

New Capabilities in Lunar Surface Environment Testing at MSFC



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PLANET:

Planetary, Lunar, & Asteroid Natural Environment Testbed

PLANET is a new, high-fidelity, combined space environments laboratory currently being designed, built, and outfitted at NASA Marshall Space Flight Center in Huntsville, AL.

PLANET is based on a 2-meter diameter, 3-meter long high-vacuum chamber. It was sized to optimize R&D work on materials, sub-scale assemblies, and instruments at a reasonable cost, while being able to provide a full space environment to the units under test.

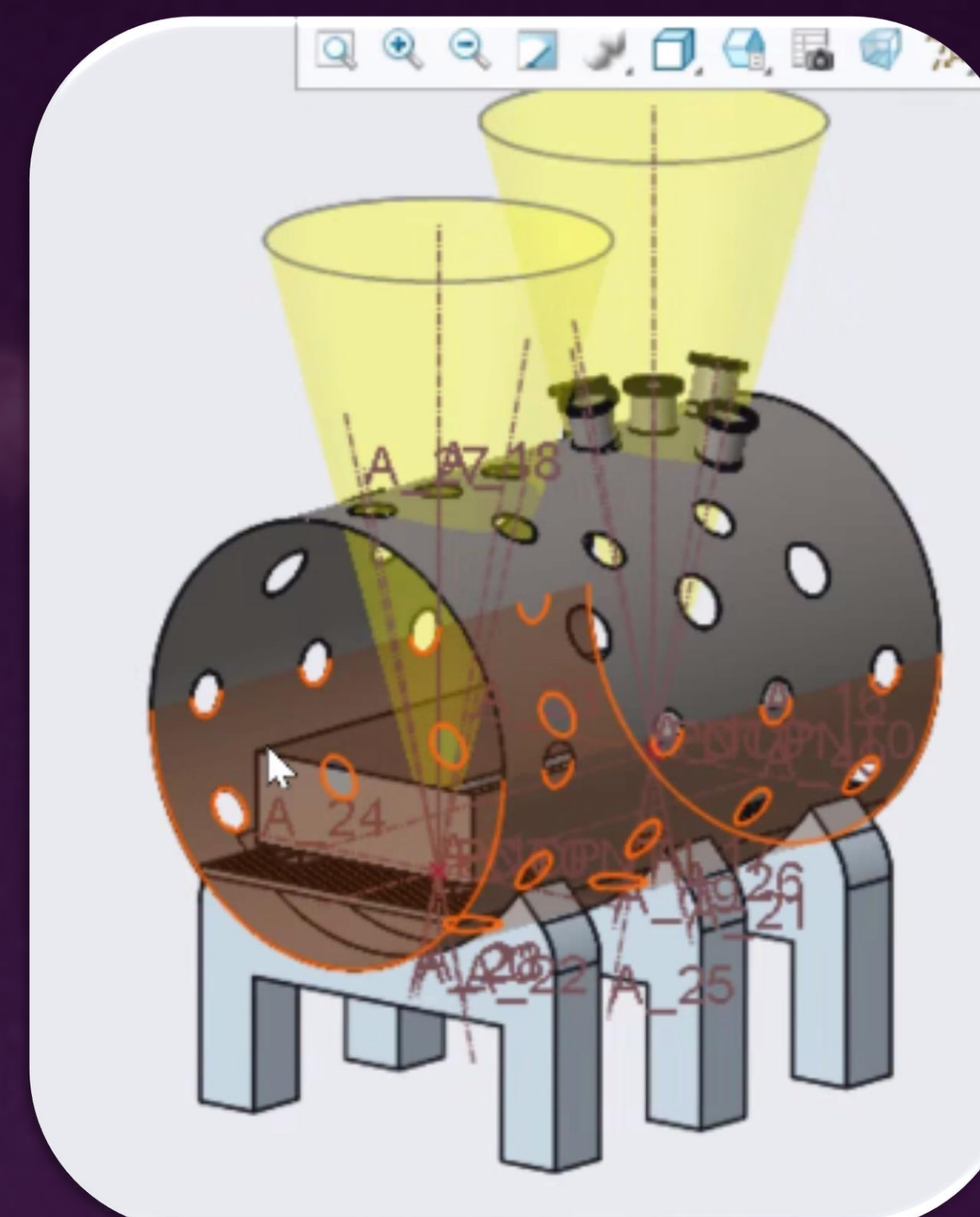


Image courtesy Leybold USA (Univex S 2000)

PLANET will house a 4'x8' regolith tray (depth 8"), with room for instrumentation below it. Different simulants are planned for different tests, including lunar highlands, lunar mare, and Mars surface.

PLANET will eventually be instrumented to provide the following environments, simultaneously or individually, per customer requirements:

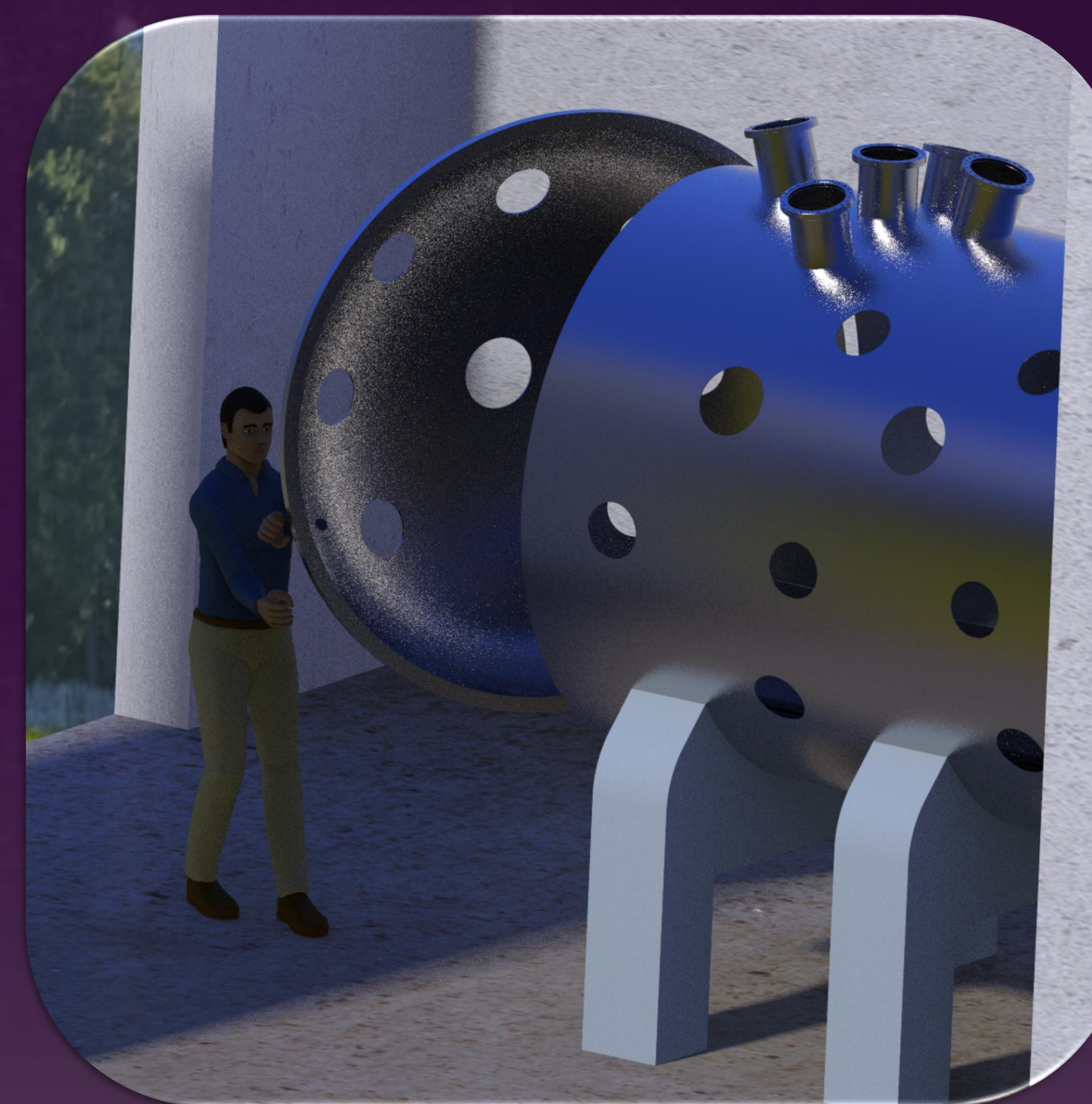
- Charged particle radiation (low energy electron and proton)
- Low density plasma, high vacuum (10E-7 Torr), or planetary/Martian atmosphere
- Ultraviolet radiation (vacuum and near UV wavelengths)
- Thermal extremes
 - Cryogenic system (liquid nitrogen; with future plans for helium cooling!)
 - Heating via contact or infrared
- Regolith simulant bed (lunar or Martian) & distribution system



PLANET features a custom port arrangement with nearly 40 ports for bringing in the space environment, instrumentation, power and data, pumping, and viewing.

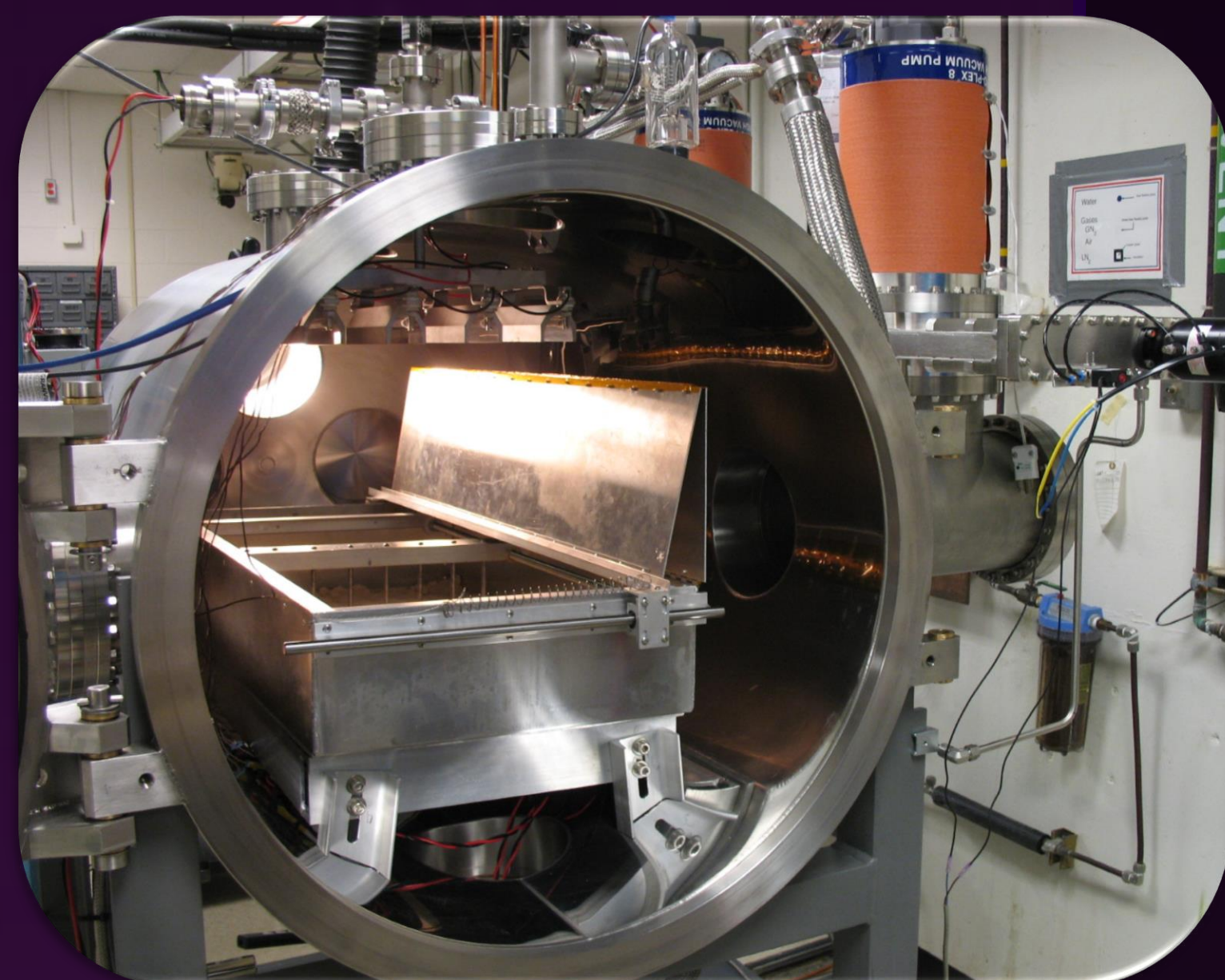
Environments are primarily introduced from above, and the chamber has two main zones with different focal planes.

The bottom of the chamber will have a single large port which can be used to extend the regolith depth for drilling studies.



PLANET will be fully online and available for customer use by mid-2024.

LETS: Lunar Environment Test System



- 30" diameter high-vacuum chamber for testing materials, components, and small mechanisms for the lunar surface
- Featuring:
 - Regolith simulant box (with loose lid for pump down)
 - Cryogenic (LN2 shroud) and heating (IR or contact) capability
 - Low energy electron (100 keV) and proton guns
 - Ultraviolet (NUV/VUV) capability
 - Particle imaging velocimeter
- Has been fully operational since 2008 in Bldg 4605

MSFC's dirty vacuum capabilities are complementary, providing solutions for projects at different sizes, budgets, and development levels

V20 DTVAC



- 20' diameter x 28' long high-vacuum chamber for testing full-scale hardware performance
- Conversion from a clean TVAC chamber to dirty is underway, with completion mid-2022
 - Regolith simulant beds undergoing fabrication
 - "Shallow" and "deep" options
- Features include cryogenic shroud (LN2) and heating capability, but no other space environment capabilities

Interested in working with us?

NASA MSFC partners with other NASA Centers, as well as universities and commercial ventures through Space Act Agreements, by

- performing basic materials research,
- advancing new technologies, and
- lowering mission risk!

Testing in one of our Space Environments chambers can raise your technology to **Technology Readiness Level (TRL) 6** – Qualification in a Relevant Environment!

Please get in contact to see how we can work together to enable the future of exploration!

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