SPACE POWER SYMPOSIUM (C3)
Wireless Power Transmission Technologies, Experiments and Demonstrations (2)

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ENABLING INTERSTELLAR TRAVEL – THE NEED FOR A DIVERSE MIX OF ADVANCED ENERGY CONCEPTS: SAFE TRACKING LASER POWER TRANSMISSION, HARVESTING PROBES, FUTURE PROPULSION SYSTEMS AND HOW TO START TODAY.

Abstract

A systematic evaluation of power systems in terms of their power generation capacity, size, risks and availability led to the finding that no one power system can be relied upon for interstellar travel. Neither single, hybrid nor backed-up concepts of nuclear reactors, fuel cells, photo-voltaic cells, or current anti-matter concepts appear feasible.

This paper makes strategic considerations on topics such as space resupply stations, wireless power transmission to spaceships (while at high velocity, using tracking/tethering with lasers), as well as harvesting probes. Futuristic propulsion technologies like the solar sails, hull ionisation and radioisotope thermoelectric generators are considered.

To boost the development of promising technologies, an open access programme is proposed that includes utilising existing reproducible prototypes for educational purposes. The prototype kit, in its current iteration – a miniature model of a city – allows for electricity to be transmitted wirelessly across

50 inches (127cms) to power a building. The inherent technology can power moving objects and transmit data, too. By choosing a different frequency band, the range can be increased significantly, which suggests short-term potential for commercial asteroid and terrestrial applications.

Methods: Physics-based assessment of current power systems for manned space flight with special consideration for their potential of a 100-year longevity. Technology-readiness analysis of subsystems such as power extraction, power transmission, power storage and power usage. Each finding is further analysed for risks for humans. Strategies and systemic use cases are mapped out. Experience-curve analysis is used to identify the critical path of investment necessary to arrive at technological and financial viability in due time. Prototypes have been built and tested.

Conclusion: Building a coherent energy system that is based on a mix of technologies and combines a multitude of methods is found to be significantly more feasible than making use of one or two independent systems. To enable interstellar travel (with or without humans), it is suggested to send probes ahead of missions, to build a network of re-powering and resupplying stations. This follows the principle of the expansion of American settlers by means of rail, the British by means of ships as well as settlers in Europe on foot. Such resupply stations and pure power station that wirelessly re-power spaceships are found to be vital concepts for the success of interstellar missions. To facilitate timely readiness of such advanced systems, a framework is suggested that includes conducting open development efforts with scalable and available low-cost technologies.