3rd Space Exploration Conference

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Ares V Overview

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Agenda

- **Ares V Gross TLI Capability Requirements**
  - Crewed Missions
  - Cargo Missions
- **Ares V Vehicle Architecture**
- **Ares V Trade Space**
- **Ares V Reference Vehicle Configuration**
- **Ares V Shroud Design**
- **Summary Schedule**
- **Forward Work**

Ares V Gross TLI Capability Requirement: Crewed Outpost Lander Mission

	Metric (mT)	English (lbm)
Orion	20.2	44,500
Lander (Crew)*	45.9	101,192
Level II Margin	4.0	8,818
Level III Margin	5.0	11,023
Total TLI Capability	75.1	165,567
Total ETO Capability	54.9	121,034

*Includes Lander Adapter

- **Earth to Orbit Derived Performance Requirement**
  - = Lander + L2MR + L3MR
  - > 45 t (CARD)
- **TLI Derived Performance Requirement**
  - = Lander + Orion + L2MR + L3MR
  - > 67 t (CARD)

- **ETO Mission Destination: 130 nmi, 29 degrees**
- **Loiter Duration 4 days (CARD TBD)**
- **TLI Maneuver Starting Conditions: 100 nmi, 29 degrees**
- **TLI delta-V = 3175 m/s + Gravity Loss**

Ares V Gross TLI Capability Requirement: Cargo Outpost Lander Mission

	Metric (mT)	English (lbm)
Lander (Cargo)*	54.5	120,152
Level II Margin	4.0	8,818
Level III Margin	5.0	11,023
Total TLI Capability	63.5t	139,994
Total ETO Capability	63.5t	139,994

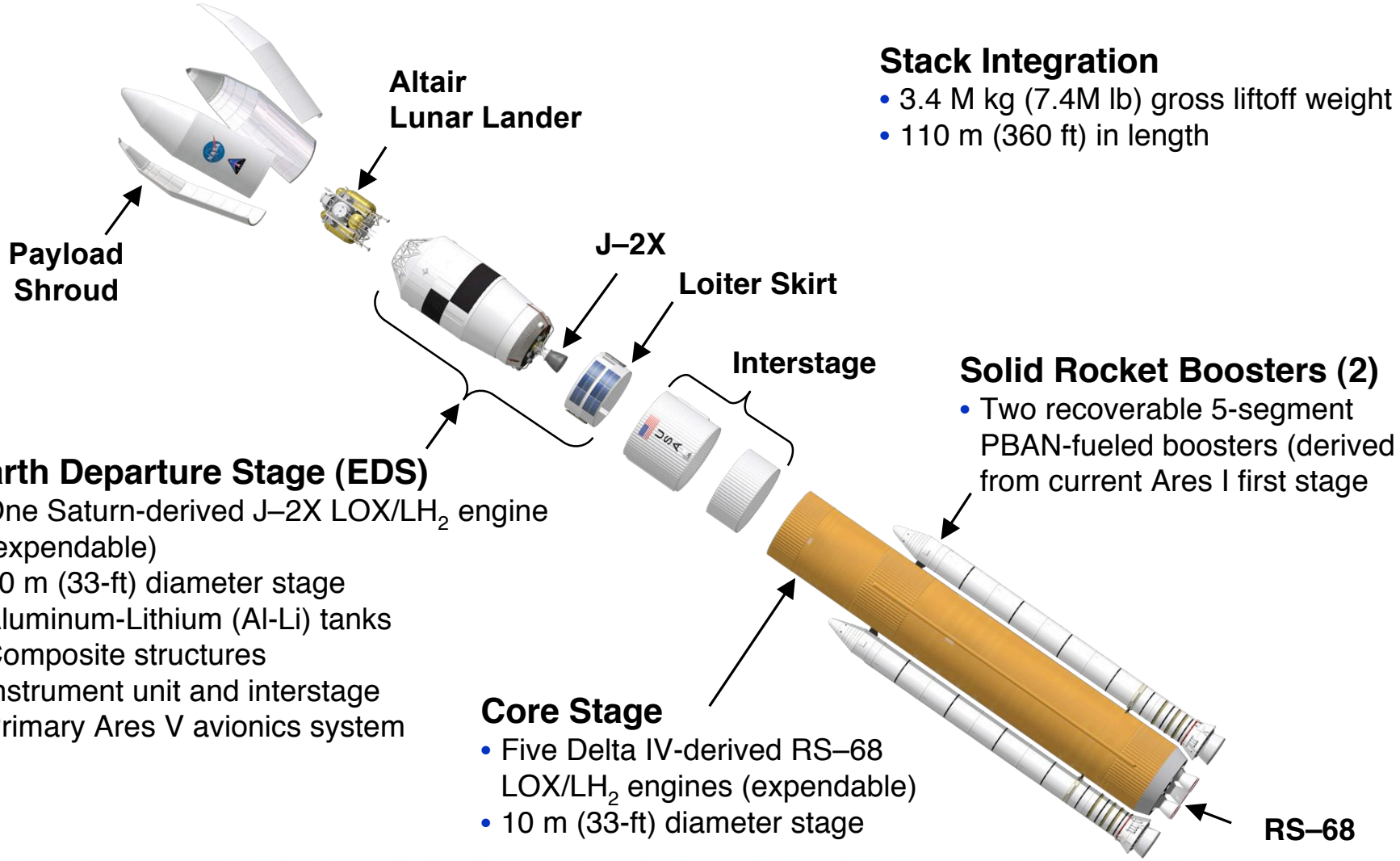
*Includes Lander Adapter

- **Earth to Orbit Derived Performance Requirement**
  - = Lander + L2MR + L3MR
  - > 54.6 t (CARD)
- **TLI Derived Performance Requirement**
  - = Lander + L2MR + L3MR
  - > 54.6 t (CARD)

- **ETO Mission Destination: Phasing Orbit**
- **Loiter Duration: None (no loiter capability on EDS)**

Note: Saturn V TLI Payload Capability was 48.6t (Apollo 17 - CM/SM/ LM/SLA), Ares V Earth-to-TLI requirement exceeds Saturn V Capability by 31%

Ares V Vehicle Architecture



Stack Integration

- 3.4 M kg (7.4M lb) gross liftoff weight
- 110 m (360 ft) in length

Earth Departure Stage (EDS)

- One Saturn-derived J–2X LOX/LH_2 engine (expendable)
- 10 m (33-ft) diameter stage
- Aluminum-Lithium (Al-Li) tanks
- Composite structures
- Instrument unit and interstage
- Primary Ares V avionics system

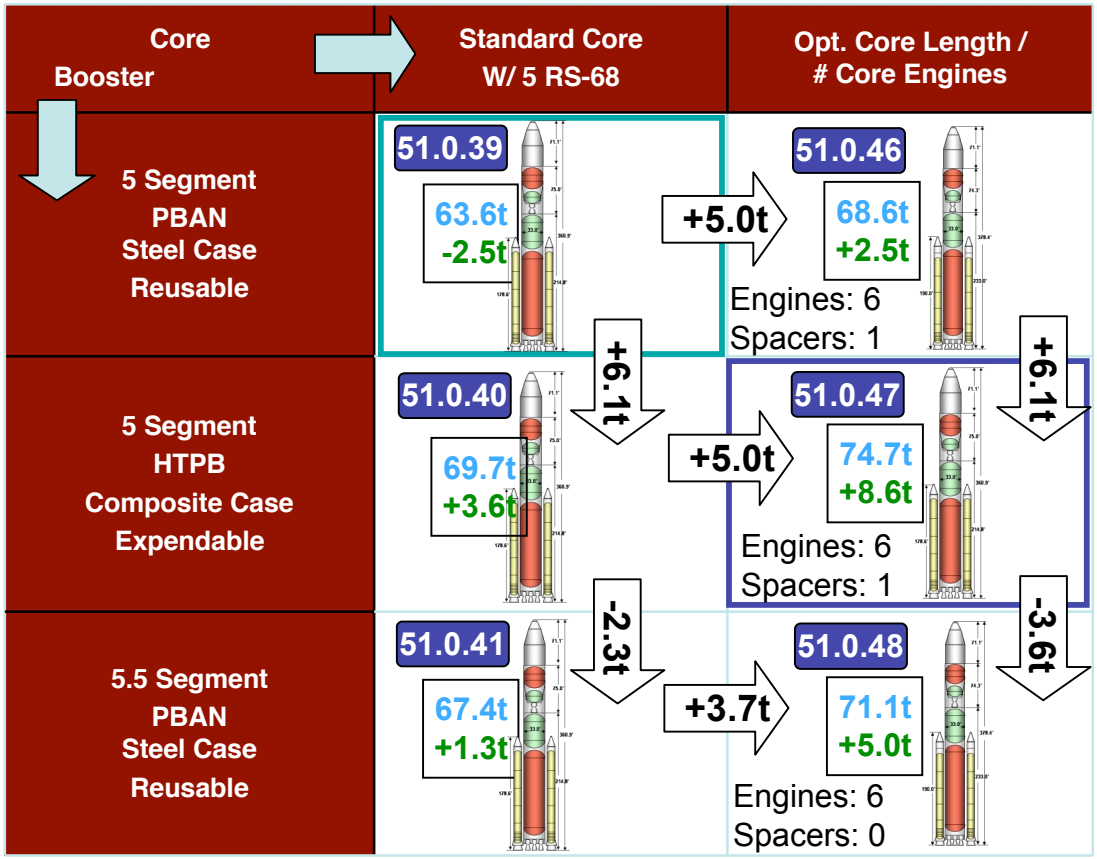
Solid Rocket Boosters (2)

- Two recoverable 5-segment PBAN-fueled boosters (derived from current Ares I first stage

Core Stage

- Five Delta IV-derived RS–68 LOX/LH_2 engines (expendable)
- 10 m (33-ft) diameter stage

Ares V Trade Space
(4-day Loiter, 29° Inclination, 130nmi Insertion, 100nmi TLI Departure)



Current Ground Rules and Assumptions

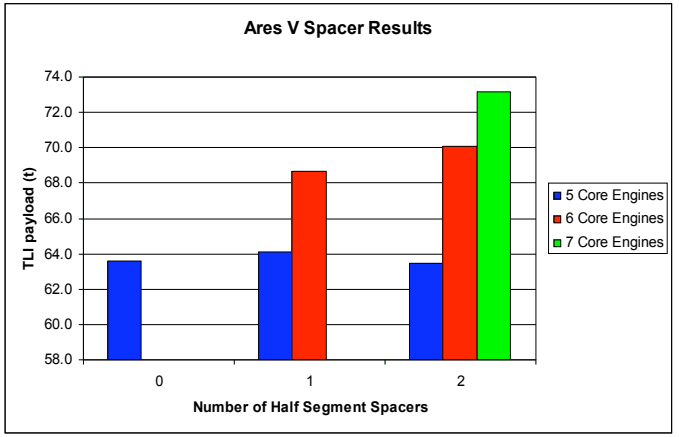
- TLI Payload Requirement: 75.1t
  - Lander (45.9t) + Orion (20.2t) + L2 Margin (4t) + L3 Margin (5t)

Note: L2/L3 Margin (green) is remaining capability above Lander/Adapter Mass. Performance (blue) is TLI Payload in conjunction with Ares I.

Common Ares V Vehicle Features

- Composite dry structures
  - Core, EDS, and Shroud
- Metallic Cryo tanks (Core & EDS)
- RS-68 (108%)
  - 414.2 sec, 797K lbf @ Vac
- Shroud: 10m diameter, 9.7m barrel length, 8.8m usable diameter

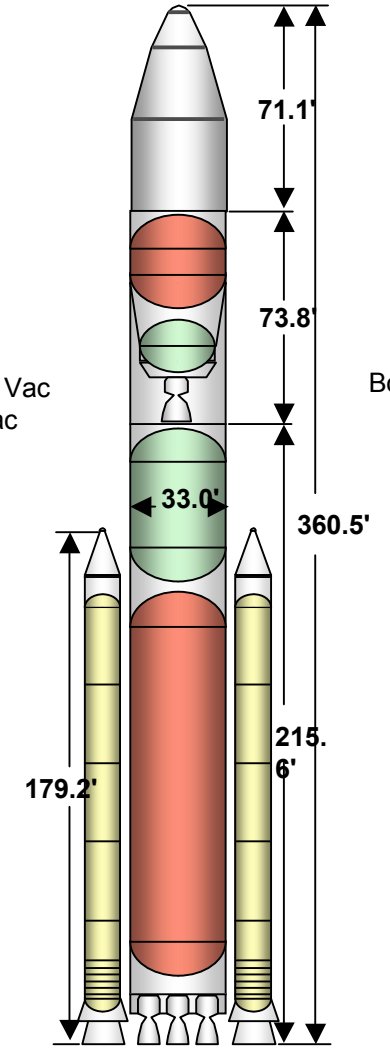
LCCR Study Reference | LCCR Study Upgrade



Ares V Reference Vehicle Configuration (51.0.39 Vehicle)

EDS Stage	**4 day LEO loiter**
Propellants	LOX/LH2
Usable Propellant	516,953 lbm
Propellant Offload	0.0 %
Stage liftoff pmf	0.8808
Launch Dry Mass	50,144 lbm
TLI Burnout Mass	55,287 lbm
Suborbital Burn Propellant	310,000 lbm
Pre-TLI Jettison Mass	6,895 lbm
LEO FPR	7,804 lbm
# Engines / Type	1 / J-2X
Engine Thrust (100%)	294,000 lbf / 238,000 lbf @ Vac
Engine Isp (100%)	448.0 sec / 449.0 sec @ Vac
Mission Power Level	100.0 % / 81.0 %
Suborbital Burn Time	472.4 sec
TLI Burn Time	390.4 sec

Delivery Orbit	1.5 Launch TLI
LEO Delivery	130 nmi circular @ 29.0°
TLI Payload from 100 nmi	140,177 lbm (63.6 t)
CEV Mass	44,500 lbm (20.2 t)
LSAM Mass	95,677 lbm (43.4 t)
Insertion Altitude	131.6 nmi
T/W @ Liftoff + 1 sec	1.34
Max Dynamic Pressure	623 psf
Max g's Ascent Burn	3.90 g
T/W @ SRB Separation	1.32
T/W Second Stage	0.43
T/W @ TLI Ignition	0.58



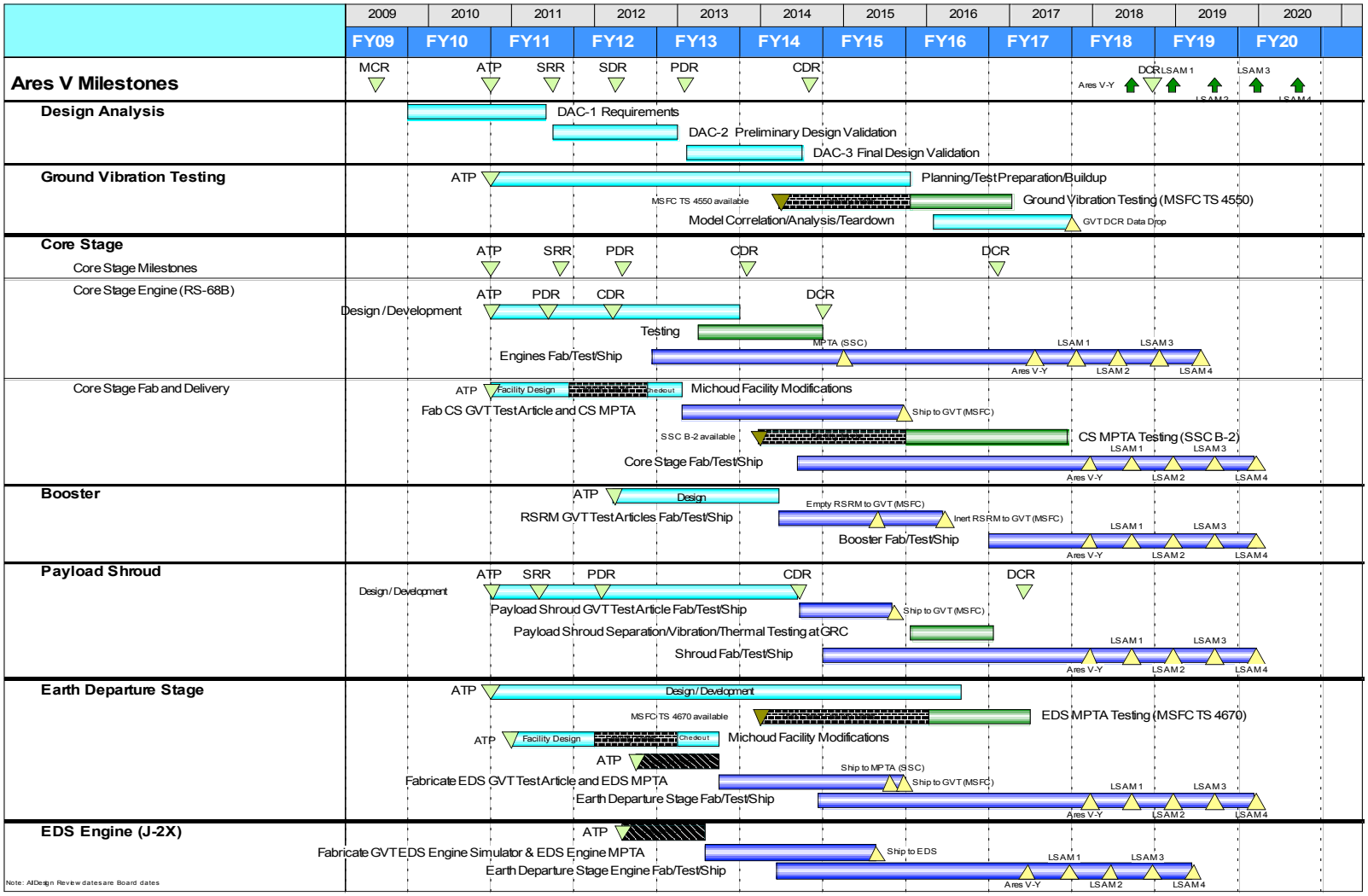
GLOW	**7,440,326 lbf**
Payload Envelope L x D	25.3 ft x 30.0 ft
Shroud Jettison Mass	19,388 lbm

Booster (each)	
Propellants	PBAN (262-07 Trace)
Overboard Propellant	1,390,548 lbm
Stage pmf	0.8628
Burnout Mass	221,175 lbm
# Boosters / Type	2 / 5 Segment SRM
Booster Thrust (@ 1.0 sec)	3,571,974 lbf @ Vac
Booster Isp (@ 1.0 sec)	272.8 sec @ Vac
Burn Time	125.9 sec

Core Stage		
Propellants	LOX/LH2	
Usable Propellant	3,164,794 lbm	
Propellant Offload	0.0 %	
Stage pmf	0.9052	
Dry Mass	296,952 lbm	
Burnout Mass	331,411 lbm	
# Engines / Type	5 / RS-68	
Engine Thrust (108%)	702,055 lbf @ SL	797,000 lbf @ Vac
Engine Isp (108%)	360.8 sec @ SL	414.2 sec @ Vac
Mission Power Level	108.0 %	
Core Burn Time	328.9 sec	

Interstage	Core/EDS
Dry Mass	18,672 lbm

Summary Schedule



Forward Work

- **Support to LCCR architecture and requirements analysis - June LCCR**
- **Integrated Vehicle and Core Stage detailed study - Feb- July**
- **EDS detailed trade studies and design concepts - July 07-Oct 08**
- **Wind tunnel testing - April**
- **Ares I avionics extensibility assessment to Ares V Earth Departure Stage Instrument Unit - Jan-Oct.**