

## **TRIDENT (The Regolith and Ice Drill for Exploring New Terrain) for VIPER rover**

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The goal of the VIPER mission is to capture and identify volatiles species within the top one meter of the lunar surface. The TRIDENT drill has been designed to generate cuttings and place them on the surface for analysis by the Near InfraRed Volatiles Spectrometer Subsystem (NIRVSS) and Mass Spectrometer observing lunar operations (MSolo).

The drill is based on the TRL4 Mars Icebreaker drill and TRL5 LITA drill developed for capturing samples of ice and ice cemented ground on Mars and represents over a decade of technology development effort funded by NASA. The drill consists of 1. Rotary-Percussive Drill Head, 2. Sampling Auger, 3. Brushing Station, 4. Feed Stage, and 5. Deployment Stage.

To reduce sample handling complexity, the drill auger is designed to capture cuttings as opposed to cores. High sampling efficiency is possible through a dual design of the auger. The lower section has deep and low pitch flutes for retaining of cuttings. The upper section has been designed to efficiently move the cuttings out of the hole. The drill uses a “bite” sampling approach where samples are captured in ~10 cm depth intervals all the way to 1 m depth. This allows for stratigraphy to be maintained while reducing drilling power and forces.

The Engineering Test Unit (ETU) of TRIDENT has been tested in NASA GRC’s lunar vacuum chamber at  $\sim 10^{-5}$  torr vacuum and  $\sim 150$  K temperature. The ETU has also been successfully vibration tested at NASA KSC.

The TRIDENT passed PDR and is scheduled to have CDR in the summer of 2020.