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TANDEM SYSTEM FOR FUTURE COMMERCIAL EXTRAVEHICULAR ACTIVITY

Abstract

Over the past two decades, companies such as Space Adventures and Axiom Space have investigated the possibility of enabling a commercial ExtraVehicular Activity (EVA), while the first private, all-civilian spacewalk is due to take place during the Polaris Dawn SpaceX mission. Amidst the burgeoning interest in commercial space ventures, the challenges and risk factors associated with enabling private EVAs, as well as the extensive EVA training requirements, underscore the pressing need for a new approach. The conceptualization of a new system is required in order to make future private EVA operations safe and feasible, particularly for prospective customers with reduced training time.

This research project explores the feasibility of a tandem system for future commercial EVA operations, utilizing a deployable and retractable tether. Similar in concept to a tandem skydiving rig, it allows spacewalk participants to perform their activities under the supervision of an accompanying astronaut. During the egress and ingress stages of an EVA, the spacewalk participant is attached to the astronaut instructor and guided to a point of safety, where the cable tether can be extended. The participant and the professional astronaut remain connected throughout the EVA, meaning if an emergency situation arises, the participant can be reeled back in and spacewalkers can return to the airlock. Working closely with leading EVA experts and space materials engineers, a tandem system was designed, suitable candidate materials for the cable were selected and analog EVAs were conducted in an environmental chamber, subjecting the materials to conditions replicating the space environment.

In addition to the applications associated with commercial space tourism, a tandem EVA system would help provide equitable access to EVA operations to a multitude of prospective clients. It would enable private astronaut researchers to conduct their experiments in the space environment, or allow correspondents and science communicators to utilize spacewalks for educational purposes. The tandem system could be leveraged as part of a training program for future EVA personnel, forming a logical bridging step between Neutral Buoyancy Lab training and professional EVA missions. Given the current prohibitive access to private EVA operations, the creation of a tandem EVA system would represent a significant milestone in commercial spacewalk accessibility, reducing operational costs and ensuring the relative safety of future spacewalk participants.