

SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Concepts (6)Author: Mr. Matthew Duchek
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United StatesSOLAR ELECTRIC PROPULSION ORBITAL DEBRIS FERRY, VEHICLE CONCEPT AND
REFERENCE MISSION**Abstract**

The hazards of orbital debris in Low Earth Orbit (LEO) are well understood and concepts for Active Debris Removal (ADR) have been proposed in the literature, yet no mission has been launched to date, in part due to the technical risk associated with the concepts. After evaluating a number of ADR options, a Solar Electric Propulsion (SEP) ferry approach has been determined to provide a very feasible solution to ADR that can be implemented within the next five years. This approach uses a single space vehicle to independently and autonomously rendezvous with multiple LEO debris objects, secure them, and ferry them to a sufficiently low disposal orbit. This mission architecture is enabled by flight-proven, relatively high-power SEP technologies and Autonomous Rendezvous and Docking (ARD) algorithms and systems. The high Specific Impulse (Isp) of SEP provides lower propellant requirements for removal of many objects, comparing favorably with other concepts, such as attaching deorbit modules or chemical propulsion for a one vehicle-to-one piece of debris disposal technique. Results from low-thrust trajectory analysis for deorbit of real objects and the resultant delta-V requirements are provided. This analysis provides sizing and basis for the included vehicle design, description, and concept of operations. Results show that the SEP orbital debris ferry approach is a relatively low-cost and low-risk solution to mitigate the threat of orbital debris.