REQUEST FOR INFORMATION FOR
INPUTS TO THE SCIENCE MISSION DIRECTORATE STRATEGIC PLAN FOR SCIENTIFIC DATA AND COMPUTING

Solicitation Number: NNH18ZDA017L
Release Date: September 18, 2018
Response Date: 11:59 PM Eastern Time October 19, 2018

1. Summary:
This Request for Information (RFI) invites comments and suggestions to assist NASA’s Science Mission Directorate (SMD) in the development of a new Strategic Plan for Scientific Data and Computing. Over the next five years the plan will be used to guide the evolution of the array of data and computing systems supporting research across four science areas: Astrophysics, Earth Science, Heliophysics and Planetary Science. This notice is published to solicit input from all stakeholders, including but not limited to members of scientific community, academic institutions, other agencies, the private sector, professional societies, advocacy groups, the general public, and international collaborators. Information gathered through this RFI will solely be used for strategic planning purposes and program development.

2. Principles:
As NASA’s Science Mission Directorate develops its Strategic Plan for Scientific Data and Computing, the following four principles underlie this work:

   1. Continued free and open access to scientific data for any use
   2. Improved ease of use and discoverability
   3. Enhanced science applications and new use cases
   4. Incorporates best practices and “state of the art” through partnerships

3. Background:
Consistent with NASA’s 2018 Strategic Plan\(^1\), the SMD seeks to expand human knowledge through new scientific discoveries in order to understand the Sun, Earth, Solar System, and Universe. SMD, in partnership with the Nation’s science community, conducts scientific studies of the Earth and Sun from space, returns data and samples from other bodies in the Solar System, and peers out into the vast reaches of the Universe. This work seeks to address three core contexts that span the breadth of SMD’s activities\(^2\):
   ● Discover the secrets of the Universe
   ● Search for life elsewhere
   ● Safeguard and improve life on Earth

SMD organizes its work into four broad scientific pursuits: Astrophysics, Earth Science, Heliophysics, and Planetary Science. Each of these pursuits is managed by a Division within the

\(^1\) [https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf](https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf)

\(^2\) [https://science.nasa.gov/about-us](https://science.nasa.gov/about-us)
Directorate and has its own science sub-goals. In addition, SMD manages satellite acquisition on behalf of other federal agencies, most notably the National Oceanic and Atmospheric Administration, through its Joint Agency Satellite Division. Additionally, through the Science Engagement and Partnerships Division, SMD’s results are broadly disseminated through a variety of media to learners of all ages.

Each of the four Science Divisions within SMD generates, analyzes, and archives large amounts of data to support unique science objectives and delivers data and scientific results to millions of users around the world. In the past, management of data and computing resources has been conducted based on the specific needs of each mission or Division, with limited consideration for enabling inter-disciplinary research.

Currently SMD stores over 100 Petabytes (PB) of observational and model data. For example, the Earth Science Division archives contain nearly 30PB of observational data and more than 70PB of model output. By 2023, the Earth Science archives will contain over 150PB of observational data with an annual growth rate of nearly 50PB per year. Within 5 years, nearly 100PB of data will be collected by instruments or generated by models each year across SMD. This anticipated growth of SMD’s science data presents unique opportunities for new scientific discovery as well as significant challenges for data management, curation, access, analysis, maintenance of provenance and computing.

In addition to its archives, SMD supports two major supercomputing centers which provide more than 10 Petaflops peak capacity for the Agency’s scientific research and engineering workloads. These centers mainly support research in areas of Astrophysics and Heliophysics theory development and validation, weather and climate modeling and data assimilations, and large-scale data synthesis and analysis.

4. SMD Data and Computing Systems:
Data and computing systems supporting the Science Mission Directorate have embraced a system-of-systems approach. These loosely coupled systems have allowed each Science Division flexibility to support unique science requirements and user needs of the communities. Please visit the following URLs for more information.

- Astrophysics Data System - https://science.nasa.gov/astrophysics/astrophysics-data-centers
- Earth Observation Data and Information System – https://earthdata.nasa.gov
- High-End Computing - https://www.hec.nasa.gov/
- Planetary Data System - https://pds.nasa.gov/

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3 https://earthdata.nasa.gov/about/eosdis-cloud-evolution
4 https://www.nas.nasa.gov/hecc/resources/environment.html
5. Development of a Strategic Plan for SMD Data and Computing:

Responses to this RFI will inform development of a Strategic Plan for Scientific Data and Computing for NASA’s Science Mission Directorate. The objective of the Strategic Plan is to articulate a whole-of-SMD five-year strategy that has four overall goals:

- Improve discovery and access for all SMD data for immediate benefit to science data users and to improve the overall user experience
- Identify large-scale and cross-disciplinary/division science users and use-cases to inform future science data system capabilities
- Enable strong theory programs that are firmly based on NASA’s observations
- Modernize science data and computing systems to improve efficiency and enable new technology and analysis techniques for scientific discovery and commercial use

6. How to respond to this RFI:

The Strategic Plan for Scientific Data and Computing is intended to span the range of activities within the Science Mission Directorate, including opportunities for cross-disciplinary science investigations. Respondents are therefore encouraged to think broadly about future capabilities and needs, and we encourage members of all fields of NASA science, engineering, industry, and academia to respond to this RFI in order to ensure a range of views.

NASA may use your response to aid in programmatic decisions about future investments for data and computing, including partnerships with private sector and philanthropic organizations. This RFI is not to be construed as a commitment by the Government nor will the Government pay for information solicited. No proposals will be awarded funding as a result of this RFI.

Responses will be accepted only if submitted as a Notice of Intent (NOI) via NSPIRES at https://nspires.nasaprs.com/external; see Section 9 for instructions. Responses provided by email, mail or other means will not be accepted.

Each response to this RFI should provide the following information:

I. Cover Page that includes:
   a. Title of the response
   b. Author name(s)
   c. Company/Organization or specify “No Affiliation”
   d. Email
   e. “Summary” that includes the author(s)’ Research domain(s), discipline(s), industry and summary of the response (‘abstract’; 1500 characters maximum)

II. Answers to the following questions in the Program Specific Data section of the NOI:

1. Groundbreaking Research:
   a. What large-scale and inter-disciplinary/divisional science investigations could be enabled by advanced data and computing capabilities? (4000 characters maximum)
b. Describe pressing research questions within or among SMD-supported science areas, the current state-of-the-art and how new data and computing capability could lead to groundbreaking science. (4000 characters maximum)

2. Data and Computing Architecture and Infrastructure:
   a. Describe any limitations, including absence of existing science data tools or computational capabilities, which must be addressed to: (4000 characters maximum)
      ● Support groundbreaking research
      ● Support fundamentally new approaches to science (including machine learning, deep learning and artificial intelligence)
      ● Manage and provide open access to nearly an exabyte of data by 2025.
   b. How does SMD data and computing architecture and infrastructure need to evolve to support groundbreaking science? (4000 characters maximum)

3. Discoverability, Use and Preservation:
   a. How can SMD harness advances in data science and modern computational platforms to provide seamless search, discovery and use of data and computing across Divisions? (4000 characters maximum)
   b. Describe standards, access methods, analysis tools and visualization capabilities that will increase the use of NASA science data by researchers, the public and commercial users. (4000 characters maximum)
   c. Describe use cases and how to improve the user experience and user interfaces, including for citizen scientists. (4000 characters maximum)
   d. How can data from multiple locations/sensors/sources be identified as it is collected? As data is analyzed, how can data be identified for repeatable science investigations? (4000 characters maximum)
   e. How can SMD continue to provide free and open access to scientific data and maximize availability and discoverability while also maintaining data integrity? How can SMD prevent unauthorized usage, disruption, modification or destruction? (4000 characters maximum)

4. Partnerships:
   a. How can SMD partner with academic, nonprofit, commercial and international organizations to improve access to, analysis of and long-term perseverance of scientific data? (4000 characters maximum)
   b. How can SMD partner with existing academic and commercial high performance computing networks to improve large scale analysis of data and models? (4000 characters maximum)

5. Other: (4000 characters maximum)
   a. What else should SMD consider with regards to data, computing, storage, and networking, software, algorithm release, software portability, development practices/approaches, policies and open data, etc. that was not previously addressed? (4000 characters maximum)
7. Submission Information:
Due October 19, 2018 by 11:59 PM Eastern Time

Submissions will be used to inform development of the Science Mission Directorate’s Strategic Plan for Scientific Data and Computing. As such, please think broadly about responses to ensure that they are in alignment with the cross-SMD nature of this activity. Information gathered through this RFI will be solely used for strategic planning purposes and program development. Respondents shall not provide any information that is considered proprietary and/or confidential as all information collected through this RFI will be used to develop a public plan.

It is emphasized that this RFI is neither a Request for Proposal, nor an Invitation for Bid. This RFI seeks information for planning purposes only; therefore, NASA does not plan to respond to the individual RFI responses. As stipulated in FAR 15.201(e), responses to this notice are not considered offers and cannot be accepted by the Government to form a binding contract. Pursuant to FAR 52.215-3, entitled Request for Information or Solicitation for Planning Purposes, this information is being made available for market research, information, and planning purposes and to allow potential proposers the opportunity to verify reasonableness and feasibility of the requirements, as well as promote competition. This RFI is subject to review or cancellation at any time and is not to be construed as a commitment by the Government to enter into a contract. The Government will not pay for the information submitted in response to this request, and respondents will not be notified of the results.

Please do not request a copy of the solicitation, as no solicitation exists at this time. If a firm requirement is developed and a solicitation is issued, the solicitation will be made available through NSPIRES (https://nspires.nasaprs.com/external/). It is the responsibility of Offerors and interested parties to monitor the internet sites for the release of the solicitation and amendments, if any, and they will be responsible for downloading their own copy of the documents. NASA Clause 1852.215-84, Ombudsman, is applicable. The Center Ombudsman for potential acquisitions can be found at http://prod.nais.nasa.gov/pub/pub_library/Omb.html.

8. Contact:
Questions concerning this RFI may be addressed to Kevin Murphy, Science Mission Directorate, NASA, Washington, DC 20546; Email: hq-smd-data-computing-rfi@mail.nasa.gov and Ellen Gertsen, Science Mission Directorate, NASA, Washington, DC 20546; Email: hq-smd-data-computing-rfi@mail.nasa.gov.

9. NSPIRES Instructions:
All submissions will be in the form of a Notice of Intent (NOI) submitted via NSPIRES. The individual submitting the NOI must have an NSPIRES account, but does not require an affiliation with an NSPIRES organization. See registration instructions at http://nspires.nasaprs.com (select “Getting Started”). Once submitted, an NOI cannot be edited or deleted. Any changes should be made by submitted a “revised” NOI as a second submission.
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: Inputs to SMD Strategic Plan for Scientific Data and Computing (NNH18ZDA017L)" 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 or choose an organization to link this to. Note that once a link it made it cannot be changed.
9. Click "Save" on next page.
10. It is not necessary to complete the following "NOI Details" sections: Business Data; Budget; Team members. HOWEVER, it is imperative that you complete the “Summary” (this is the abstract mentioned in “I.e.” above) and answer all “Program Specific Data” questions. These answers make up your RFI response and reflect the content described in Section 6 above.
11. Click Submit NOI button. NOTE that this does not complete the submission process.
12. Ignore any warnings about incomplete NOI elements. Click "Continue".
13. 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 change the answers to the Program Specific Data questions any time before the submission deadline, however once your RFI is submitted, it cannot be deleted.