

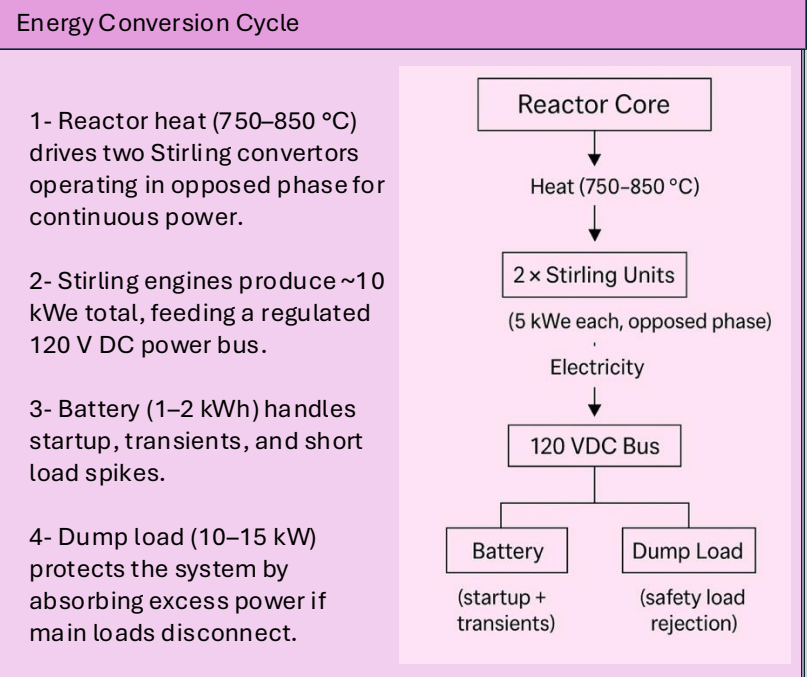
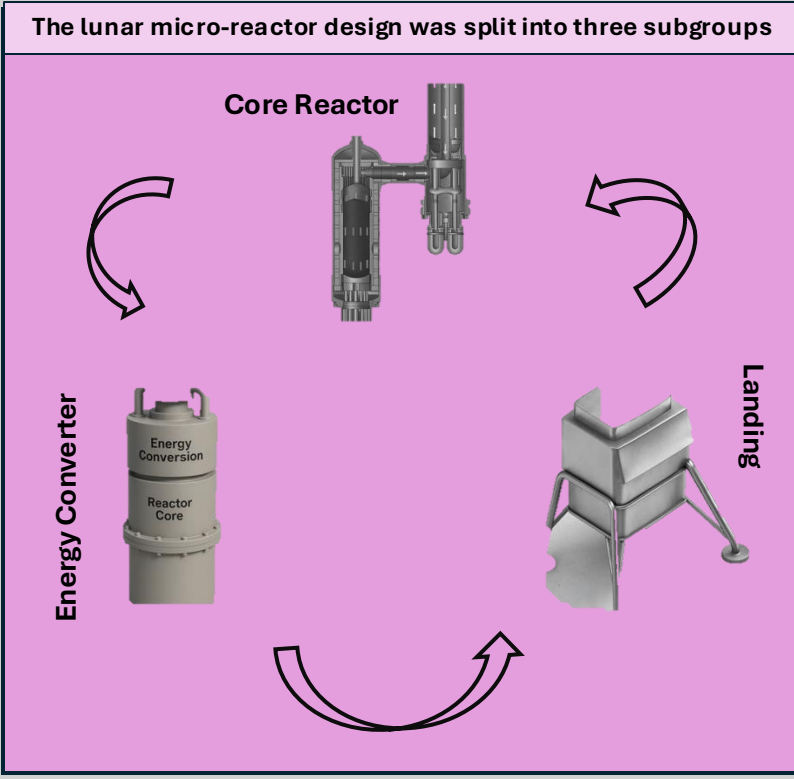
Assumptions And Design Needs:

- Key Design Needs:**
 - Energy Output
 - Weight Limitations
 - Lunar Regolith Mitigation
 - Long No-Maintenance Lifespan
 - Transportable
- Key Design Assumptions and Decisions**
 - Geometry mimics original XENITH Design and payload removing need of neutronics validation
 - Weight assumption: original at max weight ≤ 10 metric tons from loading standards of large trucks
 - Energy/Performance Output - 3-10 MW
 - Structural - Factory Assembled
 - Materials – Corrosion, Radiation, and Oxidation resistant
 - Thermal Stability - $750 \pm 50^\circ\text{C}$
 - Safety/Environmental Compliance
 - TRISO-X Fuel Utilization
 - CAD Software – Design

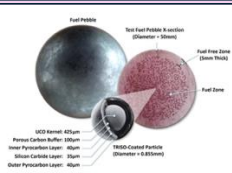



The **PANTHeR** is a retrofitted X-energy Xenith reactor modified to withstand extreme lunar conditions and provide long term power to future lunar missions.

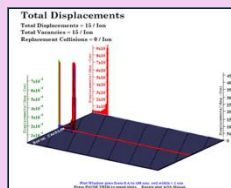
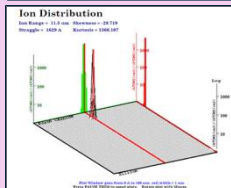
Designed for remote and limited infrastructure locations; and has the capability to completely decommission within two years.

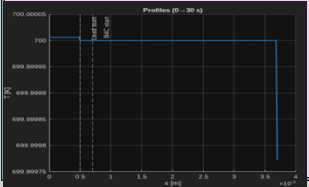


PANTHeR core – X-energy XENITH Retrofit



- Modern TRISO-X fuel ensures high temperature resilience and 20- year maintenance free lifespan
- Carbide layer surrounding UCO kernels serves as a diffusion barrier, limiting fission product migration and improving particle integrity under irradiation.



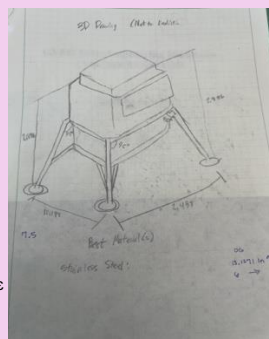
Housing and Landing – Materials and Lunar regolith mitigation

Primary Structure:

- Shell:** Carbon Fiber Reinforced Polymer Composite
- Abrasion:** Titanium alloy patches resist lunar dustwear.

Multi-Layer Radiation Shielding:

- Neutron capture:** 5 cm borated polyethylene (B-PE) attenuates $>90\%$ thermal neutrons.
- Shield:** 10–30 cm HDPE/UHMWPE panels reduce SPE 10–30 cm HDPE/UHMWPE panels reduce SPE dose



KW Scale Control:

Path: Al 6061-T6 heat-pipe channels conduct waste heat.

Rejection: C-C composite radiators ($\epsilon \approx 0.9$). $Q = \epsilon A T^4$

Limit: Polymer layers $\leq 120\text{--}140^\circ\text{C}$.

Passive Dust Protection:

Design: Dust overhang, retractable bulkhead, and vented buffer gap minimize contact.

Seals: PTFE-graphite composite prevents



Additional SRIM/TRIM Data

