

## **NASA Response to the *Enabling Planetary Science and Exploration: A Review of the Solar System Exploration and Research Virtual Institution Report Recommendations***

- Recommendation 1.1.1 The SSERVI model that is funded by multiple directorates should continue. SSERVI funding levels from both sources should be agreed upon between the mission directorates and should remain stable for the duration of each CAN. [Section 5]  
RESPONSE: We concur. It is important for the different directorates within NASA to work together. As Artemis human missions are implemented, the overall shared contributions of ESDMD, SOMD, and SMD for exploration/science activities and capabilities are going to increase dramatically at a much larger scale than the SSERVI investment considered alone. In that context, the contributions of each mission directorate to SSERVI should not be considered as a metric of cross-directorate collaboration in the future because of many additional joint contributions that are planned.
- Recommendation 1.2.1: With input from NASA HQ (both HEOMD and SMD) and the planetary science community, a focused charter should be developed for SSERVI, which can serve as a mechanism for SSERVI strategic planning. The charter should identify potential initiatives that engage both SSERVI and members of the broader planetary science and exploration communities. The SSERVI Charter should be reviewed at a regular cadence with NASA mission directorates in conjunction with development of the next SSERVI CAN in order to be responsive to new discoveries and exploration priorities. [Sections 3, 4, 5]  
RESPONSE: We concur. NASA will work with SSERVI HQ to develop the inaugural charter and review it regularly.
- Recommendation 2.1.1: SSERVI focus should be directed on the Earth's Moon for the next cycle of node selections, and the current SSERVI nodes should align their work to include a focus on the Moon. For example, SSERVI should place greater emphasis on the Moon and should focus on integrating science and exploration objectives, as well as research needed for exploring new areas on the Moon, and exploration concepts for sustained human missions on the Moon, as well as exploration concepts on the Moon that could feed forward to Mars. [Section 3, 4]  
RESPONSE: We concur. Based on this recommendation and the renewed focus on human exploration of the Moon, [CAN-4](#) has a lunar focus.
- Recommendation 2.2.1: Use the successes and lessons learned from growing the lunar science community over the past decade to similarly rebuild and replenish the sample science community over the coming decade. Consider sample training, collection, documentation, preservation, curation, measurements, and science with integration among nodes in future focus themes and CANs. [Section 3]  
RESPONSE: We concur. There is an emphasis in developing the lunar sample community in CAN-4.
- Recommendation 2.3.1: Future CANs should continue to target diverse expertise for NASA to carry out its exploration goals and to respond to new scientific discoveries. Scientific diversity may be achieved through the identification of other NASA divisions that could benefit and support a focused SSERVI node, especially in responding to new scientific discoveries. [Section 4]

RESPONSE: We concur. The Biological and Physical Sciences (BPS) division will be participating in CAN-4, and the Astrophysics Division has partially funded previously awarded SSERVI nodes.

- Recommendation 3.1.1: High-level strategic coordination should occur between SSERVI Central leadership, SSERVI teams and NASA Mission Directorates on at least an annual basis to determine the highest priority needs of SMD and the human exploration community, which in turn could be used to redirect SSERVI team research. This method of communication will also help to ensure timely infusion of SSERVI research and results into NASA programs. A system should be established for requesting, expediting, and integrating with human exploration research activities.

RESPONSE: We concur and already implement this. NASA HQ (both PSD and ESDMD) and SSERVI Central meet weekly to discuss topics relevant to both communities. Both PSD and ESDMD personnel also attend the monthly and twice-yearly EC meetings.

- Recommendation 3.1.2: All initiatives carried out by SSERVI must have a deliverable associated with the activity. SSERVI Central should develop a quantitative mechanism to evaluate and measure success that (a) tracks both science and exploration topics that SSERVI teams are working on, and (b) also tracks how those topics map to current NASA priorities. Success criteria (different from science research reporting and publications) should be developed for evaluating exploration/operational research and products to ensure human exploration relevance and increase potential for infusion into exploration operations.

RESPONSE: We concur. NASA HQ will work with SSERVI Central to develop these metrics and to periodically evaluate SSERVI's success with respect to these metrics, where applicable.

- Recommendation 3.1.3: All published research products enabled by SSERVI funding should acknowledge this source of support.

RESPONSE: We concur. SSERVI Central should work with SSERVI team members to ensure SSERVI funding is acknowledged for all products produced with SSERVI funding.

- Recommendation 3.2.1: SSERVI Central should better communicate the flexibility of SSERVI and its teams to the science and exploration community and clearly distinguish SSERVI from typical ROSES grants.

RESPONSE: We concur. SSERVI Central and NASA HQ will continue to communicate this message. For example, in coordination with the release of each CAN, we will hold a public town hall where it will be explicitly discussed how a credible SSERVI proposal differs from a typical ROSES proposal. Indeed, a townhall occurred on April 28, 2022 in conjunction with the release of CAN-4.

- Recommendation 3.2.2: To respond to new discoveries and changing NASA needs, SSERVI, in coordination with NASA, should redirect nodes and communicate the redirection to the planetary science and exploration communities. This redirection could include new areas of scientific research and as well as active coordination across teams for engaging in complex operational studies such as analog activities. As part of this, SSERVI should have the monetary flexibility to add expertise to nodes to quickly respond to new discoveries and priorities. The application and approval process for revectoring research efforts needs to be formalized, as should the communication of selections/changes to the community.

Revectoring efforts should be done so as not to provide an unfair competitive advantage to SSERVI teams in future funding opportunities.

RESPONSE: Cooperative agreements are very flexible in allowing teams to adjust and grow their research plans as the science evolves and/or exploration needs become apparent. However, they do not allow NASA to explicitly redirect/revector teams as suggested in this recommendation.

- Recommendation 3.2.3: As part of strategic planning, SSERVI, in coordination with HEOMD and SMD, should develop criteria for determining the success of collaboration between different SSERVI nodes, and should develop quantitative metrics to assess the success of the large, diverse, and integrated team model. [Section 8]

RESPONSE: We concur and will work with SSERVI Central to develop these metrics.

- Recommend 3.3.1: SSERVI should continue coordinating, communicating, and hosting community workshops and continue to adjust formats and other attributes of the online forums to ensure the broadest possible participation by the community on important exploration and science topics.

RESPONSE: We concur. SSERVI Central has been a leader in virtual workshops since before the pandemic and has recently done an incredible job supporting numerous virtual workshops, including the Lunar Surface Science Workshops.

- Recommendation 4.1.1: SSERVI nodes should be funded for 5 years, with a set of new nodes selected every 2.5 years to bring in new perspectives, and to respond to changes in science and exploration. [Section 3]

RESPONSE: We concur. This recommendation is consistent with past practice and future expectations. Nodes will continue to be funded for 5 years and the cadence of future CANs will be dependent on funding.

- Recommendation 4.2.1: The review of data confirmed that previously funded nodes appear to have a competitive advantage over new submissions. However, there appears to be no intrinsic bias in the review or selection processes. Debriefing of unsuccessful PIs should be improved and transparent.

RESPONSE: We concur and are heartened that the SSERVI review panel did not find any bias in the review or selection processes. NASA HQ will continue to provide debriefs to those unsuccessful PIs who request them, as we recognize importance of providing feedback to unsuccessful PIs to improve their proposals.

- Recommendation 4.2.2: Advertise SSERVI more widely in the community and give talks/workshops about the proposal process, so that a larger number of prospective PIs can be reached. Extreme care must be taken during the development of new CAN announcements and their review processes to identify areas of expertise and to select proposals based on innovative science and/or exploration excellence.

RESPONSE: We concur. NASA HQ will direct SSERVI Central to find creative ways to engage the broad lunar community that has interest in participating in a SSERVI proposal. Specific areas of particular interest to NASA have been called out in the newest CAN and proposals rated highly by the review panels will be selected.

- Recommendation 5.1.1: The goal(s) of SSERVI focus groups need to be better defined. It is recommended that all focus groups have a charter developed that link to the overall goals of the SSERVI (embodied in the SSERVI Charter - see Recommendation 1.2.1), clarify the

roles of each focus group, and include guidelines and metrics for developing and evaluating how they integrate across nodes and planetary/exploration communities, and resulting products. This includes developing annual plans and work products that are of science and exploration value. Structured focus groups should serve as a mechanism for community input to the goals of SSERVI and NASA. [Section 4, 8]

RESPONSE: We concur to the extent practical but acknowledge that these groups are all volunteer and this recommendation would require a significant amount of labor. NASA HQ will direct SSERVI Central to work with the leads of each of the focus groups to develop charters that include metrics to evaluate how these focus groups are integrating across nodes and the planetary and exploration communities, which will be reviewed by NASA HQ. NASA HQ also encourages these working groups to develop mechanisms through which the community can provide input into the broader goals of SSERVI and NASA.

- Recommendation 5.1.2: SSERVI Central should have the ability to create new focus groups in response to changing needs and new discoveries. Such an effort could be done in conjunction with other relevant organizations (e.g., the Lunar Exploration Analysis Group, LEAG and the Lunar Surface Innovation Consortium, LSIC) so as to ensure the broadest possible participation.

RESPONSE: We concur. NASA HQ considers the creation of new SSERVI focus groups to be within the purview of SSERVI Central and will direct them to work with other community groups to determine gaps that would be filled by these new focus groups without being redundant with existing groups.

- Recommendation 5.2.1: SSERVI should encourage continued and expanded coordination amongst the funded teams through the Analogs Focus Group with regard to analog field activities in order to reduce unnecessary duplication of effort and maximize sharing of resources. With increased awareness of SSERVI-funded field activities, SSERVI will be able to better assess the progress being made and then communicate to NASA and other stakeholders the impact of these analog field activities. In addition, SSERVI and NASA will be able to better communicate to SSERVI teams and proposers what the human exploration needs are. This enhanced awareness and communication will be particularly important as the pace of planetary exploration increases with the beginning of robotic and human operations on the Moon as part of Artemis. In addition, the SSERVI Field Analogs Focus Group is an ideal conduit to involve broader community participation. [Section 5]

RESPONSE: We concur. NASA has stood up the OHAT (Objectives for Human Analogs Team) to better coordinate analog efforts across the agency, including those funded through SSERVI. We are coordinating with the Analogs Focus Group on those discussions. In addition, the LEAG recently completed a [Specific Action Team study on Analog Objectives for Artemis](#) to capture and describe Artemis-relevant analog objectives in order to provide oversight and strategic coordination for analog activities designed to impact and inform future lunar surface exploration.

- Recommendation 6.2.1: Develop and disseminate a document that describes the roles and responsibilities of all SSERVI staff positions. Succession and workforce planning will benefit greatly from this effort. Develop and disseminate organizational charts and points of contact for SSERVI as well as the teams/nodes. [Section 7]

RESPONSE: We concur. NASA HQ will direct SSERVI Central to develop a description of the roles and responsibilities of its members and a corresponding organizational chart and share these in a prominent location on the SSERVI website.

- Recommendation 6.3.1: To similarly advise SSERVI on human exploration needs and activities, it is recommended that SSERVI bring in a SSERVI senior exploration advisor. (Sections 4, 7, 8)

RESPONSE: NASA HQ has discussed this finding and believes that having two advisors to SSERVI would further divide the lunar science and exploration communities and that the SSERVI Distinguished Scientist role encompasses both lunar science and human exploration endeavors. ESDMD is working with SMD to develop better connectivity with human exploration within NASA.
- Recommendation 6.3.2: SSERVI should consider selecting a small number of students or post-docs that are either scientifically linked to multiple nodes or represent a discipline or expertise that are distinct yet complementary to nodes. They should be integrated into collaborative activities among nodes. [Sections 4, 8]

RESPONSE: We concur and already do this. Historically, a NASA Postdoctoral Program (NPP) Fellow has been funded through SSERVI Central and works with multiple teams. Additionally, we can point to many cases where students have been associated or funded on one node and have gone on to be postdoctoral fellows/Co-Is at another.
- Recommendation 6.4.1: On an annual basis, SSERVI, together with HEOMD and SMD, should define and/or review requirements and establish priorities to the services that SSERVI provides to the community to ensure that SSERVI's limited resources support the central capabilities according to NASA's priorities. Similarly, NASA and SSERVI should develop priorities for SSERVI investments that are community resources, including facility investments, expectations for community availability of the facilities, and metrics to document facility investments, operating costs, and projects/users.

RESPONSE: We concur. NASA HQ will direct SSERVI Central to create a list of SSERVI-funded facilities and how community members can request access. SSERVI Central shall also document existing priorities for access to the services provided by SSERVI and how those decisions are made.
- Recommendation 6.5.1: NASA and SSERVI should develop guidelines for facility investment, including availability policies for broader community use, mechanisms to facilitate utilization, and metrics to document facility investments, operating costs, projects/users, continuing operations, and end-of-life plans.

RESPONSE: We concur. NASA HQ will work with SSERVI central to develop guidelines for facilities consistent with those for other PSD-funded facilities.
- Recommendation 6.5.2: Laboratory facilities are available within US and international SSERVI nodes. SSERVI should support the shared use of analytical facilities throughout the virtual network and encourage the interaction among these nodes through the coordination of laboratory use. Further, SSERVI should encourage community access to facilities developed or supported by SSERVI funds at a reduced rate. [Section 3]

RESPONSE: We concur. NASA HQ will direct SSERVI nodes to clearly state on their websites what facilities are available to other SSERVI team members and outside users along with any information necessary to access these facilities and the cost to use them.
- Recommendation 6.6.1: SSERVI and NASA should review SSTP on an annual basis to develop annual plans and priorities and ensure that SSTP development aligns with NASA needs. Further, NASA should evaluate the SSTP mission and consider whether to

consolidate SSTP development and place it under the purview of the Chief Scientist for the Planetary Data Ecosystem.

RESPONSE: We concur. SSTP is explicitly within the Planetary Data Ecosystem (PDE) and was included in the recent PDE Independent Review Board report, which can be found here: <https://science.nasa.gov/science-pink/s3fs-public/atoms/files/PDE%20IRB%20Final%20Report.pdf>. NASA HQ leadership for the Planetary Data Ecosystem will work with the PDE Chief Scientist and SSERVI to coordinate a review of SSTP.

- Recommendation 6.6.2: SSERVI should require teams/nodes to submit analysis-ready data products to the relevant TREKS portal and then communicate the availability of those products to the community (e.g., press releases and social media, as relevant).

RESPONSE: We concur. We will direct SSTP to work with the teams to socialize this. NASA HQ meets with the SSTP team each year to prioritize and coordinate additional content and tools. In addition, the upcoming CAN encourages researchers to coordinate with SSTP to integrate their spatial data products into the online tool.

- Recommendation 7.1.1: Explore new possibilities with commercial entities through relevant workshops and focus groups, and opportunities for shared students and/or postdocs.

RESPONSE: We concur and encourage SSERVI central to follow this recommendation.

- Recommendation 8.1.1: Future CANs should continue to sponsor innovative development opportunities for early career scientists through resources such as LunGradCon and activities like field training for early career researchers, however, efforts should be made to diversify the locations and training teams to reflect changes in the strategic direction and demographics within the community. SSERVI should create an internship/development program for training scientists to become effective managers and leaders within the community.

RESPONSE: We concur. SSERVI is known for supporting early career researchers and SSERVI CANs have emphasized and will continue to emphasize training and development of these members of the community. NASA HQ is happy to work with SSERVI Central to develop an internship or training program should they be interested in setting one up.

- Recommendation 8.1.2: To the fullest extent possible, SSERVI Central should encourage teams to formally track demographics of early career researchers, follow/document the careers of students after leaving the program, and communicate success stories of early career researchers who obtain jobs in the fields of space science and exploration.

RESPONSE: We concur. NASA agrees that SSERVI should track student and early career researchers' demographics and their careers as much as is reasonable and allowed by law. However, collecting detailed demographic information can raise legal and ethical concerns and should only be done in a manner that respects individual privacy, protects all data, and that is commensurate with legal restrictions. Thus, NASA HQ will work with SSERVI to ensure that these concerns are addressed.

- Recommendation 9.1.1: NASA should continue to encourage SSERVI's EDIA efforts and lead the community by example, develop resources for the community to use and share, develop a set of goals for increasing EDIA in the community, formally require teams to include EDIA efforts in their proposals, and encourage partnerships with Minority Serving and other institutions that are geographically and ethnically diverse. SSERVI should formally

report on and communicate the results of EDIA efforts at conferences and in monthly and annual reports.

RESPONSE: We concur. SSERVI has been a consistent champion for and leader of IDEA efforts. CAN-4 has an additional required section for IDEA activities and required Inclusion Plans, which will be scored as part of the evaluation criteria.

- Recommendation 10.1.1: SMD and HEOMD should conduct regular reviews of their SSERVI investment and alignment. The reviews should be tied to decadal surveys and NASA Strategic Plan development.

RESPONSE: We concur. NASA thanks the review panel for their hard work and we will continue to conduct regular reviews of SSERVI.