

## Request for Information on Stirling Devices for Space Power Generation

### General Information:

Solicitation Number:	NNC15ZMR015L
Posted Date:	June 3, 2015
Proposal Due Date:	August 5, 2015
Recovery and Reinvestment Act Action:	No
Classification Code:	A – Research and Development
Issued By:	Science Mission Directorate
NAICS Code:	541712
CFDA Number:	43.001 Science

The National Aeronautics and Space Administration (NASA) Glenn Research Center (GRC) releases this request for information (RFI)/sources sought notice for information and planning purposes and is not to be construed as a commitment by the Government. **RFI respondents are requested to complete and submit the Stirling Power Technology Questionnaire (Appendix A) of this RFI by the August 5, 2015 deadline.** It is the intent of the Government to use this information for market research, information and planning purposes. The Government will not pay for the provision of any information received in response to this RFI, nor will it compensate any respondents for the development of any such information.

Respondents will not be notified of the results of the RFI. This is not a request for proposals, quotations, or bids. Responses to this RFI will not be returned. Not responding to this sources sought does not preclude participation in any future and potential solicitations or procurement activities. If a formal solicitation is released, it will be available via Federal Business Opportunities (FedBizOpps) <https://www.fbo.gov> . It is the potential respondent's responsibility to monitor the site for the release of any solicitation or synopsis. All offerors who provide goods or services to the Federal Government must be registered in the System for Award Management (SAM) located at <https://www.sam.gov> .

### **Introduction:**

The Radioisotope Power System Program (RPSP) under the Planetary Science Division (PSD) within the Science Mission Directorate at the National Aeronautics and Space Administration (NASA) in partnership with the Department of Energy (DOE) Office of Space and Defense Power Systems seeks to identify Stirling based technology options that could be utilized in a 100 to 500 We Stirling Radioisotope Generator (SRG). The SRG power output in this RFI scenario may be satisfied using one or more individual Stirling convertors to form an integrated system. This Request for Information (RFI) will provide the RPSP with data on possible robust and reliable Stirling convertor designs that deliver high efficiency, low mass, simple operation and long life (without maintenance) for deep-space missions lasting 10 years or more.

Robustness is a system characteristic enabled by design margins that result in controlling variability such that it is tolerant to factors encountered during manufacturing, transport, user operation or time. Robustness in manufacturing results in a system that is tolerant to process

variations. Robustness in transport results in a system that is tolerant to handling variations. Robustness in user operation results in a system that is tolerant to environmental and control variations. Robustness in time results in a system that is tolerant to wear variations. Reliability is defined as the probability that a given item will successfully perform its intended function for a given period of time under a given set of conditions.

RFI input is requested from Government organizations, industry suppliers and manufacturers that have experience designing, building and operating Stirling devices, and/or industry sources that have demonstrated capabilities for manufacturing precision devices to space flight quality standards.

NASA's goal is to utilize SRGs for planetary science missions. To that end, NASA needs to understand the availability of Stirling suppliers and the supplier's demonstrated capabilities to build and operate robust and reliable hardware for robotic spaceflight applications. Future goals may include human spaceflight applications. This RFI seeks responses to understand sources of Stirling power devices and the state-of-the-art in this field. If other Stirling-cycle devices, such as cryocoolers, are available that can be modified to provide power, the Government is interested in understanding this potential.

The questions in the **Stirling Power Technology Questionnaire (Appendix A)** are posed to gain understanding about product attributes, design features and constraints, performance parameters, operating experience, testing scenarios and results, manufacturing history, reliability, and scalability. Additionally, this RFI also requests industry perspective on potential industry partnership opportunities, integration strategies, cost or time saving measures, and technology development risks.

The RPSP has formed a Government assessment team comprised of subject matter experts to perform an industry Stirling assessment, including this RFI. This team will engage the industrial community to seek inputs on industry capabilities, Stirling technology design options, and system implementation strategies. Following the collection of the data from this RFI, NASA may request site visits with the respondents. This RFI could be a precursor to a potential, future Government Request for Proposal (RFP) for SRG technology maturation leading to the development of a flight-ready SRG for a potential future PSD mission application. This RFI does not constitute a commitment, implied or otherwise, that NASA or the Government will take procurement action in this matter, nor does it prohibit the Government from taking action. Further, neither NASA nor the U.S. Government will be responsible for any costs incurred in furnishing this information.

**Prior to the RFI submission deadline, a Stirling Technical Interchange Meeting (STIM) is planned for June 29, 2015.** Registration materials and the draft agenda for the STIM are posted with this Stirling Devices for Space Power Generation RFI. The agenda for the STIM includes a review of Government plans, offers RFI respondents and STIM attendees time to present non-proprietary information to the community, and provides time for individual Government to industry discussions. RFI respondents and interested parties are encouraged to complete and submit the STIM registration form by June 17, 2015, for attendance at the STIM event being

held June 29, 2015. Further information related to this RFI and the STIM event will be posted on FedBizOpps, as it becomes available.

This RFI is used solely for information planning purposes and does not constitute a solicitation. In accordance with Federal Acquisition Regulation (FAR), responses to this RFI are not offers and cannot be accepted by the Government to form a binding contract. The Government is under no obligation to issue a solicitation or to award any contract on the basis of this RFI. The specific information provided in responses to this RFI will not be made public in an effort to protect any proprietary company information. The RFI assessment team will use the submitted information to complete the assessment. Respondents to the **Stirling Power Technology Questionnaire (Appendix A)** shall clearly and properly mark any propriety or restricted data contained within their submission so it can be identified and protected. Respondents are solely responsible for all expenses associated with responding to this RFI. Responses to this RFI will not be returned, and respondents will not be notified of the result of the review.

#### **Stirling Technology Assessment Process:**

This assessment will consist of the phases described below:

Data Collection Phase: NASA is utilizing the RFI vehicle to collect input from industry with experience in designing, building and operating Stirling devices. Prior to the RFI submission deadline of August 5, 2015, the Stirling Technical Interchange Meeting (STIM) is taking place June 29, 2015, to accomplish group and one-on-one information dialogue(s) between NASA and industry. **RFI responses are requested in the form of answers to the Stirling Power Technology Questionnaire (Appendix A) of this RFI by the submission deadline of August 5, 2015.** RFI respondents are encouraged to answer all questions, or any subset that are relevant to their situation. Any RFI response information supplied that is company proprietary shall be marked accordingly. Responses will not be shared outside of the Government assessment team and the RPS Program Management and the PSD management.

Analysis Phase: During this phase, the assessment team will review the written RFI responses for favorable convertor design options and implementation strategies that could be considered for future SRGs. The results of this phase will be shared with RPS Program Manager prior to any further contact with industry. The contact plan for follow-on conversations with respondents, where considered beneficial, will be formulated based on the outcome of the activities in this phase and shared with the RPS Program Manager for concurrence.

Conversation Phase: During this phase, individual contact may be made with RFI respondents. There will be specific follow-up questions, and those questions will be structured to facilitate dialogue to better understand the industry capability and further understand the written RFI responses received from the **Stirling Power Technology Questionnaire (Appendix A)**. This phase may include correspondence, teleconferences, and site visits with the respondents. The site visits would focus on facility tours and hardware inspections. The Government team may consider the use of procurement and non-procurement vehicles, such as non-reimbursable cooperative agreements (e.g. Space Act Agreement), for further data gathering or to facilitate temporary bailment agreements and hardware loans for Government testing.

Planning Phase: This phase will document all information received and will summarize the information for use in Government planning. This phase will identify opportunities to improve technology development planning and technology infusion opportunities for future Government use. The planning may also include recommendations for RPSP funding to conduct tests of hardware assets at respondent facilities, or to acquire test hardware for further use by the Government. Any further contractual actions by NASA, DOE or the Government would be pursued through separate procurement activities.

**RFI Response Details**

RFI responses shall include:

- Name of the primary point of contact for the response and business title
- Institution or organization affiliation
- Postal address, e-mail address, and phone number
- Identification of other key individuals who collaborated on the RFI response
- Responses to **Stirling Power Technology Questionnaire (Appendix A)** of this RFI.

RFI Response Submission Requirements:

- The RFI response time has been set for 45 days. Responses to this RFI shall be submitted no later than 11:59 PM Eastern Time, on August 5, 2015. RFI submissions shall be submitted and accepted as e-mail attachments only. All RFI responses shall be sent to Dawn R. Pottinger, NASA Contracting Officer at: [dawn.r.pottinger@nasa.gov](mailto:dawn.r.pottinger@nasa.gov) , with “Stirling Technology RFI Response from [Company Name]” in the subject line.
- All files with confidential or proprietary information shall be sent via secure file transfer, with passwords provided. If a secure file transfer system is not available, please contact Dawn Pottinger at (216) 433-5063 for assistance.
- Responses shall be limited to 20 pages total including figures and references as appropriate. Use single-spaced, 12-point, Times New Roman font. Requested file formats are: Microsoft Word (.docx) or Portable Document Format (PDF). Where possible, please provided figures in “native file” format to allow for review in greater detail.
- An e-mail confirmation of RFI response receipt will be sent from NASA to respondents within a one-week period to the designated point of contact.

**RFI Primary Point of Contact:**

Dawn R. Pottinger  
NASA Glenn Research Center  
Contracting Officer  
[Dawn.R.Pottinger@nasa.gov](mailto:Dawn.R.Pottinger@nasa.gov)  
216-433-5063

**RFI Alternate Point of Contact:**

June F. Zakrajsek  
NASA Glenn Research Center  
Radioisotope Power Systems Program  
[June.F.Zakrajsek@nasa.gov](mailto:June.F.Zakrajsek@nasa.gov)  
216-977-7470

### **Stirling Technical Interchange Meeting (STIM) Details**

- STIM Registration Forms Due: June 17, 2015
- Submit STIM forms to: [dawn.r.pottinger@nasa.gov](mailto:dawn.r.pottinger@nasa.gov)
- STIM Event Date: June 29, 2015
- STIM Time: 8:00 a.m. – 5:30 p.m.
- STIM Location: Ohio Aerospace Institute, 22800 Cedar Point Road,  
Cleveland, Ohio 44142.

Submit RFI responses to Dawn R. Pottinger, NASA Contracting Officer at: [dawn.r.pottinger@nasa.gov](mailto:dawn.r.pottinger@nasa.gov)  
**RFI: NNC15ZMR015L - Responses Due: August 5, 2015**

## Appendix A

### Stirling Power Technology Questionnaire

Please respond to the following questions regarding your capabilities, hardware products, and strategies for developing and operating robust and reliable Stirling convertors for deep-space power generation use. Please use consistent units of measure throughout your responses (all metric or all English). You may respond to any or all questions.

- 1) Does your company have existing Stirling devices that are relevant for use in 100 to 500 We Stirling Radioisotope Generators? If so, how are they currently used? If they are not used, please describe the current maturity level? (NASA uses Technology Readiness Levels (TRLs) to describe technology maturity. If possible, please state the maturity level of the device using TRL. For TRL definitions see:  
[http://www.nasa.gov/pdf/458490main\\_TRL\\_Definitions.pdf](http://www.nasa.gov/pdf/458490main_TRL_Definitions.pdf)
- 2) How does your Stirling device work? What are the configurations, masses and physical sizes? What are the key performance parameters including power output, efficiency, and operating temperature? What, if any, hardware or operational error fault tolerance is built into the devices? How does the device operate without adjustment over a range of thermal input, and what is the range?
- 3) How many units have been built of each Stirling device? Have the units been operated at their intended performance levels and for how long? Do the units show repeatable performance? What are the average lifetimes of your Stirling devices? If long duration operational data is not available, what are the key risks that must be overcome to achieve >10 year operating life?
- 4) What are the scalabilities of the design in terms of power level, mass and physical size? What are the expected performance sensitivities as the design is scaled lower or higher in power output? If your device is not a Stirling convertor, please indicate how the device can be modified to provide power.
- 5) What experience does your company have in building space flight hardware and in developing nuclear power systems?
- 6) What company assets and expertise could be utilized in developing a space-rated Stirling convertor?
- 7) What is your production strategy for delivering a space-rated Stirling convertor? What industry partnerships could be leveraged?
- 8) What options exist to sustain your company's Stirling design and production capabilities during periods of inactive use by the Government?
- 9) Is there any other information that you would like to share about your company or your products that would be beneficial to the objective of this RFI?