

Partnership Opportunity Document (POD)
for
NASA Goddard Space Flight Center (GSFC)
Turbo-molecular Vacuum Pump Development
June 4, 2014

General Information

Procurement Supplied

Contracting Office Address

NASA/Goddard Space Flight Center, Code 210.8, Greenbelt, MD 20771

1.0 Introduction and Scope

This partnership opportunity is for multiple NASA Planetary Mission Opportunities in 2014. NASA/GSFC is seeking partners for spaceflight instrument development for potential proposals to these opportunities.

GSFC mission teams will be submitting proposals that will include Discovery and Europa Instrument announcements currently scheduled for release in 2014. Both of these opportunities will be two-step processes, with the first proposal response being primarily focused on the scientific merit and technical feasibility of the proposed mission and its associated scientific investigation. The initial submissions will then be down-selected after formal peer review and the resultant subset of proposals will be funded to perform Phase A mission concept studies. During Phase A, proposals will be expanded and refined to detail the entire end-to-end life cycle concept, with greater attention to engineering implementation, cost, and schedule.

Information on the Discovery AO can be found in the Community Announcement Regarding Discovery Program Draft Announcement of Opportunity (<http://nspires.nasaprs.com/external/viewrepositorydocument/cmdocumentid=398476/solicitationId=%7B0CA4625F-7B23-C1F5-9FC5-E695B3F0A50D%7D/viewSolicitationDocument=1/Discovery%20Community%20Announcement.pdf>) The time frame for the solicitation is intended to be:

Release of draft AO.....	May 2014(target)
Release of final AO.....	September 2014(target)
Preproposal conference.....	~3 weeks after final AO release
Proposals due.....	90 days after AO release
Selection for competitive Phase A studies...	May 2015(target)
Concept study reports due.....	April 2016(target)
Down-selection.....	October 2016(target)
Launch readiness date.....	NLT December 31, 2021

Information on the Europa Instrument Program Element Appendix (PEA) of the Stand Alone Missions of Opportunity Notice (SALMON-2) can be found in the Upcoming Europa Missions Announcement (https://www.fbo.gov/index?s=opportunity&mode=form&id=e713baa8075be75054d20f25693a4ecd&tab=core&_cvview=0). The time frame for the solicitation is intended to be:

Release of PEA Community Announcement ...	Late April 2014 (target)
Release of final PEA	July 2014 (target)
PEA Preproposal conference	~3 weeks after final PEA release
PEA Proposals due	90 days after PEA release
Selection for competitive Phase A studies	April 2015 (target)
Concept study reports due	December 2015 (target)
Down-selection	April 2016 (target)

This partnership opportunity is being issued to interested and qualified teaming partners to help prepare the NASA/GSFC concepts for proposal submittal and to provide a flight qualified instrument subsystem should the instrument be selected for flight. The subsystem NASA/GSFC is interested in finding partners for is a turbomolecular vacuum pump suitable for operation with a single rotary stage (hereafter designated as a wide range pump, or WRP). For this partnership opportunity dealing with the preparation of the initial submission, there will be no exchange of funds between the teaming partners. Funding will be available for Phase A and subsequent phases should the investigation be approved to continue through the mission-defined gates for flight. NASA/GSFC reserves the option to not select any teaming partners under this POD offering on the basis of materials received.

2.0 Instrument Overview

The WRP subsystem of interest will enable measurements of chemical and isotopic compositions using mass spectrometry of solid or gas samples acquired. Mass spectrometry requires low pressure (high vacuum conditions) to be maintained within a vacuum vessel for operation. The controlling electronics for the WRP system will be provided by GSFC.

3.0 Pre-selection Support

3.1 Initial Proposal Support

SOW: It is expected that the selected respondent will provide support using their own resources to help develop and write the Instrument proposal in response to the opportunities in the area of the WRP. This will involve meeting with the scientists and the overall instrument engineering team: to help define the end-to-end performance requirements, including interfaces to the various subsystems and the spacecraft; to identify study topics; and to predict performance. This will include cost estimation for all development phases. The period of performance for this interval is the timeframes shown above from POD selection to initial proposal submission.

3.2 Phase A Study and Phase A Proposal Support

SOW: If the instruments are selected for Phase A studies, the proposal team will receive funding to conduct a Phase A study and submit a detailed Concept Study Report (CSR) to NASA. The respondent providing the WRP will be allocated a portion of this funding to perform trade studies as identified in the initial proposal. The respondent will also be expected to contribute to designing, documenting, and costing the WRP system design, fabrication, integration and testing for inclusion in the final Concept Study Report. The period of performance for this interval is detailed in the above timelines.

3.3 POD Response Instructions

The respondent shall address each of the following:

- 1) The pump design shall have a mass of 600 grams or less.
- 2) The pump shall require on average less than 12 watts operating under normal load using a source voltage of 12 volts. Peak current during start up shall be less than 2.5 amps. A three phase delta arrangement is assumed for the motor windings.
- 3) The 1x life time requirement is 350 hours at speed with 256 stop/start cycles. This averages out for a typical run of 82 minutes of operation at speed, ~4 minutes for spin-up/spin-down, and 10 minutes rest between cycles (96 minute test cycle x 256).

A 2x life demonstration is required for a successful life test qualification (700 hours at speed, 512 stop/start cycles). During the qualification life testing the pump will operate at temperatures with this distribution of time and temperature: 20% at 15C, 30% at 35C, 30% at 45C and 20% at 65C. The pump shall be operated using NASA supplied flight-like drive electronics.

- 4) Pump survival temperatures range from -50C to 115C although the upper limit may be reduced as the mission requirements are further defined. The rotor must maintain balance after repeated exposure to the operational and survival temperature ranges. Operational temperatures at the mounting interface will be controlled to be within the range from 15C to 55C. The QM unit will demonstrate operation at 0C at speed (starting/stopping at normal elevated temperature, see following paragraph).

The pump will be able to use NASA supplied heaters located approximately 2/3 of the way up from the interface to heat the unit during start-up and shut-down. The pump temperature during this short phase of operation will be between 15C to 20C. The Contractor can use substitute heaters for WRP testing at the Contractor's facilities.

- 5) Mars surface ambient atmosphere shall be the nominal environment for the pump in terms of CO₂ exposure and exhaust pressure (5 to 10 Torr).

Minimum output/input pressure compression ratio to be developed shall be at least 10^8 (10 Torr exhaust implies a capability for as low as 0.1 microTorr at the inlet).

6) The use of organic materials must be minimized and exceptions formally approved on a case-by-case basis. Perfluorinated fluids for ball bearing lubrication are acceptable. All materials must meet stringent out-gassing requirements; the WRP shall outgas less than 8.7 E-15 g/s .

7) There shall be one platinum o-ring plumbing interface at the distal end of the pump.

8) The electrical interface shall be at the distal end of the pump using a hermetically-sealed 9-pin connector.

9) These pumps will be exposed to random and sine vibration environments in each of 3 axes:

Sine sweep vibration in X, Y, Z:

Freq (Hz)	Level (g)
5	1
30	25
100	25

The frequency ranges are with a slope from 5Hz starting from 1g. The duration is 2 oct/min (5 -100 Hz) Sweep up and down. Note: Notching is allowed below 100Hz to limit exceeding the DLF.

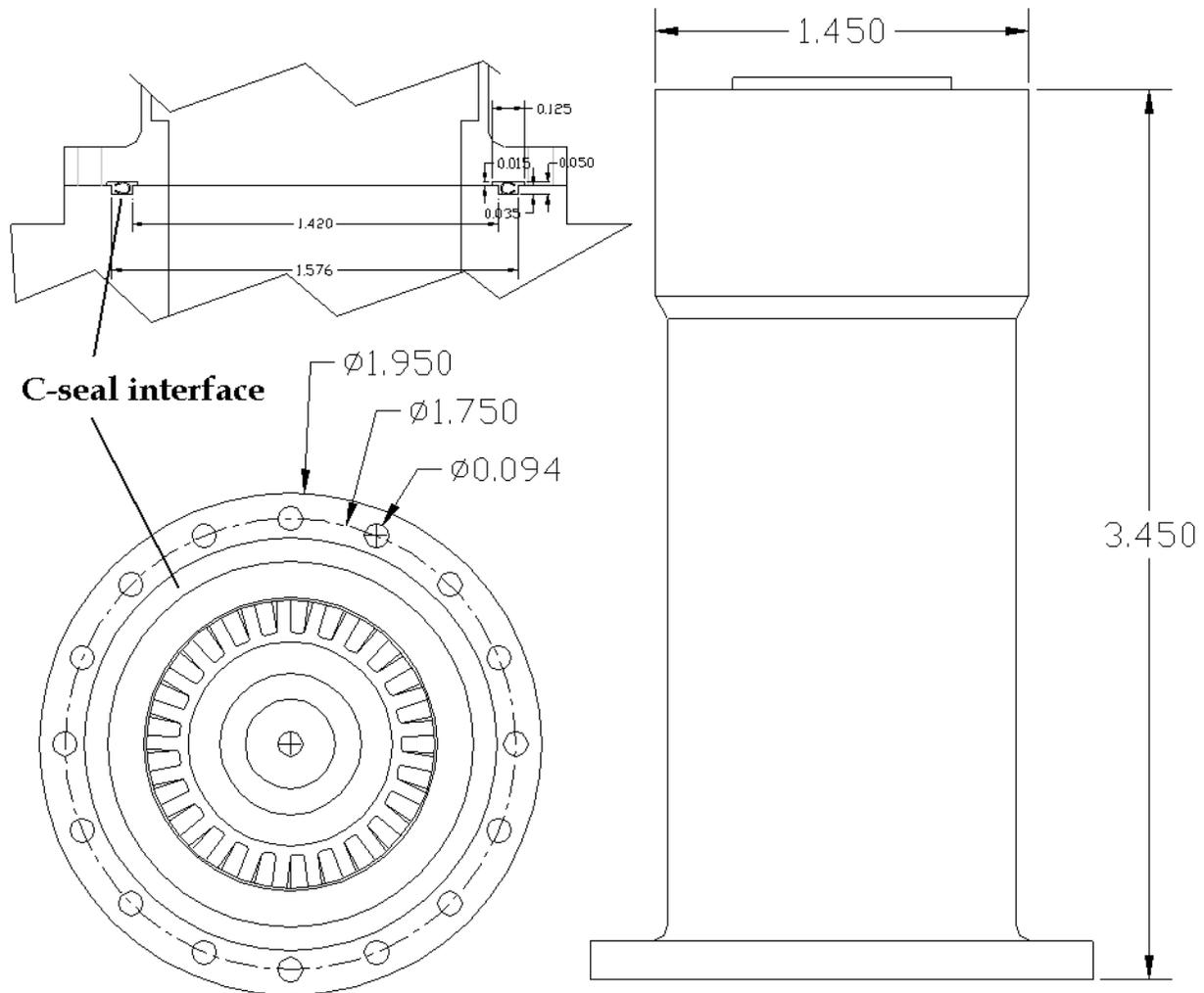
Random vibration in X, Y, Z:

Freq (Hz)	Level (g^2/Hz)
20-40	+6dB/oct
40-450	0.16
450-2000	-6dB/oct

Overall: 11.00 grms. 2 min for qual/prototype model, 1 min for acceptance or protoflight.

PUMP MECHANICAL INTERFACES

The below figure represents the approximate geometry of the an example WRP (units in inches):



10) Identify which missions they have successfully supported in this capacity and provide a customer reference POC.

11) Provide a very Rough Order of Magnitude (ROM) cost estimate and timeline for the scope of the design, fabrication, and testing of the WRP. This ROM will not be considered a binding commitment, but will serve as a consideration during the partnership evaluation. The respondent is invited to comment on the reasonableness of the placeholder cost.

4.0 General Instructions for POD Response

Potential respondents are asked to contact the GSFC point of contact (listed below) as soon as possible after release of this document with a **Notice Of Interest** (intentionally not called a notice of intent). This Notice of Interest does not create an obligation to respond to the POD, but allows the NASA/GSFC team to provide answers to questions from potential partners. Respondents may send questions to the NASA/GSFC at the E-

mail address listed below. All questions and answers will be made available to all those who respond to the Notice of Interest. The source of the questions shall be held confidential. Questions and answers that contain information unique to a respondent's proprietary approach will not be shared if they are identified as such. There are no plans to provide additional details on the proposed mission beyond those already included in Section 3.0 of this POD unless requested. The Notice of Interest is to ensure that any questions and answers are provided to all interested parties.

For purposes of this partnership opportunity, the POC is Mike Adams, Michael.I.adams@nasa.gov, 301-286-2010.

Responses to the Partnership Opportunity Document shall:

- 1) Be in a presentation format (viewgraphs in the form of Powerpoint slides) that shall not exceed 30 pages. The font size for the text shall be no smaller than 12 point.
- 2) Be specific about the system that the response is addressing.
- 3) Address all requirements noted in sections 3.0 of this document.

Responses will be treated as proprietary information and controlled as such.

The respondents shall deliver the requested information in presentation format. Final presentation packages must be received by 1600 EDT, June 20, 2014. Presentations are to be delivered electronically to Michael Adams at the above listed email address.

5.0 Selection Criteria for Awarding Partnership Opportunity

Selection criteria will be consistent with the desire to encourage cost effective partnerships between the Government and Industry. The information requested in Section 3.3 will allow the subject-matter-expert evaluators to determine how well the respondent's WRP is appropriate to this instrument.

Selection Criteria

Technical Performance (60 points)

- Experience (and Team skills) including past performance on flight instrument and/or mission developments. Experience developing and implementing similar space flight hardware is a minimum requirement.
- Demonstrated capability to meet the performance parameters specified in Section 3.0 (via quantitative information)
- Experience and past performance in proposal phases

Cost Reasonableness (40 points)

- Reasonableness of cost and schedule estimates, including demonstration of past performance on equivalent systems
- Estimated total cost of WRP and associated I&T
- Level of resources allocated to the proposal phase

Acronyms List

AO	Announcement of Opportunity
CSR	Concept Study Report
EDT	Eastern Daylight Time
NASA/GSFC	NASA/Goddard Space Flight Center
PEA	Program Element Appendix
POC	Point of Contact
POD	Partnership Opportunity Document
ROM	Rough Order of Magnitude
SALMON-2	Stand Alone Missions Or Opportunity Notice
SOW	Statement Of Work
WRP	Wide Range Pump