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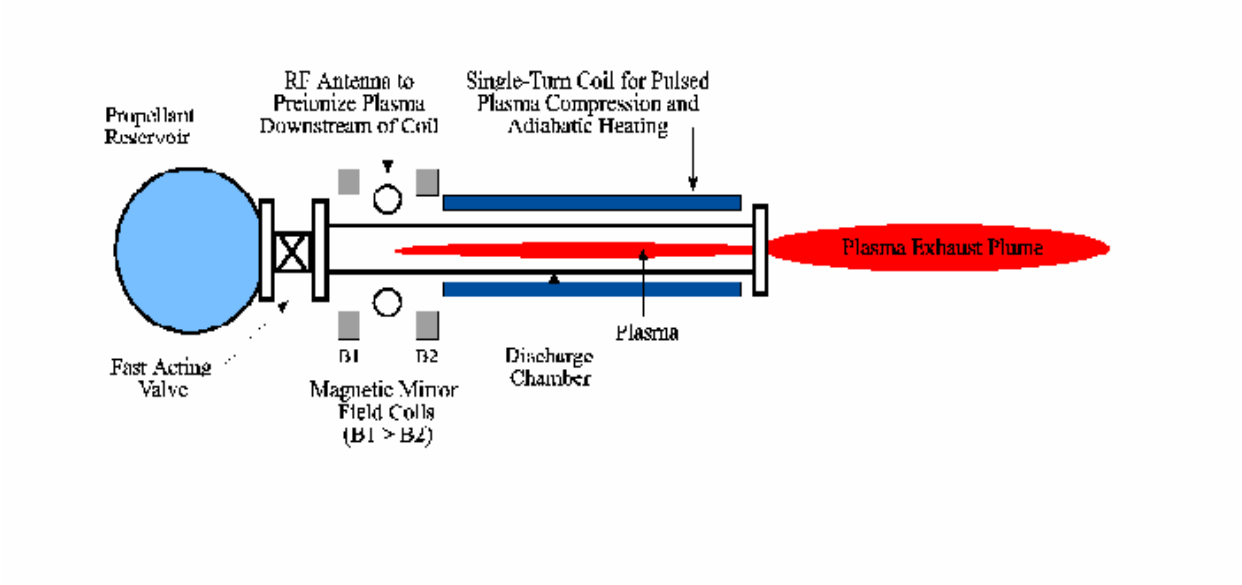
"Primary Propulsion for Piloted Deep Space Exploration"

The piloted deep space exploration missions envisioned by the NASA Human Exploration and Development of Space initiative will require the development of advanced electric propulsion systems capable of providing high specific impulse for extended periods of operation. Current electric propulsion thrusters are well-suited for orbit maneuvering and robotic exploration, but at present they cannot provide the combination of specific impulse, lifetime, and efficiency required for piloted deep space missions.



This proposal outlines a new concept for a high density, high temperature plasma thruster that can meet future deep space propulsion requirements. Efficient microwave pre-ionization of a gas propellant in tandem with rapid adiabatic compression is used to generate, heat and expel high-density plasma. The concept is electrodeless, and radial compression of the plasma by the magnetic field of the discharge coil mitigates material erosion to ensure long thruster lifetime. Because the heated plasma is free to flow along axial magnetic field lines during compression, a magnetic mirror located at the entrance to the discharge chamber is used to help direct the plasma flow out of the thruster. The thrust and specific impulse of the engine can be tailored for a given mission scenario through the selection of plasma density, compression coil discharge current, and compression repetition rate, making this an unique concept among the high power electric propulsion systems of the future.