Investigation of a Light Gas Helicon Plasma Source for the VASIMR Space Propulsion System J.P. SQUIRE, F.R. CHANG-DIAZ, V.T. JACOBSON, T.W. GLOVER, *Advanced Space Propulsion Laboratory, NASA Johnson Space Center,* F.W. BAITY, M.D. CARTER, R.H. GOULDING, *ORNL,* R.D. BENGTSON, *UT Austin,* E.A. BERING, III, *University of Houston.*

An efficient plasma source producing a high-density (~10^{19} m^{-3}) light gas (e.g. H, D, or He) flowing plasma with a high degree of ionization is a critical component of the Variable Specific Impulse Magnetoplasma Rocket (VASIMR) concept. We are developing an antenna to apply ICRF power near the fundamental ion cyclotron resonance to further accelerate the plasma ions to velocities appropriate for space propulsion applications. The high degree of ionization and a low vacuum background pressure are important to eliminate the problem of radial losses due to charge exchange. We have performed parametric (e.g. gas flow, power (0.5 – 3 kW), magnetic field, frequency (25 and 50 MHz)) studies of a helicon operating with gas (H_2, D_2, He, N_2 and Ar) injected at one end with a high magnetic mirror downstream of the antenna. We have explored operation with a cusp and a mirror field upstream. Plasma flows into a low background vacuum (< 10^{-4} torr) at velocities higher than the ion sound speed. High densities (~ 10^{19} m^{-3}) have been achieved at the location where ICRF will be applied, just downstream of the magnetic mirror.