# Tristan Forks: Engineering Portfolio

**Tristan Forks**

*Aerospace Engineering*

*tristanforks@tamu.edu*

*(210) 748-2514*

TEXAS A&M UNIVERSITY
Engineering

# RASC-AL Competition Design Project (VIRUS)

Sep 2023 - May 2024

TEXAS A&M UNIVERSITY
Engineering

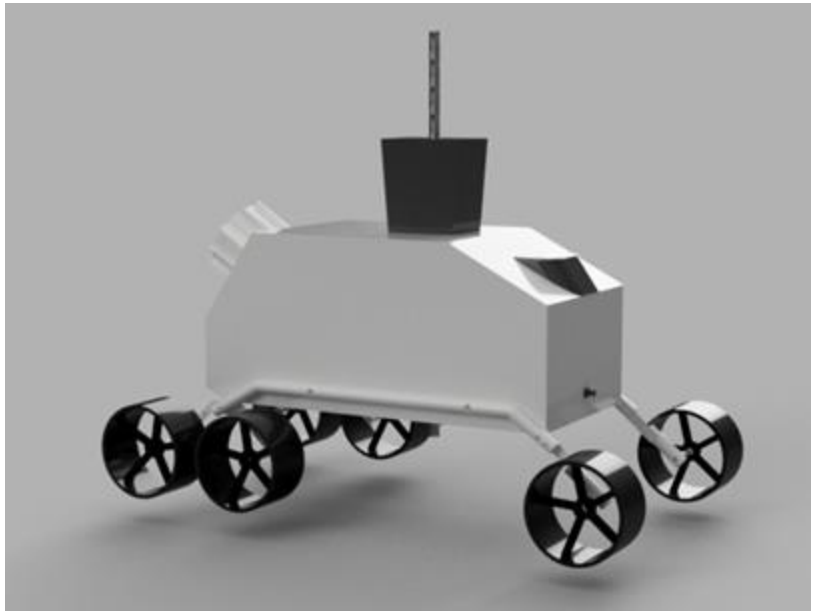

**Figure 1.** CAD rendering of *Prospect*, the primary VIRUS rover concept designed to operate in the permanently shadowed regions of the lunar South Pole. The rover incorporates a rocker-bogie suspension, science instrumentation, and shielding for long-duration exploration and in-situ volatile analysis.

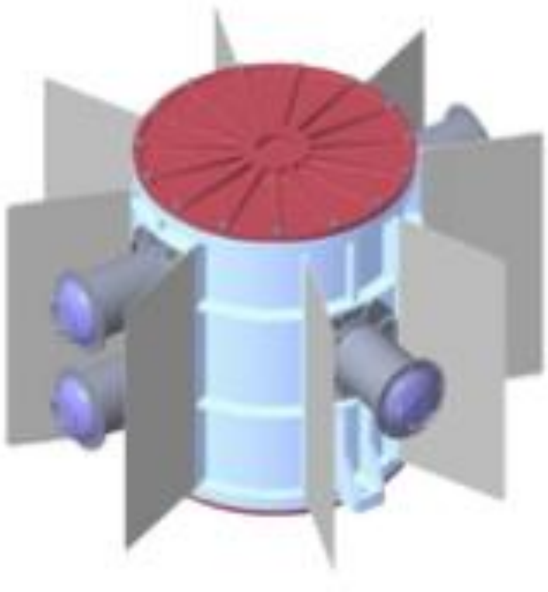

**Figure 2.** Modeled Radioisotope Stirling Converter (RSC) selected as the power source for *Prospect*. The Stirling engine provides ~190 W of continuous power using three General Purpose Heat Sources (GPHS) and six converters arranged for redundancy, reducing Pu-238 requirements and improving specific power relative to traditional rover power sources.

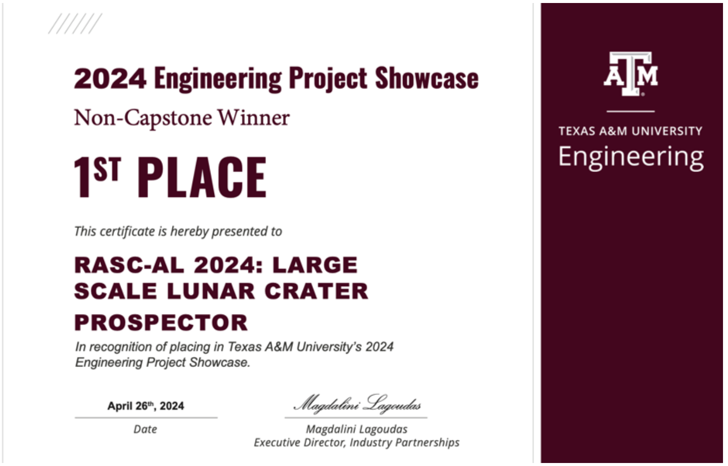


**Figure 3.** Certificate awarded for 1st place finish in the Non-Capstone design category in the 2024 Texas A&M Engineering Project Showcase.

# RASC-AL Competition Design Project

Motivation:

As part of NASA's Artemis program and the push for sustained lunar presence, my team and I designed a rover concept capable of operating for a year in the permanently shadowed regions of the Moon's South Pole. These craters are believed to contain water ice deposits critical for future human exploration. Our mission concept, VIRUS (Volatile Investigating Rover Utilizing Segmentation), aimed to characterize these resources through advanced mobility, drilling, and in-situ analysis technologies.

Experience/Learning:

As the engineering lead, I contributed primarily to the mechanical design and systems integration of the Prospect rover, modeling structures and subsystems in SolidWorks (**Figure 1**). This included CAD development of the rover chassis, mobility system, and mounting configurations for scientific instruments. Additionally, I worked on integrating the Stirling Radioisotope Power System (**Figure 2**), which required balancing thermal efficiency, shielding, and mass constraints for long-duration operation. Beyond my technical work, I collaborated with sub-teams in aerospace and nuclear engineering, ensuring design consistency and feasibility across disciplines.

Outcome:

Our concept achieved a cohesive system architecture that addressed lunar dust mitigation, extreme thermal environments, and efficient resource characterization. The project culminated in a written proposal and presentation, where our team was awarded **1st place for non-capstone teams** (**Figure 3**) at the Texas A&M Engineering Project Showcase. This experience gave me direct exposure to large-scale space mission design and the challenges of integrating diverse engineering disciplines into a unified system.

# *Undergraduate Research Project*

**Jan 2024 - May 2024**

TEXAS A&M UNIVERSITY
Engineering

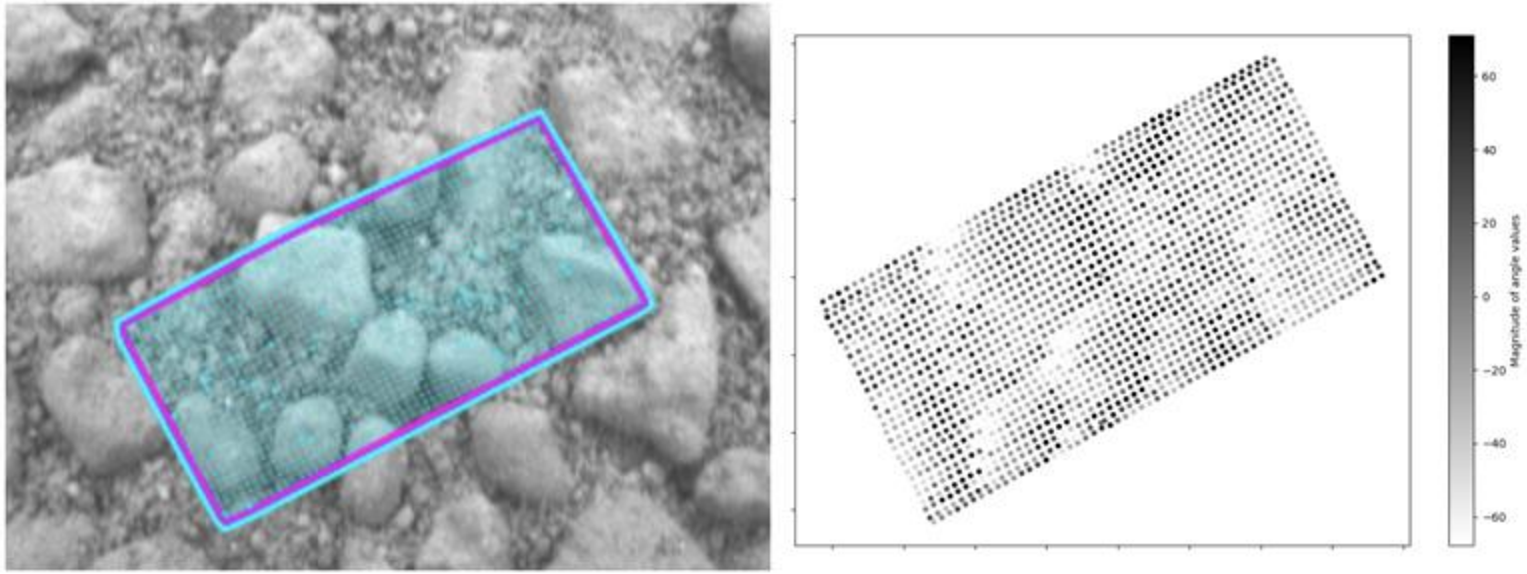


**Figure 1.** Raw PIXL instrument scan of Martian rock (left), and corresponding Python-based analysis (right) showing computed X-ray deflection angles at each observation point.

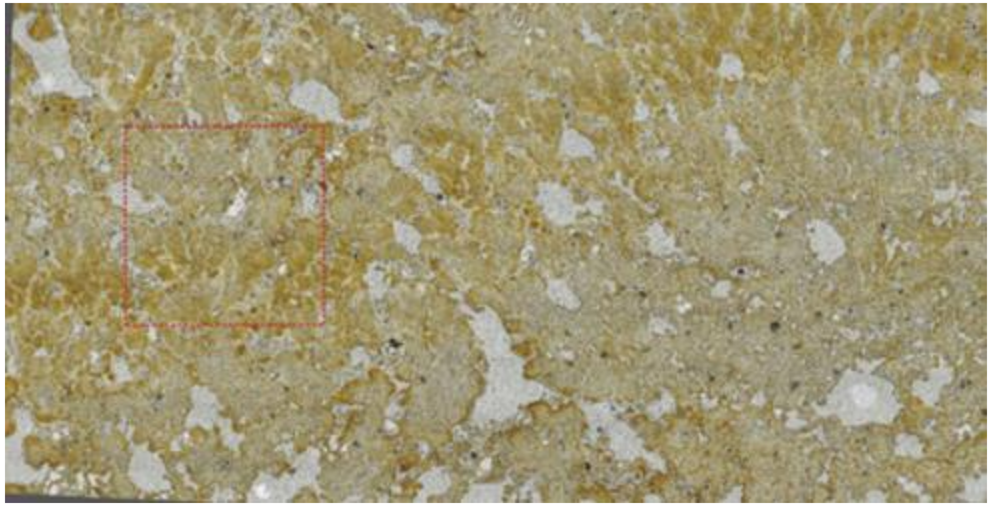

**Figure 2.** Laboratory image of a Crystal Geyser rock sample with the highlighted region (red box) scanned using X-ray fluorescence (XRF). These measurements were used for comparative analysis with PIXL instrument data collected from Martian rocks.

# Undergraduate Research Project

Motivation:

As part of NASA's Mars rover research initiative, I investigated methods to detect lighter elements like Hydrogen, Carbon, and Oxygen in Martian rock samples that the PIXL instrument cannot directly measure. My work focused on developing physics and statistics based data analysis techniques for X-ray fluorescence (XRF) signals to improve the detection of potential biosignatures on Mars.

Experience/Learning:

My work involved processing and interpreting data from 20+ geologic samples with advanced analytical instruments such as the Crystal Geyser rock in **Figure 2**. I also designed Python workflows (NumPy, SciPy, Matplotlib) to extract and visualize elemental patterns, X-Ray deflection angles, and light diffraction. I created figures and conducted comparative analyses (**Figure 1**), building visuals that revealed insights into the physical and chemical properties of Maritan samples.

Outcome:

My work ultimately allowed for more detailed chemical characterization and improved interpretation of PIXL's measurements. This research directly supported a postdoctoral researcher whose findings have since been published in multiple peer-reviewed papers, giving me early exposure to how every research contribution has the ability to integrate into impactful scientific publications.