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Paper Title:	**Evolved Commercial Solar Electric Propulsion: a Foundation for Major Space Exploration Missions**

Abstract:

Second-generation Solar Electric Propulsion (SEP) systems now in commercial production are a key step forward enabling cost-effective and mass-efficient space transportation for exploration missions. As designed with 5 kW class Hall Effect thrusters, they are suitable for Discovery class missions carrying significant sensors and/or targeting faraway objects. As outcomes of a judicious methodology for scaling up existing SEP flight systems by a factor ~3, they provide a sound basis for similar low-risk steps toward 15-kW and then 50-kW class thrusters including essential solar array and power control equipment. The big missions supported by the latter capabilities directly benefit from US Government and commercial development of flexible solar arrays and NASA investments in very long life, high-power Hall thruster technologies.

Fielding these technologies for exploration missions can benefit from commercial space product development approaches which are strongly focused on early product configuration decisions, modularity and scalability, all anchored in design for manufacturability and rigorous qualification to an envelope of application environments. The benefits resulting from this uncompromising bottom line approach include schedule-certain development, qualification, product insertion, and cost-effectiveness of recurring production. Valuable SEP technology enhancements in work at US Government labs should be transitioned to industry for commercial development completion to further benefit the cost effectiveness of these missions.

In addition to a SEP roadmap covering enhanced commercial, smaller planetary, and large space transportation capabilities, two examples are highlighted of exploration missions based on commercial production SEP spacecraft optimized for deep space operations. One illustrates how a notional main belt asteroid or Mars moon science mission can be accomplished with nearly 100% commercial SEP hardware. The other shows how a much larger near-earth asteroid redirect and mass return mission can be performed with replication of the same, modular commercial hardware and further enhanced in capability with an additional ~3x scale up of key SEP components.