18th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Sustainable Space Development and Settlement - Systems (2A)

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POWER SYSTEMS ENGINEERING INFRASTRUCTURE: SCALABLE INTEROPERABLE, EVA AND ROBOTIC COMPATIBLE POWER GENERATION, STORAGE, AND DISTRIBUTION SYSTEMS FOR CISLUNAR SPACE

Abstract

The ability to provide sustainable power and ancillary services when and where needed is essential to virtually all aspects of human endeavor and enables all forms of space exploration, development, and settlement. Architecting the problem/trade space for the same in a manner which supports the definition of scalable interoperable, EVA and robotic compatible power generation, storage, and distribution systems for use throughout Cislunar space (LEO through to the Lunar Surface and beyond) is the critical focus of this paper.

Starting with a top level functional block diagram of all extent end-to-end power generation, storage, and distribution system technologies with specific interface planes coded by Technology Readiness Level (TRL) the problem space will be defined.

The functional block diagram will be then be exploded to detail the flows across each interface plane on a first principles basis for those technologies which have TRLs suitable for the intended application venues.

Subsequently, the necessary sub-elements required to support the flows across each interface plane will be developed for some number of the intended application venues.

The intention is draw out novel approaches to infrastructure development which leverage available technology development work (space and terrestrial), synergies and commonality (both between different technologies and system elements), and thereby help mitigate cost, schedule, and technical risk associated with their application.

This approach is anticipated to lead to Power Systems Integration Standards including both accommodation requirements and interface design standards. This body of work will draw from and is directly analogous to the work on the ISS robotic systems integration standards and external utility port convergence efforts which the author was responsible for.

This work will draw from and build on previous work by the author and colleagues associated with technology development, demonstration, and deployment mission development including power and ancillary services beaming, convergence of solar dynamic and compact nuclear fission heat engine technologies, In Situ Resource Utilization (ISRU) processing, Cislunar power systems conceptual analysis, and commercial lunar propellant architectures.