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VASIMR VX-200 thruster throttling optimization from 30 to 200 kW JARED SQUIRE, CHRIS OLSEN, FRANKLIN CHANG-DIAZ, BENJAMIN LONGMIER, MAXWELL BALLENGER, MARK CARTER, TIM GLOVER, GREG MCCASKILL, Ad Astra Rocket Company — The VASIMR® VX-200 experimental plasma thruster incorporates a 40 kW helicon plasma source with a 180 kW Ion Cyclotron Heating (ICH) acceleration stage integrated in a superconducting magnet. Argon propellant mass flow is injected up to 140 mg/s. Rapid plasma start up (< 100 ms) and high pumping speed ($> 10^5$ liters/s) in a 150 m^3 vacuum chamber achieve performance measurements with the charge exchange mean-free-path greater than 1 m in the background neutral gas (pressure $< 10^{-5}$ Torr). The thruster efficiency at 200 kW total power is $72 \pm 9\%$, the ratio of effective jet power to input RF power, with an Isp $= 4900 \pm 300$ seconds (flow velocity of 49 km/s), and an ion flux of $1.7 \pm 0.1 \times 10^{21}$/s. The thrust increases steadily with power to 5.8 ± 0.4 N until the power is maximized and there is no indication of saturation. The plasma density near the device exit exceeds 10^{18} m^{-3} with a power density over 5 MW/m^2. An extensive study of thruster performance, efficiency and thrust-to-power ratio, as a function of Ar propellant flow rate and ICH-to-helicon RF power ratio has been carried out over a total power range of 30 to 200 kW. Optimized throttling set points are determined. The experimental configuration and results of this study are presented.

Jared Squire
Ad Astra Rocket Company

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