

FLEX: Flexible Logistics & Exploration Rover. J. B. Matthews¹, ¹Venturi Astrolab, Inc., 12536 Chadron Ave Hawthorne, CA 90250 (Contact: jaret@astrolab.space)

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 (Figure 1). 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: The FLEX rover is an LTV-class mobility platform with adaptive utility enabled by modular payloads

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 3m³ and masses of up to 1,500 kg.

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]. These included the transport of crew and their EVA equipment, deployment of a Vertical Solar Array Tower, and the semi-autonomous transport and deployment of various types of cargo (Figure 2).



Figure 2: FLEX's modular payload interface and novel mobility system enable it to perform a multitude of functions, including (left to right, top to bottom): outpost logistics, crew exploration and science, infrastructure deployment, robotic science, and crew rescue tasks

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)