Written Testimony from AstroForge, Inc.

A Commercial Deep Space Mining Company Focused On Critical Materials

On "The Mineral Supply Chain and the New Space Race"

Submitted to the Committee on Natural Resources

Subcommittee on Oversight and Investigations

U.S. House of Representatives

December 27, 2023

INTRODUCTION:

AstroForge is a commercial deep space mining company focused on extracting critical minerals from asteroids. Our mission is to autonomously mine Near-Earth Asteroids (NEAs) for precious and rare-earth metals with the intent of aiming to reduce the United States' dependence on foreign critical mineral supply chains. Our first mission, a prototype of our in-space refinery, launched in April of 2023 and is currently in Low Earth Orbit (LEO). Our second mission, which will target, track, and image a Metallic asteroid approximately 30 million miles away, will launch in Spring of 2024.

Currently, the United States relies on geopolitical adversaries for these materials, sourced through traditional mining and refining methods.[1] Critical minerals like Platinum, Iridium, and Cobalt, are fundamental raw materials that modern technologies rely on[2]—they are abundant on

[1] *See e.g.*, Critical mineral resources of the United States—Economic and environmental geology and prospects for future supply: U.S. Geological Survey Professional Paper 1802 (Klaus J. Schulz, John H. DeYoung, Jr., Robert R. Seal II & Dwight C. Bradley eds., 2017), http://doi.org/10.3133/pp1802; Sara Schonhardt & E&E News, *U.S. Looks to Mongolia, Wedged between China and Russia, for Critical Minerals,* Sci. Amer. (Jul. 31, 2023), https://www.scientificamerican.com/article/u-s-looks-to-mongolia-wedged-between-china-and-russia-for-critical-minerals/.

[2] Notice of Final Determination on 2023 DOE Critical Materials List, 6450-01-P, U.S. Dep't Energy (July 28, 2023), https://www.energy.gov/sites/default/files/2023-07/preprint-frn-2023-critical-materials-list.pdf; Press Release, U.S. Geological Survey Releases 2022 List of Critical Minerals, U.S. Geological Survey (February 22, 2022), https://www.usgs.gov/news/national-news-release/us-geological-survey-releases-2022-list-critical-minerals.

asteroids[3] – but without steady access to supply and transparent pricing here on Earth, our technological progress and industrial base will be severely and irreparably weakened.

IS ASTEROID MINING POSSIBLE?

Short answer: Based on recent missions, advances in deep space exploration and technology, and coupled with the United States' trademark ingenuity, we think it will be very possible—not in 60 years, but before the end of this decade.

The skepticism around asteroid-related missions is understandable, given the complexity and novelty of space exploration. However, there have been several successful government-led missions to asteroids that highlight our growing capabilities in space technology and exploration.

The Japanese Aerospace Exploration Agency (JAXA) executed two successful missions, Hayabusa[4] and Hayabusa2,[5] which both collected samples from asteroids. The National Aeronautics and Space Administration (NASA) executed three successful missions, NEAR Shoemaker,[6] DART,[7] and OSIRIS-REx,[8] which accomplished a range of asteroid related objectives.

Government-led missions to explore asteroids have been a huge success. However, past commercial ventures to mine asteroids have failed for two big reasons:

1. **Launch costs were too high.** 10+ years ago, launch costs were as much as 13,000% more expensive. This dramatic reduction in costs, coupled with a more robust space economy, allows AstroForge to use its resources on focused innovations.

2. **Focus on inefficient off-asteroid mining and refining.** Past commercial asteroid mining endeavors revolved around hauling large chunks of asteroids closer to Earth to refine them, which is simply not energy efficient or cost effective. Our proprietary approach to mining and refining asteroids in-situ is better.

---

[3] Kevin M. Cannon, Matt Gialich & Jose Acain, *Precious and structural metals on asteroids*, 225 Planetary & Space Sci. (Jan. 2023), https://www.sciencedirect.com/science/article/pii/S0032063322001945.
[4] Nat. Aeronautics & Space Admin., *Hayabusa*, https://science.nasa.gov/mission/hayabusa/ (last accessed Dec. 26, 2023).
[5] Nat. Aeronautics & Space Admin., *Hayabusa2*, https://science.nasa.gov/mission/hayabusa-2/ (last accessed Dec. 26, 2023).
[6] Nat. Aeronautics & Space Admin., *NEAR Shoemaker*, https://science.nasa.gov/mission/near-shoemaker/ (last accessed Dec. 26, 2023).
[7] Nat. Aeronautics & Space Admin., *Double Asteroid Redirection Test (DART)*, https://science.nasa.gov/mission/dart/ (last accessed Dec. 26, 2023).
[8] Nat. Aeronautics & Space Admin., *OSIRIS-REx*, https://science.nasa.gov/mission/osiris-rex/ (last accessed Dec. 26, 2023).

There is still significant work to be done to scale these endeavors to match the capacity of mining critical minerals that would substantially benefit the United States. The path forward is getting clearer and can be strengthened with government support. We continue to innovate each day to make this a reality.

OUR APPROACH TO ASTEROID MINING

Boiling it down, AstroForge's innovative approach to mining in deep space involves three fundamental moments:

1. **Targeting Metallic Near-Earth Asteroids:** AstroForge aims to dock with these asteroids, which are primarily composed of iron, using electromagnets.

Figure #1 – Round Trip Mission

2. **In-Situ Mining and Refining:** AstroForge plans to mine and refine precious and rare-earth metals directly on the asteroid. This process includes laser ablation, mass separation using mass spectrometry, and magnetic collection of the refined metals.

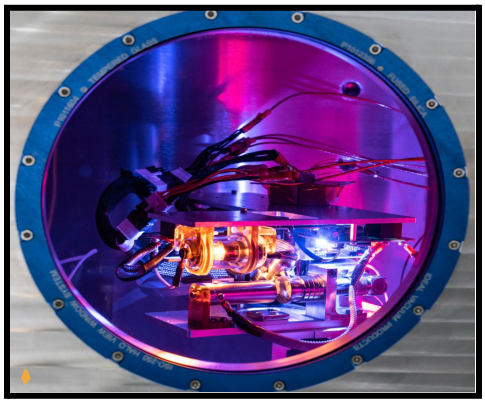

Figure #2 – Prototype forge, currently in low earth orbit.

3. **Return to Earth:** After extracting approximately a metric ton of precious and rare-earth metals, which are currently valued between $70M to $100M, the mission will return to Earth.

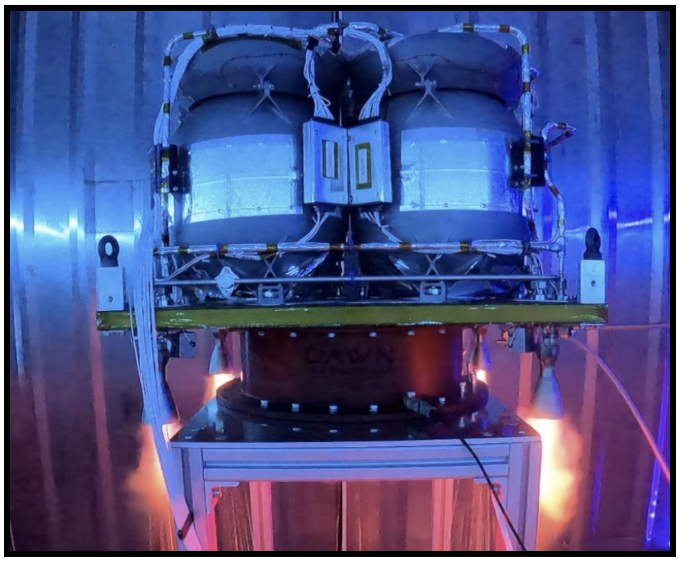

Figure #3 – Launch vehicle test for second mission in 2024

Our ideal mission profile, illustrated in Figure #1, is approximately two years. In the ideal end-state of our technology, we will have many autonomous missions occurring simultaneously to maximize success and the volume of collection.

WHY SHOULD THIS COMMITTEE ACT NOW?

The House Committee on Natural Resources is uniquely positioned to support this innovation since space resources are natural resources. In the not-so-distant future, innovations in space mining will also trickle down into terrestrial mining, creating a dual-use innovation loop that the United States has successfully created in the past and led to ground-breaking technologies like GPS, memory foam, and LEDs.

Nearly all modern technology relies on precious and rare-earth metals. To keep pace with consumer demand, technological innovation, and a dwindling terrestrial supply, the United States needs to develop better ways to consistently access these critical resources. America's boundless innovation is its super power, however the raw materials to fuel that innovation could be a severe bottleneck to the future of computer chips, green technology, and energy independence. The Department of Energy has listed multiple precious and rare-earth minerals as "critical" on the path toward the United States' 2050 climate change goals.[9]

[9] *See* U.S. Dep't Energy, *What Are Critical Materials and Critical Minerals?*, https://www.energy.gov/cmm/what-are-critical-materials-and-critical-minerals#:~:text=Critical%20materials%20for

Our imperative to innovate is made even more clear by geopolitical pressures to our critical mineral supply chain. Right now, China and Russia control or influence the mining and refining process of many of the critical minerals on which American industry relies.

AMERICA NEEDS TO BE THE FIRST

The Chinese Communist Party (CCP) is trying to mine asteroids[10] — we need to do it first.

If asteroid mining is possible, the United States needs to have that first-mover advantage. The United States is already reliant on China for many critical minerals and we can not risk ceding another major supply chain for these massively important raw materials.

In the off-chance that asteroid mining for critical minerals is not economically feasible, learning more about deep space and building commercial deep space capabilities still has enormous value. The United States cannot miss this opportunity for downstream innovations, instead we should reap their benefits.

RECOMMENDATIONS TO CONGRESS

Below are six recommendations to Congress that could rapidly advance deep space mining innovation for commercial companies in the United States.

1. Develop a strategy to support a broader commercial deep space economy that allows commercial companies in the United States to lead and innovate.
2. Provide funding for research and development for deep space mining, specifically for the critical minerals that the United States has deemed critical to industry and defense.
3. Allocate additional funding to NASA's Space Technology Mission Directorate (STMD), NASA Innovative Advanced Concepts (NIAC) Program, and NASA and JPL's Small Bodies Group, for the continued exploration of near-earth asteroids.
4. Clearly direct the United States Space Force to support and protect critical mineral supply chains in deep space.
5. Direct the Department of Energy to prioritize deep space mineral acquisition within their critical minerals innovation programs.
6. Urge the Department of Commerce to allocate CHIPS funding towards deep space mineral acquisition to bolster raw material availability for chip manufacturing.

%20energy%3A%20aluminum,silicon%2C%20silicon%20carbide%20and%20terbium (last accessed Dec. 27, 2023).

[10] *See e.g.*, Tim Marshall, *China's Bid to Win the New Space Race*, WIRED (Apr. 12, 2023), https://www.wired.co.uk/article/china-space-race.

CONCLUSION

AstroForge is ready to engage with the committee to further discuss its plans and the broader implications for U.S. leadership in space. We believe our mission aligns closely with national interests in technology, defense, and economic independence.

# # #