

# TRIDENT Drill for VIPER and PRIME-1 Missions



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## 10 Second Summary

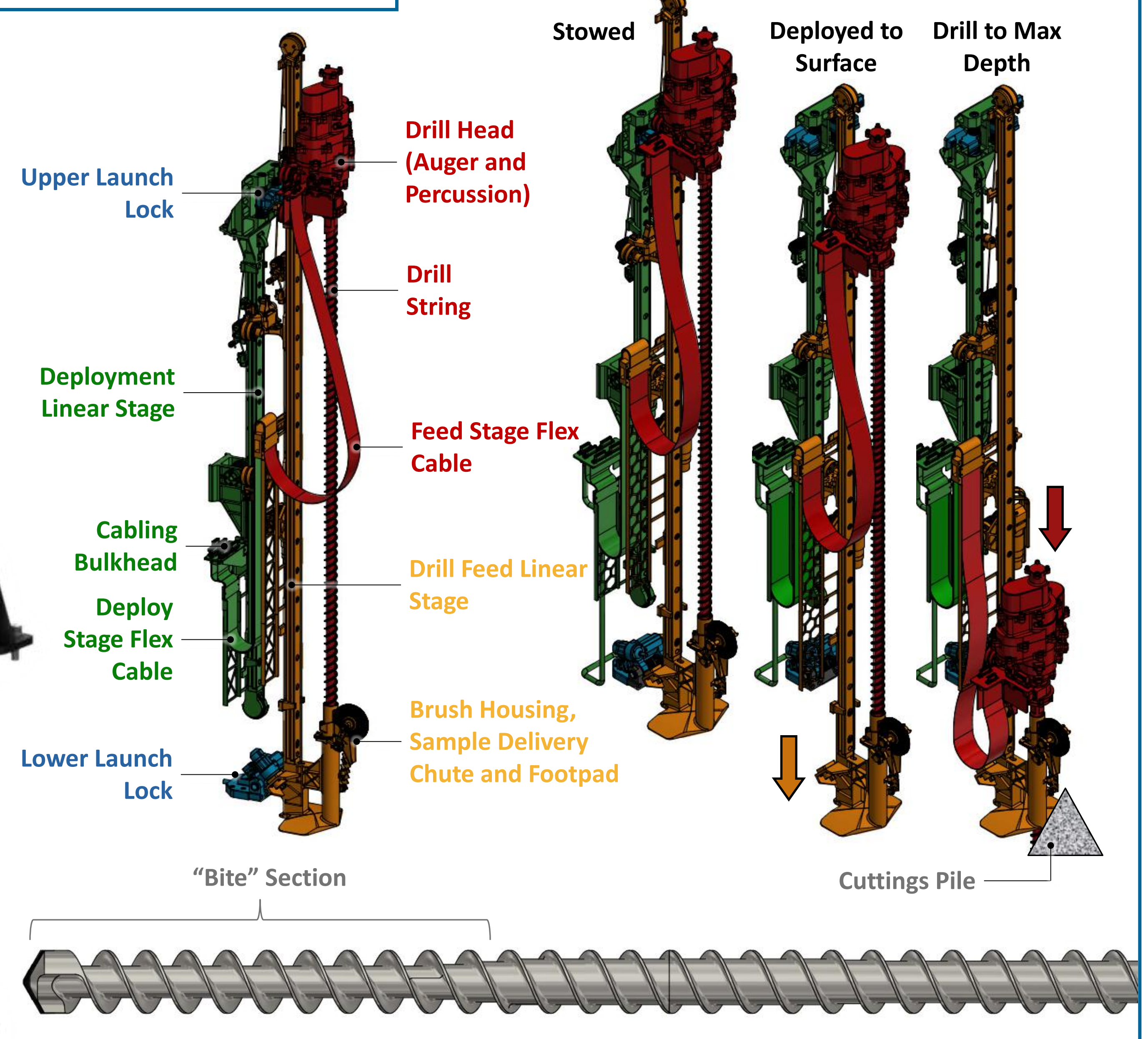
TRIDENT (The Regolith and Ice Drill for Exploring New Terrain) is a 1 m class Rotary-Percussive drill designed for VIPER rover mission and PRIME1 lander mission. The purpose of TRIDENT is to capture subsurface ice-rich regolith in 10 cm 'bites' and deliver it to surface for analysis by MSolo mass spectrometer (VIPER and PRIME1) and NIRVSS near infrared spectrometer (VIPER).

TRIDENT's bit integrated temperature sensor will measure subsurface temperature while drilling telemetry would be used to determine regolith strength, and via calibrations and in concert with other instruments, the fraction and the state of ice.

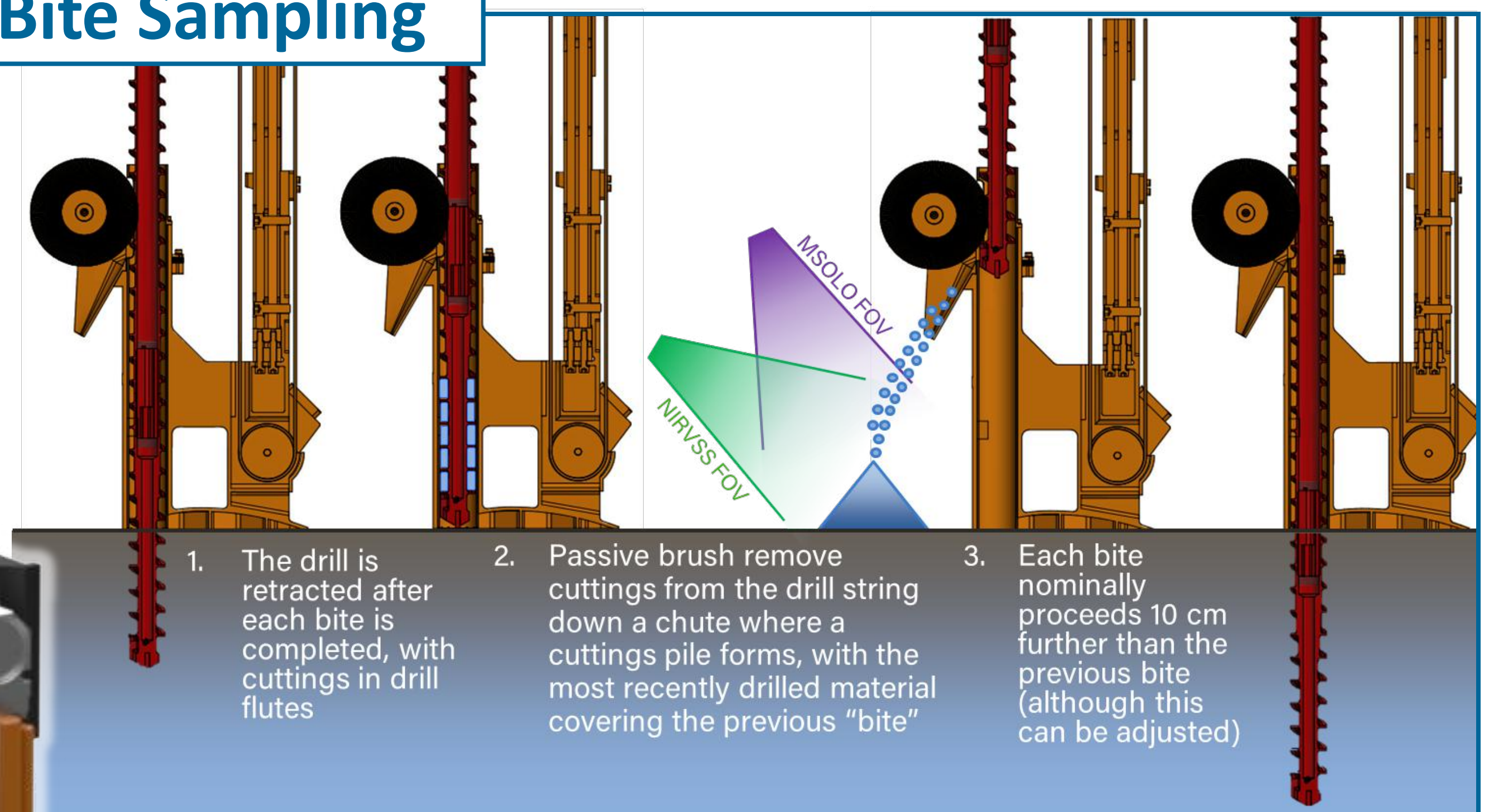
TRIDENT also has integrated heater in the 1 m drill string to enable additional measurements (time permitting), such as thermal conductivity.



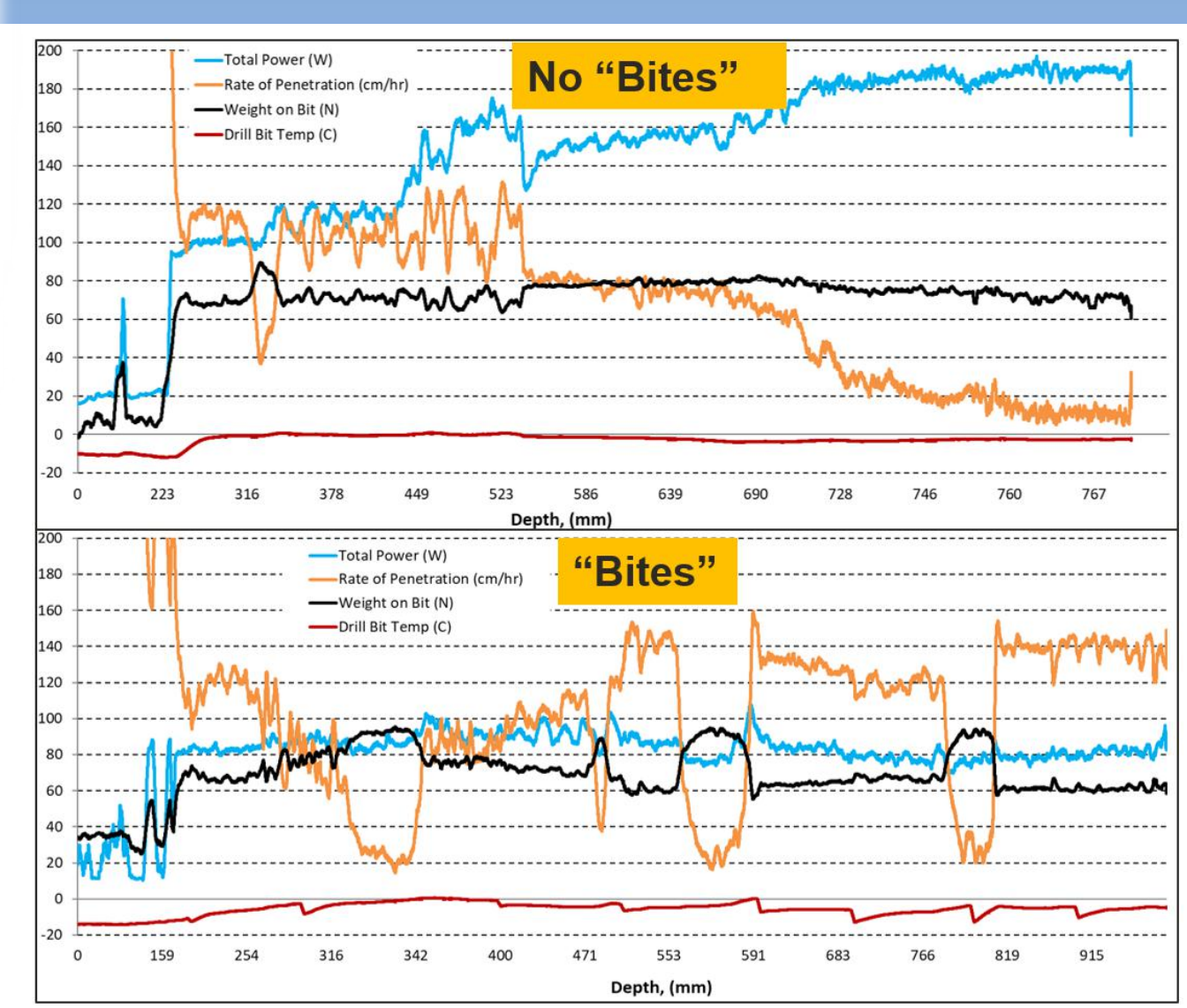
## Overview



## Bite Sampling

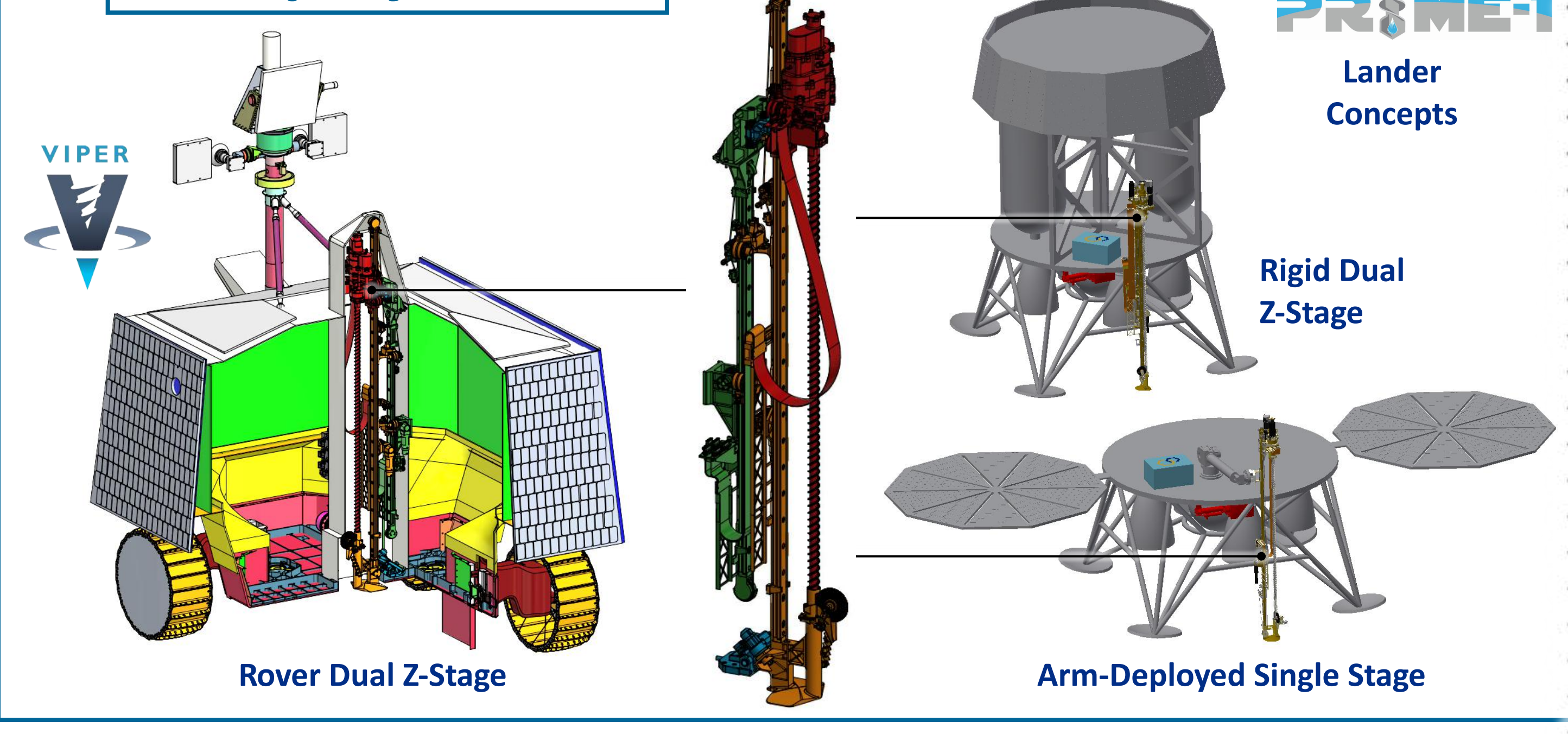


1. The drill is retracted after each bite is completed, with cuttings in drill flutes
2. Passive brush remove cuttings from the drill string down a chute where a cuttings pile forms, with the most recently drilled material covering the previous "bite"
3. Each bite nominally proceeds 10 cm further than the previous bite (although this can be adjusted)

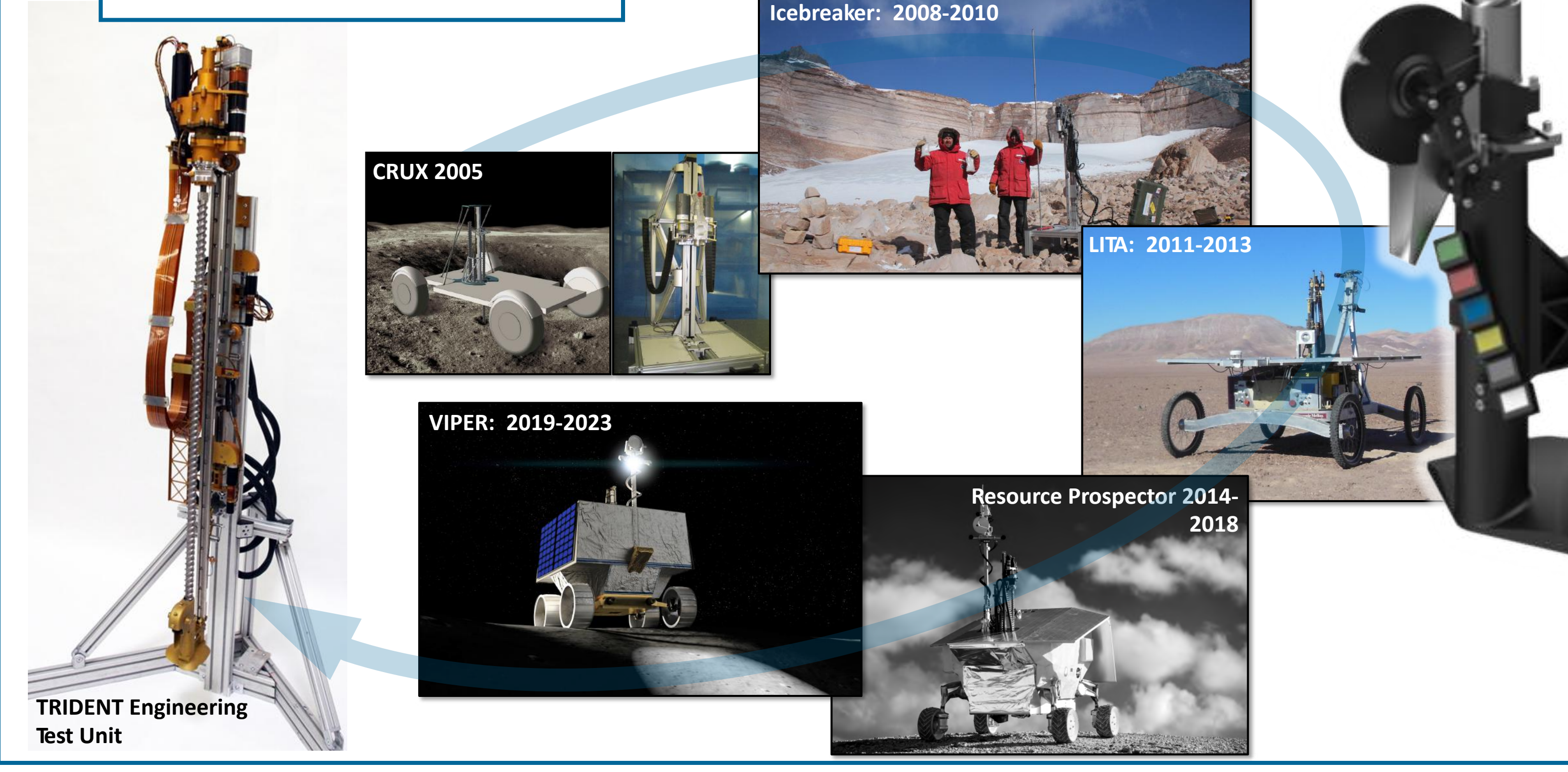


- ### Advantages of "Bite Sampling"
- Stratigraphy is preserved in 10 cm "Bites"
  - More accurate material strength determination through Drill Bit Torque
  - Auger Torque (Side wall friction) is minimized
  - More accurate downhole temperature
  - Lower overall power consumption
  - Higher Rate of Penetration

## Deployment



## TRL Maturation



## Testing at GRC

- Test conditions:
  - Vacuum:  $< 1 \times 10^{-6}$  torr
  - Chamber Temperature:  $< -80^\circ\text{C}$
  - Regolith Temp.:  $< -150^\circ\text{C}$
  - Regolith NU-LHT-3M water doped: room dry, 2.5 wt%, 5 wt% (layers separated by Al foil)
- $>> 30$  holes drilled in several soil bins
- MSolo and NIRVSS data correlated well with water concentration

