

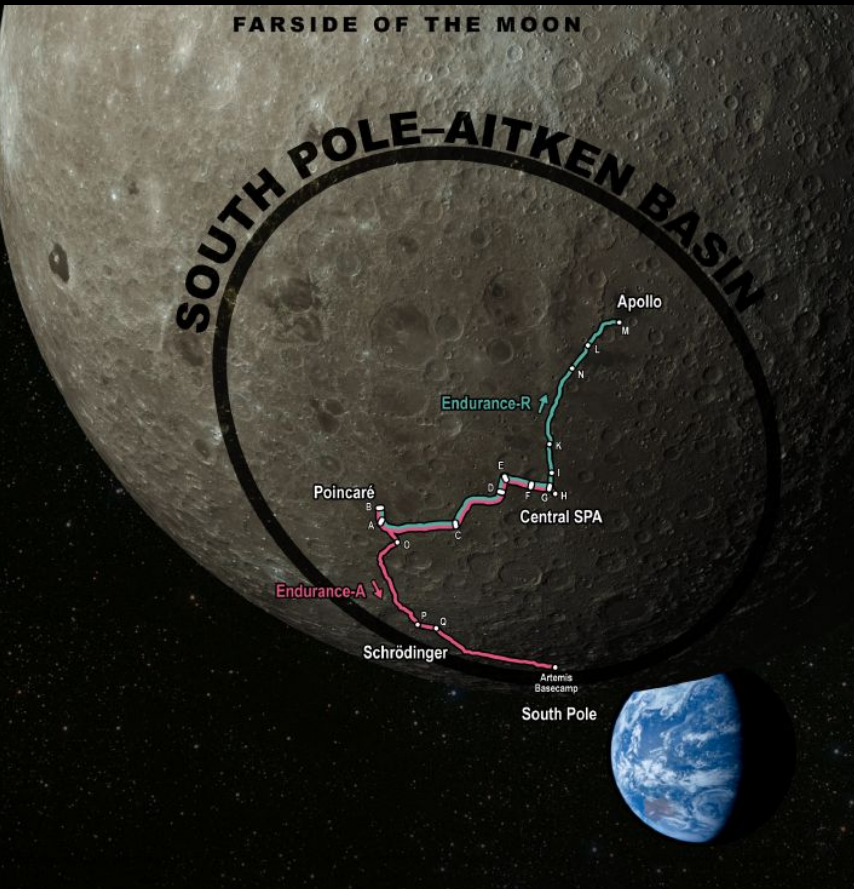
Leveraging VIPER Geotechnical and Mobility Insights for Endurance Rover and Traverse Development



V. T. Bickel¹, E. Rezich², **A. Deutsch**^{3,5}, A. Schepelmann², K. Lewis⁴, K. Ennico-Smith⁵,
J. Heldmann^{5,6}, Z. Mirmalek^{3,5}, U. Wong⁵, J. Kleinhenz⁷, K. Zacny⁸, T. Colaprete⁵

1 CSH University of Bern, 2 NASA Glenn Research Center, 3 Bay Area Environmental Institute Inc., 4 Johns Hopkins University Applied Physics Lab, 5 NASA Ames Research Center, 6 NASA Headquarters, 7 NASA Johnson Space Center, 8 Honeybee Robotics

Geotechnical and Mobility Insights provided by VIPER



Mobility is key for long-duration rovers like Endurance.

VIPER will reveal new information about:

1. The **physical properties** of sunlit and shadowed (sub)surfaces, including potentially volatile-rich regolith.
2. The **mobility system response** to wheel-soil interactions.

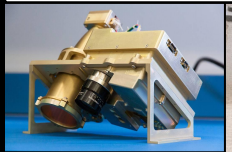
VIPER will generate insights on the design of Endurance:

- **Hardware** -- wheels, mobility systems, and lander footpads.
- **Traverses** -- long range and/or through challenging terrain.

Examples of VIPER observations of rover mobility and geotechnical properties



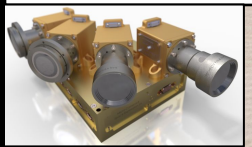
***Near-Infrared Volatiles Spectrometer System (NIRVSS)**
Image drill piles to characterize subsurface physical properties.



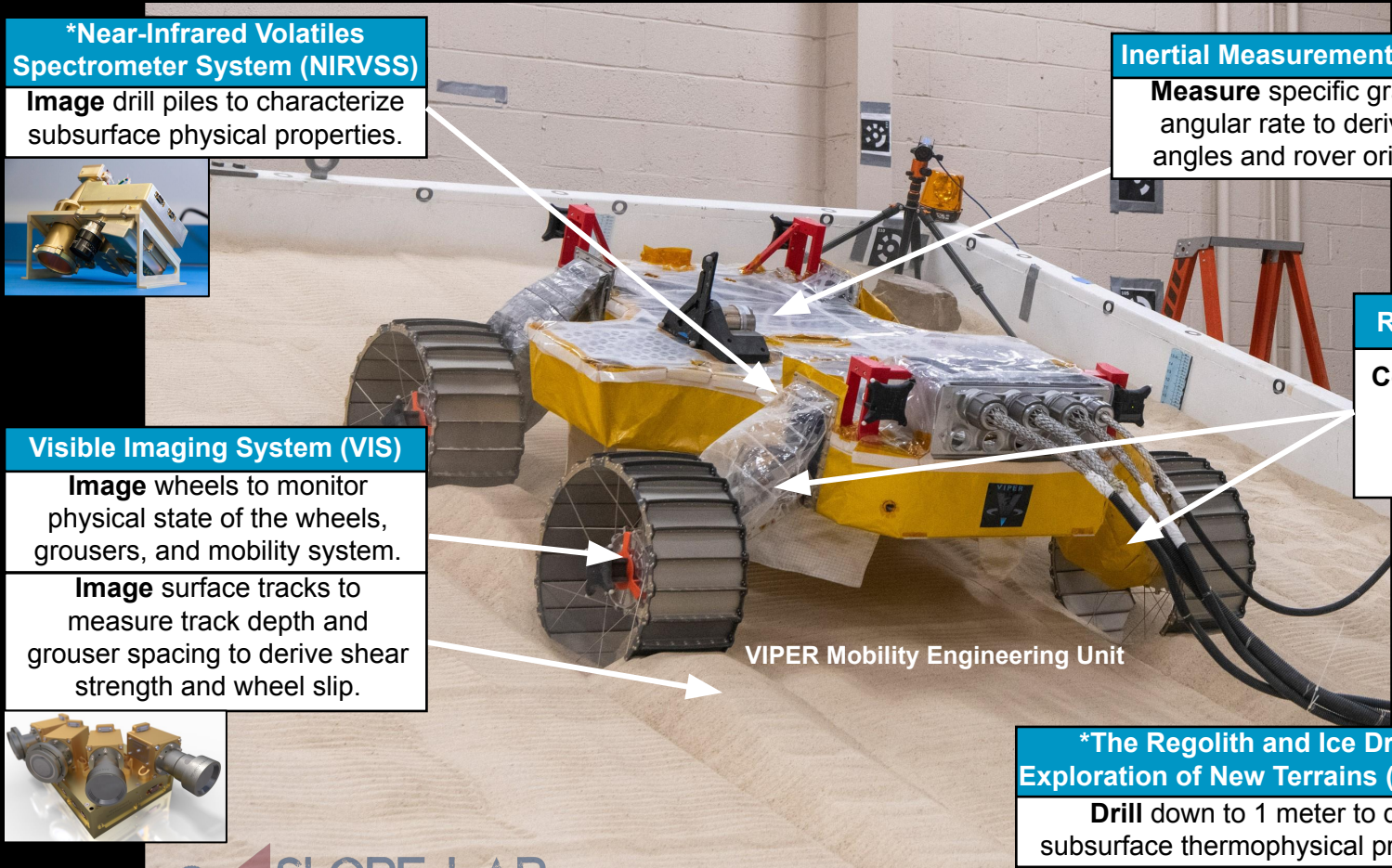
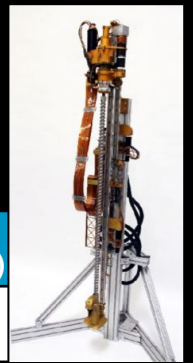
Inertial Measurement Unit (IMU)
Measure specific gravity and angular rate to derive slope angles and rover orientation.

Rover Wheel Suspension
Control and Measure pose and load on wheels to support geotechnical experiments.

Visible Imaging System (VIS)
Image wheels to monitor physical state of the wheels, grousers, and mobility system.
Image surface tracks to measure track depth and grouser spacing to derive shear strength and wheel slip.



***The Regolith and Ice Drill for Exploration of New Terrains (TRIDENT)**
Drill down to 1 meter to derive subsurface thermophysical properties.



VIPER Mobility Engineering Unit

*not visible here