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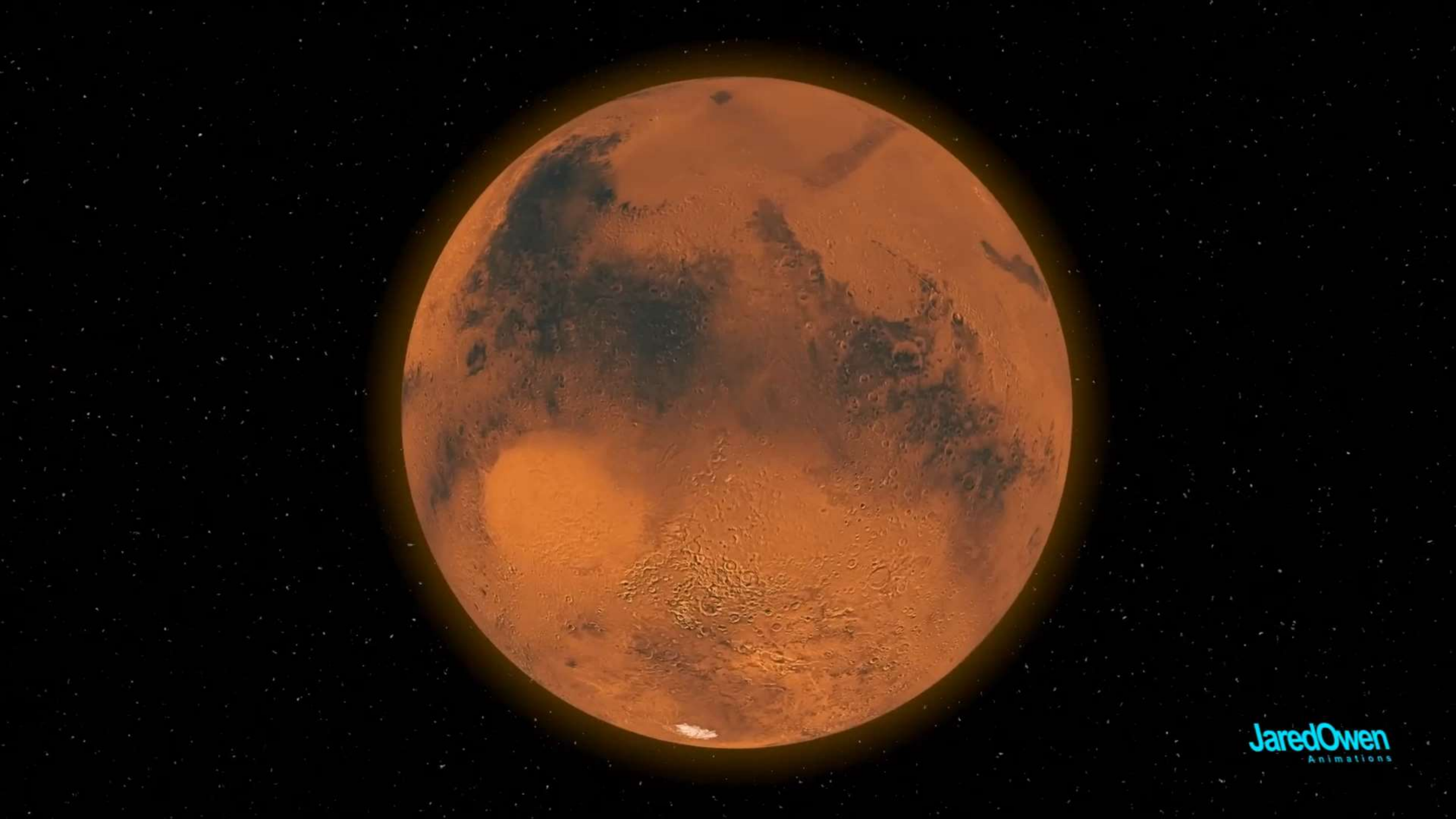
A Journey to Mars

Yannick d'Escatha
Grégoire Lambert

framatome Space


HD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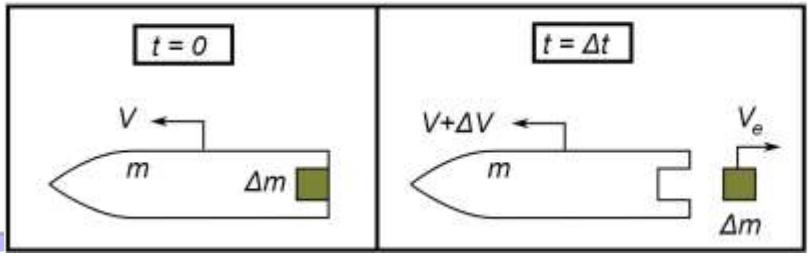
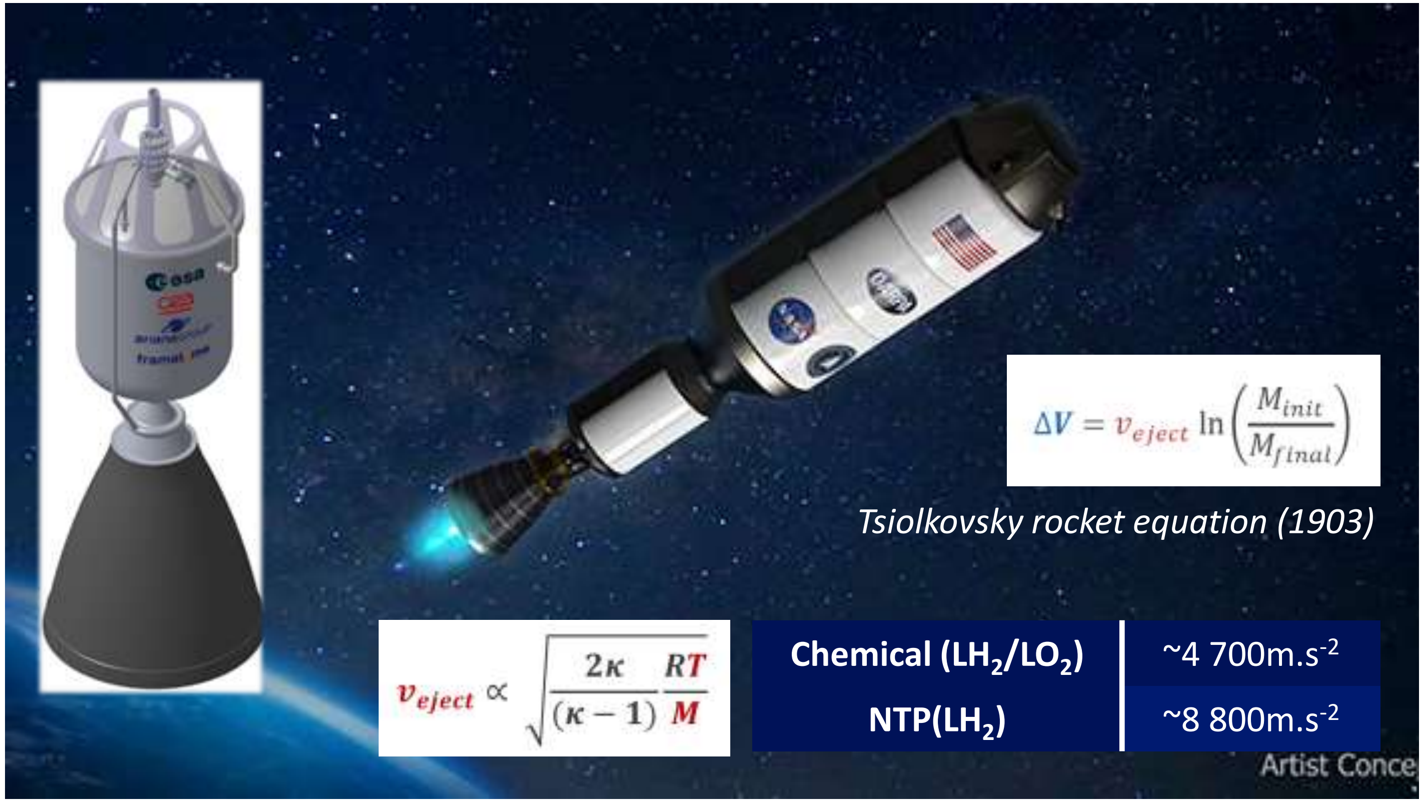
Nuclear Thermal Propulsion



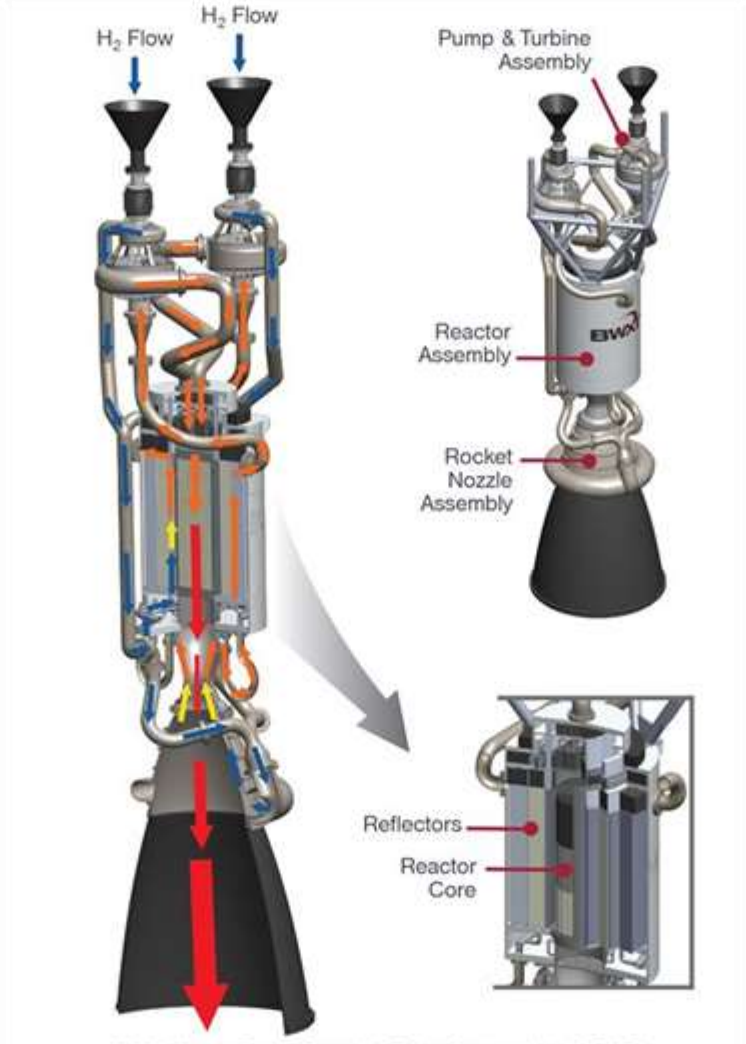


$$\Delta V = v_{eject} \ln\left(\frac{M_{init}}{M_{final}}\right)$$

Tsiolkovsky rocket equation (1903)

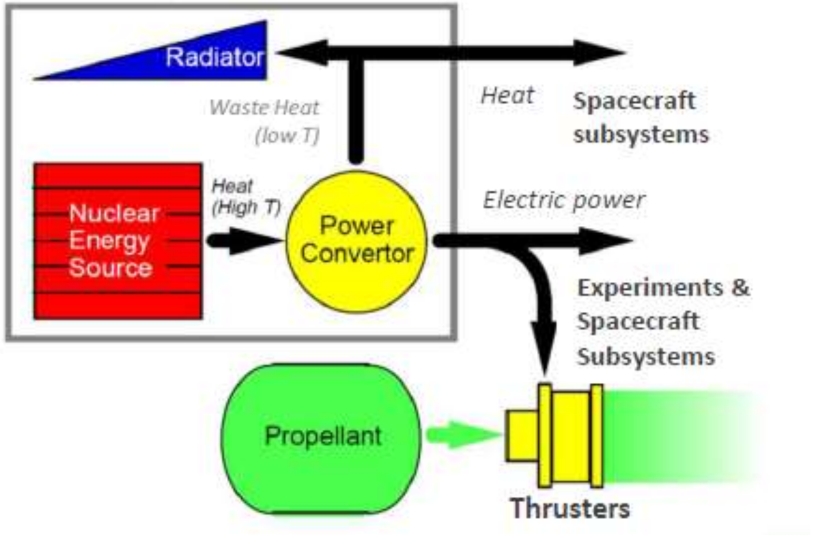
$$v_{eject} \propto \sqrt{\frac{2\kappa}{(\kappa - 1)} \frac{RT}{M}}$$

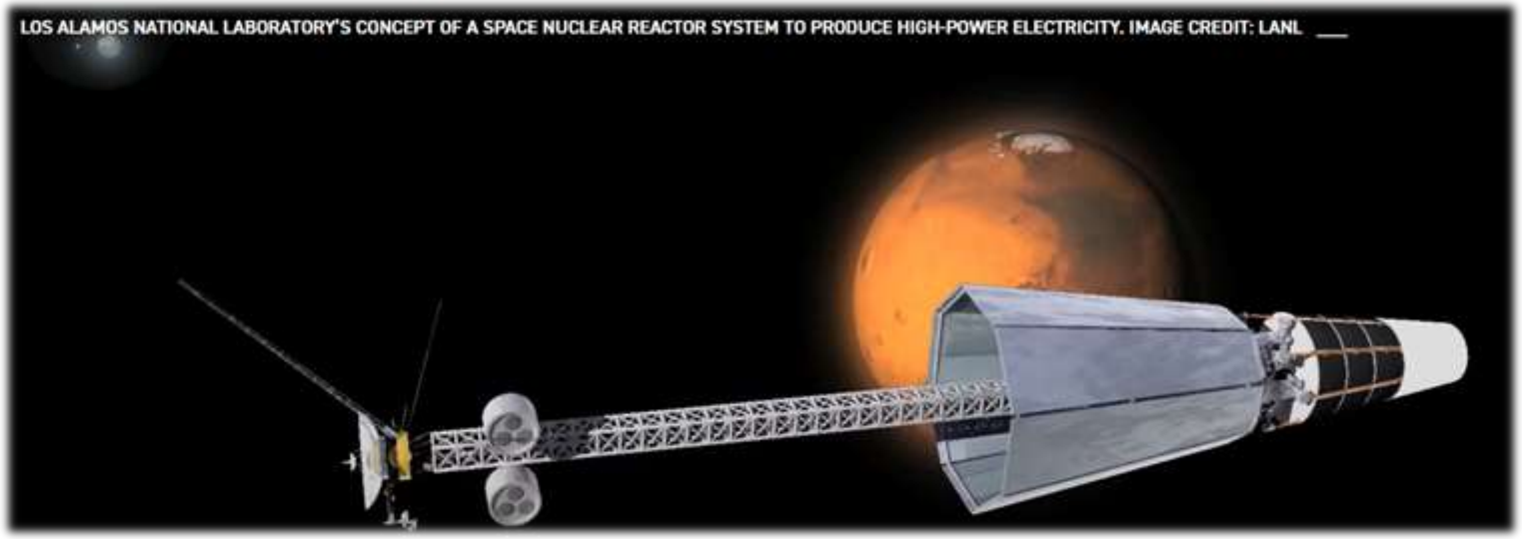
Chemical (LH_2/LO_2)	~4 700m.s^{-2}
NTP(LH_2)	~8 800m.s^{-2}



NASA's Nuclear Thermal Propulsion Engine System, of which BWXT is providing support for reactor and fuel design and analysis.

Nuclear Electrical Propulsion





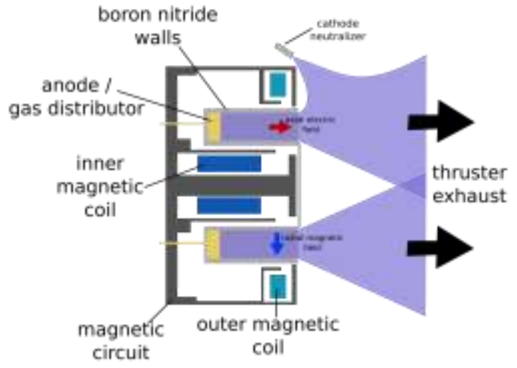
$$\Delta V = v_{eject} \ln\left(\frac{M_{init}}{M_{final}}\right)$$

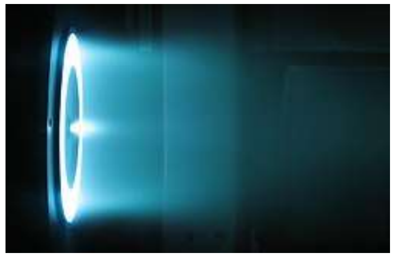
Chemical (LH_2/LO_2)	~4 700 $m.s^{-2}$
NTP(LH_2)	~8 800 $m.s^{-2}$
NEP (Xe)	~29 000 $m.s^{-2}$

Specificity

- \+ High DeltaV
- \- Very Low Thrust
- \- Constant propulsion (no burst as thermal propulsion)

Hall Thruster (Test in NASA Jet Propulsion laboratory)





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COLONIZING
MARS
The Challenge of an Unforgiving World
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TEMPERATURE
VOLUME AND MASS
DISTANCE
Solutions for Survival
METHANE GENERATION
EXTRACTING WATER FROM AIR
GETTING GROUNDWATER
POWER FROM THE SUN
PORTABLE POWER
NUCLEAR POWER
MARTIAN GREENHOUSES
BETTER BREATHING THROUGH CHEMISTRY
LIVING IN LAVA TUBES
COMMUNICATION
HIDDEN GLACIERS
MARS

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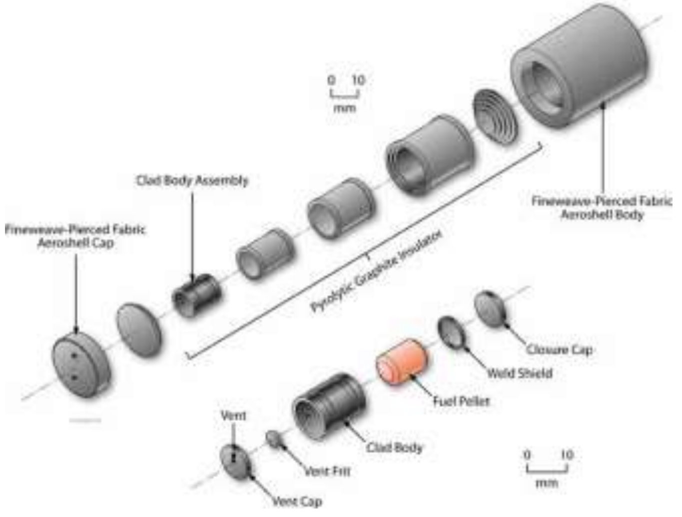
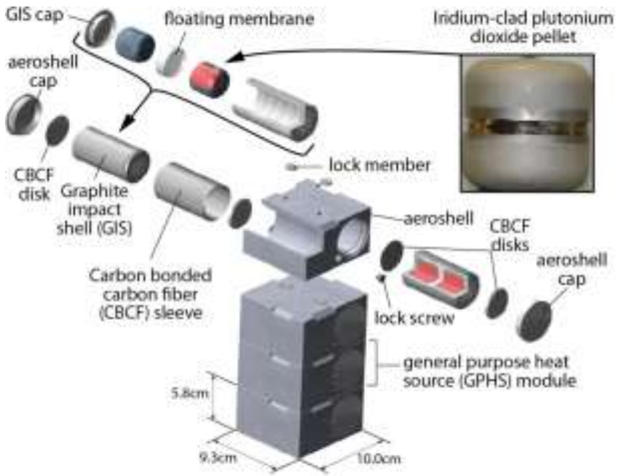
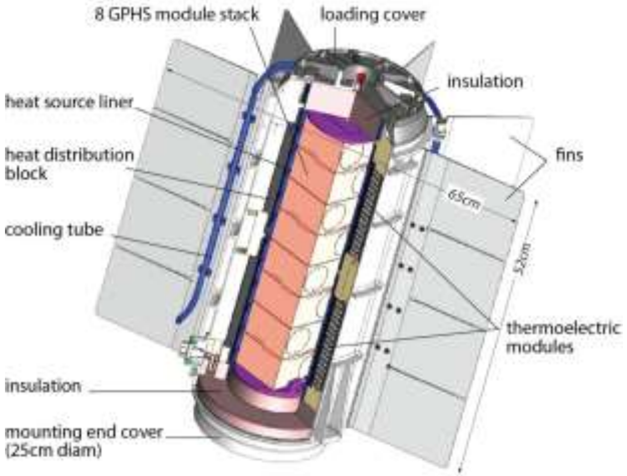
Radioisotope Power System (RPS)







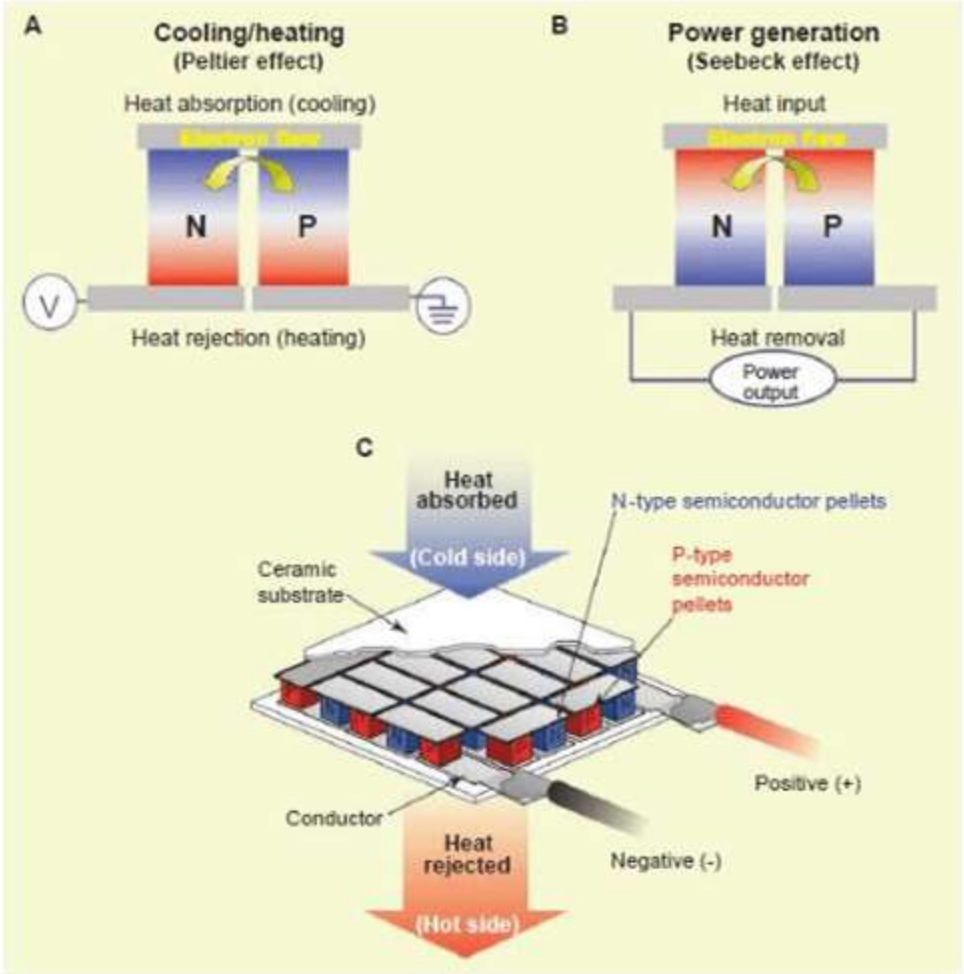


TABLE I. Attributes of Primary Candidate RHU and RTG Isotopes

Material	Shielding requirement	Power density (W_{th}/g)[1]	Half-life (years)[1]	Commercial Availability
^{238}Pu	Low	0.54	87.7	None[2]
^{90}Sr	High	0.46	28.8	Available[3]
^{210}Po	Low	140	0.378	None[4]
^{241}Am	Medium	0.114	432	Available[3]

Fission Surface Power : an HTR

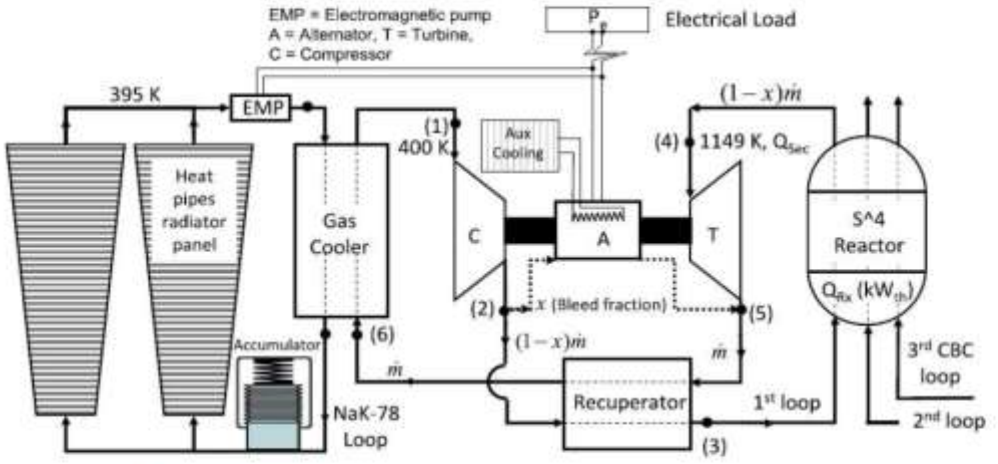
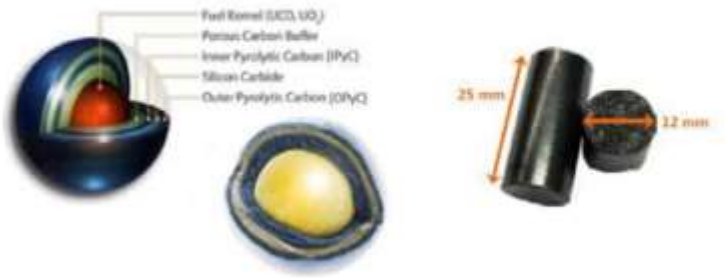
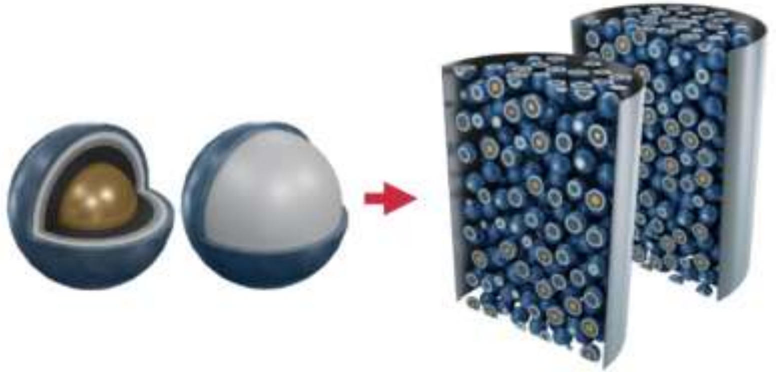


Figure 3: A CBC-space power system nominal operation parameters and layout [1].



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Thank you