

OPERATION OF A SMALL TETHERED PAYLOAD

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ABSTRACT

This paper presents results of a study currently being performed at Stanford University sponsored by NASA/Goddard Space Station Small Attached Payloads.

The use of tethers as a means of dynamic isolation for small attached payloads shows promise in reducing orbital maneuvering vehicle requirements to service co-orbiting facilities while still providing a stable contamination-free platform for precision pointing instruments. Tethers may also be used as a means of deorbiting small sample return vehicles. These return vehicles might be dedicated small experiment carriers for a specific mission and require little manned interaction, or they might be loaded with experimental samples for de-orbit and re-entry. Another application lies in electrodynamic tether research for ionospheric and vehicle charging and potential studies to continue the effort initiated with the Space Shuttle Tethered Satellite System.

The study focuses on defining the issues and resource requirements for small tethered payloads. Areas highlighted include attachment and structural interfaces, communication and data handling facilities, power and electrical interfaces, and dynamics and proximity operations issues.

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Riding the Beam: Small Satellite Launching with Laser Propulsion

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Abstract

A laser launch system using a large ground-based laser can place small payloads in orbit at costs approaching \$10/lb. The key to this low cost is simplicity: a laser-launched vehicle can consist of little more than a block of inert solid propellant with a payload on top. Although the individual payload size is limited to approximately 1 kg per megawatt of laser power, launch rates as high as several payloads per hour give total launch capacities that easily exceed those of the Shuttle or proposed expendable launchers. Relatively little new technology is involved, and a small (25 - 100 MW) launcher could be built well before the end of the century.

However, the viability of laser propulsion depends on the development of suitable payloads: low mass, low cost, mass-produceable satellites or modular satellite components. Missions requiring large numbers of satellites or rendezvous of many small payloads (e.g., propellant or consumables) are needed to take advantage of high launch rates.

In this paper, we provide an overview of the capabilities and limitations of laser propulsion, and of the current status of the SDIO Laser Propulsion Program and related research, with the expectation that increased cooperation between the Small Satellite and Laser Propulsion communities will be beneficial to both.