Mars Today 1

An immediate and inexpensive program for manned Mars visitation

Basic Assumptions

- No nuclear components
- No heavy lift launch capability
- No oversized components
- Use existing components to minimize development
- Emergency supplies for crew
- Recycle ?

Major systems

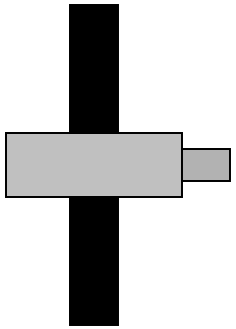
- Space Propulsion
- Transit Habitation
- Surface Habitation
- Mars Lander
- Crew Ferry Vehicle(s)

Space Propulsion

- Centaur (Mentaur)
- Empty Mass 2200Kg
- Lox/H2 16,800Kg
- Lox/CH4 42,200kg

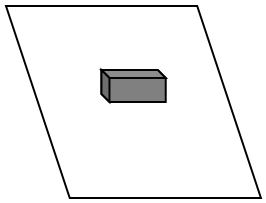
A Mentaur is a Centaur upper Stage with modified RL-10 Engines and propellant tanks for CH4 instead of LH2. Same shape, different mass.

Transit Habitation



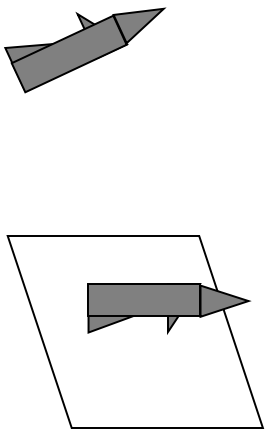
- ‘ The Mir core’
- 20,000 Kg
- Orbital crew habitat
- Long range Earth communications
- 16000 Kg Provisions

Surface Habitation Equipment



- Multiple deliveries
- 3m diameter
- 5m long
- 10,000Kg

Mars Lander



- 20,000 kg GLOW
- Hypersonic aerodynamic L/D 1.0
- 10,000 Kg Payload (surface module etc)
- Mars launch capability (if resupplied with 10,000 kg propellant)

Crew Ferry Vehicle

- Deliver and retrieve crew
- Space Shuttle
- Soyuz/Apollo/etc

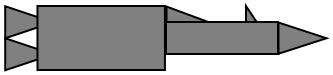
Mars Today Supply Profile

- LEO Assembly
- First LEO Impulse
- Trans Mars Impulse
- Trans Mars Cruise
- Direct Entry to Landing

Supply First LEO Impulse

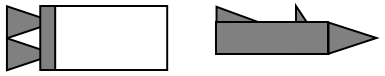
- Orbit = 300x300 km Alt
- Mass 58 (116) Mg
- Burn Centaur (Mentaur)
- DeltaV=1.5 km/s
- New Orbit = 300x11000km Alt
- Stage Centaur

Supply Trans Mars Impulse



- Mass 39 (72) Mg
- Burn Most of Centaur
- DeltaV=2.4 km/s
- Escape Excess V = 4.3 km/s or less

Supply Cruise / Entry

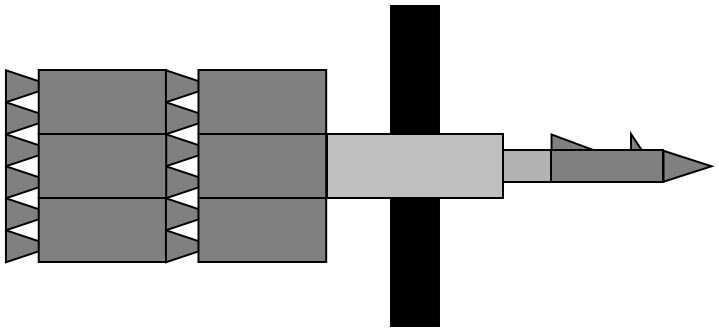


- Time 9 months
- Available DeltaV = 0.25 km/s
- Aerobrake for Mars Orbit Capture
- Autoland / Remote

Mars Today Manned Profile

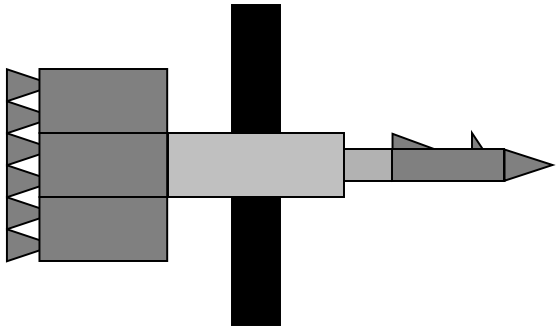
- LEO Assembly
- First LEO Impulse
- Trans Mars Impulse
- Trans Mars Cruise
- Mars Orbit Capture
- Mars Braking Descent
- Mars Surface Stay
- Mars Orbit Rndvs
- Mars Lander Return
- Trans Earth Impulse
- Earth Orbit Capture
- Crew Recovery

Manned First LEO Impulse



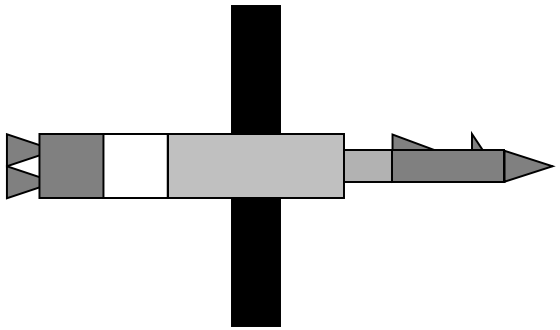
- Burn Four Centaurs
- DeltaV = 1.7 km/s
- New Orbit = 300x1300 km Alt
- Stage Centaurs

Manned Trans Mars Impulse



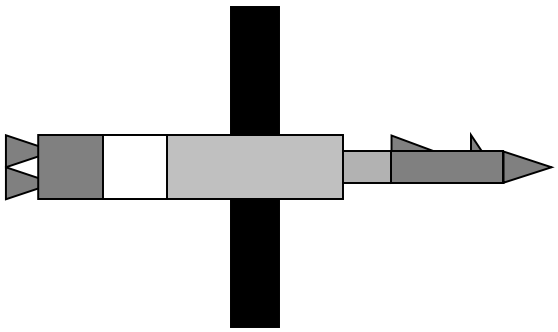
- Burn 3.25 of Centaurs
- DeltaV = 4.2 km
- C3 = 4.3 km or less depending on req.

Manned Cruise



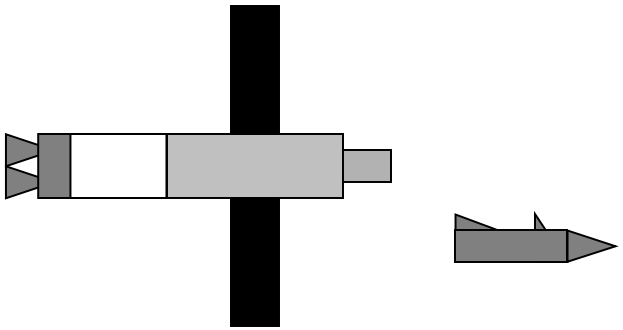
- Time 10 months
- Supplies for 36 month with failed recycling at minimal levels

Manned Mars Orbit Capture



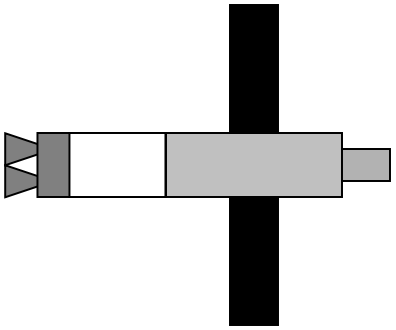
- 2/3 of Supplies Rem
- Initial C3 = 4 km/s
- Burn 1 Centaur
- DeltaV = 1.4 km/s
- Final orbit =
  - 3700 x 357000 km
  - (300x354000 alt)

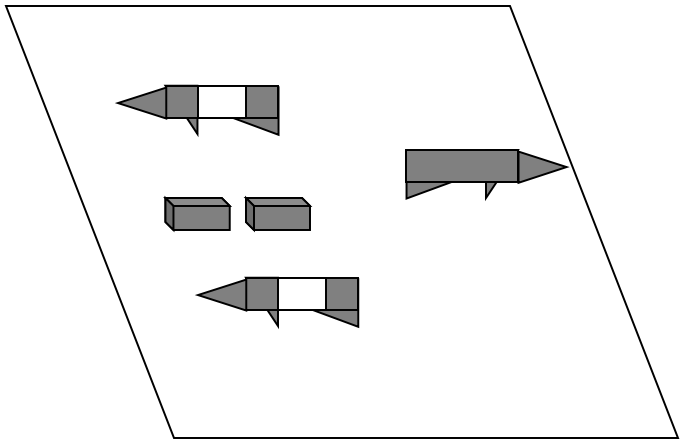
Manned Mars Braking Decent



- Aerobrakes
- Land with beacon assistance
- DeltaV = 200-500m/s

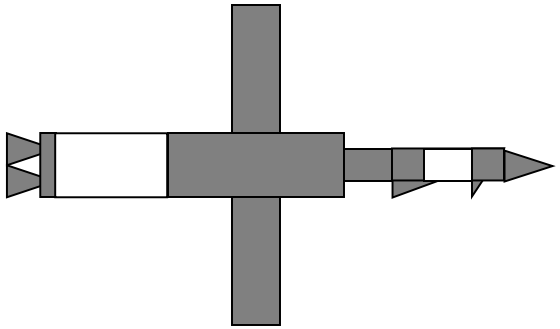
Mars Surface Stay





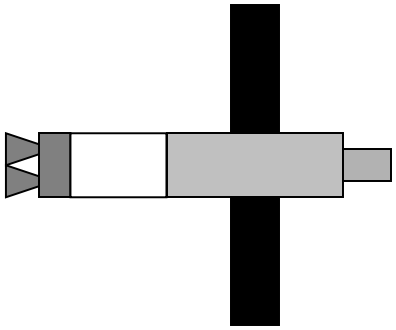
- Two+ early supply missions
- Surface stay 1.5 Yrs
- Supplies for 36 month with failed recycling at minimal levels
- Resupply option
- Abort to orbit early

Mars Orbit Rendevous



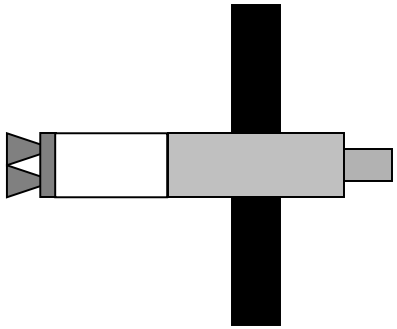
- Lander fueled for ascent to orbit
- final orbit matched with transit hab
- Offload extra supplies
- Hab may have lowered orbit during stay

Manned Trans Earth Impulse



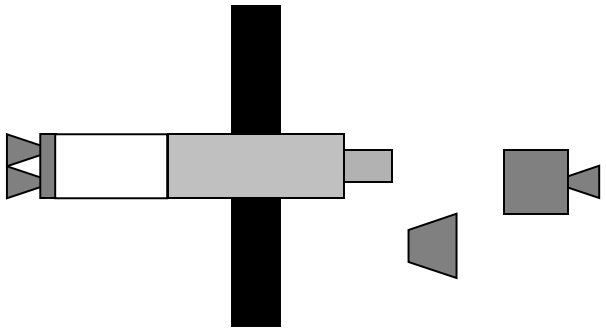
- Leave Lander
- Burn 1/2 of Centaur
- DeltaV = 1.47
- Final final C3=4km/s

Manned Earth Orbit Capture



- Initial C3 = 4.2 km/s
- Burn 0.125 of Centaur
- DeltaV = 0.8 km/s
- Final orbit =
  - 300x 787000 km
- Alternate RV
  - 3000kg vs 4200kg

Optional Crew Recovery



- Parking orbit
- Rendezvous with crew transfer vehicle
- Trasit hab may be braked to Leo

System Costs

- Centaur Space Propulsion = $20M
- Transit Habitat = $30M
- Surface Habitat = $30M
- Lander Development = $200M
- Lander = $30M
- Launch of 20000kg = $20-300M

Supply Mission Cost

- 2 Centaurs $40 M
- 1 Lander $30 M
- Payload $30 M
- Launch 3 units $300M

  – Total = $400M

Manned Mission Cost

- 9 Centaurs $180 M
- 1 Lander $30 M
- Tranist Hab $30 M
- Launch 11 units $ 1100M

  – Optimistic Total = $1340M

Total First Costs

- 3 Supply Missions $1200M
- 1 manned mission $1340M
- Lander development $300M

  - Total Cost for first mission = $2840M
  - +shuttle flights and assembly

Launch Costs

- 20 Launches
  - Assuming $100M/Proton
  - Launch costs = $2000M
- Total Price is $2840M
- Reducing Launch to $20M
  - $1000kg (1/2x Zenit x2)
- Total Price is $1240M