Second Generation EmDrive Propulsion Applied to SSTO Launcher and Interstellar Probe

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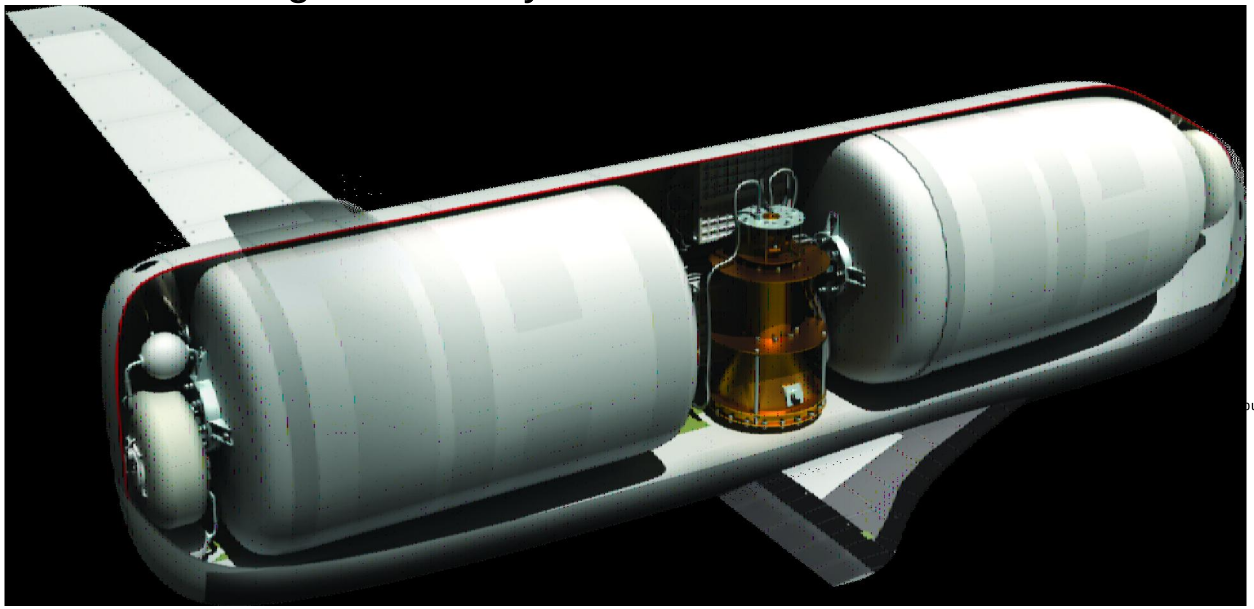

publishing

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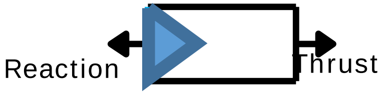
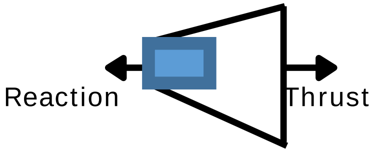
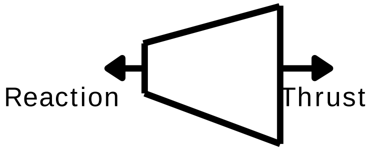
2014 Summary of Published Test DATA



Cavity with Dielectric

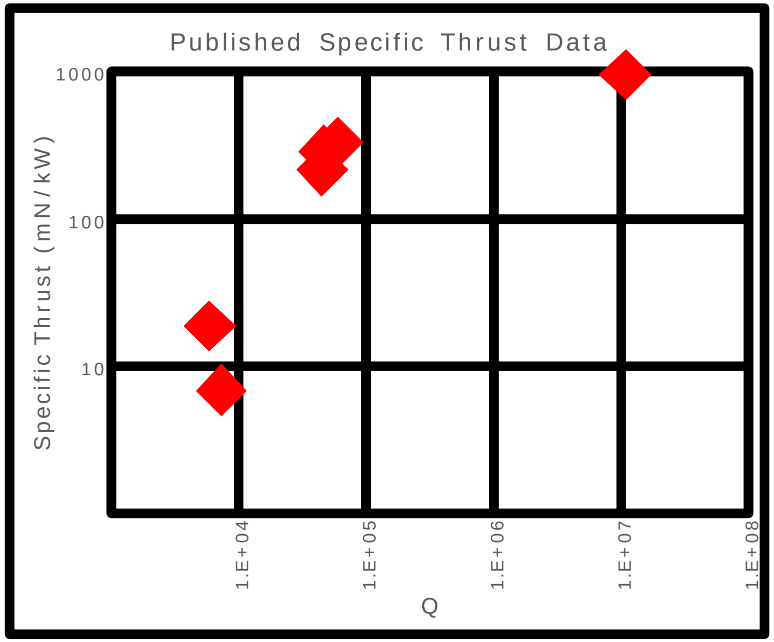


Tapered Cavity with Dielectric



Tapered Cavity

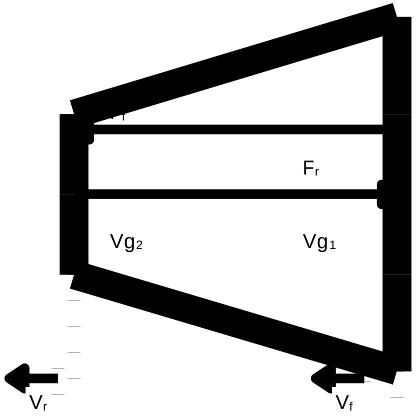
Thruster Design	Specific force mN/kW	Force Direction
CANNAE room temperature	1.73	Thrust
NASA tapered cavity with dielectric section	6.86	Thrust
SPR tapered cavity with dielectric section	18.8	Thrust
SPR Demonstrator Engine	214 243	Thrust Reaction
NWPU Thruster	288	Reaction
SPR Flight Thruster	330	Reaction
CANNAE superconducting	952	Thrust



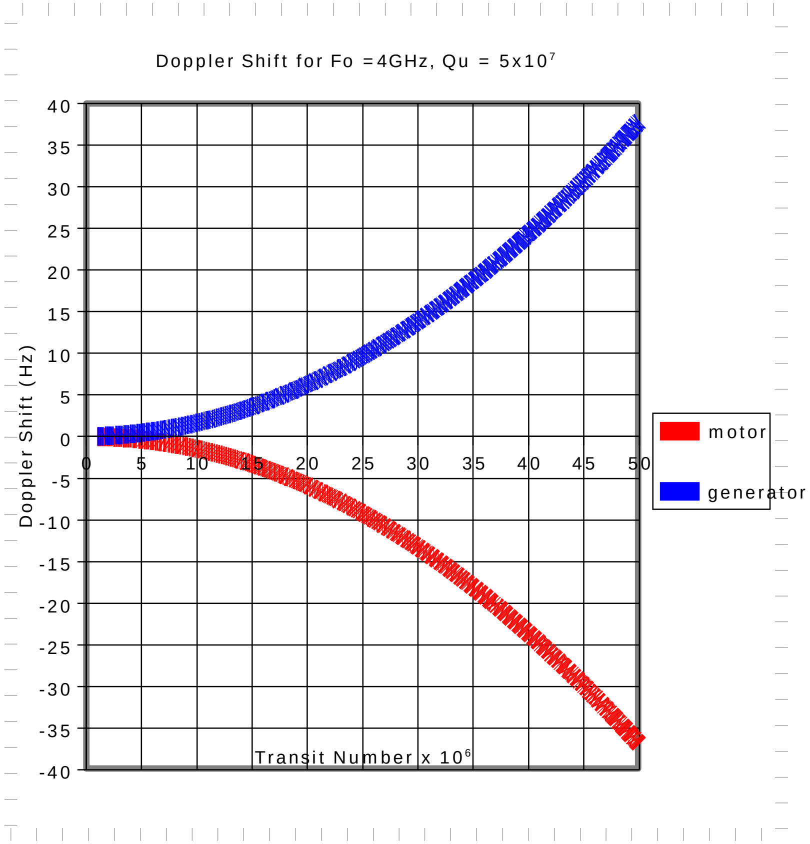
Thrusters exhibit both Thrust and Reaction forces, therefore obeying Newton's laws

Increasing cavity Q increases specific force

Conservation of Energy



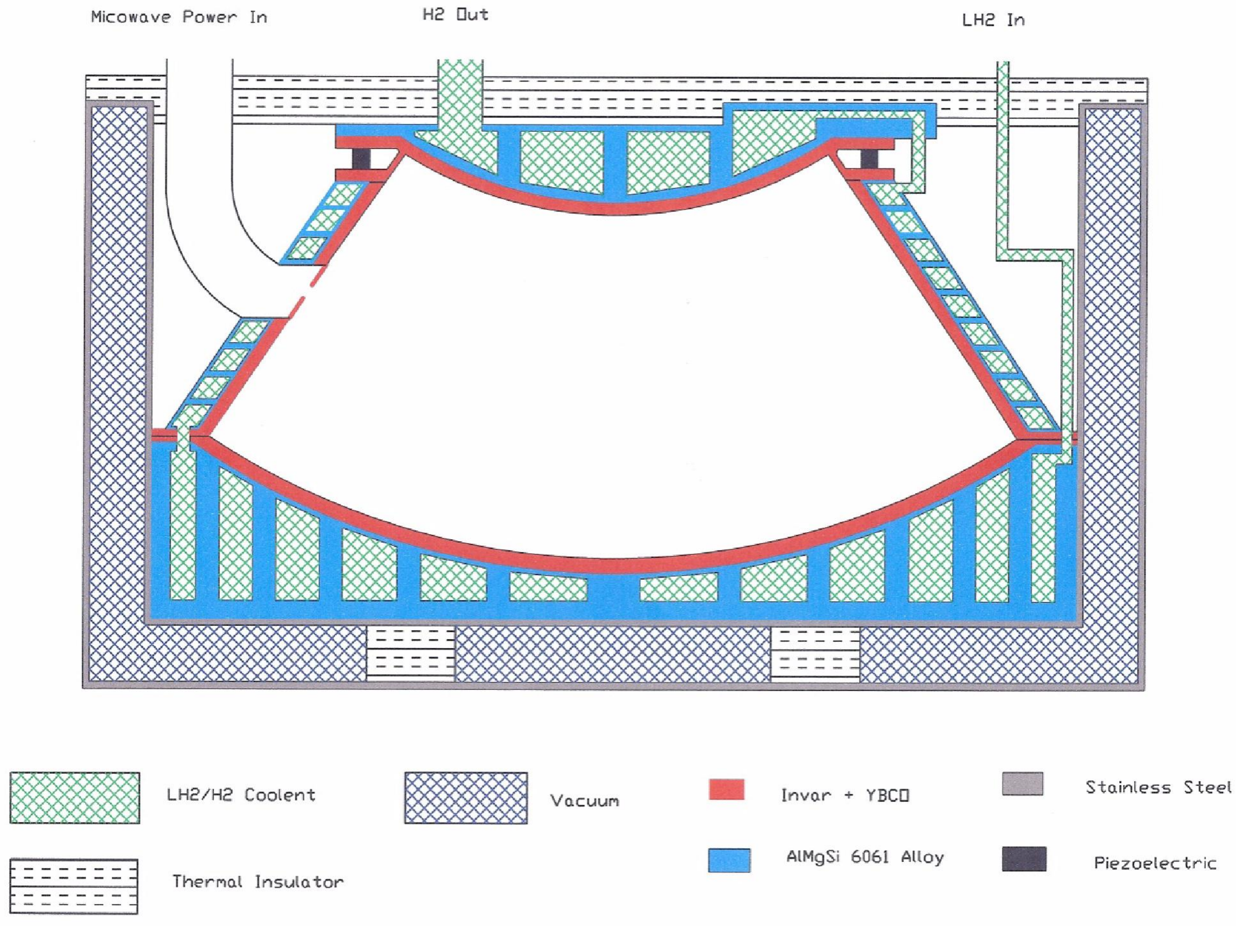
Cavity Acceleration



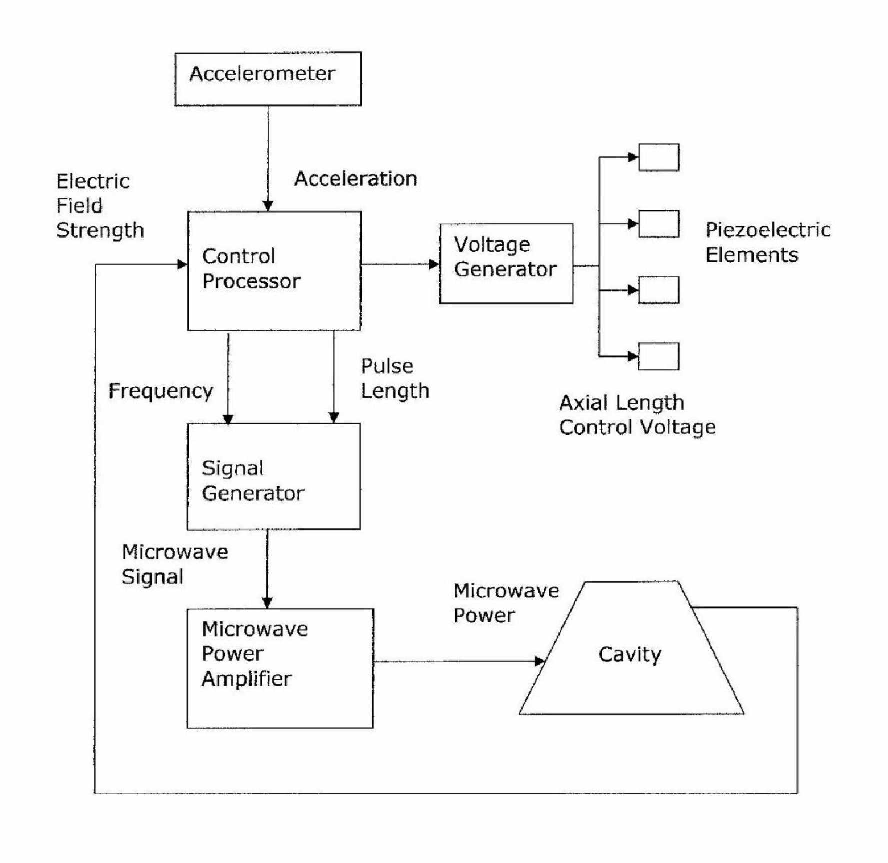
Cavity acceleration produces unequal Doppler Shifts in F_f and F_r during each wavefront transit.

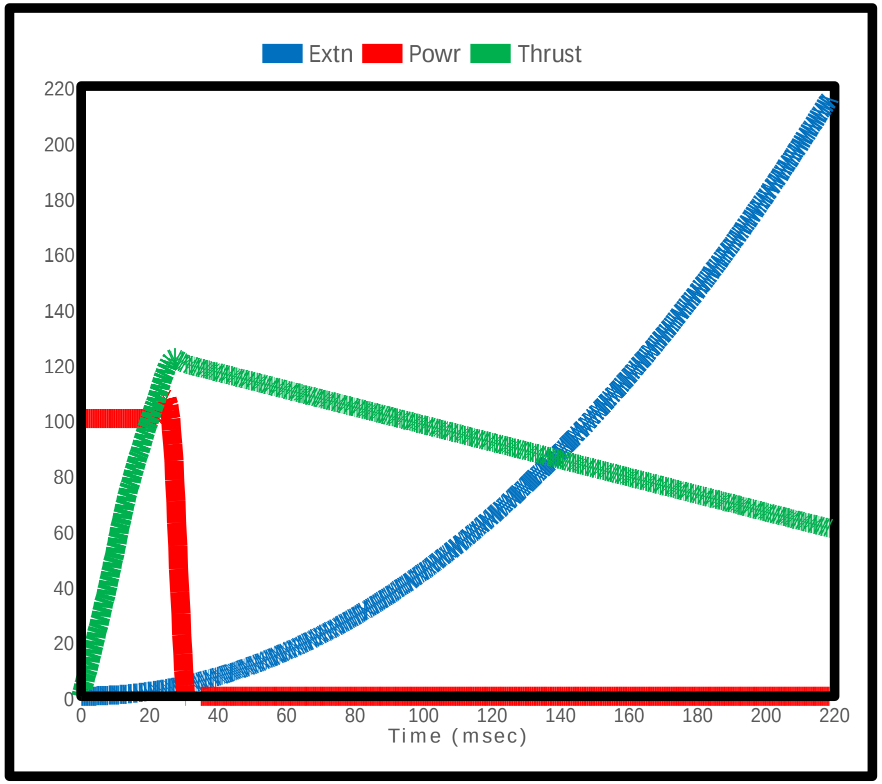
Doppler Mathematical model illustrates Doppler shift for both Motor and Generator modes.

Superconducting Cavity With Piezoelectric Compensation for Doppler Shift



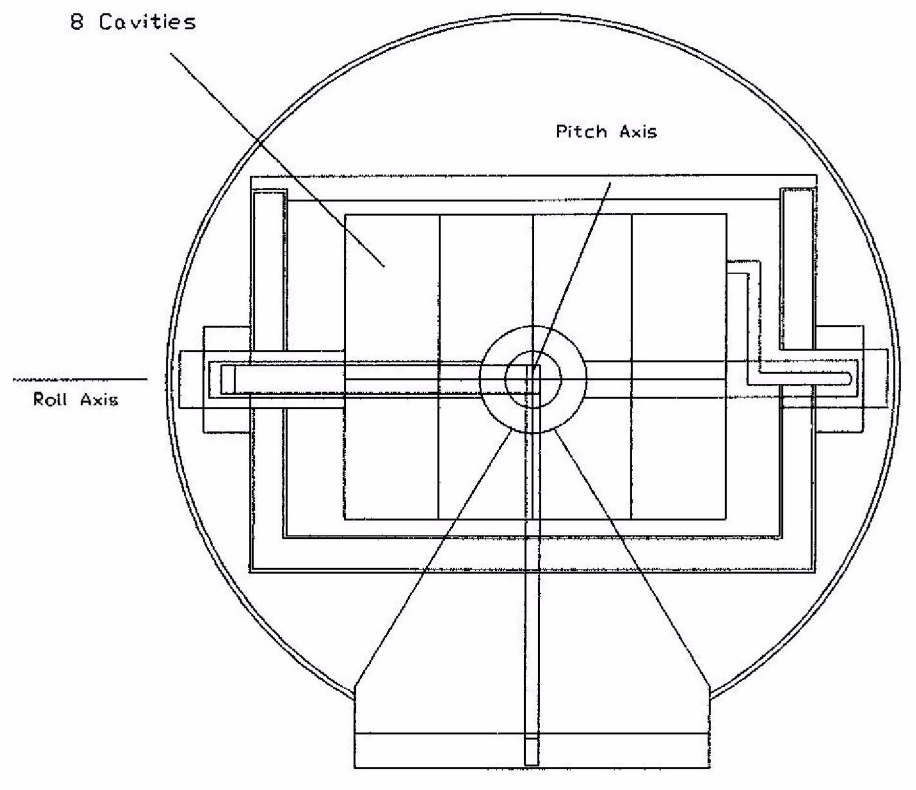
2G EmDrive Engine Control





Eight Cavity Lift Engine For SSTO Spaceplane

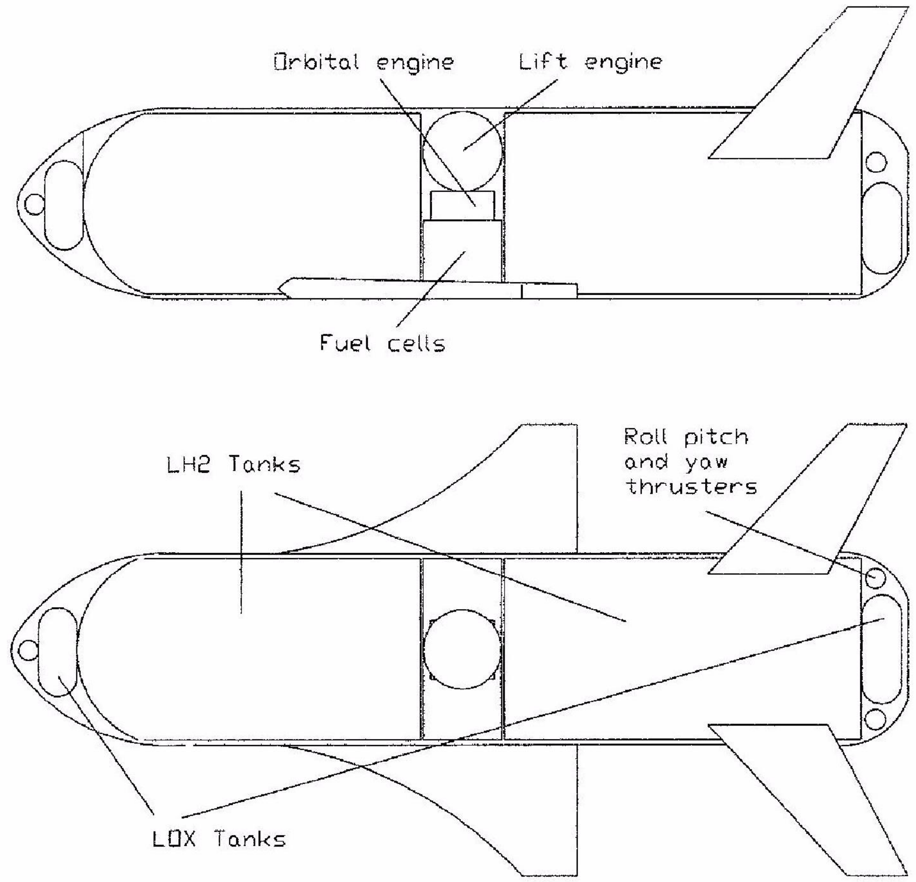
915 MHz
LH2 Cooled (total loss)
667N/kW
0.39m/s/s
2 Axis Gimballed
Vertically stabilised



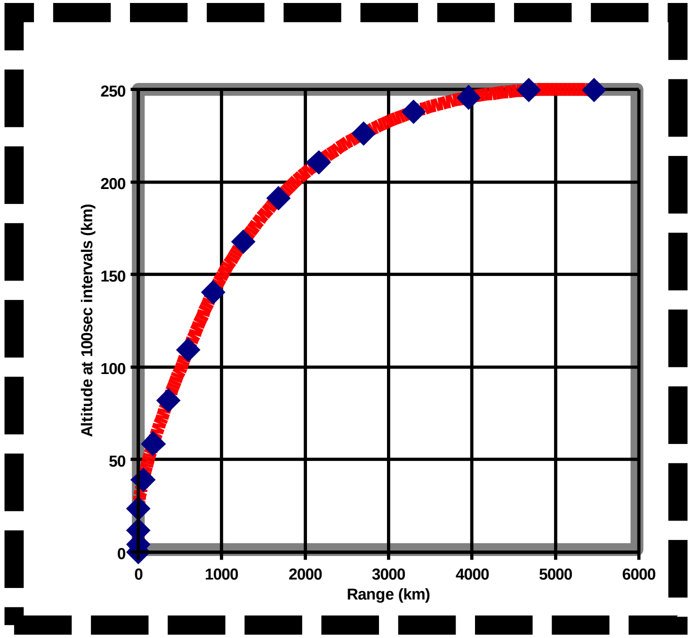
All-Electric SSTO Spaceplane

Orbital Engine
1.5GHz
LH2 cooled (total loss)
185mN/kW
6m/s/s

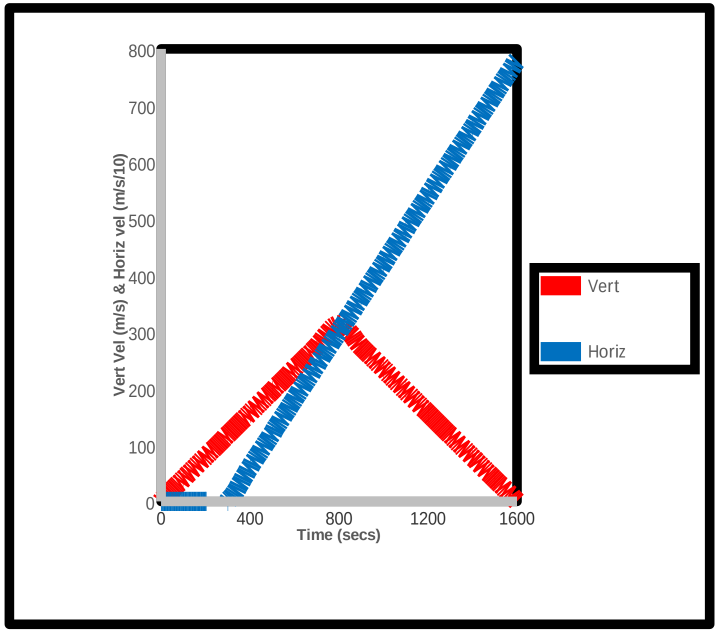
Launch mass 9,858 kg
Payload mass 2,000 kg
Length 8.8m
Width 4.5m
Height 2.9m
500kW Fuel cell



Spaceplane Mission



Ascent Profile

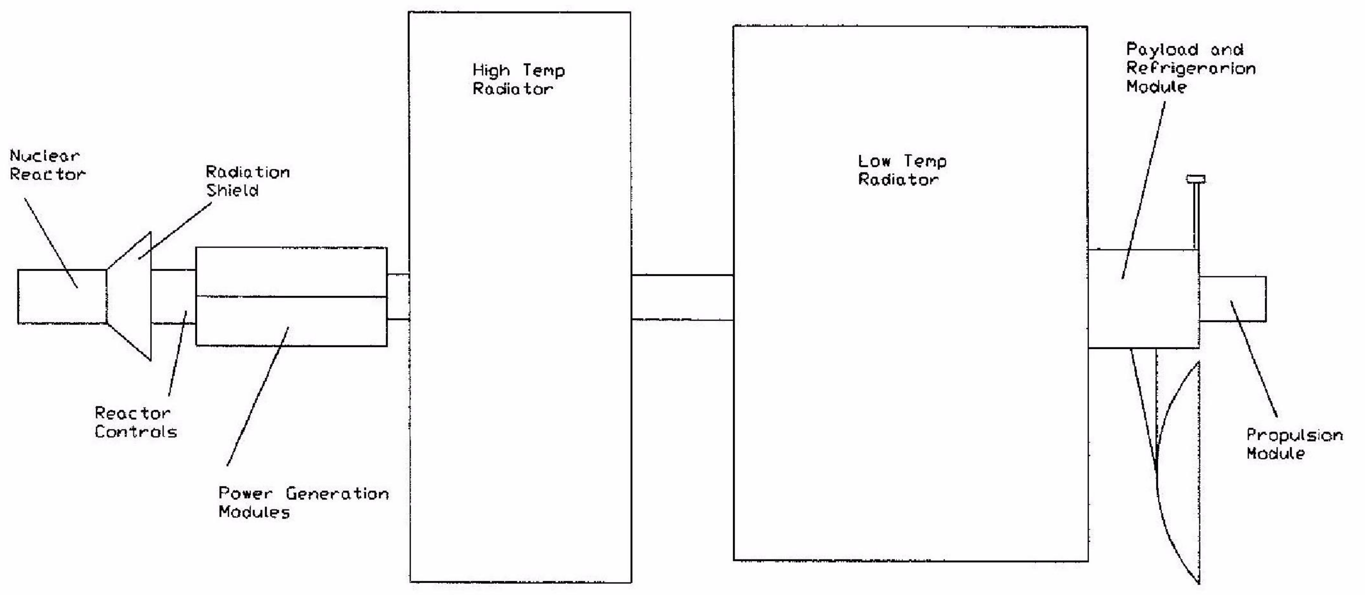


Velocity Profile

Interstellar Probe

Main Engine
500Mhz
LN2 cooled (closed cycle)
304N/kW
1m/s/s
200kW nuclear generator

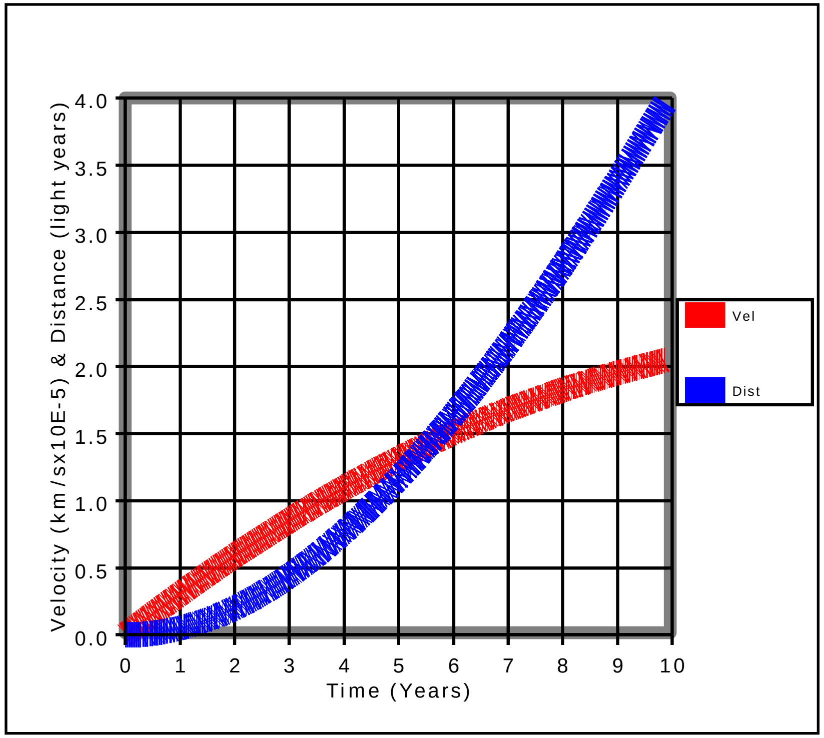
Spacecraft mass 8,936 kg
Payload mass 1000 kg
Length 28.2 m
Width 12.8 m



Interstellar Probe Mission

Nominal acceleration modified by:
EmDrive velocity correction
Relativity energy effect

After 9.86 years propulsion:
Terminal velocity = 204,429 km/s
Distance = 3.96 Light Years



Mission Efficiencies

The EmDrive thruster efficiencies can be calculated for each mission from:

$$\frac{\text{Kinetic energy of spacecraft at terminal velocity}}{\text{Total microwave energy input during acceleration}}$$

The calculated thruster efficiencies were:

SSTO spaceplane orbital engine = 0.363
Interstellar probe main engine = 0.31

The overall mission efficiencies can be calculated from:

$$\frac{\text{Kinetic energy of spacecraft at terminal velocity}}{\text{Total energy input during acceleration}}$$

The calculated mission efficiencies were:

SSTO spaceplane to orbital velocity = 0.243
Interstellar probe to terminal velocity = .0046

Conclusions

- Published Test Data from four independent sources, in three countries confirms EmDrive theory
- Mathematical model quantifies acceleration energy conservation effect at high Q
- Engine design studies illustrate method for compensating for acceleration
- Spacecraft design studies demonstrate:

  SSTO Spaceplane giving low cost access to space

  Interstellar Probe enabling a 10 year mission to the nearest star
- These (or similar)spacecraft will fly
- When ?
- Who will build them ?