NC STATE UNIVERSITY

Department of Mechanical and Aerospace Engineering

LAIKA

A TWIST ON TRADITION

Lunar Assessment and Investigative Kinematic Automation

Aerospace Engineering Capstone Senior Design 2021-2022

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- Link to our 2022 NASA Big Idea Challenge Video Submission

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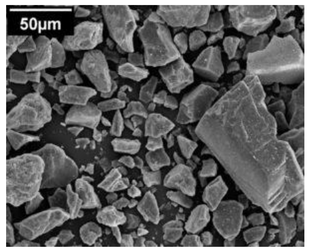
Sponsor: Engineering Trust Fund

Mission Overview

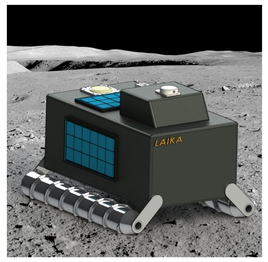
The main mission of the LAIKA Rover is to explore Shackleton Crater and to search for the presence of water ice. This mission is in support of the NASA Artemis Program which seeks to create a permanent human presence on the moon.

The main mission objectives of the LAIKA Rover are as follows:

- Collect and analyze soil samples at multiple locations in Shackleton Crater to determine if water ice is present
- Use LiDAR sensors and cameras to map Shackleton Crater
- Transmit soil analysis data back to the Lunar Gateway

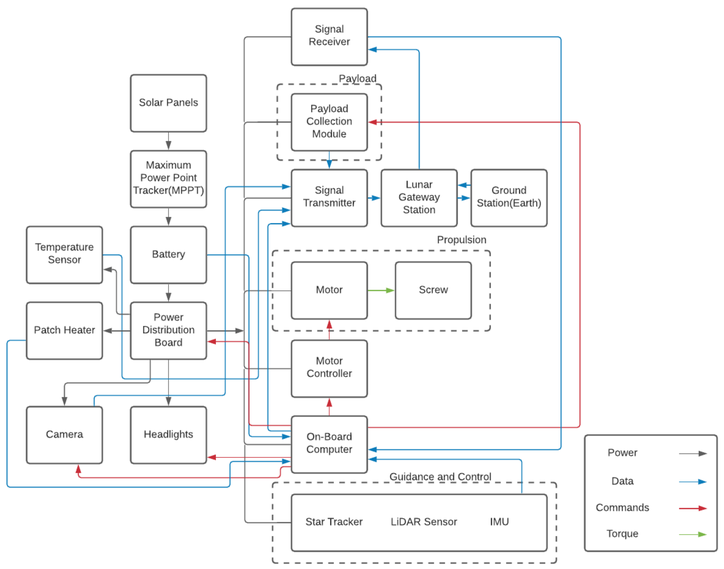


Lunar Regolith

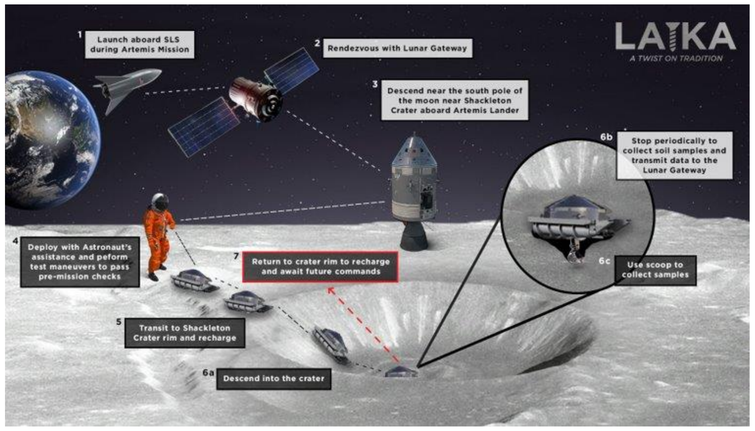


Lunar Design Solution

Functional Block Diagram

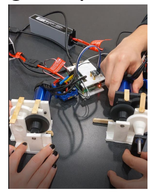


Concept of Operations



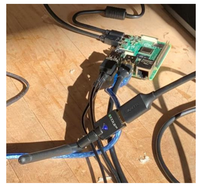
VV&T

As part of verification and validation for the prototype rover, 18 VV&T tests were completed to verify different subsystem met their design requirements.

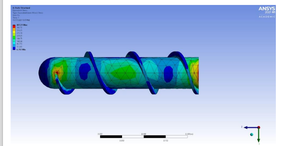


Motor Controller Test

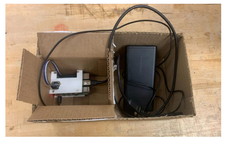
Camera Test



Antenna Test



Screw Rigidity Test

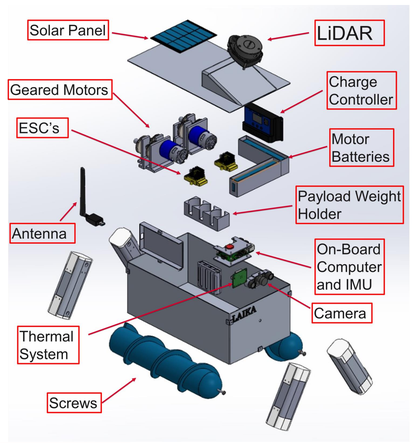


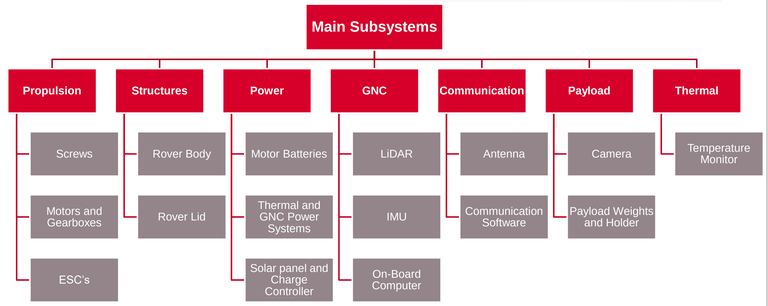
Orientation Test

Solar Panel Test

Prototype Design

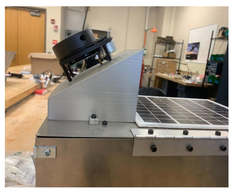
The purpose of the LAIKA prototype was to demonstrate the feasibility of the design solution presented for the full-scale lunar Rover. The prototype was designed so that it could prove the ability of each subsystem that will be present on the full-scale Rover.

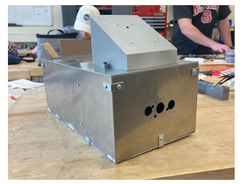


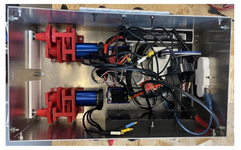


Prototype Manufacturing

The LAIKA Rover consists of a chassis manufactured from Aluminum 6061 and PLA 3D printed screws. The Rover body was put together through a joint process of welding and using angle brackets with nuts and bolts. The screws were printed in 3 sections and connected with pegs and epoxy. The LiDAR housing was 3D printed and bolted to the lid of the Rover.







The internal components consist of batteries, the Raspberry Pi, antenna, motor controllers, gear boxes and all wiring. Gear boxes and cases for internal components were also 3D printed using ABS and PLA. Internal components and cases are either bolted down or epoxied to the Rover body.

Final Prototype