LUNARTICS

Group 1

David Bishop, Alex Brito, Kayla Garoust, Michael Gerber, Jeff Glynn, Austin Horrell, & Devin Pryor

Mission Requirements

- Able to be transported as a co-manifested payload on board the SLS.
- Capable of transporting a 200kg payload in a 1.2m x 0.5m x 0.5m container up to 300 km away from Shackleton Crater Station.
- Able to navigate to and land within 10m of a safe landing site.
- Able to operate under lunar night conditions for up to 72 hours.

Abstract

The Lunartics Suborbital Lunar Transport (SLT) is an unmanned lunar hopper capable of supporting astronauts anywhere within 300 km of Shackleton Crater Station at the lunar south pole. The ability to carry payloads with a volume of 0.3 m^3 and a mass of 200kg allows for many supplies and equipment to be sent to astronauts per their needs. The SLT is an autonomous vehicle which when given the location of astronauts in need can locate a safe place to land nearby within a few hours with a precision of 10 meters. If necessary, astronauts can also manually control the landing if the terrain is too rough for its precision. In addition, to prioritize astronaut safety, the SLT's launch sequence is designed to eject as little regolith as possible as exhaust plumes carrying regolith can severely damage their EMU's and equipment.

Technical Specifications

Mass: 540 kg (dry), 1790 kg (wet)
Thrust: 14 kN (3100 lbf)

Propulsion

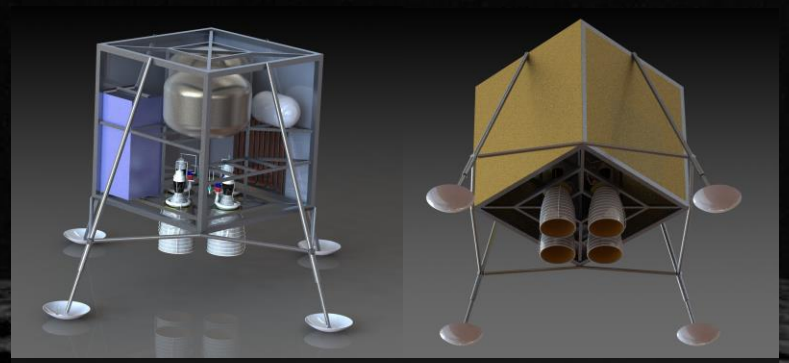
Four DASA S3K engines provide 3500 N (790 lbf) of thrust each, using monomethyl hydrazine and mixed oxides of nitrogen as a bipropellant fuel/oxidizer source. With a total propellant mass of ~1250 kg stored in twin 700L tanks, along with a small helium pressurant tank, the main engines provide a dV of ~3500 m/s. Additionally, 8 bipropellant ACS thrusters (Moog DST-12) provide attitude control at 22 N (5 lbf) each.

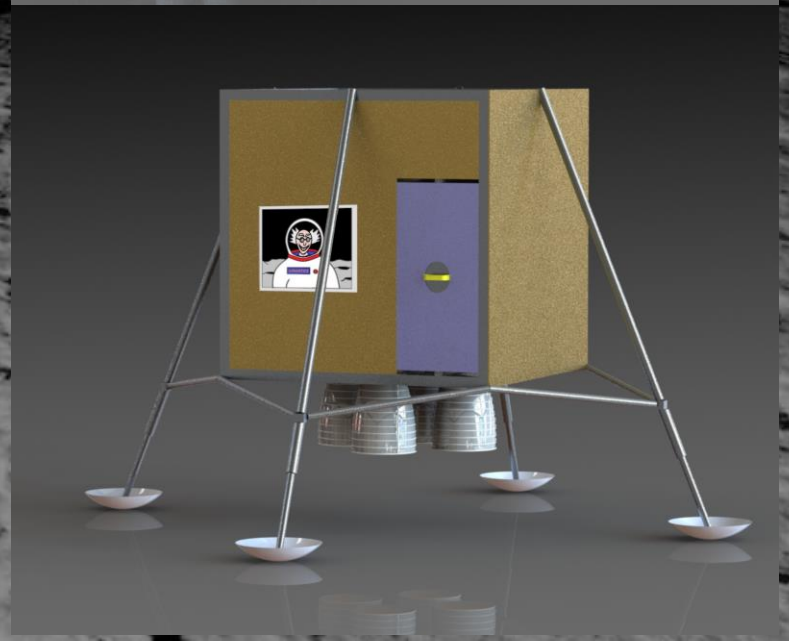
Environmental

A single-phase fluid loop system capable of moving or rejecting heat from electric components. In addition, an 18-layer surface insulation can reflect 83.4% of solar radiation. The onboard vibroacoustic damping system is capable of isolating engine vibrations during launch aboard the SLS and during normal operations.

Structures

Truss structure interior with a top shelf for storing tanks for propulsion subsystem and a lower shelf for storing electronics. Cantilever landing leg system with four landing legs for stability.





Guidance and Control

System is divided into three subsystems: typical flight operation, descent and landing, and vehicle health. The typical flight subsystem is composed of star trackers, sun sensors, IMU's, reaction wheels, ACS thrusters, and a flight computer. The descent and landing subsystem has its ow dedicated IMU and computer, based on SPLICE technology. This subsystem also contains cameras, altimeter, NDL, and HDL technology for hazard avoidance landing. The vehicle health subsystem contains an ECTV fuel sensor. The vehicle is capable of landing within 10 meters precision.

Mechanisms

Utilizes state of the art shock absorbing technology known as metal bellows shock absorbers, these dampers are reusable, hermetically sealed to reduce leaking, and do not require active thermal management. The payload deployment module is designed for easy EVA use both manually and remotely. This robust system allows for the transport of a rover or other payloads to successfully complete any mission objectives.

Budget and Schedule

Total budget: <$0.4 Billion for first flight unit and <$1.5 for 5 years of operation

- CDR: 4/15/2022
- FRR: 4/27/2022
- Launch date: 11/2030