on Earth. Selected activities are expected to advance the development of scientific instruments or instrument components to the point where the instruments could credibly be proposed in response to future flight opportunity announcements, including instruments that could be accommodated on or in small satellites (under 50kg total spacecraft mass) or as small payloads in support of future science activities associated with missions of human exploration. Note that proposals to build and fly hardware on a specific mission opportunity are not a part of this solicitation. In addition, this program solicits the development of instruments for use in future field campaigns under the Astrobiology Science and Technology for Exploring Planets (ASTEP) Program (see Appendix C.20).

This year, this program is also soliciting mission-concept proposals for Astrobiology missions that may be considered within the scope of future opportunities to use small satellite systems (under 50kg mass) or that could support human exploration missions, but need further refinement prior to being considered under a future small satellite / small payload mission solicitation. The only mission concept study proposals that will be accepted under ASTID this year are small satellite / small payload mission concept study proposals.

The scientific goals and objectives of NASA's Astrobiology program are described in the Astrobiology Roadmap that is available on the Astrobiology web site at <http://astrobiology.arc.nasa.gov/roadmap>. Instrumentation and astrobiology mission concepts developed from research supported through this ASTID program element are meant to address two fundamental questions in Astrobiology, namely, "How does life begin and evolve?" and "Does life exist elsewhere in the Universe?" Objectives that

could be addressed by new spacecraft instrumentation and astrobiology small payload missions include, for example:

- To determine whether the atmosphere of the early Earth, hydrothermal systems, or exogenous matter were significant sources of organic matter;
- To search for evidence of ancient climates, extinct life, and potential habitats for extant life on Mars;
- To determine the presence of chemical precursors and potential habitats for life in the outer Solar System; and
- To determine if compounds of biological significance are present beyond our Solar System.

## 1.2 ASTID Goals for Flight Instruments and Technologies

To take advantage of the wide range of mission opportunities, including aircraft and other suborbital platforms, Astrobiology requires the development of innovative technologies. Because of limited spacecraft accommodations, scientific instruments often must be very small and robust and have low power and telemetry bandwidth requirements. In most cases, instruments on spacecraft need to operate autonomously or allow teleoperation while conducting complex *in situ* sample analyses. Successful instruments must operate in environments often characterized by extremes of temperatures, pressures, gravity, vibrations, and/or radiation, and may have to survive long dormant periods while in transit to other worlds and / or subsequent to high-g landing impacts. Sensors already exist that range from fingernail to matchbook sizes, and a wide array of miniaturized chemical laboratories exist that can fit on a compact disk; however, relatively few are ready to be proposed successfully for space flight.

Major targets of Astrobiology interest include Mars, Europa, Titan, comets, asteroids, the Earth, extra-solar planetary systems, and dense interstellar molecular clouds. In addition, future opportunities are expected to include astrobiological studies from and on the Moon, and significant opportunities may exist in missions that orbit the Earth at low, medium, and high orbital distances. ASTID program emphasis will be placed on proposals that are relevant to missions possessing the greatest potential of meeting Astrobiology goals for which instruments have not yet been selected or on which instruments may be changed. Furthermore, support can be provided for long lead-time definition studies, for innovative approaches that may provide entirely new classes of instruments, for the development of new enabling technologies for missions further in the future, and/or for development studies that may advance the technology for a wide range of instrumentation applications. It is anticipated that, to develop potential space flight instruments, some approaches will require novel instrument concepts while other approaches will focus on reductions in mass, volume, power requirements, and/or costs of existing technologies. NASA also recognizes that some approaches may require field tests to improve instrument utility and robustness.

While proposals in all areas relevant to Astrobiology goals and objectives may be considered for the ASTID instrument development opportunity, specific needs in the following areas are recognized and will be given high priority for selection:

- The selection and handling of samples collected for astrobiological objectives;
- *In situ* detection of possible chemical / organic biomarkers, and precision measurements of isotopic abundances of the elements C, H, N, O, P, S, and other life-related elements such as Fe, Mn, Mo, etc.; or
- For small satellites / small payloads, instruments that can be accommodated within the scope of the small payload opportunities discussed in the June 2007 Workshop report (see <http://nai.arc.nasa.gov/asp>).

Under this ASTID instrument-development announcement, proposals are sought at three general levels: (i) feasibility study and instrument definition (i.e., proof of concept), (ii) instrument development and definition (i.e., the breadboard stage), and (iii) development of instruments to a sufficiently mature “brassboard” level that they may be proposed in response to future announcements of flight opportunities (flight opportunities include suborbital, orbital, planetary, and deep space platforms).

In recognizing the need for development of miniaturized instrument systems, with this solicitation NASA is also soliciting “lab-in-a-teacup” development projects. The goal is to apply micro/nanotechnology to planetary instrumentation and develop highly integrated miniature instruments suites with the capability to address astrobiology interests in planetary exploration.

Proposals to define or develop one or more instrument components, rather than whole instruments, are allowed, particularly for immature or very complex new instruments. *However, at least one or more likely scenarios for possible follow-on instrument development activities must be described in the case of component-only proposals, that is, such proposals to study a component must be placed in the context of a complete instrument that can serve to achieve some objective in Astrobiology even for a hypothetical mission.* Scientific objectives of proposed instruments or components must be discussed in the proposal, and proposers are encouraged to relate their proposals as closely as possible to future missions of interest to the Astrobiology program and demonstrate how the technology addresses Astrobiology goals and objectives.

### 1.3 Examples of Future Missions

Proposals for long-lead time definition studies, novel instrument concepts, and innovative approaches leading to new instrument classes that could be relevant to one or several missions will be considered. Missions suitable for instrument-development under this Astrobiology instrument-development call may include Discovery, New Frontiers, or small payload/small satellite opportunities as defined by recent National Research Council reports or by the Astrobiology Small Payloads workshop report, as well as possible future Flagship mission opportunities. These include missions to small bodies such as comets or asteroids, the icy satellites of Jupiter and Saturn, Mars missions, and

future missions of lunar exploration, as well as Earth orbital missions and other free-flying experimental or observational platforms such as astronomy missions under development or study by NASA and its international partners.

#### 1.4 Nonflight ASTID Goals

Although the focus of the ASTID program is development of scientific instruments for future flight opportunities, consideration will also be given to proposals for development of ground-based laboratory or field instrumentation important to the goals and objectives of the Astrobiology program. Of particular interest will be instrumentation that would potentially enable new research capabilities for Astrobiology, such as the ability to measure novel biomarkers. The proposals for the development of new field-deployable instruments in support of the Astrobiology Science and Technology for Exploring Planets (ASTEP) program are also welcome.

#### 1.5 Mission Concept Studies

Astrobiology mission concept studies are solicited through this program to help increase the ideas available for mission planning and to take advantage of mission opportunities such as the Astrobiology Small Payloads missions, and the Discovery, Explorer, and New Frontiers Programs.

**[Clarification added November 28, 2007]**

**The only mission concept study proposals that will be accepted under ASTID this year are small satellite / small payload mission concept study proposals.**

An ASTID mission concept study proposal must contain a description of a mission that has astrobiology objectives, the technology and science involved, and the progress toward mission reality that would be accomplished with the requested funding. Mission-concept study proposals must clearly state one or more Astrobiology science objectives to be achieved by the mission. The evaluation criteria for this procurement are merit, relevance, and costs, as stated in Appendix C of the *NASA Guidebook for Proposers* (see further below) with the following additional criteria as part of the scientific merit:

- the degree to which the mission concept would accomplish the science,
- the feasibility and completeness of the mission concept,
- identification of the enabling new technology required in the mission concept, if any, and
- feasibility and completeness of the study plan that would be accomplished with concept study money.

## 2. Programmatic Information

### 2.1 Program Overlap

Currently, the Planetary Instrument Definition and Development (PIDD) program (Appendix C.16) also supports instrument development for potential future space flight to planets but by definition excludes instrumentation focused primarily on astrobiology objectives. Therefore, proposals for development of instruments focused on astrobiology should be submitted only to this ASTID program. NASA reserves the right to resolve any overlap of proposals submitted to the PIDD and ASTID programs at the programmatic level at the time of selections. Proposers should be aware that each of these programs has different constraints, and proposals appropriate to one may not be appropriate to the other (for instance, the ASTID program will consider proposals for a broader time frame than that for PIDD, as well as for development of laboratory instrumentation). Similarly, proposals for development of astronomical instruments focused on astrobiology, other than detectors, may be submitted to the ASTID program.

### 2.2 Size and Duration of Awards

Pending the approval of NASA's Fiscal Year 2008 budget, approximately \$5M may be available this year for support of new selections in the ASTID program. Instrument-development awards are expected to range from \$30K to \$300K per year for a maximum of four years. For mission concept studies, approximately 5-8 new studies may be selected for funding, and proposals should be limited to one year of study, although proposers may include an option for a second year if a continuation should be indicated by the first year's results.

### 3.0 Summary of Key Information

Expected annual program budget for new awards	~ \$5M
Number of new awards pending adequate proposals of merit	~ 10 for instrument/instrument concept development, plus potentially an additional 5-8 mission concept studies
Maximum duration of awards	4 years
Due date for Notice of Intent to propose (NOI)	December 14, 2007
Due date for proposals	February 15, 2008
NASA strategic objective(s) which proposals must state and demonstrate relevance to	Every proposal must address one or more strategic goal or research objectives from Table 1. See also Sections I(a) and IV(e) in the <i>Summary of Solicitation</i> of this NRA.
General information and overview of this solicitation	See the <i>Summary of Solicitation</i> of this NRA.

Detailed instructions for the preparation and submission of proposals	See the <i>NASA Guidebook for Proposers Responding to a NASA Research Announcement – 2007</i> at <a href="http://www.hq.nasa.gov/office/procurement/nraguidebook/">http://www.hq.nasa.gov/office/procurement/nraguidebook/</a> .
Page limit for the central Science-Technical-Management section of proposal	15 pp; see also Chapter 2 of the <i>NASA Guidebook for Proposers</i>
Submission medium	Electronic proposal submission is required; no hard copy is required. See also Section IV in the <i>Summary of Solicitation</i> of this NRA and Chapter 3 of the <i>NASA Guidebook for Proposers</i> .
Web site for submission of proposal via NSPIRES	<a href="http://nspires.nasaprs.com/">http://nspires.nasaprs.com/</a> (help desk available at <a href="mailto:nspires-help@nasaprs.com">nspires-help@nasaprs.com</a> or (202) 479-9376)
Web site for submission of proposal via Grants.gov	<a href="http://grants.gov/">http://grants.gov/</a> (help desk available at <a href="mailto:support@grants.gov">support@grants.gov</a> or (800) 518-4726)
Funding opportunity number for downloading an application package from Grants.gov	NNH07ZDA001N-ASTID
NASA point of contact concerning this program	See next page

<p>NASA point of contact concerning this program</p>	<p><i>For instruments intended for future SMD interplanetary missions</i>  Dr. Michael New  Planetary Science Division  Science Mission Directorate  NASA Headquarters  Washington, DC 20546-0001  Telephone: (202) 358-1766  E-mail: <a href="mailto:Michael.H.New@nasa.gov">Michael.H.New@nasa.gov</a></p> <p><i>For instruments and mission concept studies for Astrobiology small payload / small satellite opportunities</i>  Dr. John D. Rummel  Planetary Science Division  Science Mission Directorate  NASA Headquarters  Washington, DC 20546-0001  Telephone: (202) 358-0702  E-mail: <a href="mailto:John.D.Rummel@nasa.gov">John.D.Rummel@nasa.gov</a></p> <p><b>New contact added on November 26, 2007</b></p> <p><i>For technical information regarding Astrobiology small payload / small satellite opportunities</i>  Mr. Bruce D. Yost  Mission Development Manager  MicroNano Spacecraft and Payloads Office  Small Spacecraft Division  NASA Ames Research Center  Moffett Field, CA 94035  Telephone: (650) 604-0681  E-mail: <a href="mailto:Bruce.D.Yost@nasa.gov">Bruce.D.Yost@nasa.gov</a></p>
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