

Arizona State University

VELOS - Variable Exploratory Lunar Observation System

Faculty Advisors: James Bell and Tyler Smith

Team Video: <https://youtu.be/9ie00Bf0wOI>

The Variable Exploratory Lunar Observation System (VELOS) utilizes spring launched probes to explore a permanently shadowed region (PSR) at the lunar poles. After landing within 100 m of a PSR, three probes that are equipped with temperature sensors, an inertial measurement unit, and a single chip spectrometer, are launched to different locations within the PSR. Each probe can collect data for up to 5 hours, and can communicate wirelessly back to the lander directly or through a fourth probe that serves as a communication relay during flight.

Colorado School of Mines with the University of Arizona

Lunar Autonomous Scalable Emitter and Receiver (LASER) System

Faculty Advisor: George Sowers

Team Video: <https://youtu.be/DZOA81w1XN8>

The Lunar Autonomous Scalable Emitter and Receiver (LASER) payload demonstrates wireless power transmission. This power transmission will occur via a laser mounted on the lunar lander to eight FemtoSats ejected onto the lunar surface. The FemtoSats, developed at the University of Arizona, are small receivers covered in solar panels that are approximately the size of just over two 1" cubes side by side. The solar panels will measure the amount of light received from the lander-mounted laser and report back to the lander via Wi-Fi communication, thus proving the concept of wireless power transmission.

Dartmouth College

SHREWs: Strategic Highly-compliant Roving Explorers of other Worlds

Faculty Advisor: Laura Ray

Team Video: <https://youtu.be/wNhZI8MEZaA>

The Strategic Highly-Compliant Robotic Explorers of other Worlds (SHREWS) is a novel modular mobility system optimized for exploring areas near the lunar poles. It can be configured as a single 4 wheeled unit with an innovative expandable joint between the set of wheels or be configured with additional units into a tram-like system that will reduce the likelihood of getting stuck on difficult terrain. Each of the units can be configured with a different payload creating a flexible system for deploying instruments into lunar PSRs.

Massachusetts Institute of Technology

Multifunctional Expandable Lunar Lite and Tall Tower (MELLTT)

Faculty Advisors: Jeffrey Hoffman, Dava Newman, Olivier de Weck

Team Video: <https://youtu.be/-jK5FYnqh4s>

The Multifunctional Expandable Lunar Lite & Tall Tower (MELLTT) provides infrastructure for PSR exploration, deploying a 30m tall tower that provides line of sight communication to rovers exploring permanently shadowed craters. A universal top of tower payload platform can host radio repeaters and imaging instruments that will significantly aid PSR exploration.

Michigan Technological University

T-REX (Tethered - permanently shaded Region Explorer)

Faculty Advisor: Paul van Susante

Team Video: https://youtu.be/9lGaR_z4Z84

The Tethered-permanently shaded Region Explorer (T-REX) will deploy a lightweight, superconducting cable for power and communications into a permanently shadowed region. It will be unspooled by a two-wheeled rover that traverses down the slope of the crater. After reaching its final destination, the rover becomes an electrical recharging hub and a communications relay for other robots operating in the dark region. This technology leverages the ultra-cold temperatures of the Moon's polar shadows, enabling the use of superconducting materials without active cooling systems.

Northeastern University

SCOUT and DOGHOUSE

Faculty Advisors: Alireza Ramezani and Taskin Padir

Team Video: <https://www.youtube.com/watch?v=-njTJBvVCAE>

SCOUT & DOGHOUSE is a rover and charging station combination designed to explore the Moon's polar regions. SCOUT is a legged rover that can carry science payloads as it navigates around the Moon. It is paired with DOGHOUSE, which is a deployable solar power collecting and communications hub. DOGHOUSE remains on a crater rim as SCOUT explores inside shadowed craters, before returning to DOGHOUSE for recharging.

Pennsylvania State University

Instrument for Performing Light Induced Breakdown Spectroscopy (LIBS) in a Lunar Permanently Shadowed Region (PSR)

Faculty Advisor: Sven Bilén, Joseph Portelli, and Jess McTernan

Team Video: <https://youtu.be/2RyZfy8RdaM>

A Laser-Induced Breakdown Spectroscopy instrument, called Oasis, will determine the elemental composition of lunar soil within a PSR. The system incorporates an innovative closed-loop thermal control system that will reliably operate sensitive electronics at extremely cold temperatures.

University of Virginia

Beaming of Energy via Laser for Lunar Exploration (BELLE)

Faculty Advisor: Mool Gupta

Industry Advisor: Paul Jaffe (US Naval Research Laboratory)

Team Video: <https://youtu.be/emVcpCbkmvs>

A concept for delivering energy to the permanently shadowed regions of lunar polar craters, called Beaming of Energy via Lasers for Lunar Exploration (BELLE), uses solar arrays stationed on the rims of craters to provide energy to a laser. The laser will transmit power to rovers and other systems in the crater by illuminating solar panels that match the laser's wavelength. BELLE will also explore methods for locating targets in the PSRs, including triangulation via radio and tracking the reflection of the laser. By doing this, it will be possible to energize systems operating in the darkness without those systems having to leave the crater or carry their own power source.