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BETA II, A NEAR TERM, FULLY REUSABLE, HORIZONTAL TAKEOFF & LANDING TWO-STAGE-TO-ORBIT LAUNCH VEHICLE CONCEPT

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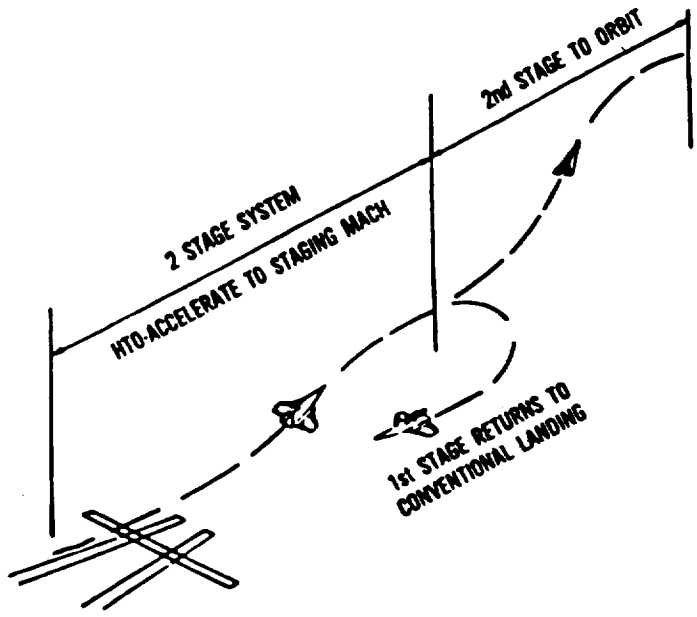
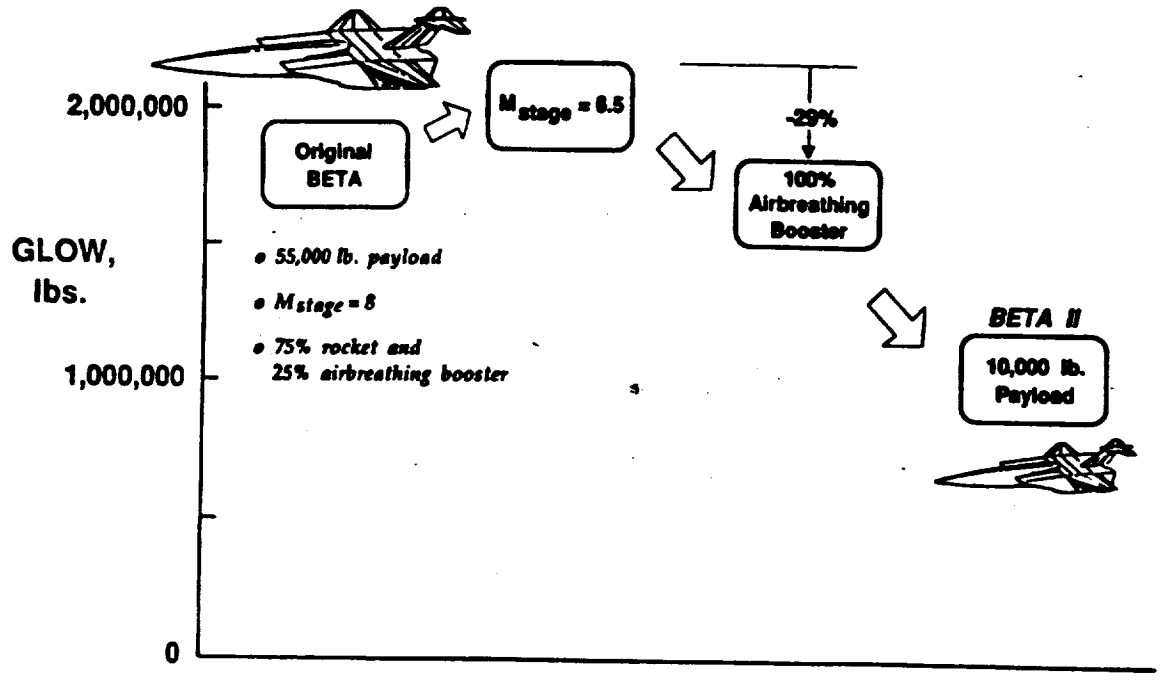
A recent study has confirmed the feasibility of a near term, fully reusable, horizontal takeoff and landing two-stage-to-orbit (TSTO) launch vehicle concept. The vehicle stages at Mach 6.5. The first stage is power by a turboramjet propulsion system with the turbojets being fueled by JP and the ramjet by LH_2. The second stage is powered by an SSME rocket engine. For about the same gross weight as growth versions of the 747, the vehicle can place 10,000 lbm. in low polar orbit or 16,000 lbm. to Space Station Freedom.

Design Goals

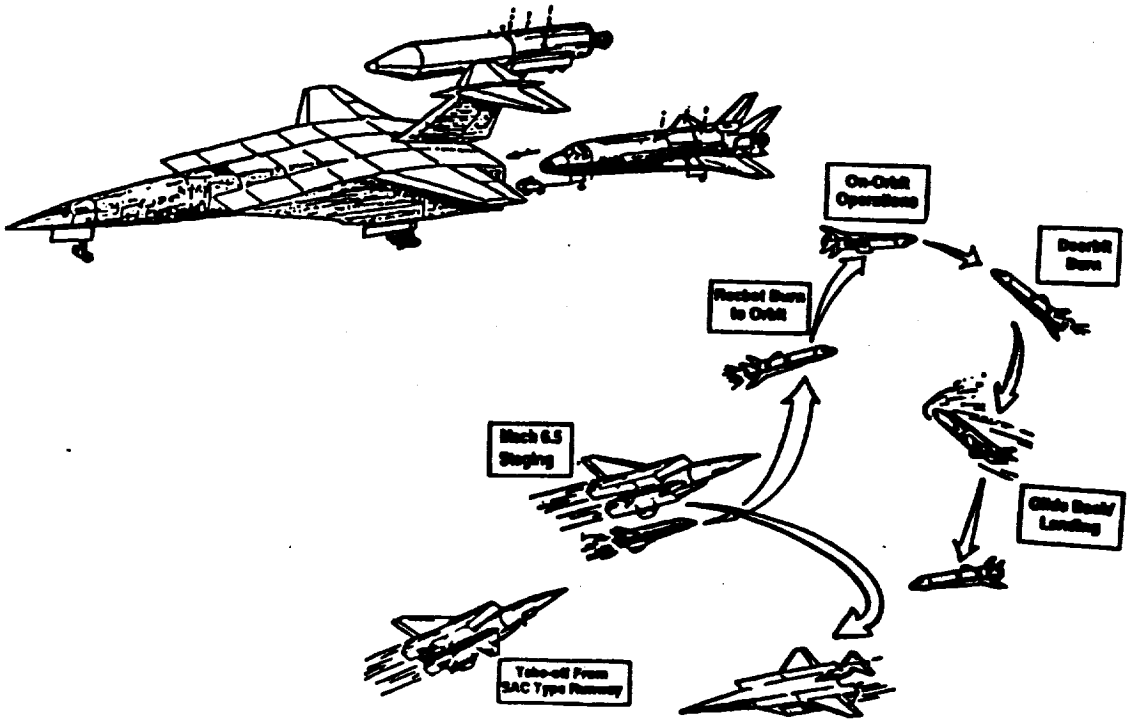
- *Near-term staged system*
- *Doable technology levels*
- *Airbreathing first stage*
- *Rocket second stage*
- *Full reuseability*
- *All Azimuth launch*
- *Horizontal take-off and landing*
- *Bottom drop staging mode ease in handling and separation*
- *Integrated ferry capability*



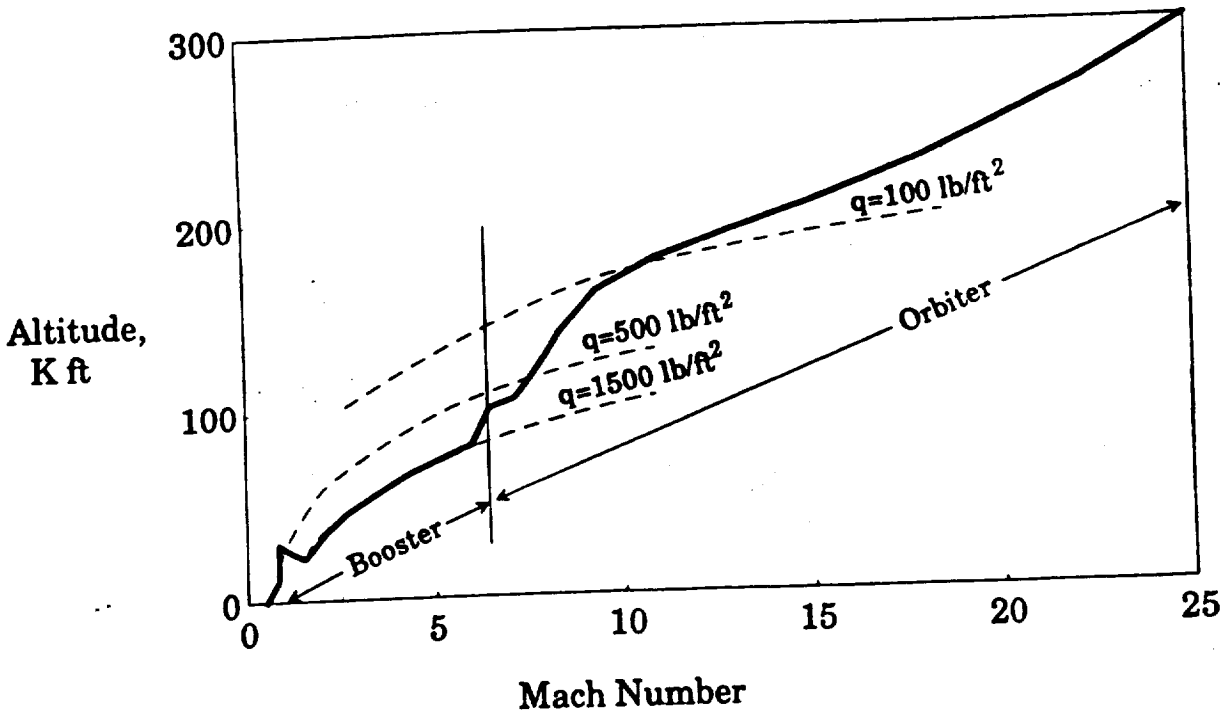
Evolution of BETA Airbreathing Launch Vehicle



Typical Mission Profile



Optimum Trajectory



Beta II General Arrangement

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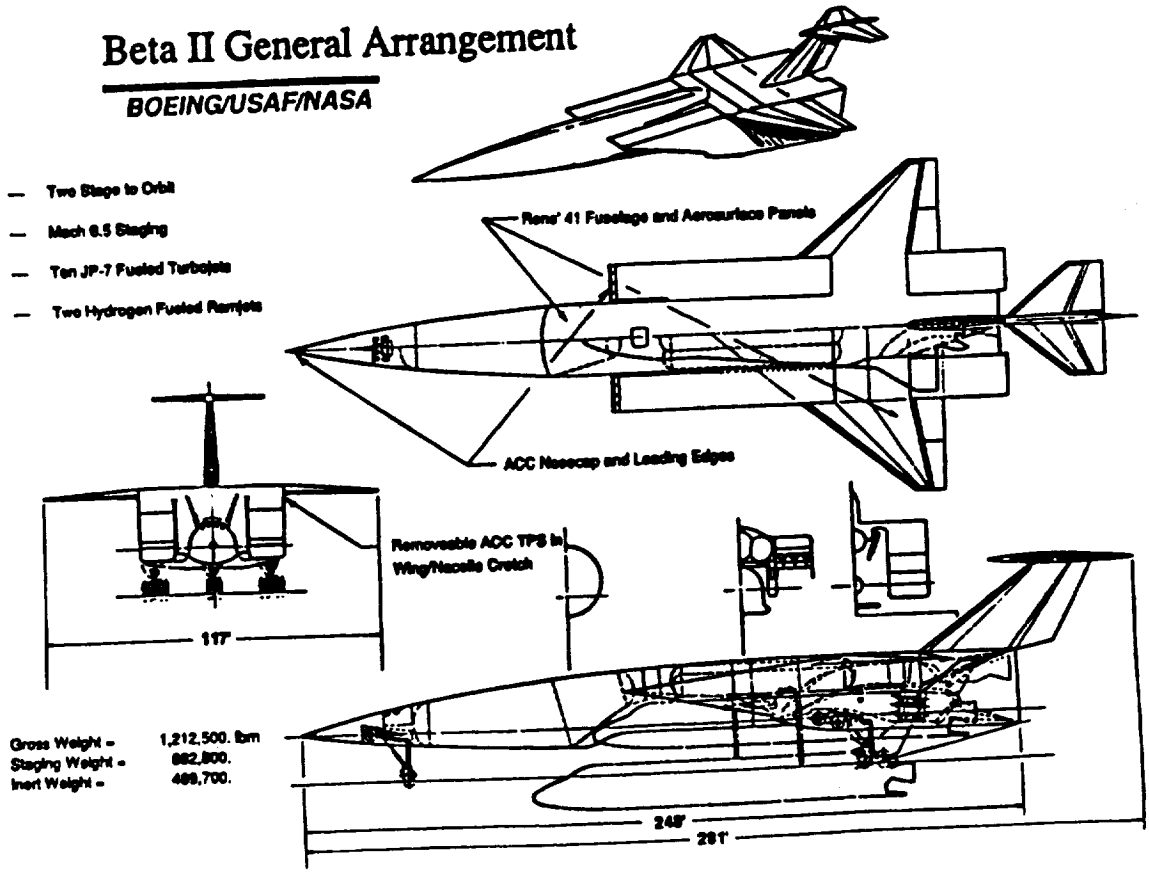
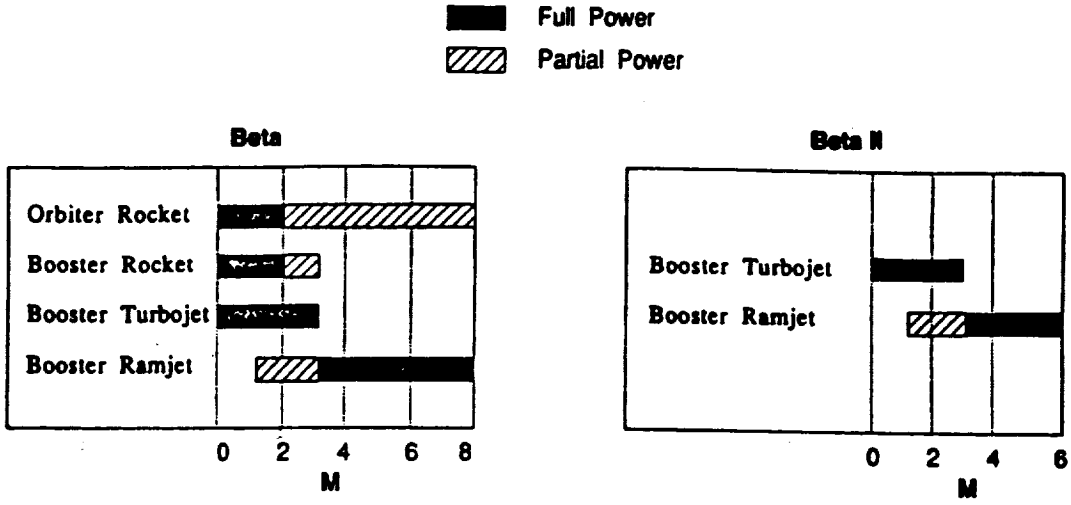
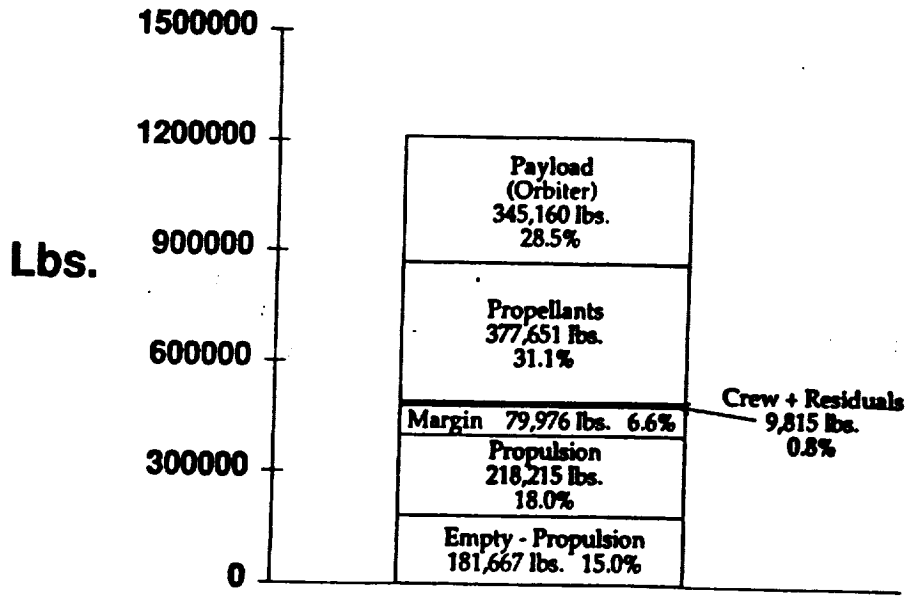


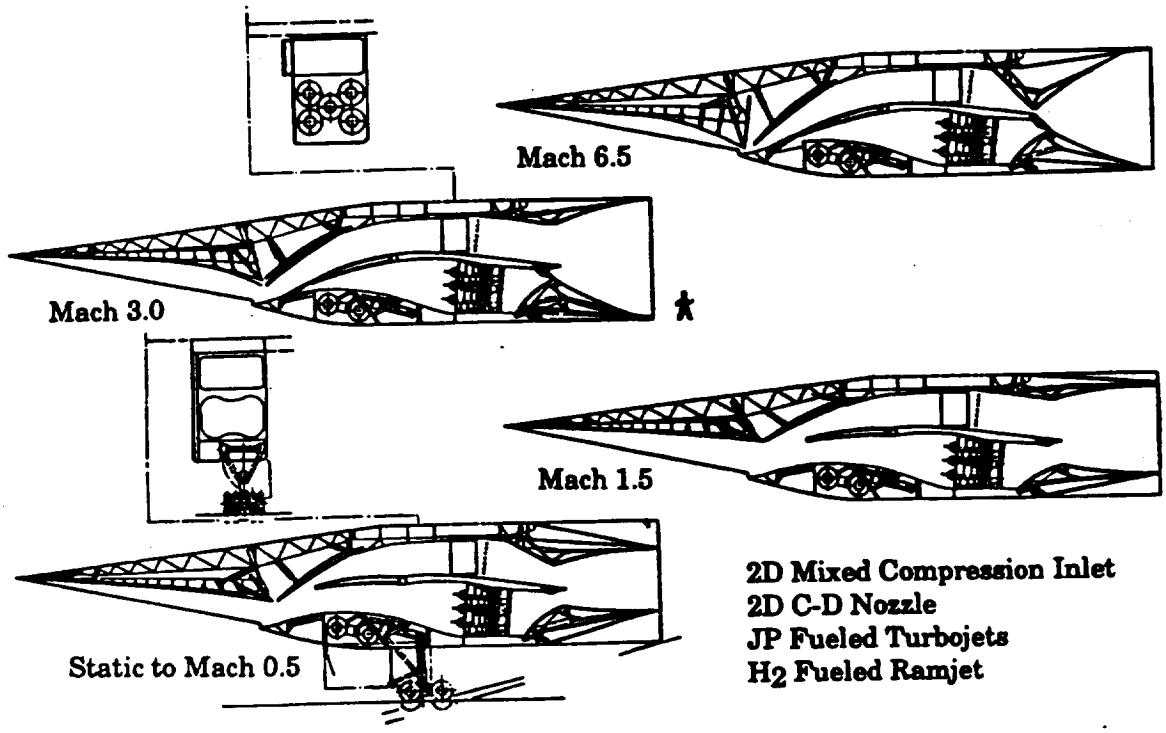
BETA ENGINE OPERATING SCHEDULE



Beta II Booster Weights



Beta II Nacelle at Selected Operational Modes

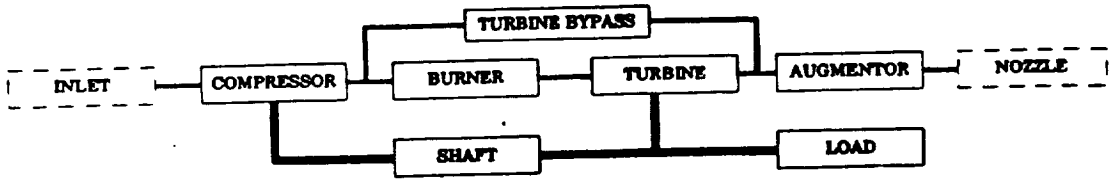


2D Mixed Compression Inlet
2D C-D Nozzle
JP Fueled Turbojets
H_2 Fueled Ramjet

BETA Turbine-Bypass Engine Major Parameters

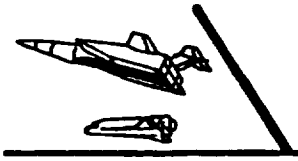
(Engine From Concurrent HSR Studies)

One-spool turbine bypass engine



CORRECTED AIRFLOW	OVERALL PRESSURE RATIO	MAXIMUM T41	WEIGHT	LENGTH	DIAMETER
625 lbm/sec	20.4	3360 R	6850 lbs	123 inches	66 inches

Sea Level Static	Maximum Dry	Maximum Augmented
Net Thrust	55143 lbf	78400 lbf
TSFC	0.9429	1.6382



Mach 6.5 Staging Beta Orbiter

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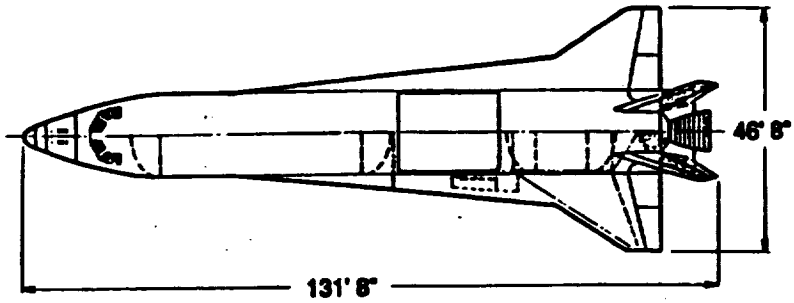
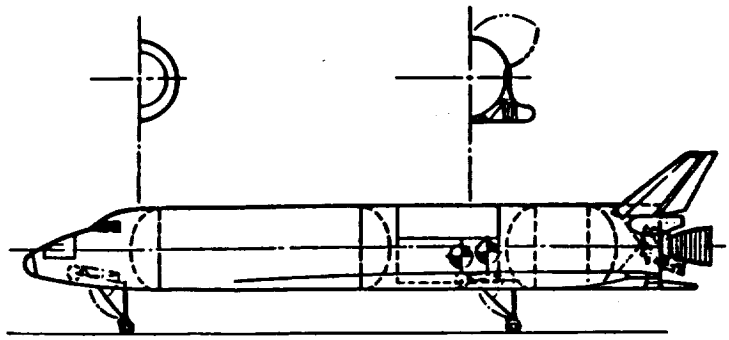
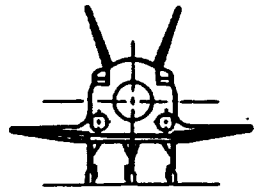
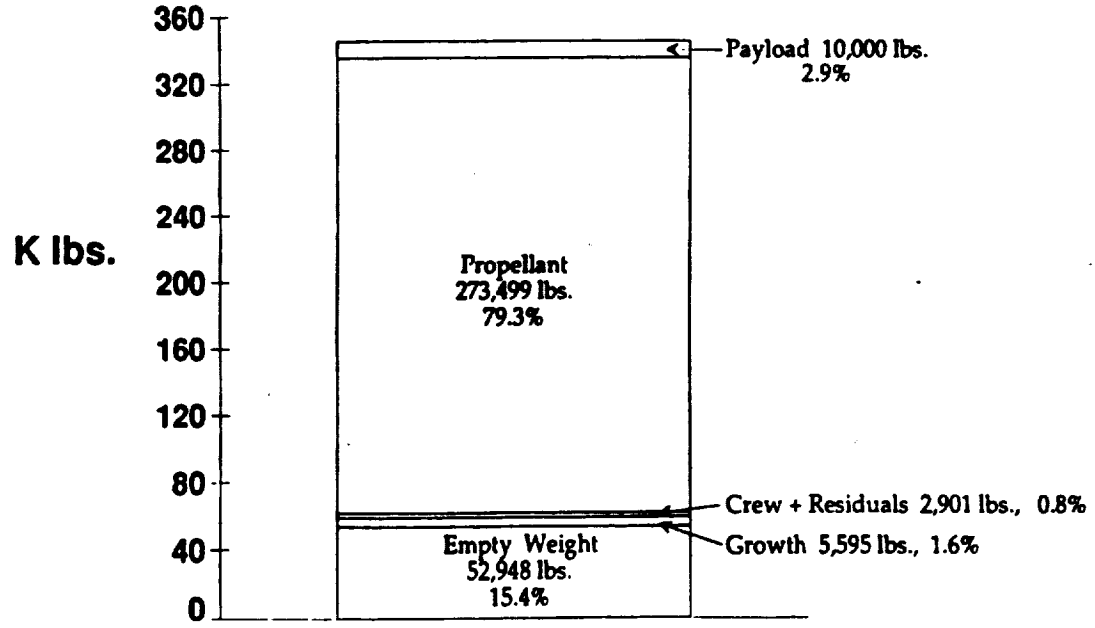


- 10 klb Payload to 120 x 120 nmi Polar LEO
- All LOX-Hydrogen Propulsion
- 345,160 lb Gross
- 61,444 lb Inert
- λ'=0.811





Beta II Orbiter Weights



BETA II

- **Viable and robust**
  - Conservative design, structures, materials
  - Minimum technology development
  - 20% growth margin built in
  - 747 weight class
- **Potential for low cost operation**
  - Simple stage mating
  - Airplane-like operations (intact, safe abort)
  - Fully recoverable
  - No ferry aircraft required
- **Versatile**
  - 10K —polar
  - 10 men + 10K — space station
  - 30K — space station (expendable 2nd stage)
  - All weather launch
  - M 4 - 6 research aircraft (booster)
  - Carrier for airbreathing M 6 - 25 research vehicle
  - Multi-mission vehicle

Advanced Manned Lanuch System (AMLS) Prop. Status

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(Paper Not Received in Time for Printing)