



### Vehicle Concept Characteristics - LV 41.5005.08001

#### UPPER STAGE

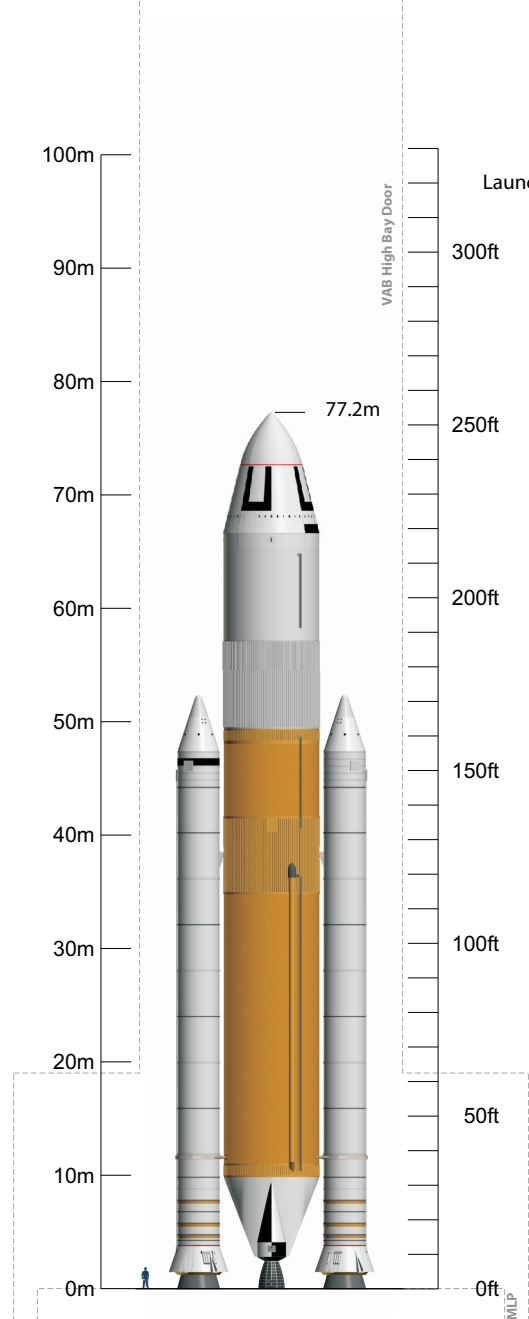
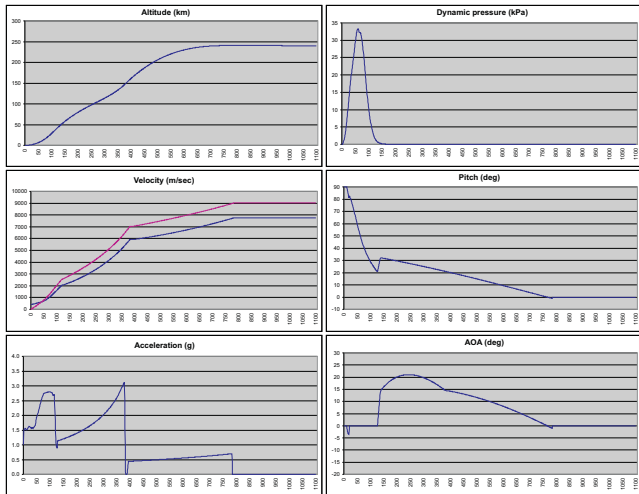
|  |                                   |
|--|-----------------------------------|
| Design Heritage                        | Boeing ACES / Lockheed-Martin WBC |
| Propellants                            | LOX / LH2                         |
| Maximum Gross Propellant               | 433,061lb (196,433kg)             |
| Usable Ascent Propellant               | 156,894lb (71,166kg)              |
| Ascent Flight Performance Reserve      | 7,073lb (3,208kg)                 |
| Usable Post-Ascent Propellant          | 262,105lb (118,889kg)             |
| Post-Ascent Flight Performance Reserve | 2,648lb (1,201kg)                 |
| Unusable Residuals                     | 4,174lb (1,893kg)                 |
| Ascent In-Flight Losses                | 168lb (76kg)                      |
| RCS Propellant                         | 992lb (450kg)                     |
| Propellant Offload                     | 0.00%                             |
| Stage pmf                              | 0.9322                            |
| Dry Mass                               | 27,037lb (12,264kg)               |
| Burnout Mass                           | 31,211lb (14,157kg)               |
| # Engines / Type                       | 4 / RL-60                         |
| Engine Thrust (@ 100%) Vac             | 64,992lbf (29,480kgf / 289,100N)  |
| Engine Isp (@ 100%) Vac                | 459.0s                            |
| Mission Power Level                    | 100.0%                            |
| Upper Stage Ascent Burn Time           | 397.9s                            |
| LEO Loiter Period                      | 4 + 1 days                        |
| Pre-TLI Overboard Mass                 | 7,073lb (3,208kg)                 |
| ASE*                                   | 1,102lb (500kg)                   |

#### DYNAMICS

|                           |                     |
|---------------------------|---------------------|
| Thrust : Weight @ Liftoff | 1.514 : 1           |
| Max Dynamic Pressure      | 695.9psf (33,318Pa) |
| Max g's During Ascent     | 3.13g               |
| Insertion Altitude        | 130.0nmi (240.8km)  |

#### ASCENT PERFORMANCE

|                                   |                                |
|-----------------------------------|--------------------------------|
| Delivery Orbit                    | 130.0 x 130.0nmi, 29.0°        |
| Payload w/ regular NASA GR&A's    | 266,847lb (121,040kg) †        |
| Payload w/ additional 10% Reserve | <b>240,162lb (108,936kg) †</b> |



#### Launch Site

KSC LC-39 (Latitude: 28.6084°)

#### GLOW

|                                   |                                  |
|-----------------------------------|----------------------------------|
| <b>GLOW</b>                       | <b>5,743,603lb (2,605,254kg)</b> |
| Payload Fairing                   | 27.6 x 0.0ft (8.4 x 0.0m)        |
| Payload Envelope                  | 25.0 x 0.0ft (7.6 x 0.0m)        |
| Payload Fairing Jettison Mass     | 8,724lb (3,957kg)                |
| Payload Fairing Jettison          | 356.0s @ 73.7nmi                 |
| Launch Abort System Jettison Mass | -                                |
| Launch Abort System Jettison      | -                                |

#### BOOSTERS (each)

|                            |   |
|----------------------------|---|
| Design Heritage            | Shuttle-derived 5-segment RSRMV           |
| Propellants                | PBAN                                      |
| Usable Propellant          | 1,380,873lb (626,353kg)                   |
| Stage pmf                  | 0.8656                                    |
| Dry Mass                   | 228,620lb (103,700kg)                     |
| Burnout Mass               | 232,608lb (105,509kg)                     |
| # Boosters / Type          | 2 / 4-segment Shuttle RSRM                |
| Booster Thrust (@ 0.7s) SL | 3,510,791lbf (1,592,468kgf / 15,616,776N) |
| Vac                        | 3,510,791lbf (1,592,468kgf / 15,616,776N) |
| Booster Isp (@ 0.7s) SL    | 237.0s                                    |
| Vac                        | 267.4s                                    |
| Booster Burn Time          | 126.6s                                    |

#### CORE STAGE

|                             |                                      |
|-----------------------------|--------------------------------------|
| Design Heritage             | Shuttle Super Light Weight Tank ET   |
| Propellants                 | LOX / LH2                            |
| Gross Propellant            | 1,621,191lb (735,360kg)              |
| Usable Ascent Propellant    | 1,604,979lb (728,006kg)              |
| Unusable Residuals          | 16,047lb (7,279kg)                   |
| In-Flight Losses            | 325lb (147kg)                        |
| Propellant Offload          | 0.00%                                |
| Stage pmf                   | 0.9075                               |
| Dry Mass                    | 147,479lb (66,895kg)                 |
| Burnout Mass                | 163,526lb (74,174kg)                 |
| # Engines / Type            | 4 / SSME-Block-II                    |
| Engine Thrust (@ 104.5%) SL | 392,326lbf (177,956kgf / 1,745,155N) |
| Vac                         | 490,847lbf (222,644kgf / 2,183,396N) |
| Engine Isp (@ 104.5%) SL    | 361.4s                               |
| Vac                         | 452.2s                               |
| Mission Power Level         | 104.5%                               |
| Core Burn Time              | 384.1s                               |

#### INTERSTAGE

|          |                    |
|----------|--------------------|
| Dry Mass | 11,664lb (5,291kg) |
|----------|--------------------|

#### EDS TLI PERFORMANCE

|                                  |                             |
|----------------------------------|-----------------------------|
| 2-Launch EOR                     | 266,847lb (121,040kg)       |
| TLI dV (Adj. for Gravity Losses) | 3,205.0m/s (+ FPR)          |
| LEO Loiter Period                | 5.0 days                    |
| TLI Payload Performance*         | <b>211,762lb (96,054kg)</b> |

\* ASE is part of the Payload, not additional