

## Advanced, Low Cost, Modular, Scalable, Space-Temporal Agnostic, Continuous Power Generation for All Mobility And Derivative Applications [Universal Power Supply - UPS]

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**Introduction:** NASA seeks solutions for low cost Lunar exploration and maximizing resource utilization including oxygen and water delivery while minimizing energy use and mass of equipment required to be transported to the lunar surface. Same holds true for inner and outer planet exploration and beyond, all of which share common hurdles

**The Problem:** Arguably, the key technology gap on the moon and elsewhere in all activities lies in the availability of energy and includes:

- ❖ Excavation of vast quantities of regolith;
- ❖ Delivery of large quantities of water and materials;
- ❖ Construction of buildings and infrastructure;
- ❖ Extensive exploration;
- ❖ Lightweight and efficient hardware and equipment ;
- ❖ Hardware and equipment that is reliable and durable in extreme space environments, including prolonged darkness, extreme temperature, dust, and vacuum.

**Solution:** Unlike institutionalized solution providers, NFTG's unconstrained approach solves the energy challenge uniquely in a simple, scalable, readily deployable, application agnostic, infrastructure independent, ultra-efficient power system that is space environment resistant & agnostic by leveraging current technologies, physics and several of NFTG's simple innovations.

**Function, Features, Benefits and Opportunities:** Along with NFTG's various maximally efficient, power dense innovations, the **readily available** radioisotope powered UPS concept gives rise to inherently space environment resistant, high 'specific power/energy' output [3-5X improvement] solution for compact, mobile and stationary power generation, universal mobility and equipment operation. The versatility and scalability of the small footprint components and the system allows unconstrained exploration, resource extraction, manufacturing and operation of any ancillary equipment, structure and infrastructure despite geographic location or solar energy flux [space-time/condition/environment [2, 3] agnostic] anywhere in the Solar system and beyond.

The derivative components and constellation of expedient and synergistic systems. including high performance, long range lunar terrain vehicles (LTV) atmospheric mobility systems (LAV) and robots, are similarly low cost, simple, compact, robust, reliable, modular, multi-purpose, energy and process efficient with high speed and output capacity [10-100X], that can be rapidly implemented anywhere early on in missions without any direct supporting infrastructure, providing long life with minimal downtime in transportation, construction, manufacturing, resource acquisition and processing, solutions, not limited to oxygen, water and fuel resources. Mobility comparisons in Fig.1 and at [1].

Efficient, energy/power dense mobility, machines, robots and tools, are in part enabled by revolutionary ~10X power dense gear technology which does not require lubrication and so can operate in extreme environments.

**Technology Readiness Level [TRL]:** Most of NFTG's innovations are level 2, 3 & 4 but can rapidly be turned into doctrine w/a modicum of funding. Some tech is TRL/MRL 9.

**Hurdles:** We are not aware of any significant parameters and constraints on the primary or ancillary architectures required to develop and support our energy and derivative solutions. We seek collaborators / team mates.

| FACTOR                 | LAND         | AIR       | U.P.S.    |
|------------------------|--------------|-----------|-----------|
| Maturity               | Low          | Low       | Good      |
| Wear / dust            | Severe       | Low       | Low       |
| Navigation             | Complex      | Simple    | Simple    |
| Range                  | Low          | Good      | Unlimited |
| Speed                  | Low          | Moderate  | High      |
| Payload                | Low          | Moderate  | High      |
| Thermal                | Challenging  | Simple    | Simple    |
| Delivery               | Small lander | No lander | No lander |
| Operating Envelope     | Low          | Good      | Unlimited |
| Utility                | Low          | Low       | High      |
| Data Size              | Low          | Low       | High      |
| Data Value             | Low          | Low       | High      |
| Mission Cost           | Moderate     | Moderate  | Low       |
| Mission Value          | Low          | Low       | High      |
| Mission Sophistication | Low          | Low       | High      |
| Mission Duration       | Low          | Low       | High      |
| Science Advancement    | Low          | Low       | High      |
| Technology Advancement | Low          | Low       | High      |

Fig. 1. Planetary motivity comparison. More at [2] and [3]

**Conclusion:** The system designs clearly demonstrate superior solutions which will enable sustained exploration presence on Luna and beyond for years to come. Terrestrial applications abound. Sic Parvis Magna.

**References:** [1] M. Kroupa (2021) Mobility comparison <https://www.dropbox.com/s/lbh055478o5z2xc/SP%20advance%20mobility.jpg?dl=0>

[2] M. Kroupa (2022) - 53rd Lunar and Planetary Science Conference 2022 (interactive iPosterSessions) - ADVANCED, ENDURANCE AGNOSTIC, MULTI-MISSION & VTOL CAPABLE, POWERED PLANETARY GLIDER [PPG] -- <https://lpsc2022.ipostersessions.com/default.aspx?s=78-00-E5-96-74-BC-02-00-47-CC-EE-0A-53-CA-E7-7A&questview=true>

[3] M. Kroupa (2022) - ADV, ENDURANCE AGNOSTIC, MULTI-MISSION, VTOL CAPABLE POWERED GLIDER [PPG] - 53rd LPS, 2771, online.pdf

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