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Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond (4)

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## LARGE TETHER SYSTEMS AND ISS REUSE

### Abstract

Over the twentieth and twenty-first centuries, the concept of space tether systems has evolved from a thought experiment to a feasible and tangible idea, with multiple missions having flown with tether lengths of a few meters to a few kilometers. Tether systems have many potential applications which could transform space activities in the long term. There are multiple justifications for space tether systems; culturally such a system could revolutionize access to space and open up new economic opportunities. Additionally, the scientific community could benefit through an extensive platform for scientific experiments and the concept represents an unprecedented and fascinating experiment in itself. Yet despite the potential, tether systems with hundreds or thousands of kilometers in length have never been constructed.

It is clear that there are significant obstacles hindering the implementation of large tether systems. The unreliable nature of tether deployment, the harsh nature of the space environment, and the lack of support for tethers among both space industry experts and the general public are some of the most significant inhibitors to tether projects. The best first step to solving these problems is to understand them. In order to do so a study has been conducted, outlining the main obstacles determined for the development of space tether systems and proposed recommendations to overcome them.

One promising possibility is the re-use of the ISS as part of a 6500 km tether system from LEO to MEO. This presents an interesting synergy with questions of the ISS's future and would serve as an ideal first demonstration of such a large space tether system. By virtue of broad public support, capacity for human occupation and with existing applications, the use of the ISS inherently relieves many of the

general obstacles that face tether projects. While this concept does introduce new obstacles, primarily driven by the value of the ISS and its current deorbiting date sometime in the 2020s, these issues are resolvable and the potential benefits of such a project can justify the effort needed to do so. A well designed ISS tether system, incorporating several aspects examined for use of tether systems, could aid in many problems, both for the development of tether systems and for the future of space activities. With this in mind, a suggested preliminary requirements list was defined for an ISS tether system; incorporating the recommendations developed for large tether systems.