LUNAR GEOPHYSICAL INSTRUMENT PACKAGE (LGIP) AS A PAYLOAD FOR THE INTERNATIONAL LUNAR NETWORK (ILN)

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ILN SDT SCIENCE OBJECTIVES

Determine the size, composition, and state (solid/liquid) of the core of the Moon;

Characterize the thermal state of the interior and elucidation of the workings of the planetary heat engine;

Characterize the chemical/physical stratification in the mantle, particularly the nature of the putative 500-km discontinuity and the composition of the lower mantle; and

Determine the thickness of the lunar crust (upper and lower) and characterization of its lateral variability on regional and global scales.

Evaluate the origin of lunar crustal magnetism (*additional LGIP objective not specified by the ILN SDT)

LGIP SCIENCE INVESTIGATIONS

Make spatially distributed lunar geophysical measurements over a long period of time, covering at least one lunar tidal cycle (≥6 years);

Make simultaneous measurements of seismic events - at least one from a location where waves pass from the origin through the Moon's core and at least one location where they do not;

Make heat flow measurements below 1 m depth over at least 1-2 years so that both the steady state thermal gradient and the thermal conductivity of the regolith can be reliably determined; and

Measure surface magnetic fields and solar wind ion fluxes to evaluate the nature of crustal magnetic sources and the origin of Reiner Gamma-type albedo markings.

LGIP MEASUREMENT OBJECTIVES

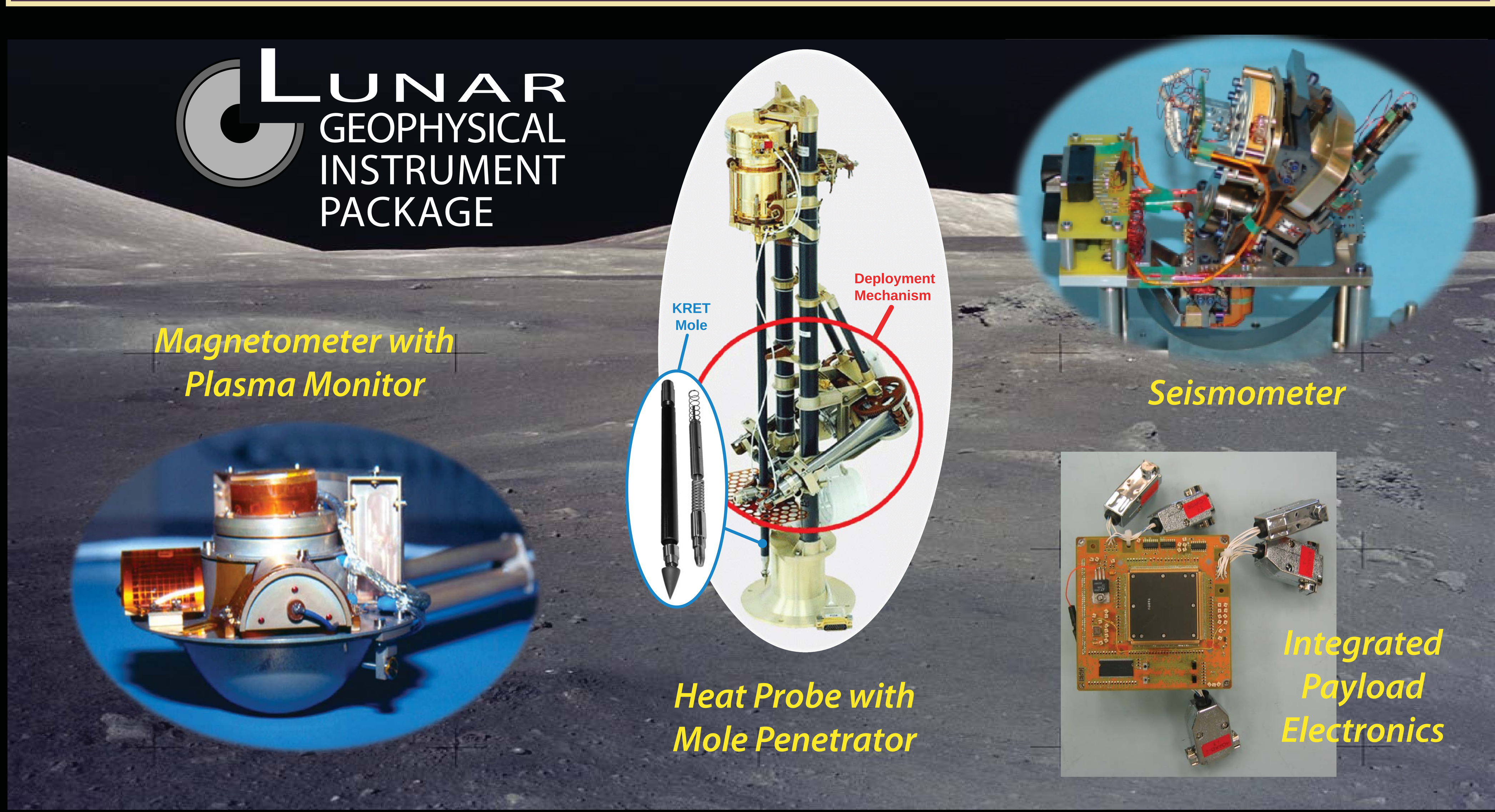
Highly sensitive *seismometers* will record lunar seismic events from multiple locations around the Moon (with a much larger areal extent compared to the Apollo Passive Seismic Network);"

A lunar surface *magnetometer* will make measurements at strategic surface locations to test hypotheses on the origin of the lunar crustal magnetic field as well as to electromagnetically sound the interior using complementary measurements with an orbital magnetometer that may be available during the life of the ILN;

A *plasma monitor* will measure solar wind ion bombardment and examine to what extent it is deflected by strong crustal magnetic anomalies;

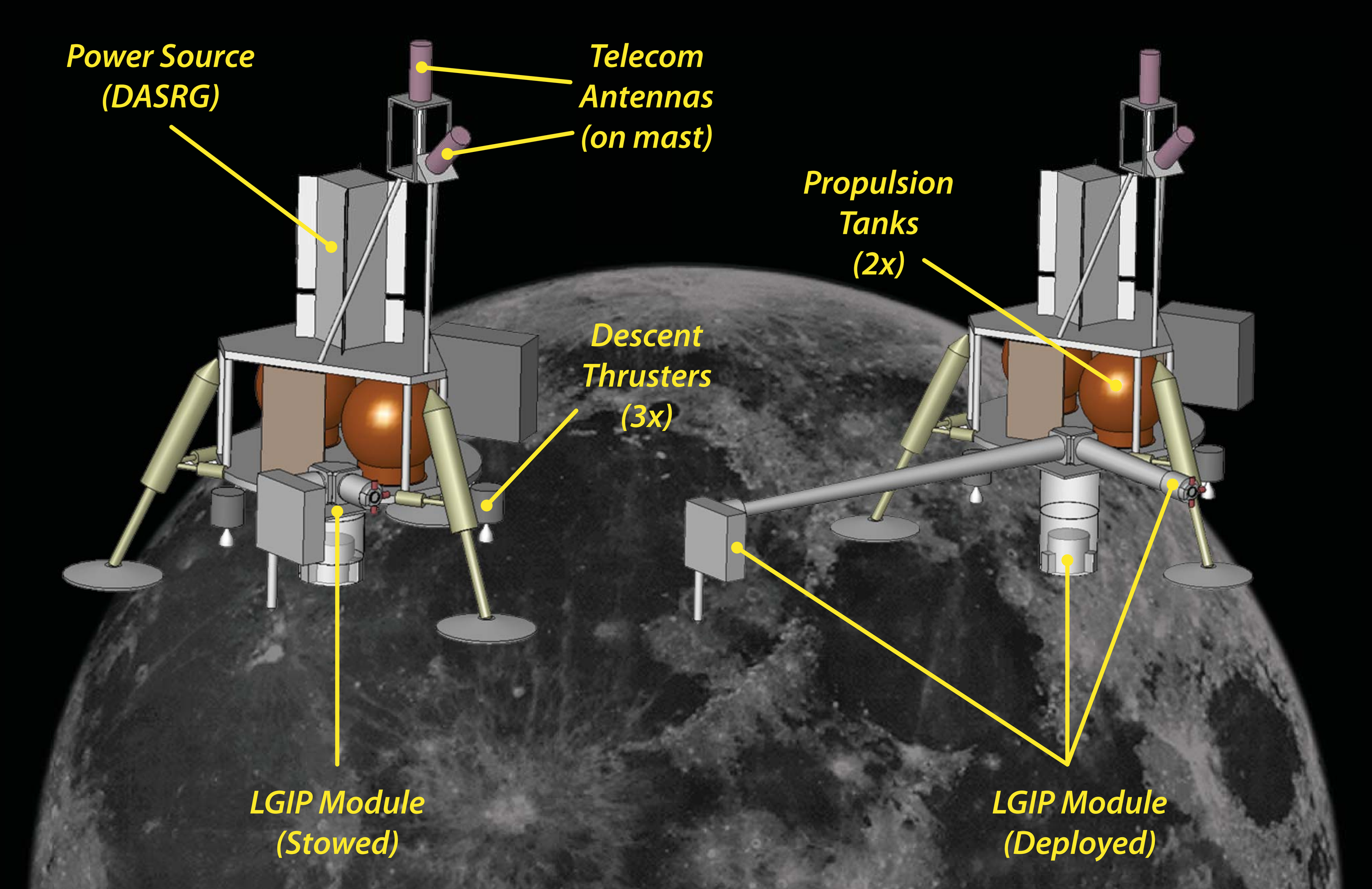
A self-penetrating subsurface *heat flow probe* will make long term measurements at multiple new lunar sites, helping to define the global lunar heat flow budget and understand the thermal evolution of the Moon; and

Integrated electronics and mechanical packaging provide powerful command, control and data handling of the instrument suite, allowing for coordinated instrument operation with maximum science return and simplified spacecraft accommodation.

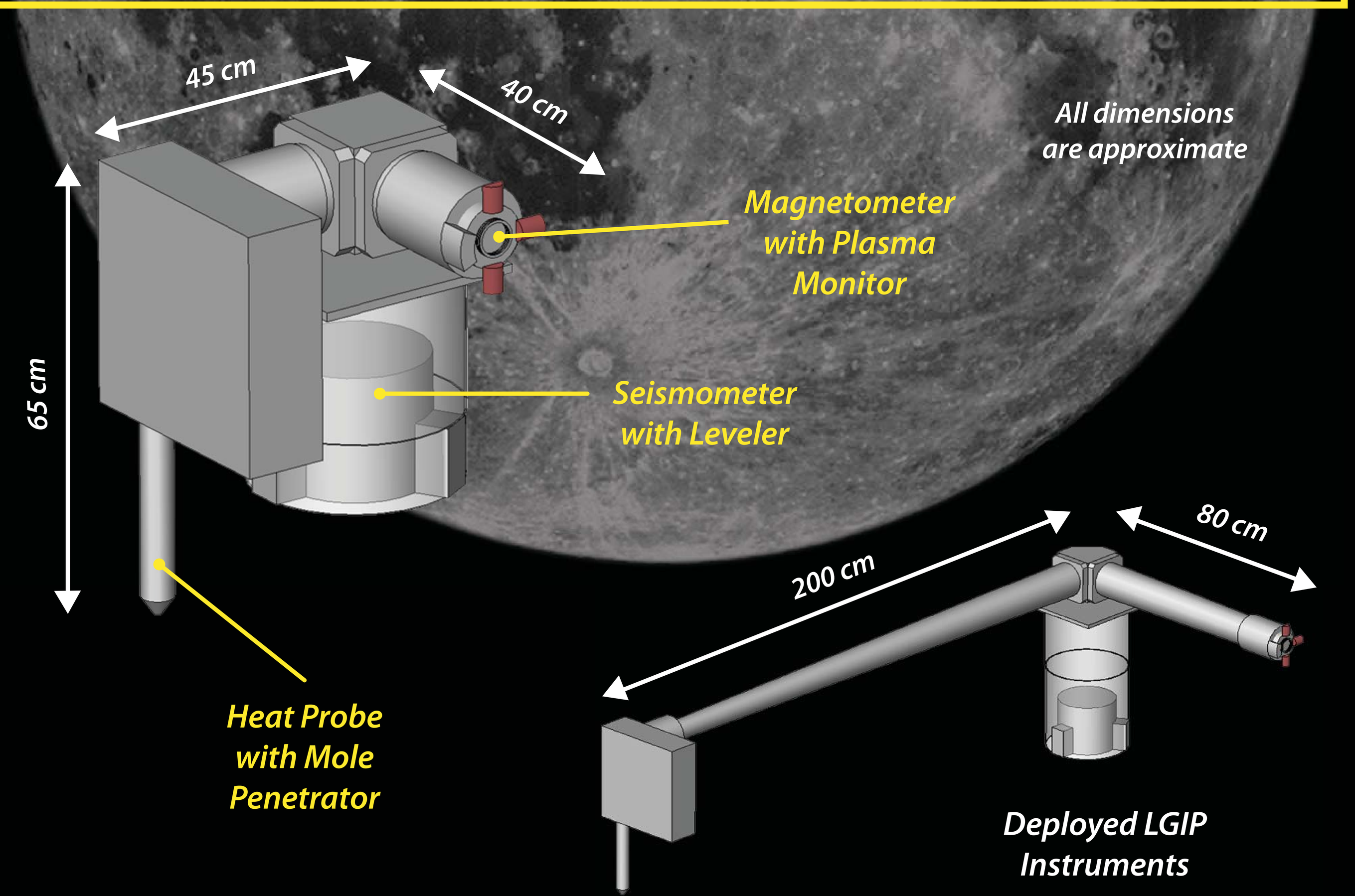


ILN LANDER*

** Lander pictures have been recreated based upon the ILN Baseline Science Lander developed by JHU/APL for NASA MSFC and the ILN Program. Conceptual ILN instruments have been replaced with the LGIP payload suite module.*



ILN LGIP PAYLOAD SUITE



ADVANTAGES OF AN INSTRUMENT SUITE

Simplified Design and Operation

All instrument needs are satisfied by the package itself, including thermal mitigation, deployment, power conditioning and command and data handling

Simplified Spacecraft Integration

Instruments are packaged in a single mechanical structure and electrical harness that may be easily mated with the spacecraft

Reduced Schedule Risk

Instruments are integrated and tested to proto-flight levels as a complete module. An L-GIP mass simulator allows parallel AI&T of both the spacecraft and instrument module

Reduced Mass

Total mass and complexity are reduced by having a fully integrated set of payload electronics and mechanical packaging

Reduced Cost

With the multiple build case of ILN, having a standard, easily integrated instrument package will reduce cost risk associated with schedule and recurring engineering

Reduced Technical Risk

All instruments are high TRL, having flown on or flight qualified for space missions

LGIP INSTRUMENTS

Specs. are approximate	SEISMOMETER	MAGNETOMETER WITH PLASMA MONITOR	HEAT PROBE WITH MOLE PENETRATOR	ELECTRONICS PACKAGE
PROVIDER	Institut de Physique du Globe de Paris	University of Arizona / University of Braunschweig, Germany / MAGSON GmbH	University of Michigan / Space Research Center of The Polish Academy of Sciences	Ball Aerospace and Technologies Corp.
HERITAGE	SEIS/Netlander, ExoMars	ROMAP/Rosetta, THEMIS, BepiColombo	MUPUS/Rosetta, KRET-mole penetrator, Netlander	CT-701 Star Tracker / STS, Deep Impact , LEO missions
MATURITY	TRL 5	TRL 5	TRL 4-5	TRL 4
MASS	5.6 kg	0.7 kg	3.4 kg	0.2 kg
POWER	2.5/6.5 W avg/peak	0.75/1.5 W avg/peak	0.4/1.0 W avg/peak	2.8 W avg
DIMENSIONS	270 (d) x 250 mm (total)	100 (d) x 150 mm (sensors)	350 x 350 x 450 mm (total) 25 (d) x400 mm (penetrator)	150 x 120 x 180 mm (total)
DATA	4000/1700 bps @ 100 Hz (raw/compressed)	80/4430 bps (slow/fast) @ 80 Hz	50 bits (once each hour)	Serial Interface to spacecraft (e.g. RS422) 2-8 GB NVM Storage