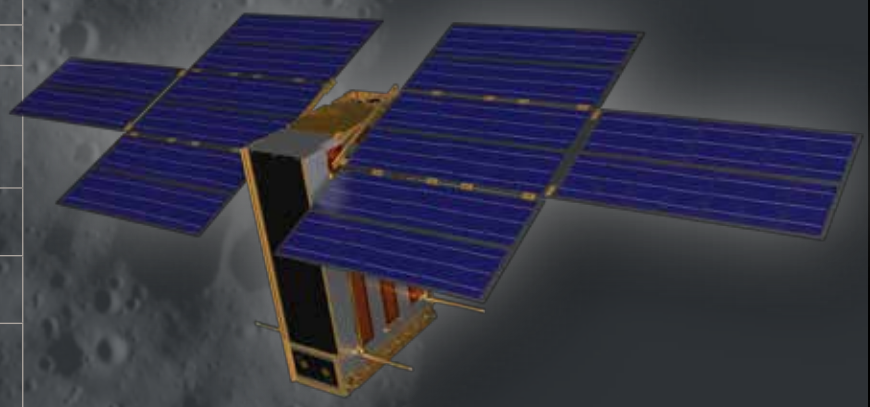
2018 FACT SHEET

LUNAH-MAP: THE LUNAR POLAR HYDROGEN MAPPER MISSION

LunaH-Map is a low-cost NASA planetary science CubeSat mission to map hydrogen enrichments at the Moon's South Pole. LunaH-Map will enter a low perilune, polar orbit and will use a miniaturized neutron spectrometer to measure the count rates of neutrons leaking from the lunar surface at low altitude. LunaH-Map will determine the spatial distribution of hydrogen within permanently shadowed regions at unprecedented spatial resolution.

LUNAH-MAP FLIGHT SYSTEM DETAILS

Dimensions	10x20x30 cm
Mass	14 kg
Power	MMA eHawk+ 90W BOL Solar Array, Blue Canyon Technologies XEPS with 56W-hr Li-ion battery
Propulsion	Busek BIT-3 ion thruster, iodine propellant
Communication	JPL Iris V2 CubeSat Deep Space Transponder
Command and Data Handling / Guidance, Navigation and Control	Blue Canyon Technologies XB-1



LunaH-Map Spacecraft

GOALS OF THE LUNAH-MAP MISSION

- Develop and qualify a neutron spectrometer for small spacecraft in deep space
- Demonstrate the use of ion propulsion to navigate into a lunar capture orbit
- Measure the hydrogen abundance within permanently shadowed regions at the Moon's south pole

MISSION SPECIFICATIONS

- 6U CubeSat form factor
- Navigate into a low altitude polar orbit with perilune centered on the lunar South Pole
- Count epithermal neutrons using two high-efficiency neutron spectrometers
- Orbit for two months

MINI-NS: MINIATURE NEUTRON SPECTROMETER FOR SMALL SPACECRAFT

LunaH-Map carries, as its primary payload, Mini-NS, a neutron spectrometer using CLYC scintillator crystals. Mini-NS has 200 cm^2 of detecting area covered in gadolinium foil making it sensitive to epithermal (>0.3eV) neutrons only.

SPECIFICATIONS

Detector	2x4 Array of 4cm x 6.3cm x 2.5cm CLYC Detectors
Sensitivities	Epithermal (E > 0.3 eV) neutrons
Dimensions	25cm x 10cm x 8cm
Mass	3.4 kg
Power	10W (standby), 22W (nominal)
Data Acquisition Times	Counts binned every 1 second
Data Rate	14 Bytes/Sec (50 kBytes/Sec stored locally)

Image Credit: N. Struebel

Front of Mini-NS

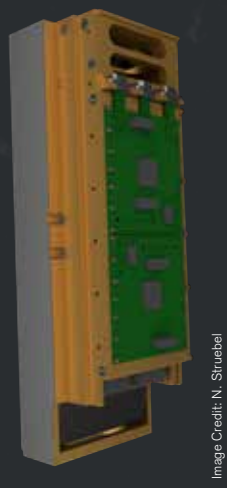
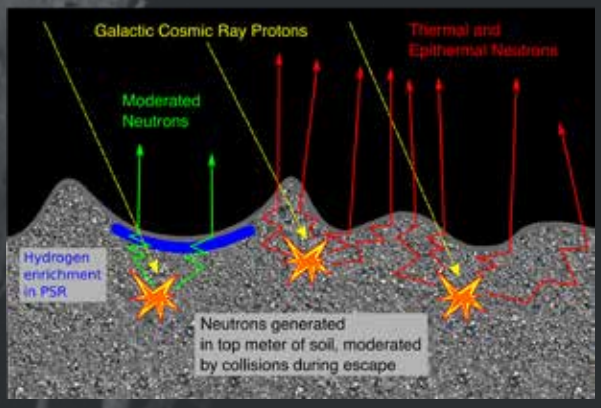


Image Credit: N. Struebel

Back of Mini-NS

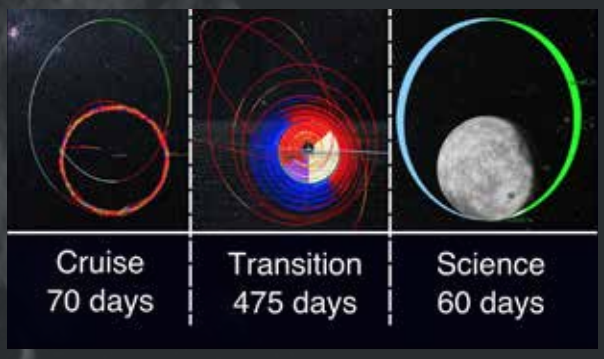
HYDROGEN DETECTION USING MINI-NS

Cosmic ray protons constantly bombard the lunar surface, producing neutrons through nuclear interactions in the top meter of the surface. As these neutrons "leak" out from the surface, they lose energy and are slowed by collisions. Lunar regolith enriched in hydrogen is more effective at moderating neutrons than unenriched regolith. Over these regions, Mini-NS will detect a lower flux (counts per cm per second) of neutrons. These "neutron suppressed regions" correspond to hydrogen enrichments, most likely in the form of water (H_2O) or hydroxide (OH).



LUNAH-MAP CONCEPT OF OPERATIONS

LunaH-Map launches as a secondary payload on the first flight on NASA's Space Launch System, Exploration Mission 1 (EM-1). After deployment, LunaH-Map uses a series of lunar fly-bys and its ion propulsion system to enter a loose lunar orbit. Over the following months, LunaH-Map uses its ion propulsion system to lower perilune and shape its orbit. The science phase lasts 60 days and is followed by spacecraft disposal in a lunar far-side crater.



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