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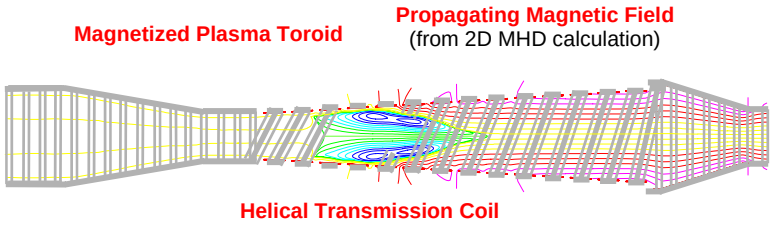
"Rapid Manned Mars Mission with a Propagating Magnetic Wave Plasma Accelerator"

For man to venture forth into the solar system, a radically different propulsion system must be envisioned to make these deep space missions possible. The requirements for deep space exploration are two-fold. First, there must be a power source that employs a fuel with a very high specific energy. This fuel must also be available in sufficient quantity for long missions. It is recognized that nuclear fusion is one known source that can satisfy this requirement. Second, there must be an efficient method for converting this energy into the thrust and I_{sp} necessary for a fast mission. It is proposed here to solve this second problem. This is accomplished by employing a travelling magnetic wave accelerator to accelerate a magnetically self-confined plasmoid, commonly referred to as a Field Reversed Configuration (FRC). Since the FRC is magnetically isolated from the accelerator, there is no contact between the propellant (RFC) and the accelerator. The transfer of momentum to the FRC occurs through an electromagnetic interaction with the magnetic wave so that the exhaust velocity could, at least theoretically, approach the speed of light. In previous experiments carried out by the proposers, FRCs of near milligram mass accelerated to velocities of $2x10^5$ m/s in a single pulse. A novel inductive magnetized plasma source now being developed at MSNW will make it possible to produce FRCs at a very high pulse repetition rate. Using this plasma source, the acceleration scheme proposed here will allow for orders of magnitude increases in I_{sp} over conventional electric propulsion with efficiencies that approach unity. The physical requirements for the accelerator are quite modest. The magnetic fields employed are ~0.3 T and superconducting coils are not required. The concept appears simple enough that a proof of principle experiment could be initiated that would produce plasma mass exhaust velocities approaching 0.01c.



Parameter	First Stage	Final
System length	5 m	25 m
Plasma mass m_p :	0.2 mg D_2	(same)
Final plasma velocity:	$3x10^5$ m/sec	(I_{sp} = 30,000 s) $1x10^6$ m/s
Acceleration (Force):	$2x10^{10}$ m/s (4 kN)	(same)
Thrust Power (1 kHz rep)	9 MW	100 MW