

# **WEAR CHARACTERISTICS FROM THE EXTENDED LIFE TEST OF THE DS1 FLIGHT SPARE ION THRUSTER**

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## **ABSTRACT**

An on-going life test of the Deep Space One flight spare ion thruster, is being conducted at the Jet Propulsion laboratory. The thruster has operated for over 27,300 hours and processed in excess of 219 kg of xenon propellant. To date several potential failure modes and wear processes have been observed and identified. Severe discharge cathode keeper erosion was first observed during and after operation at the 1.5 kW power point. Keeper erosion has continued at a steady rate, at the 2.3 kW power point, fully exposing the cathode heater and orifice plate. At the full power point, significant erosion of the accelerator grid apertures and grid webbing, has occurred, with the rate of hole enlargement increasing during the last full power test segment. At present, the thruster can no longer be operated at the full power point due the resultant increase of the electron backstreaming limit beyond the voltage capability of the flight accelerator grid supply. During operation at the minimum power point, there was a significant increase in neutralizer keeper voltage. Video data revealed the presence of deposits within the neutralizer orifice, resulting in a loss of neutralizer (minimum flow rate) margin, from plume-spot mode transition. Subsequent operation at the full power point, removed the deposits, and neutralizer operation has returned to nominal levels. Another notable erosion process is the degradation of electrical isolation between neutralizer keeper and common, and the both components to ground. Thruster performance has not degraded after 27,300 of operation, with the levels of thrust and specific impulse relatively unchanged from the beginning of test values. The thruster currently continues to perform nominally, and is running at 1kW in part to investigate neutralizer performance at the low end of the throttle range.