Improved Engine Design Calculations

Tungsten Core Heat Storage

```
E = m × c × ΔT
m = 10,000 kg per rod
c (tungsten) = 134 J/kg·K
ΔT = 2,500 K → 500 K = 2,000 K
E = 10,000 × 134 × 2,000 = 2.68 GJ per rod
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Power from Stirling Engines

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Conversion Efficiency ≈ 30%
E_electric = 2.68 GJ × 0.30 = 804 MJ per rod
100 rods in granite block = 80.4 GJ = 22.3 MWh
With 17 Stirling Engines, output ≈ 15 MW continuous for 24 hrs
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Laser Reactor Heating

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Each reactor: 20 MW industrial laser × 4 units = 80 MW total
Sustains thermal load + gas ignition
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FTL Jump Charge

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 Target: 4% c (0.04 × 3×10^8 m/s = 1.2×10^7 m/s)
Relativistic γ ≈ 1.0008
E = (γ - 1)mc²
Ship mass: 188,000 kg
E ≈ (1.0008 - 1) × 188,000 × (3×10^8)²
E ≈ 0.0008 × 188,000 × 9×10^16
E ≈ 1.35×10^19 J (13.5 EJ)
With 80 MW supply → Time ≈ 13.5×10^18 / (80×10^6) = ~5.7 years
continuous (needs Stargate assist!)
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Gas Thrust

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Propellant: N₂/CO₂ mix @ 3,000 K
Exhaust velocity: ~859 m/s
ISP: ~88 s
Δv ≈ 541 m/s for 88 t burn (maneuvering only)
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