The Flexible Logistics & Exploration (FLEX) Rover and Bucket Drum Excavation Tool. J. B. Matthews[1], A. J. Welter[1], A. K. Musaffar[2], [1]Venturi Astrolab, Inc., 12536 Chadron Ave Hawthorne, CA 90250 (Contact: jaret@astrolab.space), [2]University of California Santa Barbra (abed@engineering.ucsb.edu)

Introduction: NASA and private industry investments will soon make it possible to land unprecedented amounts of cargo on the Moon at a regular cadence. Venturi Astrolab, Inc. (Astrolab) is developing the multi-functional Flexible Logistics & Exploration (FLEX) rover with this burgeoning environment in mind. The FLEX rover's unique commercial potential comes from its novel mobility system architecture, which gives it the ability to pick up and deposit modular payloads in support of human operations, robotic science, exploration, logistics, infrastructure deployment, site survey/preparation, construction, maintenance, & repair, resource utilization, and other activities critical to a sustained presence on the Moon and beyond (Figure 1).

Figure 1: FLEX's modular payload interface and novel mobility system enable it to perform a multitude of functions, including (left to right, top to bottom): crew transport, outpost logistics, robotic science, and infrastructure deployment

Adaptive Utility: FLEX is a Lunar Terrain Vehicle (LTV)-class rover that can carry two suited astronauts and all their associated equipment, tools, instruments, and samples. FLEX features a novel wheel-on-limb mobility system that can raise and lower the ground clearance of the chassis and adapt to variable terrain while maintaining stability. This system also allows the rover to lower attached instruments and equipment to the ground and/or independently collect and deploy modular payloads. FLEX can accommodate payloads with volumes in excess of $3m^3$ and masses of up to 1,500 kg.

Analog Testing: Astrolab has developed a full-scale, fully-functional terrestrial proof-of-concept FLEX rover and recently conducted field testing at an analog site in the California desert. At these field trials, FLEX was used to conduct demonstrations of various activities and operational scenarios that will be required on the Lunar surface [1]. Additionally, Astrolab has sponsored a capstone mechanical engineering class at the University of California, Santa Barbara, to design and build a FLEX-compatible bucket drum excavator (Figure 2). This tool allows for the collection, transport, and deposition of regolith in increments of more than 150kg. Integrated tests of this system with simulated lunar regolith will take place in May 2022. Results of this testing will be presented.

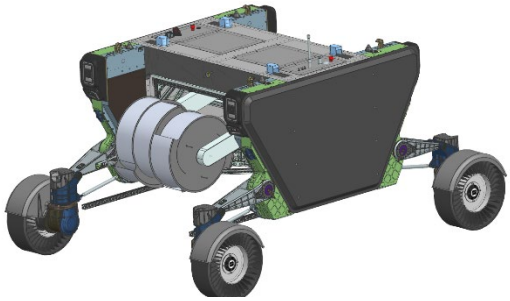

Figure 2: A UCSB student team has designed and built a bucket drum excavation tool for FLEX

Open Payload Interface Standards: Astrolab recently published a Payload Interface Guide to educate potential partners and customers on the capabilities of FLEX and the various ways it can accommodate payloads. Astrolab is now inviting government, academic, and commercial entities to partner with us in the design and field testing of payload concepts. We seek to foster a community of payload developers adhering to an open and standardized interface. We believe this will ultimately lead to a vibrant Lunar economy, in much the same way that intermodal standardized payload containers have become the lifeblood of trade on Earth. The use of standardized payload interfaces is critical for diverse participation on the International Space Station, and the approach that Astrolab is advancing will be similarly vital for a sustained human presence on the Moon.

[1] NASA HEOMD-006: Human Exploration Operations & Utilization Plan (2021)