

IAF SPACE POWER SYMPOSIUM (C3)
Solar Power Satellite (1)

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DEMONSTRATING SPACE SOLAR POWER IN ORBIT: SPS-ALPHA LEO PROTOTYPE
DEMONSTRATION MISSION DESIGN**Abstract**

Space solar power (SSP) is a potential solution for sustainably and reliably meeting the world's growing demand for energy. Solar power satellites (SPS) in Earth orbit can harness energy from the Sun and transmit this energy via microwaves to receivers on Earth. The advantage of SSP is that it can provide continuous baseload energy supply, addressing the intermittency issues of current sustainable energy solutions, such as ground-based solar and wind.

Solar Space Technologies (SST) has developed a four-stage plan to achieve full-scale SPS development and deployment of the SPS-ALPHA (Solar Power Satellite by means of Arbitrarily Large Phased Array) concept. Phase I is currently underway and involves development and demonstration of critical SPS technologies on the ground. The second phase, Phase II, will consist of a SPS prototype launched to low-Earth orbit (LEO) to demonstrate the technology in space. This will be followed by Phase III, a moderate-sized SPS providing 200 MW to a remote market, and finally a full-scale SPS providing 2 GW of baseload electricity supply in Phase IV.

This paper focuses on the design for the Phase II demonstration mission which will launch an SPS-ALPHA prototype to LEO. Key systems and technologies to be proven include (1) in-space assembly, construction and the ability to reconfigure and/or repair modules; (2) modular and extensible platform structural systems; (3) reflector-enhanced photovoltaic (PV) power generation systems; (4) wireless power transmission (WPT), including space-to-ground and space-to-space power transmission; and (5) end-to-end concept-of-operations (CONOPS) demonstration.

This paper proposes a preliminary design for the Phase II LEO prototype demonstration mission and evaluate its technical and economic feasibility. This includes an assessment of the potential mission concepts for Phase II of SPS-ALPHA, before developing the selected mission concept in further detail. The mission design considers the payload, orbit, launch vehicle, concept of operations, ground segment and end-of-life disposal. These elements form the basis for a cost estimate of the mission.