Rock & Lopen Satellite Technical Description

The overall goal of the Rock & Lopen mission is to determine the performance of a novel surface coating developed by Array Labs. The coating is expected to increase the effect of attitude on the amount of drag a spacecraft in LEO experiences, enhancing the ability for LEO spacecraft to intentionally increase or decrease drag forces during a mission. This mission consists of two nearly identical 1.5U satellites. One spacecraft ("Lopen") will have the novel coating applied to all its external surfaces, and another ("Rock") will serve as a control for the experiment and will have no special surface coating applied. Based on each spacecraft's position over time and their relative orbital decay rates, Array Labs will demonstrate the effect of the novel coating on drag in LEO. Performance data derived from this mission will be used to inform the design of Array Labs' future earth imagery constellations.

Rock & Lopen will be launched as secondary payloads aboard a Falcon 9 rocket, Transporter-11, from Vandenberg SFB on June 1, 2024. They will be inserted into a circular SSO orbit at 510 km altitude, at an inclination from the equator of 102 degrees. Transmission will begin 2 minutes after separation from the launch vehicle. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs about 10 years after launch. See the Orbital Debris Assessment Report for details.

Each of the two spacecraft has identical overall physical dimensions of 10 cm X 10 cm X 17.7 cm). The total mass is about 1.83 kg.

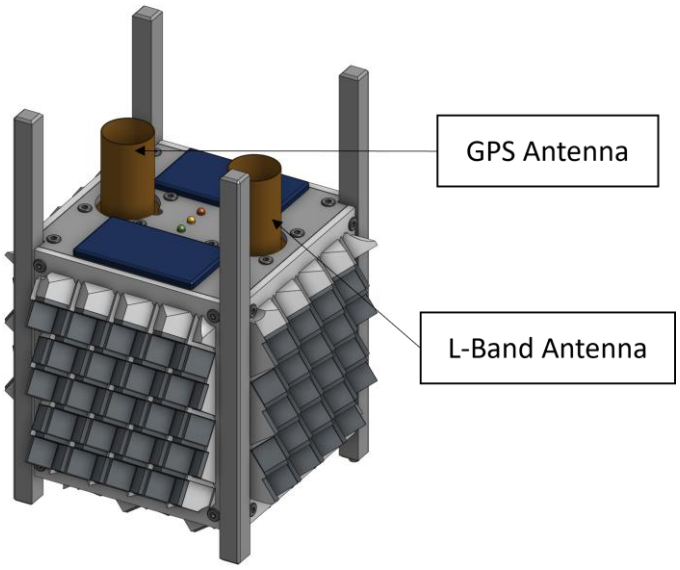

Figure 1 Rock & Lopen Overview

The satellite contains the following systems:

Structural Subsystem: Each spacecraft's structure provides support and attachment points for the other components of the spacecraft. The corner rails are compliant with the CubeSat standard and provide clearance for the antennas while the spacecraft is stowed in its deployer. The walls of the spacecraft feature a corner cube style retroreflective geometry, to ensure that air molecules which undergo specular reflective collisions are redirected back towards their originating direction. If the

novel surface coating works as intended, the spacecraft which has been coated will experience much more drag than its uncoated counterpart regardless of any difference in attitude or tumble rates.

Electrical Power Subsystem (EPS): Rock and Lopin have a limited electrical power system which includes 10 batteries, two small solar cells, and a battery charge/discharge regulator. Since the experimental data can be collected exclusively from ground radar and optical observation, the onboard electronics serve primarily to aid in initial identification after deployment from the launch vehicle. Each spacecraft will have 10 GlobTek 903178 battery cells with a total capacity of 110 Wh and two small solar cells.

Communications Subsystem: The communications subsystem consists of an L-Band Iridium transceiver, the EyeStar S4E Half-Duplex model manufactured by Near Space Launch, Inc., the NSL GPS 2.0 receiver manufactured by Near Space Launch, Inc. The spacecraft will use two Tallysman HC600E antennas – one for communication with the Iridium constellation, and another used as a GPS receiver. The transceiver will send GPS data every 5 minutes during its 3-hour active period, and then entering a deep sleep to conserve power for 6 hours. Based on a predicted power budget, the beacon will operate for no longer than two weeks before batteries are depleted. In conformance with § 5.107 Transmitter control requirements, the transmissions can be terminated via telecommand, sent from Array Labs operations center via the Iridium constellation, at any time.