SPACE POWER SYMPOSIUM (C3)
Space Power Experiments Applications and Benefits (4)

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SUSTAINABILITY ON-ORBIT: SPACE SOLAR POWER AND CLOUD COMPUTING CONSTELLATIONS

Abstract

Space-based solar power (SBSP) has been talked about many times since Peter Glaser's invention of the concept over 40 years ago, however there still has not been a single SBSP watt transmitted down from orbit. Students at San Jose State University have been researching the feasibility of a SBSP demonstration, using either the International Space Station or a free flyer small satellite in low Earth orbit. Along with this demonstration, the students have been researching on-orbit cloud computing. Much of the technology for the SBSP demonstration is directly applicable to on-orbit cloud computing. On-orbit cloud computing involves multiple small satellites connected through optical communication links. This constellation of small satellites functions as a cloud computing grid. Just as SPSP involves the transmission of a modulated (modulated to ensure proper lock-on to a receiver and safety) beam from space to ground or space to space to provide power to another satellite, an on-orbit cloud computing small satellite node transmits modulated beams to other satellites and to ground.

One of the reasons this demonstration is important is because the necessary efficiencies and losses have not yet been clearly established. The SBSP demonstration is being developed to beam 200 watts of power to Earth's surface. This demonstration was developed estimating 25% efficiency due to atmospheric losses and laser conversion losses. An 800 watt laser is a modular subsystem of the 100 kg SBSP demonstration flight article. All technology needed for the demonstration exists. The demonstration includes the following modular subsystems: the laser system, the acquisition, tracking and pointing system, the safety and control system, and the ground segment/receiver system. The safety and control system will ensure demonstration safety and will also help demonstrate on-orbit cloud computing downlinking/crosslinking capabilities. The cost, schedule and other programmatic elements of this demonstration will be provided.

SBSP and on-orbit cloud computing are both important concepts involving sustainable energy, thereby contributing to world peace, because they both make use of the abundant, renewable energy source of the Sun. These concepts can be used to provide power or information directly to places that are underdeveloped.