A.2.21 LUNAR-A U.S. CO-INVESTIGATORS

1. Scope of Program

1.1 Roles and Responsibilities of U.S. Lunar-A Co-Investigators (Co-Is)

NASA solicits science investigations to be carried out using the data that are expected to be returned from the Japanese Lunar A mission, sponsored by the Japanese Aerospace Exploration Agency (JAXA), which will be launched to the Moon in mid-2004. Pending the submission of proposals of adequate merit, one investigation each for the study of lunar seismology and for the study of heat flow through the lunar regolith, using sensors mounted on two widely separated Penetrators, will be selected. The Principal Investigators (PIs) of these investigations will be recognized as Co-Investigators (Co-Is) on this mission. Proposals are restricted to those submitted by those affiliated with U.S. institutions. Investigators affiliated with Non-U.S. institutions interested in this program should apply directly to the JAXA.

NASA expects to select two investigators through this NRA who will become Lunar-A U.S. Co-Is. The Lunar-A U.S. Co-Is will join the current members of the Lunar-A investigation teams and will coordinate their activities and analyses with those PIs and Co-Is. Lunar-A U.S. Co-Is selected through this NRA will have full access to Lunar-A resulting data, under the supervision of the JAXA-appointed Lunar-A Project Scientist, and are expected to participate in data acquisition, reduction, analysis, archiving, and publication. In addition, each selected Lunar-A U.S. Co-I is expected to participate in mission operations or other duties as assigned by the Lunar-A Project Scientist. Therefore, proposals in response to this solicitation must provide for meetings and extended visits in Japan. In particular, proposers should anticipate:

- two to three weeks in June 2004 for final integration and test of the Penetrators with the spacecraft, and
- two weeks in the period July to September 2004 for Launch Operations.
- In 2005, trips will involve the initial operation of the spacecraft and check-out of the Penetrators, (depending on the launch date) in September through October for two weeks each, and then
- two to four weeks for Penetrator deployment and initial science operations during March to May 2005.
- Finally, there will be regular science/data analysis meetings of one week each every two to three months from May 2005 to May 2006.

The Lunar-A mission is described in detail at its home page on the World Wide Web at http://www.isas.ac.jp/e/enterp/missions/lunar-a/cont.html. Questions about the Lunar-A mission and/or U.S. Co-I residency requirements and arrangements may be addressed to the Lunar-A Project Scientist:

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The responsibilities of a Lunar-A U.S. Co-I as solicited through this NRA shall include:

- Provision of science input for prelaunch mission planning and instrument operations and calibration;
- Reduction and validation of scientific data that are returned;
- Analysis, interpretation, and publication of results and findings in the peer reviewed literature; and
- Assistance in the deposition of Lunar-A data in NASA's Planetary Data System (PDS).

1.2 Mission Description of Lunar-A

The Japanese Lunar-A mission is scheduled for launch in the third quarter of 2004 using a Japanese M-V expendable launch vehicle from Japan's Kagoshima Space Center. This mission will study the lunar interior using seismometers and heat flow probes installed in two Penetrators that will be deployed into the lunar surface, one on the near side and another on the far side.

The lunar seismic data will develop a more accurate seismological model of the Moon's internal structure to facilitate the understanding of its bulk composition. In particular, determination of the lunar core size is important in order to interpret the observed depletion of siderophile elements in the lunar mantle, as well as possible extant magnetic-dynamo action or magnetic anomalies of the Moon as observed by the 1998 Lunar Prospector Mission. The seismic instruments will observe various deep moonquakes at two widely-spaced sites. Observations of the amplitudes and travel-times of near side deep moonquake events between the two Penetrator stations will reveal the size of the Moon's core, if one exists. In turn, understanding the core size and its properties are crucial to understanding the bulk abundance of the siderophile elements, which in turn is essential to the understanding of the Moon's origin.

Heat flow measurements are also of vital importance in order to help constrain the thermal history of the Moon. Since derivation of globally representative averages of the heat flow from the two Apollo sites has proven to be quite difficult, more measurements of heat flow at widely spaced geological settings will allow the derivation a far more reliable global heat flow average.

The Lunar-A Penetrators each contain a two-component seismometer and a heat flow probe, together with a tiltmeter and an accelerometer. The tiltmeter is used to discern the

attitude of the Penetrator in the lunar regolith, while the accelerometer is used to judge the depth of the Penetrator by integrating over the recorded deceleration at its impact. The Penetrators are designed to have one-year life spans.

A summary of the Lunar-A mission architecture is as follows:

- Lunar-A launch: August – September 2004
- Lunar orbit insertion: January – February 2005
- Penetrator deployment: February – March 2005
- Start of Penetrator operations: March – April 2005
- Penetrator end of design life time: March – April 2006

2. Programmatic Information

It is anticipated that this NRA will be the only solicitation for proposals in support of Lunar-A U.S. Co-Is. Continued funding of any selected investigations is contingent on availability of funds, the annual assessment of performance by their respective PIs, and the relevance of their research effort to the Lunar-A mission and program requirements.

It is anticipated that two investigations will be selected through this solicitation, one for seismology objectives and one for heat flow objectives. Starting in Fiscal Year 2004, the total available funding for each U.S. Co-I investigation is expected to range from $50K to$75K per year for each of three years.

The schedule for proposals for this opportunity is as follows:

- Notice of Intent to Propose* Due Date: January 21, 2004
- Proposal Due Date: March 22, 2004
- Target Selection Date: May 24, 2004

* Desired but not required

Proposals should identify scientific ideas and unique theoretical and/or analytical capabilities that best meet the scientific objectives of the Lunar-A mission as described in this Announcement and at its official Web site (see Section 1.1 above). Key projected milestones, accomplishments, and deliverables during each year of the proposed investigation must be identified, as must details of how the travel and residency requirements in Japan will be met.

The evaluation criteria contained in Appendix C, Section C.2, of the *NASA Guidebook for Proposers* (see Section 5 of the *Summary of Solicitation* for this NRA as well as further below under "IMPORTANT INFORMATION") shall be used to evaluate submitted proposals, where it is understood that the scientific and technical merit of a proposal will also include the following factors, of equal priority:

- A clear understanding of the Lunar-A instruments and their scientific and technical capabilities, particularly those related to the proposed investigation;
- The feasibility of the proposed investigation using the Lunar-A data, and a clear statement of the instrument data required for the proposed investigation; and
- The ability, capability, and commitment of the investigator to participate in planning, collection, reduction, and evaluation of the data to be submitted to the PDS, including a description of the specific data products that will be produced by the investigation.

Note that, although NASA will make the selection, appropriately qualified Japanese scientists may be asked to participate in the review of any submitted proposals, and the Lunar-A program personnel will be consulted prior to final selection of investigations.

IMPORTANT INFORMATION

As discussed in the *Summary of Solicitation* of this NRA, the Office of Space Science (OSS) now uses a single, unified set of instructions for the submission of proposals. This material is contained in the document entitled *NASA Guidebook for Proposers Responding to NASA Research Announcement-2003* 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 http://www.hq.nasa.gov/office/procurement/nraguidebook/. Note that the updated 2003 version of this document is the one that is applicable to this solicitation. This NRA's *Summary of Solicitation* also contains instructions for the electronic submission of a Notice of Intent (NOI) to propose and an integrated Cover Page/Proposal Summary/Budget Summary and the mailing address for the submission of a proposal.

Questions concerning this program element may be directed to the Lunar-A Program Scientist:

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