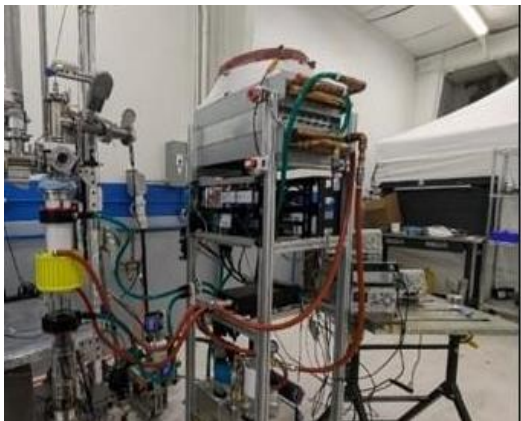


25kg Regolith Feed, O₂ Extraction and Slag Extrusion Demonstration Payload

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Introduction: Given the slower than planned evolution of large capacity cargo delivery to the moon, Terraxis began an evaluation of the potential utility provided from a 25kg lunar payload to demonstrate oxygen extraction from regolith using vapor pyrolysis. Vapor pyrolysis is a technology we have evaluated and produced multiple evolved reactor designs over the last nine years. We recently validated our ability to heat regolith, liberate gas and extrude slag through integrated testing with Outward Technologies - completed 1st quarter 2025. Building on a prior 400kg design for 250kg/year oxygen production, we evaluated the possibility of scaling the system to meet a <25kg constraint while maintaining key functionalities. Our initial assessment identified the scaling challenges which could be encountered related reactor efficiency, thermal management, and rover integration, to allow providing useful data to reduce the development schedule for a 1000kg O₂ production facility.

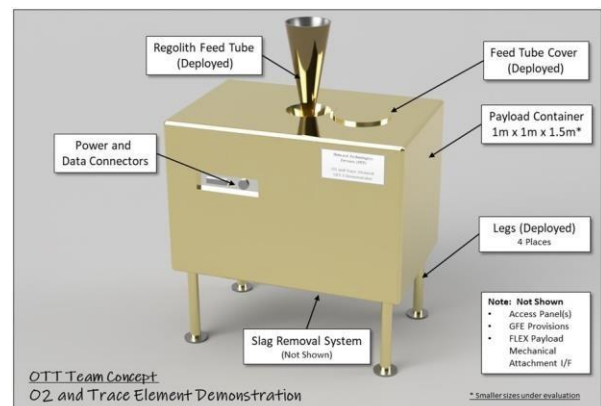
Technology Description: Terraxis' vapor pyrolysis reactor extracts oxygen from lunar regolith without chemical reactants by superheating to over 2000°C. Integrated with Outward Technologies' regolith feed and slag extrusion systems, the technology has been demonstrated for incorporation in a large payload format (400kg) configuration. Sizing was based on the capabilities of the Astrolab Venturi FLEX rover. Scaling is being evaluated to determine if a 25kg version can still effectively process regolith, extract oxygen, and extrude slag, while meeting smaller scale lunar rover capabilities. Key tasks include defining system requirements, prototyping heating methods, optimizing oxygen extraction, and testing thermal management solutions. Success could pave the way for compact ISRU demonstrations, reducing risks for larger lunar oxygen production facilities.



Integrated Test System demonstrates feed, processing and gas generation and slag extrusion



Astrolab Venturi FLEX Rover Large Payload



Terraxis-OT Integrated Pilot Plant Demonstration Unit Concept Design

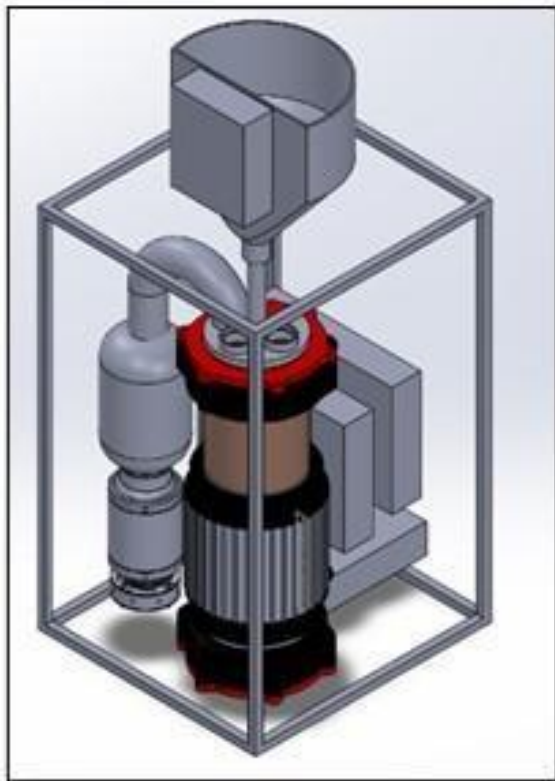
Changes in the Landscape: The development of large capacity commercial lunar transport vehicles and associated large capacity landers are years away from routine operation. Focus is shifting to small payloads with high scientific and/or risk reduction benefits. Terraxis is in the process of evaluating our larger system to determine the potential benefits provided by a 25kg demonstration payload.

Risk Reduction and Other Benefits: Scaling potential was evaluated to determine if a 25kg version can still effectively process regolith, extract oxygen, and extrude slag, while meeting smaller scale lunar rover capabilities. Key tasks identified were defining system requirements, prototyping heating methods, optimizing oxygen extraction, and testing thermal management solutions. Our success criteria is providing incremental knowledge to allow informed decision making which could pave the way for compact ISRU demonstrations to reduce risks for larger lunar oxygen production facilities.

The significant mass reduction can be accomplished by:

- **Simplification:** Integrating components with the rover (e.g., mechanical support) or host (e.g., heat rejection) eliminates standalone systems.
- **Optimization:** Efficiency improvements (e.g., electronics, thermal transport) reduce size and mass without sacrificing function.
- **Downsizing:** Drastic reductions in capacity or power (e.g., reactor, cryo storage) align with a smaller system scope.
- **Elimination:** Removing unnecessary features (e.g., offloading interfaces, continuous feeding) cuts excess mass.

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**25kg Demonstration Payload
Conceptual Packaging Design**

Risk Reduction and Other Benefits: A basis of estimate concept design was established for a scaled version of the system. We intend to continue refinement of this design and perform a feasibility and benefits assessment related to functionality, potential TRL advancement and risk retirement afforded from a lunar demonstration.