

Request For Information

Europa Mission Concepts Costing Less than \$1 Billion

General Information:

Solicitation Number: NNH14ZDA008L
Release Date: April 28, 2014
Response Date: May 30, 2014

NASA is seeking information regarding complete, low cost mission concepts for Europa exploration that meet the majority of science priorities from the Decadal Survey. The focus of this Request For Information (RFI) is Europa mission concepts costing less than \$1 billion (FY 2015 dollars), excluding the launch vehicle. The information gathered through this RFI will be used by NASA to inform its efforts to scope a mission to Europa.

In accordance with FAR 15.201 (e), the information requested is for planning purposes only and is not intended to bind the Government.

Background

Europa exploration has consistently been rated as among the highest priority scientific pursuits for NASA because it addresses the fundamental question of life beyond Earth. Europa remains a technically challenging target for exploration, and NASA has studied a variety of Europa missions that a) meet those challenges, b) build upon the results of the Galileo mission, and c) address the scientific questions and priorities defined in the Planetary Decadal Survey.

The goals provided in the Decadal Survey for a Europa mission are (in decreasing order of priority):

1. Characterize the extent of the ocean and its relation to the deeper interior;
2. Characterize the ice shell and any subsurface water, including their heterogeneity, and the nature of surface-ice-ocean exchange;
3. Determine global surface compositions and chemistry, especially as related to habitability;
4. Understand the formation of surface features, including sites of recent or current activity, and identify and characterize candidate sites for future *in situ* exploration;
5. Understand Europa's space environment and interaction with the magnetosphere.

While characterizing landing sites for future *in situ* exploration is the fourth scientific priority in the Planetary Decadal Survey, NASA places high programmatic priority on this goal to enable a potential future lander mission to Europa. Current data does not provide sufficient information to identify landing sites and design a landing system capable of safely reaching the surface.

The primary challenges facing any mission to Europa involve the harsh radiation environment and planetary protection requirements. Typical total ionizing dosages for Europa missions studied by NASA exceed 2 megarads with high fluxes near Europa. NASA has provided the GRID2 tool which can be used to calculate expected total ionizing dosage for Europa missions. The tool is available at <http://solarsystem.nasa.gov/europa/icedocs.cfm>. Planetary Protection requirements for Europa are very strict and involve ensuring that the probability of introducing a viable Earth organism into Europa is $<1 \times 10^{-4}$. To demonstrate compliance, spacecraft may either avoid impact with Europa at this level of probability, taking into account hardware and

operational reliability among other factors; or may show to this level of probability that a viable organism remains on the European surface after impact, based on a conservative assessment of starting bioburden and evaluating the lethality of the space environment as well as, if relevant, an analysis of impact heating. For more information see NPR 8020.12D (available at <http://nodis3.gsfc.nasa.gov/displayDir.cfm?t=NPR&c=8020&s=12D>) and the implementation used by the Juno project (Bernard, D. et al. Europa planetary protection for Juno Jupiter Orbiter. *Advances in Space Research* 52 (2013) 547–568).

Requested Information

The response to this RFI will be in the form of a PDF document that is uploaded through NASA's NSPIRES system (see instructions below). Each response shall not exceed 15 pages in length and shall address a single complete mission concept for exploring Europa costing less than \$1 billion (FY 2015 dollars, phases A through E), excluding the launch vehicle. Additionally, each response shall a) meet the majority of the five science goals set forth in the Decadal Survey, including the goal to characterize scientifically compelling sites to prepare for a potential future lander mission to Europa, and b) address the two primary challenges described above that face any mission to Europa. Any individual or institution may respond to this RFI, and there is no limit on the number of responses that an individual or institution may submit.

The response must contain the following information:

- Name of submitter and contact information (institutional affiliation, E-mail address);
- Description of the mission concept, including a mission timeline;
- Science objectives, including a Science Traceability Matrix linking these objectives to mission and instrument requirements and the instrument payload;
- Comparison of science objectives of the mission concept with the five Decadal Survey science goals for Europa exploration listed above, including a narrative rationale explaining the extent to which the objectives meet the Decadal Survey goals;
- Instrument payload;
- Spacecraft concept, including mass and power estimates;
- Rationale for expected mission cost, including approximate cost breakdown among subsystems and by phase.

NASA recognizes the need to protect proprietary information and does not intend to broadly disseminate the RFI responses. RFI responses should clearly mark proprietary information. Note that NASA has an obligation to properly involve the necessary stakeholders (e.g., Congress, advisory bodies, and the scientific community) in its activities, and RFI responses should include a fact sheet about the mission concept and its science objectives that can be publicly shared.

Instructions

All responses submitted in response to this RFI must be submitted in electronic form via NSPIRES, the NASA online announcement data management system, located at <http://nspires.nasaprs.com/>. For this RFI, a response submission will take the form of a Notice of Intent (NOI) within the NSPIRES online announcement data management system. The RFI response itself will be a PDF-formatted document that is attached (uploaded) to the NSPIRES system. You must be registered with NSPIRES to submit a RFI response. See registration instructions at <http://nspires.nasaprs.com> (select "Getting an account"). Neither institution registration nor an institution affiliation is required to respond to this RFI.

1. Log in to your account at <http://nspires.nasaprs.com/>.
2. Select “Proposals/NOIs” from your account page.
3. Select “Create NOI” from your proposals page.
4. Click “Continue” on the next page.
5. Select “Request for Information: NNH14ZDA008L (Europa Mission Concepts Costing Less than \$1 Billion)” from the bulleted list of announcements.
6. Click “Continue”.
7. Enter RFI response title (“NOI title” field will be shown).
8. Select “do not link at this time” for submitting organization page.
9. Click “Save” on next page.
10. It is not necessary to complete any of the “NOI Details”; all requested information should be included in the attached PDF document. Information which is entered into “NOI Details” but not included in the attached PDF document will not be considered.
11. Prepare your RFI response offline and save as a PDF document (note NSPIRES instructions on PDF formats). The response document must include the respondent’s Name, institution, and E-mail address so the file is self-contained. File names format should be “PI Last Name - First Name – Number - RFI”. “Number” will be used to distinguish multiple responses from the same PI. The response should not exceed 15 pages in length.
12. To attach (upload) your PDF document:
 - a. Click “add” under NOI attachments section;
 - b. Select “Proposal Document” from the drop down list;
 - c. Browse to attach your PDF file;
 - d. Select “Upload”;
 - e. Click “OK”;
 - f. Your RFI document has been uploaded to NSPIRES.
13. Click Submit NOI button. NOTE that this does not complete the submission process.
14. Ignore any warnings about incomplete NOI elements. Ensure that your NOI document is attached and click “Continue”.
15. Click “Submit”. This will take you to the NOI submission confirmation page, which provides you with the NOI/RFI number for your records.

Please note: You may delete and replace form fields and uploaded documents anytime before the submission deadline, however, once your RFI is submitted, it cannot be deleted

Contact Point

Questions concerning this Request for Information should be addressed to Dr. Curt Niebur, Planetary Science Division, Science Mission Directorate, National Aeronautics and Space Administration, Washington, DC 20546; Telephone: (202) 358-0390; Fax: (202) 358-3097; E-mail: curt.niebur@nasa.gov with the subject line “Europa RFI.”