Paper ID: 73978
oral

IAF SPACE POWER SYMPOSIUM (C3)
Advanced Space Power Technologies (3)

Author: Mr. Gary Barnhard
XISP-Inc, United States, gary.barnhard@xisp-inc.com

SCALABLE INTEROPERABLE POWER SYSTEMS: A KEY ELEMENT FOR FOSTERING SPACE DEVELOPMENT

Abstract

Providing 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.

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

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 identified for some number of the intended application venues.

The intention is to draw out novel approaches to infrastructure development that leverage: • available technology development work (space and terrestrial), • synergies and commonality (both between different technologies and system elements), and • the potential cost, schedule, and technical risk mitigation measures associated with their application.

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

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.

This paper revises and extends the Virtual IAC 2020 paper and presentation by the author.