National Aeronautics and Space Administration

Water Ice in Lunar Simulants: NIRVSS Drilling Observations

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Motivation

Continuing evidence for H_2O on Moon

- Missions
  - Clementine, Lunar Prospector, Chandrayan, Deep Impact, Galileo, LCROSS, LRO, Apollo samples

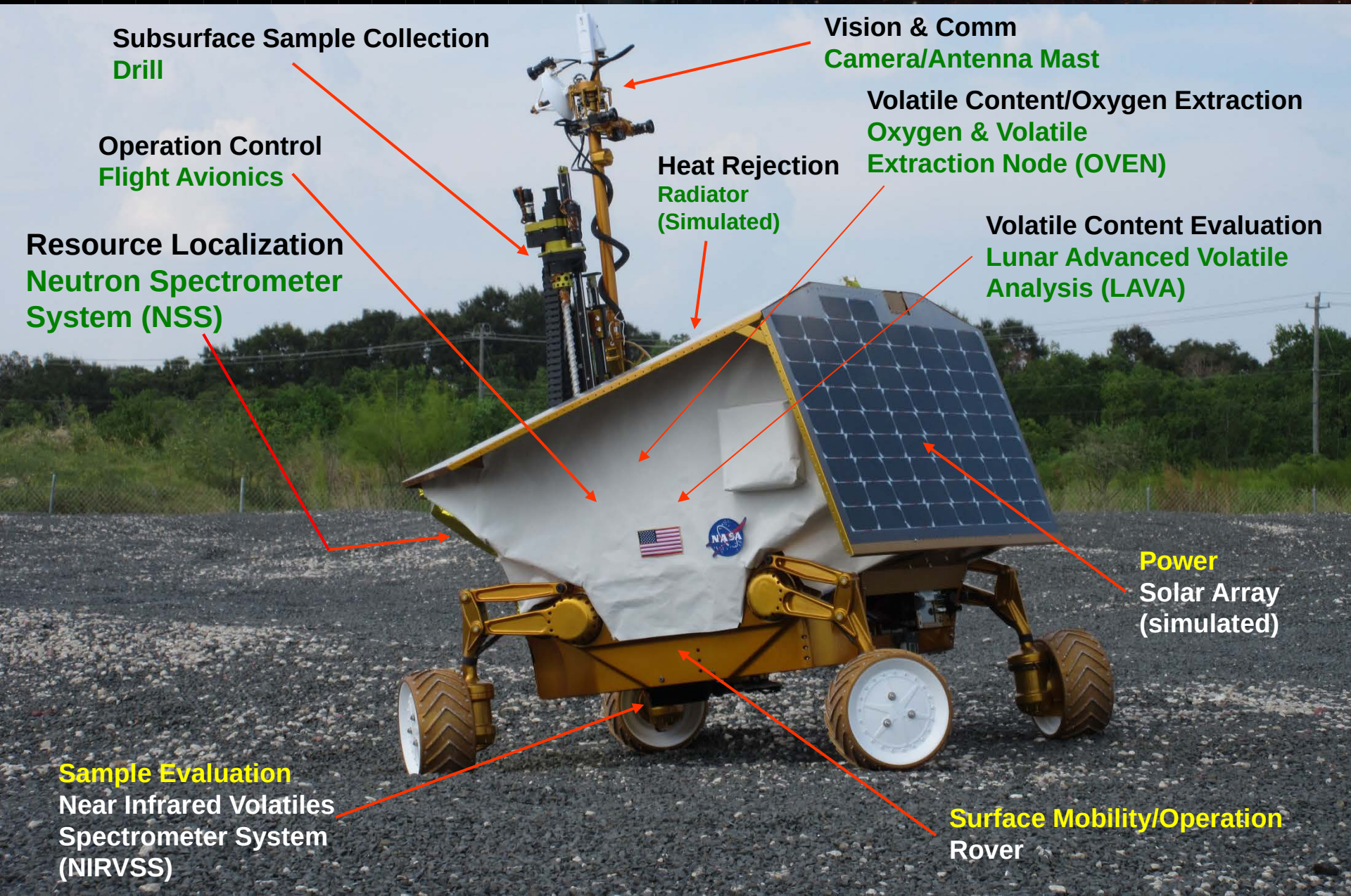
H_2O is a Potential Resource enabling living off the land

- oxygen
- fuel
- human support

Resource Prospector (RP) going to Lunar Pole to characterize distribution and abundance of H_2O and other volatiles.

Test RP payload components early and often

RP – The Tools

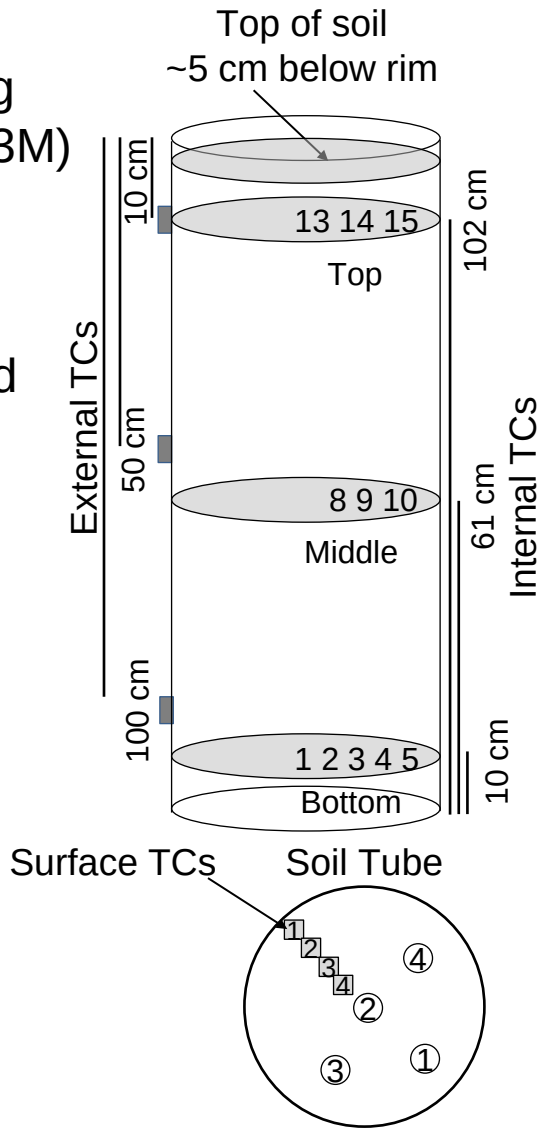

Subsurface Sample Collection
Drill
Vision & Comm
Camera/Antenna Mast
Volatile Content/Oxygen Extraction
Oxygen & Volatile
Extraction Node (OVEN)
Operation Control
Flight Avionics
Heat Rejection
Radiator
(Simulated)
Volatile Content Evaluation
Lunar Advanced Volatile
Analysis (LAVA)
Resource Localization
Neutron Spectrometer
System (NSS)
Power
Solar Array
(simulated)
Sample Evaluation
Near Infrared Volatiles
Spectrometer System
(NIRVSS)
Surface Mobility/Operation
Rover

On-Going testing of RP science components and drill at Glenn Research Center using VF-13

VF-13 accommodates:

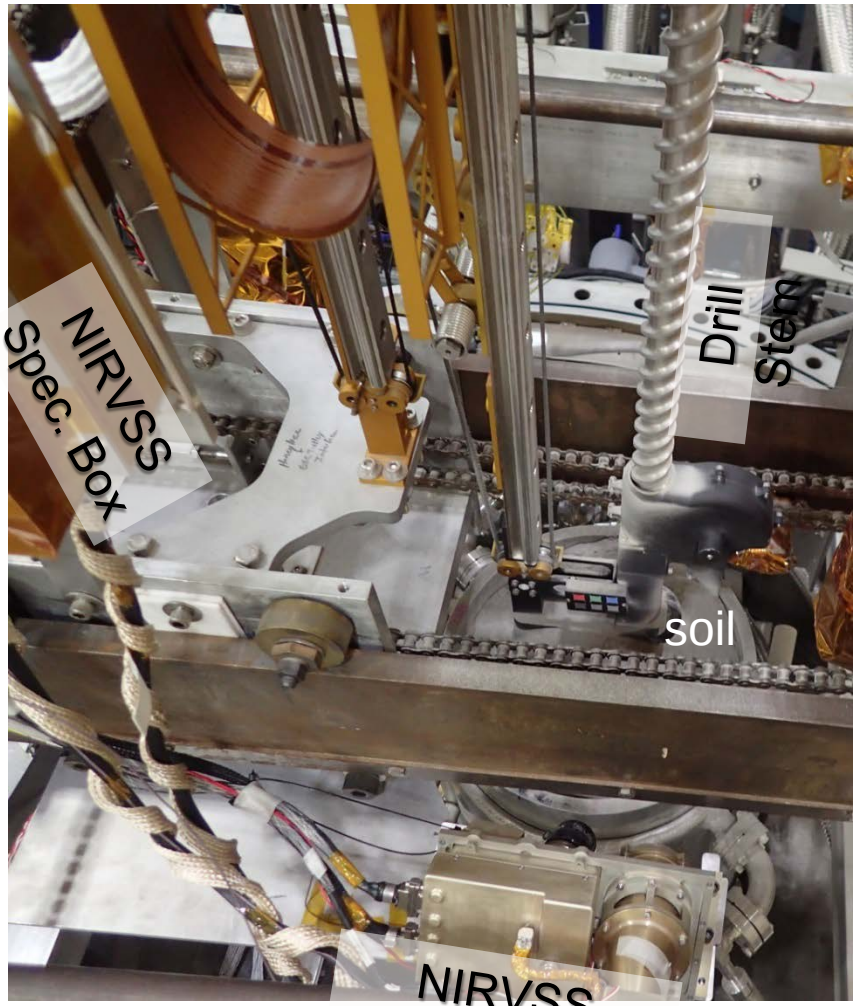
- 1.2 m x 30 cm diam. tubes containing H_2O-doped lunar simulant (NU-LHT-3M)
  - HR drill
  - ARC NIRVSS
  - JSC OVEN
- VF-13 actively cools the shroud and soil tubes
- RGA as proxy for MS

Soil Tube	Date	Wt. % H2O	Soil T, K
1	4/10/2017	2.5	~154
2	4/18/2017	0.8	~170
3a	4/24/2017	2.5	~110
3b	4/26/2017	2.5	~110
3c	4/28/2017	2.5	~110
4	5/4/2017	0.8	~143

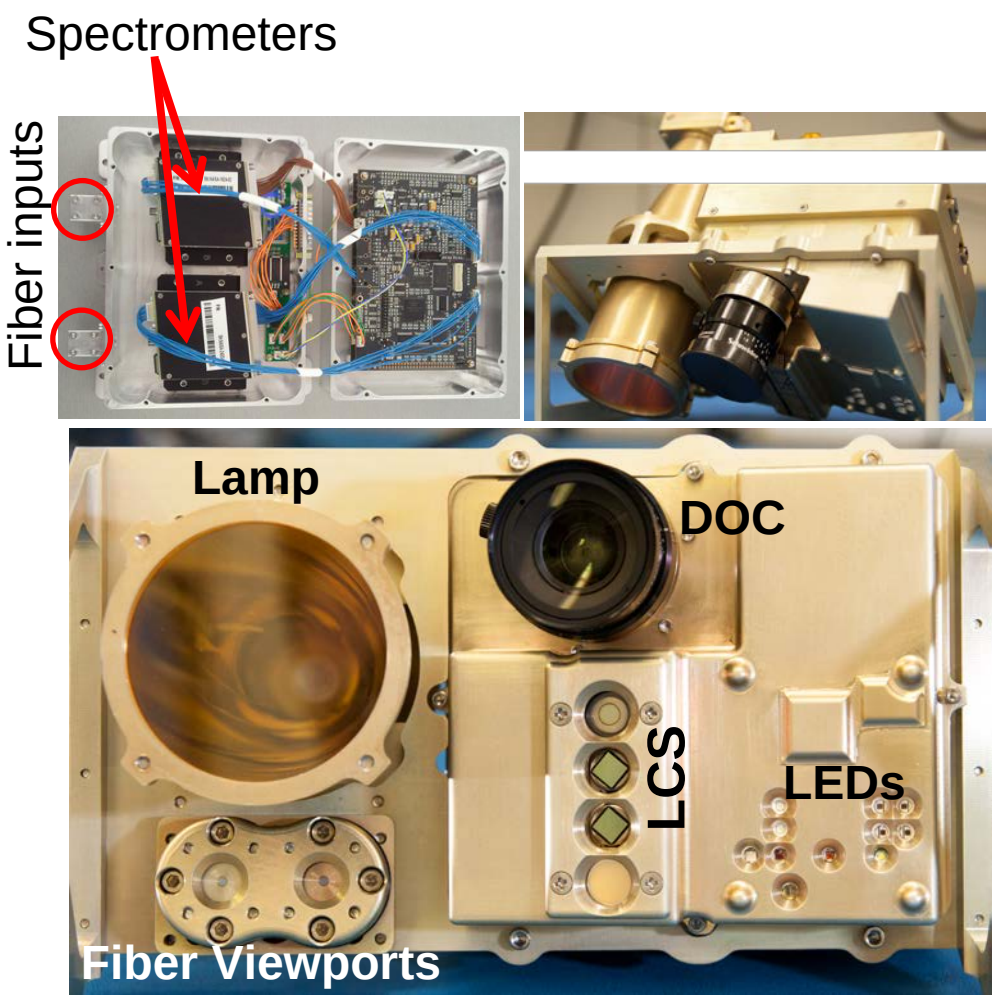


NIRVSS accommodation in VF-13 2017, and components

NIRVSS @GRC in 2017



NIRVSS components

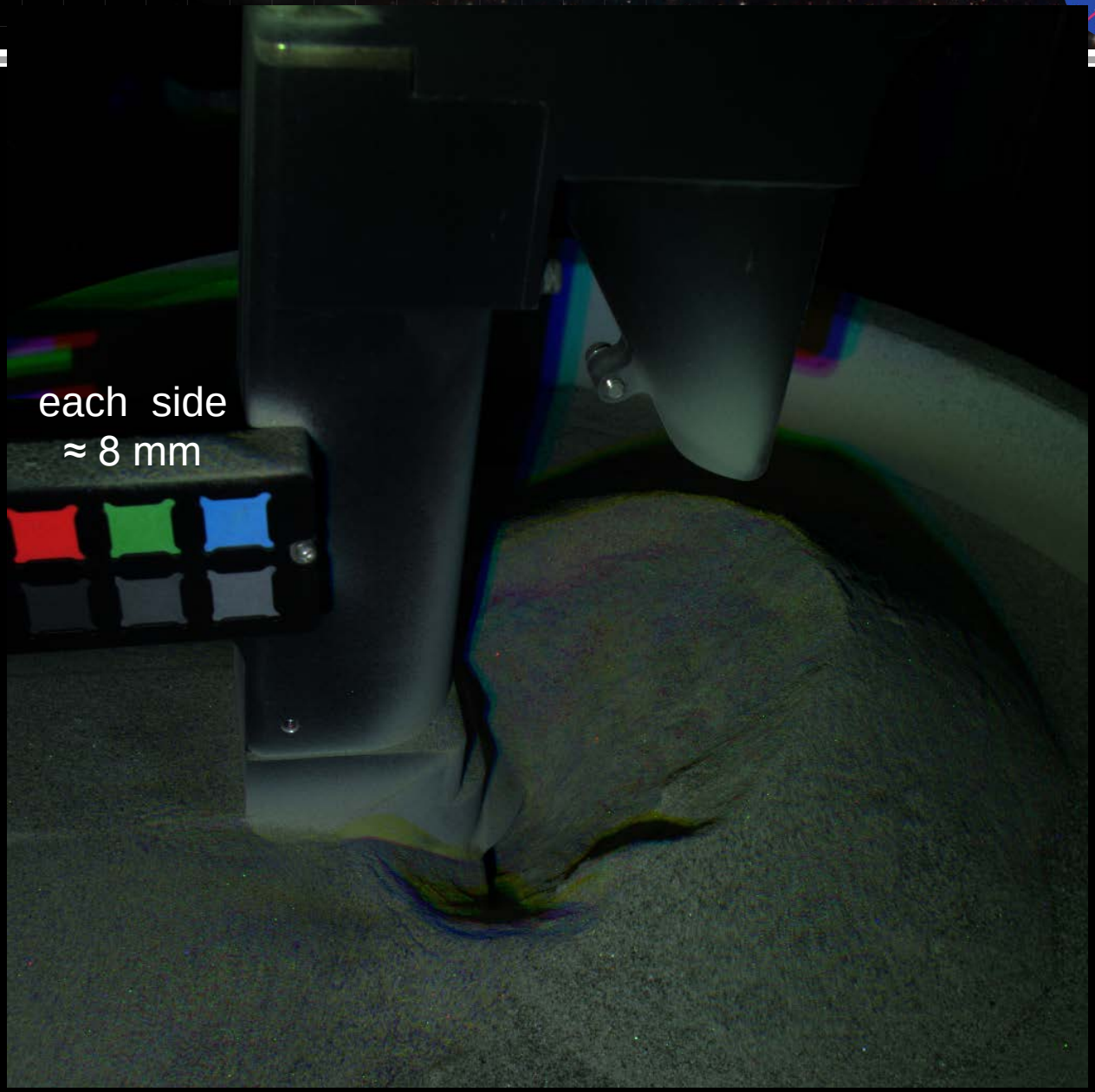


Remote Instrumental Control and Monitoring

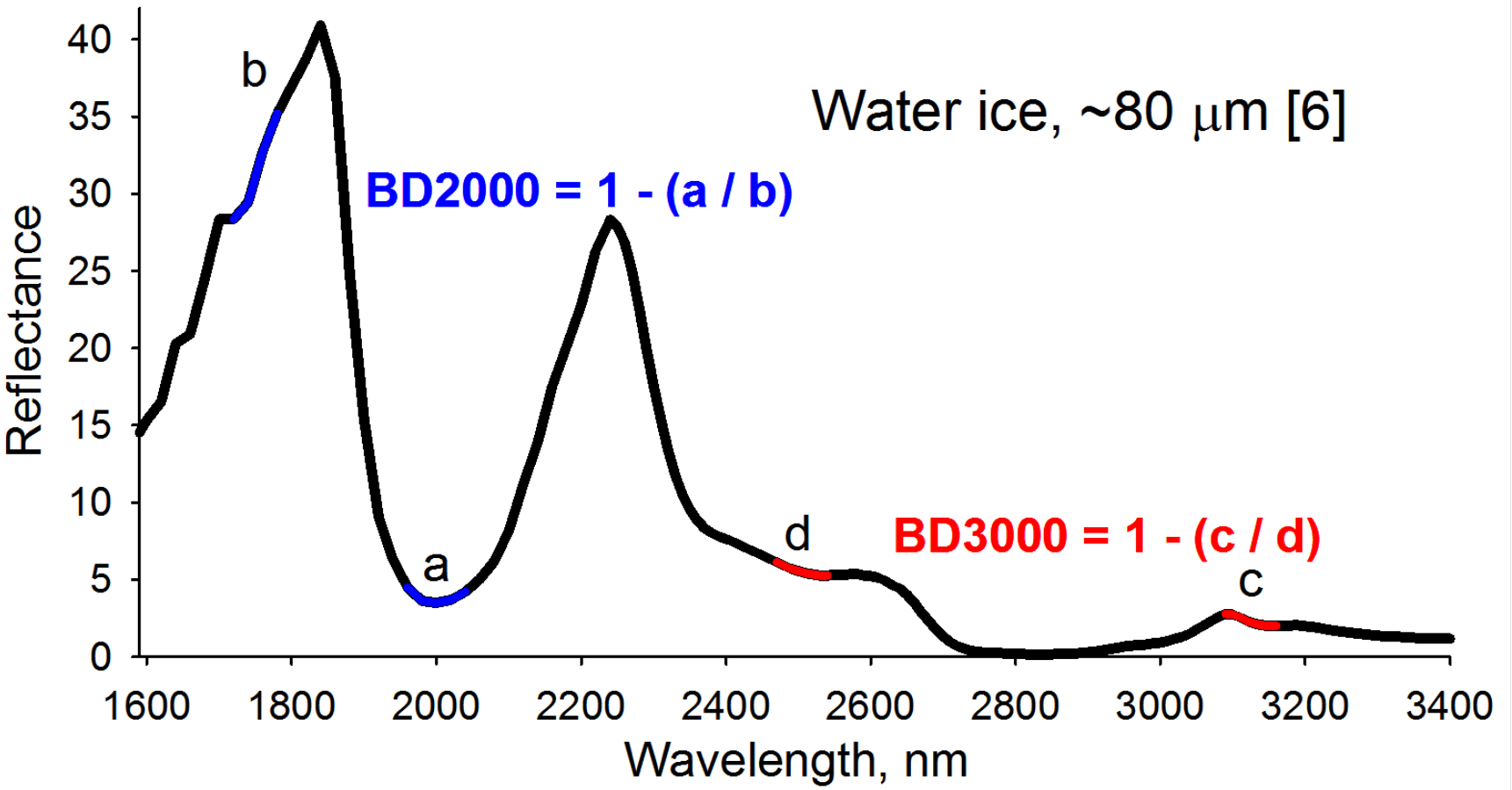
NIRVSS data collection in VF-13commanded from Ames while monitoring DOC imaging and spectral data

Near RGB Color Composite, Unstaurated Images

scale = 1
1024 x 1024
B = 410 nm LED
G = 540 nm LED
R = 650 nm LED

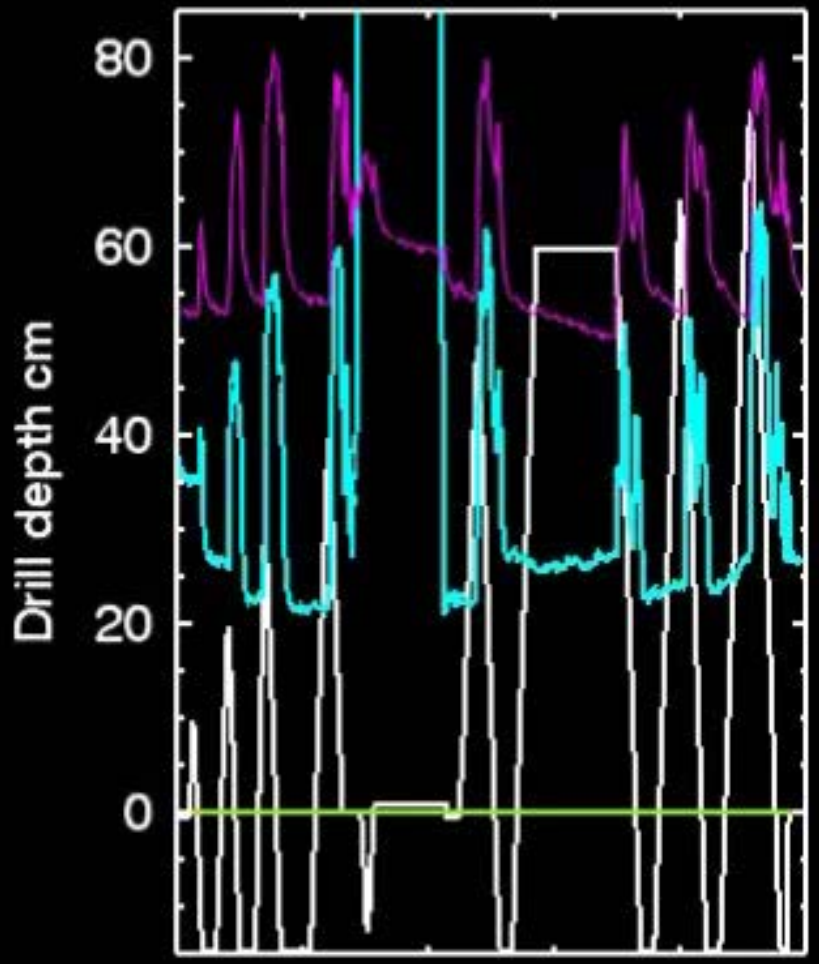


Spectral parameters to monitor water ice during drilling



BD2000*800 BD3000*100

Surface



NIRVSS GRC 2017 Summary

New cut-on filter for Lamp permits DOC and spectrometers operation simultaneously to characterize compositional and physical nature of drill cuttings pile.

New DOC calibration targets permit easier rendering of near RGB colors and can be used to assist in multi-wavelength compositional mapping from images.

Both BD2000 and BD3000 vary with drilling activities as seen in previous tests at GRC, permitting real-time monitoring of water ice in cuttings pile.
Correlation of BDs with RGA measurements remains to be performed.

Effect of differing spectrometer FOVs on compositional characterization remains to be evaluated.

BD2000 and BD3000 ↑ as drilling proceeds