



Position Paper

Supporting a Resilient ISRU Development Strategy after VIPER Cancellation

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Executive Summary

The recent NASA proposal to cancel the VIPER mission underscores the significant risks inherent in large, complex, and high-cost lunar missions. However, VIPER is not just another mission; it is a cornerstone of NASA's Artemis program, directly supporting the long-term goals of sustainable lunar exploration and resource utilization. Without VIPER, the Artemis program risks falling short of its transformative potential, reducing it to little more than a repeat of the Apollo missions.

The National Space Society supports the continuation of the VIPER mission, whether led solely by NASA or in collaboration with commercial partners. However, with VIPER's future uncertain, we additionally propose that NASA consider adopting a different approach to lunar exploration, as outlined in the NASA-funded [Evolvable Lunar Architecture \(ELA\) report](#). This report advocates for multiple small, low-cost commercial rovers sourced from multiple providers, which eliminate the risk of single-point failure and promote dissimilar redundancy. Additionally, it broadens the scope of resource identification and characterization necessary for establishing economically viable reserves. This strategy aligns with the Commercial Lunar Payload Services (CLPS) program and fosters competitive entrepreneurship in space exploration to drive future innovation.

Background

The announced cancellation of the VIPER mission due to cost overruns and development delays highlights the vulnerabilities of relying on a single, high-cost mission for critical objectives in lunar exploration. VIPER was designed to locate and analyze water ice and other volatiles at the Moon's south pole, a region believed to contain resources essential for sustaining long-term human presence on the Moon. The mission's goals include mapping the distribution of these resources, understanding their composition, and assessing their accessibility—data that are critical for developing in-situ resource utilization (ISRU) technologies. These technologies would enable the extraction and use of lunar resources for life support, fuel, and other needs, reducing dependence on supplies from Earth.

If the VIPER mission does not go forward, the consequences could be significant, potentially delaying the identification and utilization of these critical resources and hindering the broader goals of the Artemis program. This situation underscores the importance of exploring alternative approaches that enhance resiliency and ensure continued progress in lunar resource utilization and exploration. By considering strategies that involve multiple low-cost rovers and the integration of commercial partnerships, NASA can mitigate the risks associated with single-point failures and build a more sustainable path forward for lunar exploration.

The Case for Continuing VIPER with a New Partner

The National Space Society is encouraged by the strong industry response to continuing the VIPER mission. If a partner, either domestic or international, can be found to complete the testing of VIPER and fly it to the Moon, NSS fully supports this direction. In addition to domestic partners, NSS recommends considering collaboration with international partners such as JAXA and ISRO and their commercial companies with lunar landing and operations capabilities.

The Case for a Resilient Lunar ISRU Strategy

1. Resiliency and Redundancy

A small, low-cost multiple rover approach, as detailed in the ELA report, offers significant advantages over a single high-cost rover model. Multiple rovers enhance the probability of mission success by providing redundancy. If one rover encounters mission-critical issues, including cancellation, other rovers can continue, ensuring

continuous progress and data collection. This resiliency is critical for the high-risk environment of lunar exploration.

2. **Expanded Coverage**

Deploying multiple rovers allows for much greater surface coverage. This broader geographical reach is essential for identifying locations with the highest resource potential. By mapping out larger areas, multiple rovers can better assess the distribution and concentration of various resources such as water ice, aluminum, silicon, titanium, and other materials. This comprehensive resource assessment is crucial for future lunar operations and establishing a permanent human presence on the Moon.

3. **Economic Viability and Commercial Interest**

Characterizing the extent of lunar resources is a necessary step toward defining what the United States Geological Survey (USGS) refers to as a "reserve." A well-documented reserve is essential for the mining industry to raise capital for commercial extraction. By providing detailed resource assessments, multiple rovers can help attract private investment and stimulate commercial interest in lunar resource extraction, aligning with NASA's goals of fostering public-private partnerships.

4. **Cost-Effectiveness**

The ELA report demonstrates that leveraging commercial space capabilities through public-private partnerships can significantly reduce costs. The development and deployment of multiple small rovers from multiple suppliers are more cost-effective than a single, large-scale mission. This approach allows for iterative learning, technology development, and market competition, further driving down costs over time.

Commercial Development and Entrepreneurship on the Moon

NSS strongly supports the following actions to enhance commercial development and entrepreneurship in lunar exploration:

A. NSS Endorses Sending VIPER to the Moon with a New Partner

If a partner can be found, NSS strongly endorses NASA working with that partner to complete the testing of VIPER and land it on the Moon.

B. NSS Endorses the CLPS Program

NSS fully endorses the Commercial Lunar Payload Services (CLPS) program, which enables private companies to deliver scientific and technological payloads to the Moon. This

program fosters innovation by encouraging competition among companies, driving technological advancements, and reducing costs. By leveraging the capabilities of multiple private entities, CLPS ensures a diversified approach to lunar exploration, enhancing the robustness and sustainability of lunar missions.

C. Actual Payloads on the Astrobotic Mission

NSS supports the inclusion of actual scientific or commercial payloads on the upcoming Astrobotic mission instead of the proposed mass simulator. To achieve this, NSS calls for immediate funding and resource allocation to equip the lander with necessary instruments. Potential sources of these instruments could include existing NASA technologies or collaborations with commercial entities willing to provide payloads. Ensuring the mission carries valuable instruments will maximize its scientific and commercial return, demonstrating the mission's true potential and fostering further investment in lunar exploration.

D. Increased Funding for CLPS Missions

NSS calls on Congress to increase funding for the CLPS program to support additional missions specifically designed for deploying small ISRU rovers. We recommend a clear allocation of funds for at least five new CLPS missions over the next five years, ensuring continuous and comprehensive mapping and characterization of lunar resources. This sustained funding will support the development of a robust infrastructure for lunar resource utilization, driving long-term economic and technological benefits.

E. Adopt a Multi-Rover Approach

NASA should prioritize developing a small, low-cost multiple rover/mobility system strategy, as recommended by the ELA report. This strategy would involve creating several different rover models optimized for various purposes, including (1) the detection of diverse resources such as water ice, other volatiles, and various materials; (2) operation in different lunar regions such as polar, mid-latitude, and equatorial areas, each with unique environmental conditions; and (3) navigation across different terrain types, including craters, lava tubes, and rugged surfaces. By engaging multiple commercial providers, this approach would foster competition, ensure redundancy, and enhance mission success. Additionally, it would allow for broader geographical coverage and iterative testing of rover prototypes in both simulated and actual lunar environments.

F. Foster Public-Private Partnerships by Expanding CLPS to ISRU Missions

NASA should expand its collaboration with commercial partners to leverage existing technologies and reduce costs. By integrating ISRU-specific missions into the CLPS program, NASA can promote competition, drive technological advancements, and ensure diverse approaches to lunar resource utilization. Expanding PPPs to include ISRU missions

will encourage private investment, support the Artemis program, and help maintain the United States' leadership in space exploration.

G. Iterative Development and Testing

Implementing an iterative approach to rover development allows for incremental improvements and cost reductions. This involves multiple cycles of design, testing, evaluation, and refinement. Testing prototypes in lunar analog environments on Earth is essential, but a key attribute of the multiple small rover approach is enabling testing on the actual lunar surface. Commercial providers should identify and address potential issues early, ensuring rovers are well-prepared for lunar conditions.

H. Commitment to Purchasing ISRU Materials

To further stimulate commercial lunar operations, NASA should commit to purchasing ISRU materials such as water ice, aluminum, silicon, titanium, and other raw materials, as well as products manufactured from those materials. This commitment would create a reliable market for these resources, providing a strong incentive for private companies to invest in lunar resource extraction technologies and operations.

Conclusion

The announced cancellation of the VIPER mission presents an opportunity to reassess and refine NASA's approach to ISRU development. By continuing the VIPER mission with a new partner, NASA has the potential to achieve most or all of the VIPER mission objectives. By adopting a small, low-cost multiple rover strategy, promoting commercial landers and entrepreneurship, and maximizing the value of the Astrobotic mission with actual payloads, NASA can enhance mission resiliency, expand resource coverage, and stimulate commercial interest in lunar resource extraction. The National Space Society urges NASA to consider this approach to ensure the continued progress and success of lunar exploration efforts.

About the National Space Society (NSS): NSS is an independent non-profit educational membership organization dedicated to the creation of a spacefaring civilization. NSS is widely acknowledged as the preeminent citizen's voice on space, with over 50 chapters in the United States and around the world. The Society publishes *Ad Astra* magazine, an award-winning periodical chronicling the most important developments in space. To learn more, visit www.nss.org.