

A.2.19 HIGH CAPABILITY INSTRUMENTS FOR PLANETARY EXPLORATION  
(FORMERLY CALLED HIGH POWER INSTRUMENTS FOR PLANETARY EXPLORATION)

1. Scope of Program

The High Capability Instruments for Planetary Exploration (HCIPE) program supports the development of spacecraft-based instrument technologies that provide capabilities well beyond those of existing flight instruments. The primary goal of this program is to promote the development of a new generation of scientific instruments for planetary exploration that can take advantage of the capabilities enabled by nuclear electric power and propulsion (NEPP). These NEPP-enabled capabilities include:

- Electrical power up to 10-100 kW;
- Data rates ranging from 10 to 100 Megabits/sec for acquisition and transmission to Earth;
- Instrument mass up to 500 kg;
- Long observation times at targets;
- High delta V capability enabling multi-target rendezvous; and
- High duty cycles enabling extended instrument operating times.

The Solar System Exploration Division identified planetary science missions that are uniquely enabled by NEPP technologies under development by Project Prometheus. The first of these missions is the Jupiter Icy Moons Orbiter (JIMO). JIMO is an ambitious mission that will orbit three planet-sized moons of Jupiter - Callisto, Ganymede and Europa - which may harbor vast oceans beneath their icy surfaces. This mission would orbit each of these moons and perform extensive orbital investigations of their makeup, their history, and their potential for sustaining life. JIMO-class follow on missions are also under consideration by NASA.

The goal of this program is to begin development of science instruments that could potentially be launched within a decade on the JIMO spacecraft. Other instruments not suitable for the JIMO mission may be proposed and will be fully considered. HCIPE is not intended to develop flight qualified hardware, but rather to define and develop scientific instruments to the point where the instruments can be proposed in response to OSS announcements of flight opportunity without additional extensive technology development.

The proposed instrument technology must address specific scientific objectives and research focus areas described in the Solar System Exploration Roadmap ([http://sseforum.jpl.nasa.gov/library/roadmap/SSE\\_Roadmap.pdf](http://sseforum.jpl.nasa.gov/library/roadmap/SSE_Roadmap.pdf)).

Only orbital remote sensing instruments requiring the NEPP-enabled capabilities noted above are allowed under the HCIPE program. The capabilities made available by NEPP may make it possible to adapt current Earth science instruments for exploration of other planets or phenomena in the solar system. An unprioritized and nonexclusive list of examples of instruments that would be appropriate for this solicitation include:

- Synthetic Aperture Radar (SAR);
- Orbiting subsurface-profiling radar;
- Magnetospheric radio sounder;
- High-power tunable laser spectrometer;
- Laser ablation spectrometer;
- Imaging polarimeter; and
- Multiaperture hyperspectral imager.

New measurement concepts may also be proposed to the HCIPE program. In addition, modifications of existing instruments designed for previous low power space missions that would significantly improve their performance through greatly increased capabilities, such as greater power and/or data rate, may also be proposed. Therefore, proposals for instruments characterized by any Technology Readiness Level (TRL; see Appendix E.11 of the Office of Space Science Management Handbook at <http://spacescience.nasa.gov/admin/pubs/handbook/OSSHHandbook.pdf> for definition of TRL's) are appropriate for this program. However, selections will favor instruments appropriate for launch on JIMO within a decade; thus, proposals for very low TRL concepts should discuss pathways that ensure timely instrument development leading to a launch within this timeframe.

Proposals not appropriate for this HCIPE solicitation are those that seek to develop laboratory instruments, ground-based or airborne telescopes, auxiliary instrumentation such as spectrometers for telescopes, onboard data processing or data compression studies, or any space technology that is not directly related to science instrumentation. Proposals seeking to develop instrumentation for surface missions are also not appropriate at this time.

Since the specific purpose of this program is to stimulate the development of instruments that can take advantage of the high power levels and relatively high data rates expected to be available on missions using NEPP, only proposals for instruments that possess capabilities beyond those currently available for missions will be considered for selection. In addition, all proposals submitted to HCIPE must specify:

- the mission or class of missions for which the proposed instrument may be applicable;
- the NEPP-enabled science objectives of the proposed instrument; and
- the TRL of the proposed instrument and associated justification.

## 2. Background

### 2.1. Project Prometheus

NASA's newly defined Project Prometheus will develop the means to efficiently increase power and propulsion for spacecraft, thereby fundamentally increasing the capability for

Solar System exploration. Increased power for spacecraft means not only traveling farther or faster, but it also means exploring more efficiently with enormously greater scientific return. High levels of sustained power will permit a new era of Solar System missions designed for agility, longevity, flexibility, and comprehensive scientific exploration. There are two basic types of technology under development by Project Prometheus: radioisotope-based and nuclear fission-based systems.

Radioisotope Power System (RPS) development would focus on two technologies, the Multi-Mission Radioisotope Thermoelectric Generator (MMRTG) and the Stirling Radioisotope Generator (SRG), that are expected to improve the efficiency and utility of systems that NASA has been using for 30 years. These essential improvements on our current technology will enable expanded exploration of the solar system.

Nuclear fission power and propulsion research will focus on developing the nuclear systems needed for revolutionary new capabilities in space exploration. Project Prometheus will include research on reactors, advanced heat-to-power conversion, and power management and distribution technologies to provide spacecraft flexibility, long-mission durations, and orders of magnitude more power for science instruments.

### 3. Programmatic Information

#### 3.1 Nature of Awards

All activities selected under this HCIPE program will be funded solely through multiyear contracts having a base “Phase 1” period of performance of one year and Phases 2 and 3 that provide for up to two optional years. The total proposed period of performance may not exceed three years. Therefore, proposals for efforts greater than one year must be structured with a one year initial period with options for extension in time increments not to exceed one year each. Proposals should cover all phases for which the proposer intends to compete under this NRA since additional proposals for years 2 and 3 will not be solicited in the future.

Proposals must define clearly measurable milestones (a minimum of three per year). Steady progress toward reaching the milestones in a timely manner needs to be demonstrated in order to justify continuation of funding beyond the first year. *Annual Progress Reports* will be required that describe progress toward these milestones no later than 60 days in advance of the anniversary date of the award.

Funding approval for the subsequent year(s) will be based on achievements toward milestones for the prior year as described in the *Annual Progress Report*, the continued program need for the investigation, and available funds. There is no guarantee that any options will be funded for the remaining performance timeframe.

The total anticipated budget for this technology research program is expected to be \$5M and is expected to fund approximately 10-15 investigations.

### 3.2 Schedule of Solicitation

The schedule for proposals for this opportunity is:

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|--|-----------------|
| - Release Date                         | July 23, 2003   |
| - Notice of Intent to Propose Due Date | August 22, 2003 |
| - Proposal Due Date                    | October 3, 2003 |

### 3.3 Evaluation Criteria and Proposal Selection

The evaluation criteria contained in [Appendix C](#), Section C.2, of the NASA [Guidebook for Proposers](#), which is accessible by opening URL <http://research.hq.nasa.gov/>, shall be used to evaluate submitted proposals. These criteria include scientific and technical merit, relevance to NASA's objectives, and cost risk and reasonableness. In addition, the determination of the proposal's relevance shall also take into account the following factors:

- the science objectives of the proposed instrument and their relationship with the instrument's capabilities as described in the proposal, and
- the increased quality or uniqueness of science investigations enabled by the expanded capabilities of the proposed instrument.

The Selection Official for this HCIPE program is the Director of the Solar System Exploration Division. However, the selection decision for any proposals relevant to solar physics will be coordinated with the Director of the Sun-Earth Connection Division.

### 3.4 Program Overlap

Currently, the Planetary Instrument Definition and Development Program (PIDDP, Appendix A.2.11 in this NRA), also supports instrument development for potential future space flight to planets, but it requires instrumentation to be low power. Therefore, proposals for development of high capability instruments should be submitted only to this HCIPE program. NASA reserves the right to resolve any overlap of proposals submitted to PIDDP and HCIPE program 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. Any questions about the relationship of these two programs may be directed to the point of contact below.

### 3.5 Instructions for Proposal Preparation and Submission

The OSS is now using a single, unified set of instructions for the preparation and submission of proposals. This material is contained in the document entitled *NASA Guidebook for Proposers Responding to NASA Research Announcement – 2003* (or *NASA Guidebook for Proposers* for short) that is accessible by opening URL <http://research.hq.nasa.gov/>, and linking through the menu item "Helpful References," or may be directly accessed online at URL

<http://www.hq.nasa.gov/office/procurement/nraguidebook/>. This NRA's *Summary of Solicitation* also contains the instructions for the electronic submission of a *Notice of Intent* (NOI) to propose and a proposal's *Cover Page/Proposal Summary/Budget Summary*, and the mailing address for the submission of a proposal.

Questions about this program may be directed to the Program Officer:

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