

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Technologies for Future Space Transportation Systems (5)

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CONCEPTUAL DESIGN FOR PULSED ARC PROPELLED SPACE TUG SERVICES

Abstract

Space tugs have been considered for decades as a method of increasing mission flexibility and capabilities while reducing launch costs by exploiting the benefits of refuellable high efficiency engines. Recent discussions have also proposed tugs as a means of satellite lifetime extension to extend the lifetime of valuable assets, primarily in GEO. Current chemical and electric propulsion technologies appear to not be cost competitive, due to insufficient specific impulse meaning the quantity of fuel required for vehicle return is too high to make refuelling on return viable. These systems also face challenges when it comes to the refuelling process, due to the difficulties in transferring reactive liquids or pressurised gasses between vehicles in orbit. Here we present an alternative architecture based around the pulsed cathodic arc thruster under development by Neumann Space. We discuss the mission requirements for operations in near-Earth space, and present top level modelling of the propellant required for operations using current generation flight rated liquid bipropellant thrusters, Hall Effect thrusters and the highly efficient solid fuel pulsed arc electric thruster under development by Neumann Space in Adelaide. We neglect gridded ion thrusters from our analysis due to lifetime limits imposed by grid erosion. Mission types discussed will include orbit raising and disposal services for communications satellites, plane changes for satellites in sun-synchronous constellations, active debris removal from congested orbital space and interplanetary transfer concepts. We will discuss the development of our pulsed arc propulsion system to date, giving a summary of performance data from our current endurance tests for ground testing in a relevant environment.