

National Aeronautics and Space Administration



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American Astronautical Society

Wernher von Braun

Memorial Symposium

October 21, 2008

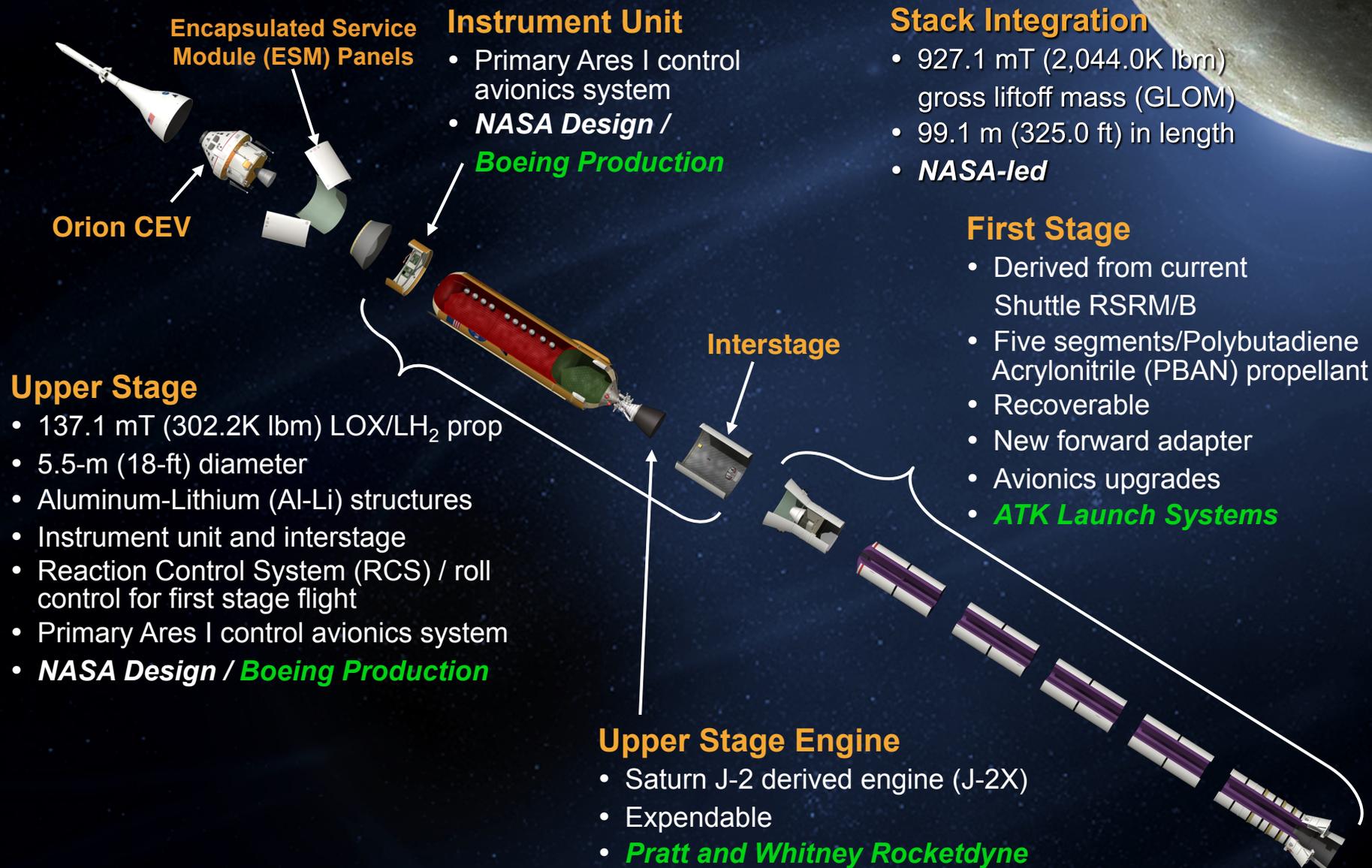


Ares I Integration Approach

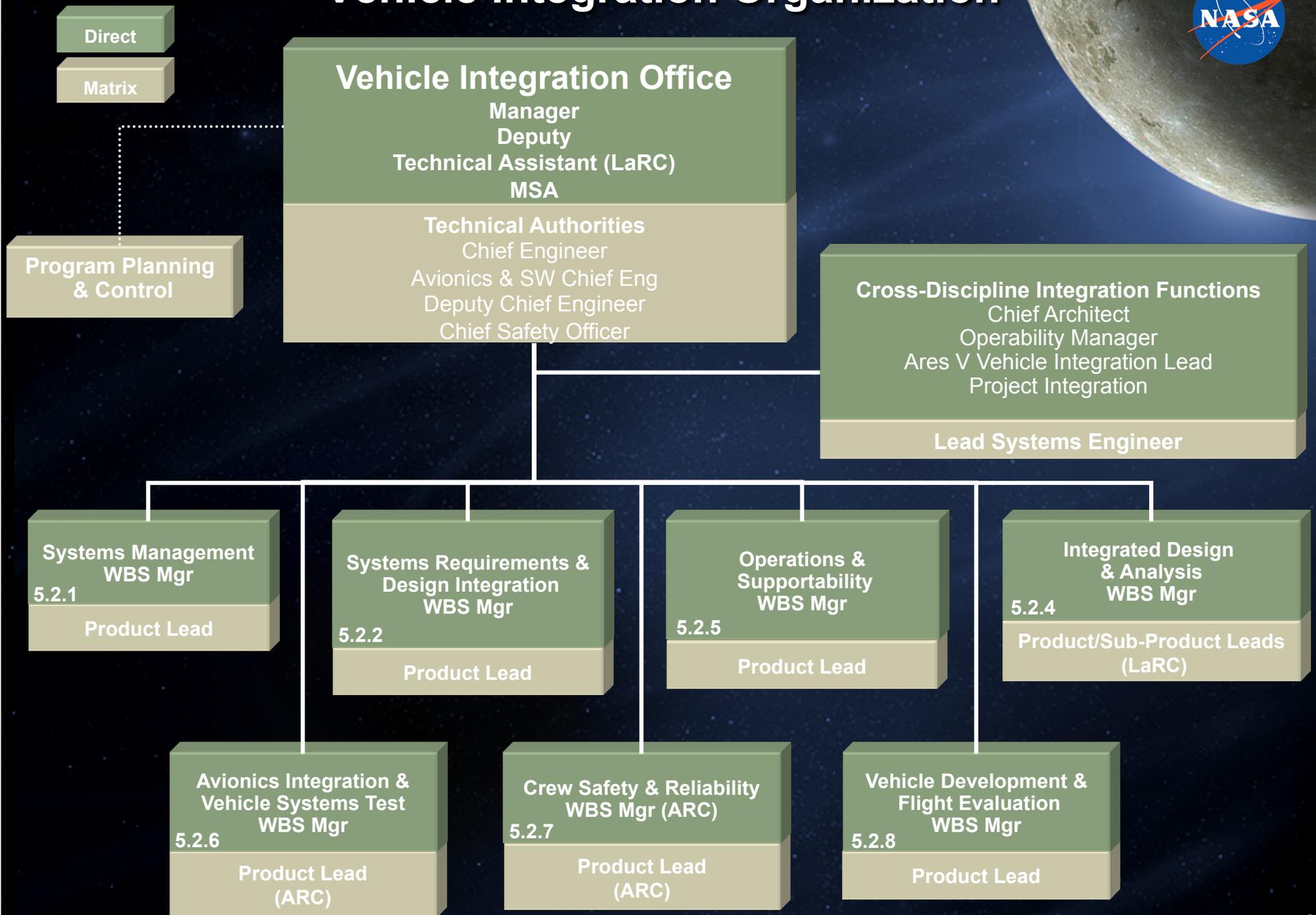
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Ares I Elements

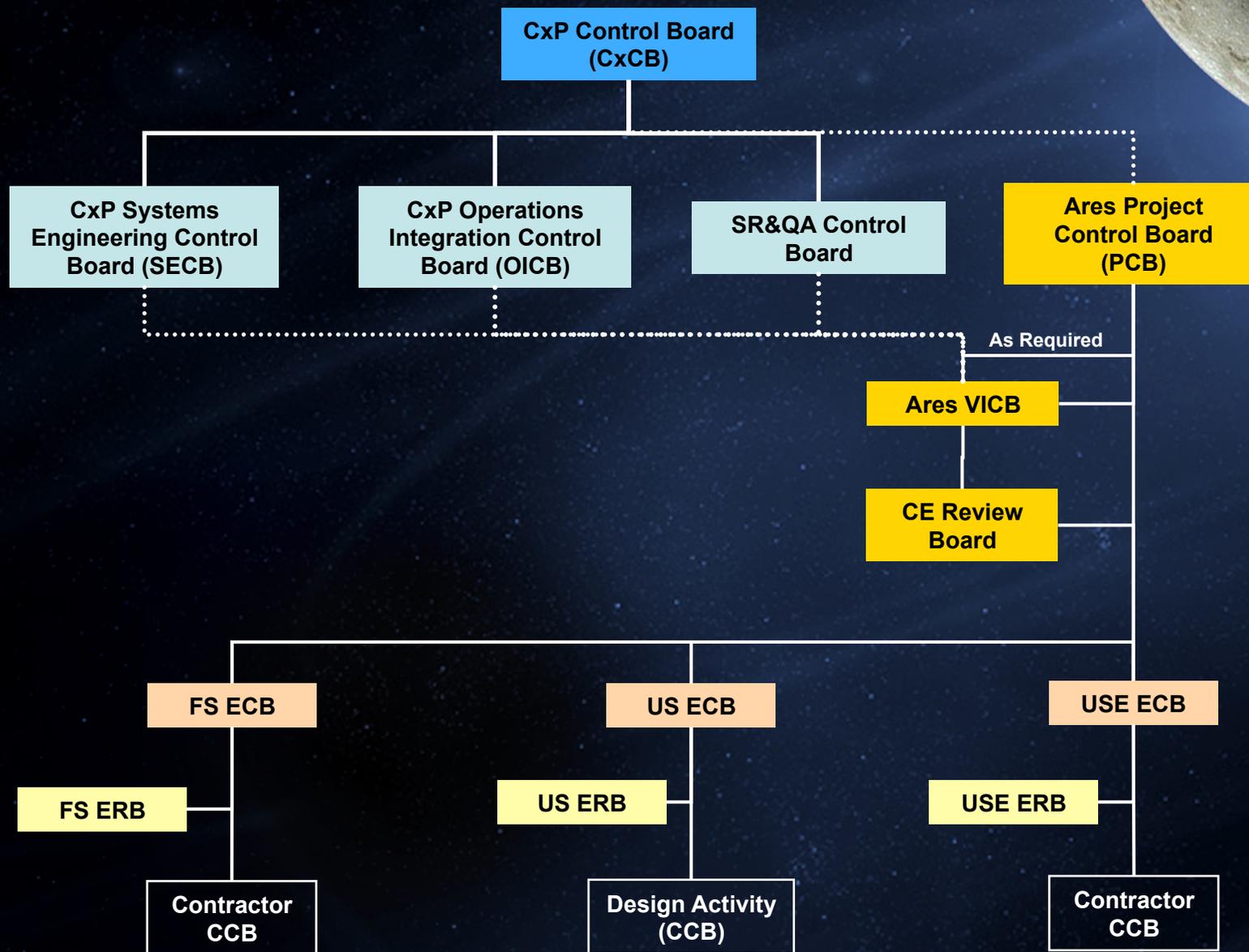


Vehicle Integration Organization



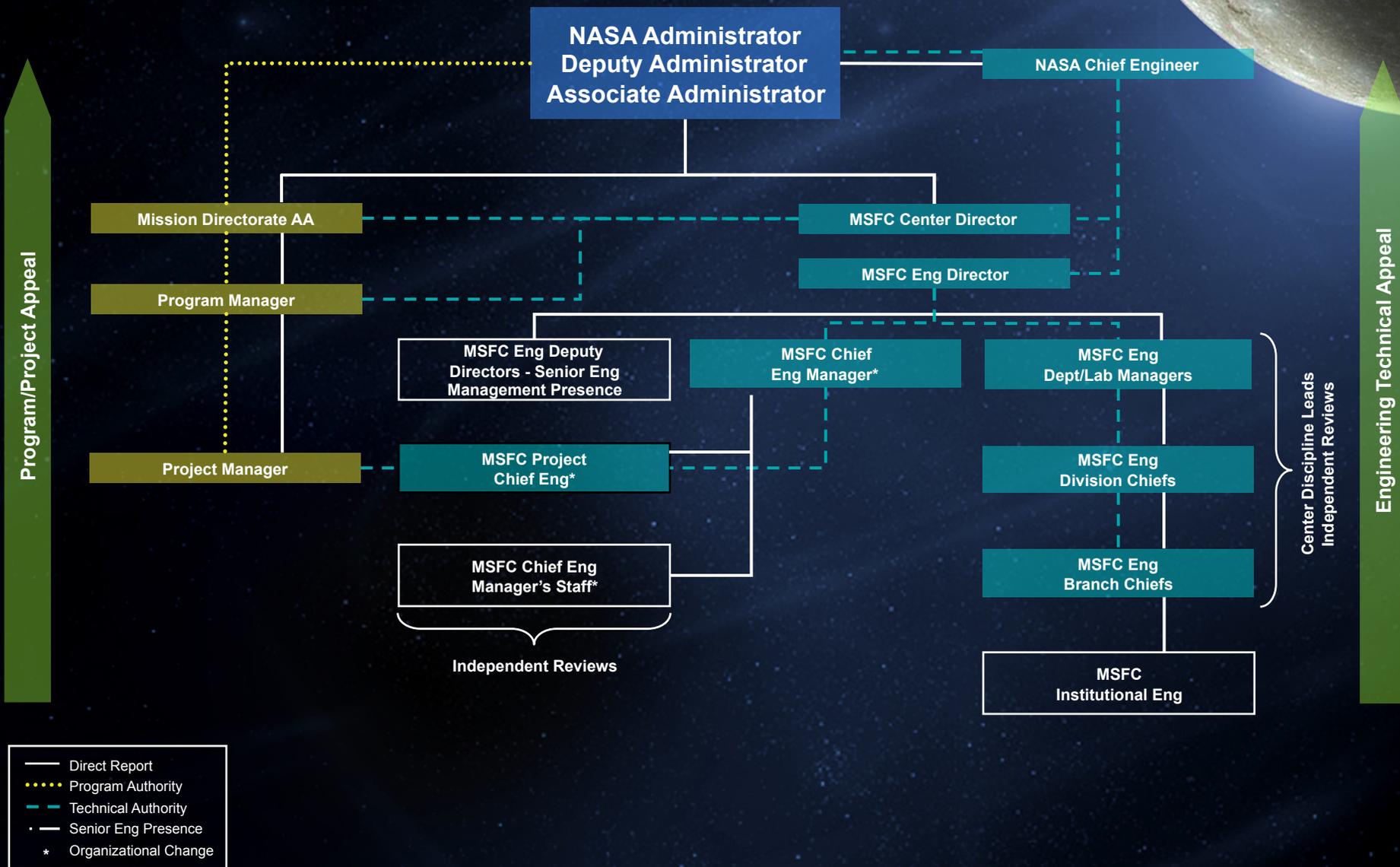


Integration Control Process





Technical Authority



Ares Integrated Launch Vehicle Responsibilities



Maximum Dynamic Pressure

Time = 58.6 sec
 Altitude = 39,669 ft
 Mach = 1.60
 Dynamic Pressure = 767 psf

Maximum Axial Acceleration

3.79 g

Main Engine Start

Time = 126.9 sec

Main Engine Cutoff (MECO)

Time = 590.7 sec
 Burn Duration = 463.8 sec

Spacecraft Separation

Time from Single Engine Cutoff (SECO) to Apogee

Altitude = 70 nmi
 -20.4 x 185,200 m
 -11.0 x 100.0 nmi = 21.7 min

Launch Abort System (LAS) Jettison

Time = 156.9 sec
 Altitude = 269,191 ft
 Mach = 7.14

Solid Rocket Booster (SRB) Separation

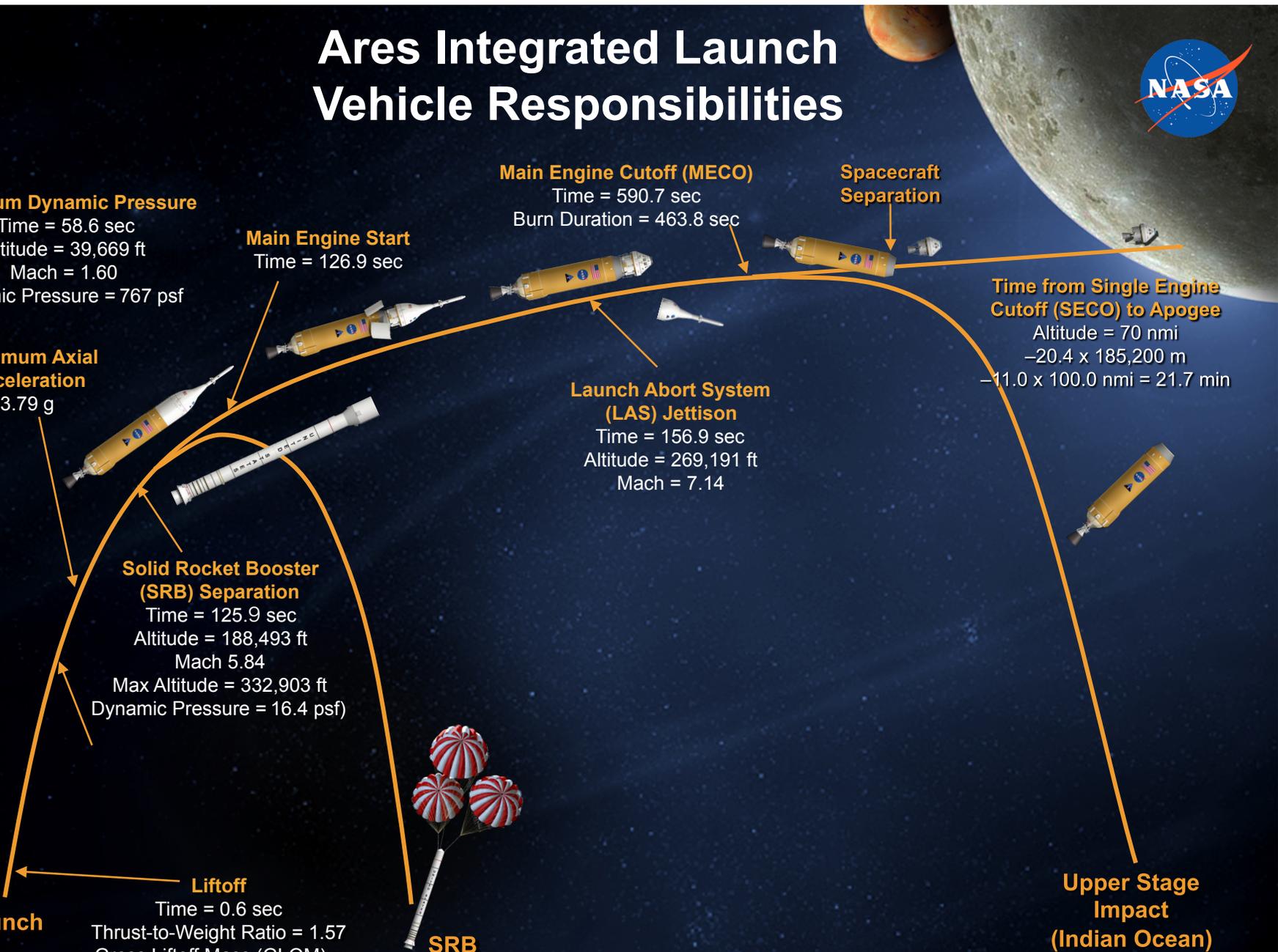
Time = 125.9 sec
 Altitude = 188,493 ft
 Mach 5.84
 Max Altitude = 332,903 ft
 Dynamic Pressure = 16.4 psf)

Liftoff

Time = 0.6 sec
 Thrust-to-Weight Ratio = 1.57
 Gross Liftoff Mass (GLOM) = 2,043,946 lbm

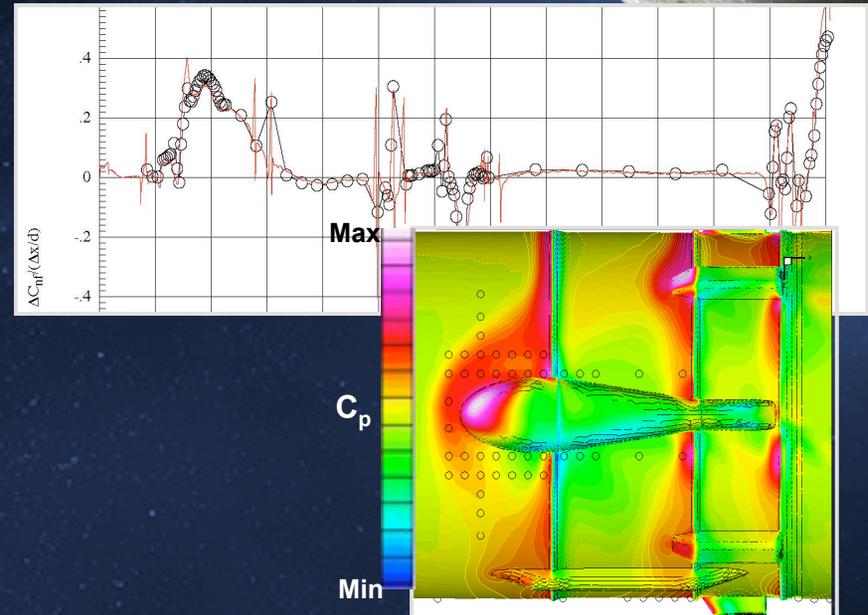
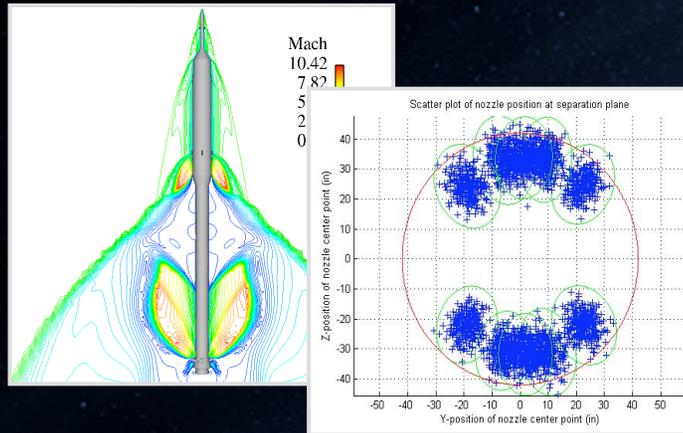
SRB Splashdown

Upper Stage Impact (Indian Ocean)



Reference and Design Trajectories

Ares Integrated Launch Vehicle Responsibilities



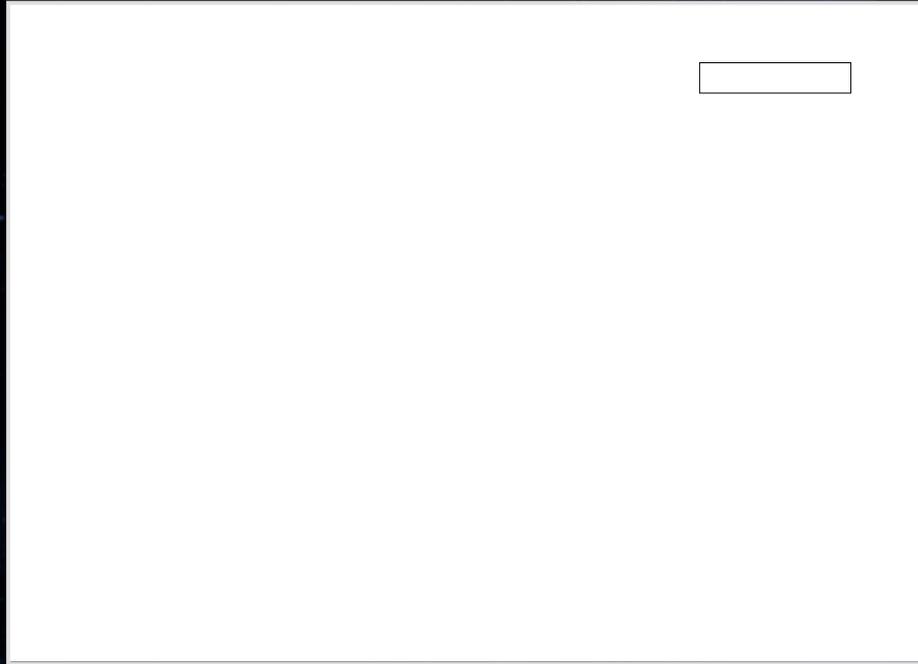
First Stage/Upper Stage Separation Analyses

Aerodynamics
 - Wind Tunnel Testing
 - CFD

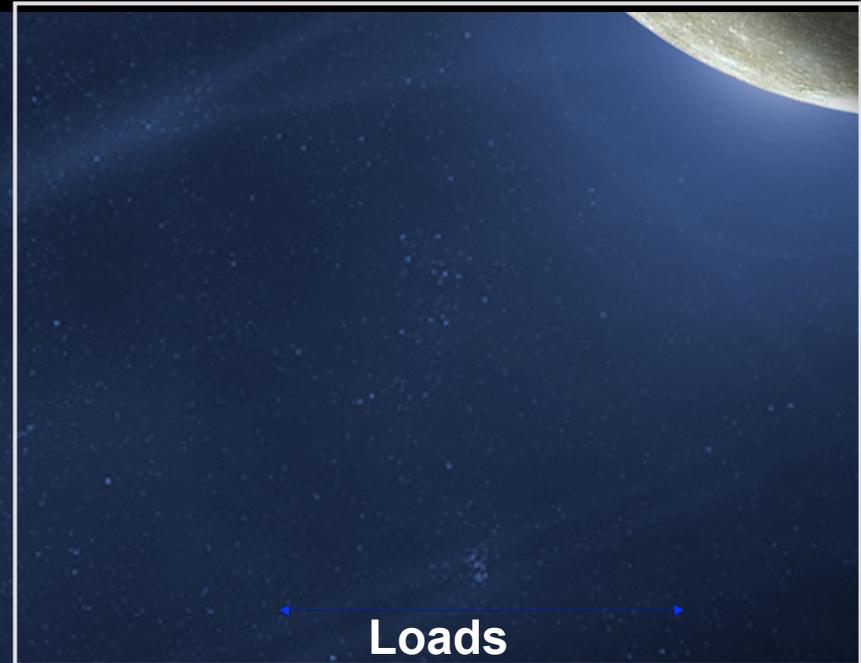
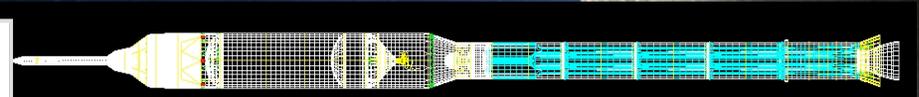
ADAC-2B 1% Force & Moment Testing



Ares Integrated Launch Vehicle Responsibilities



Reference & Design Trajectories

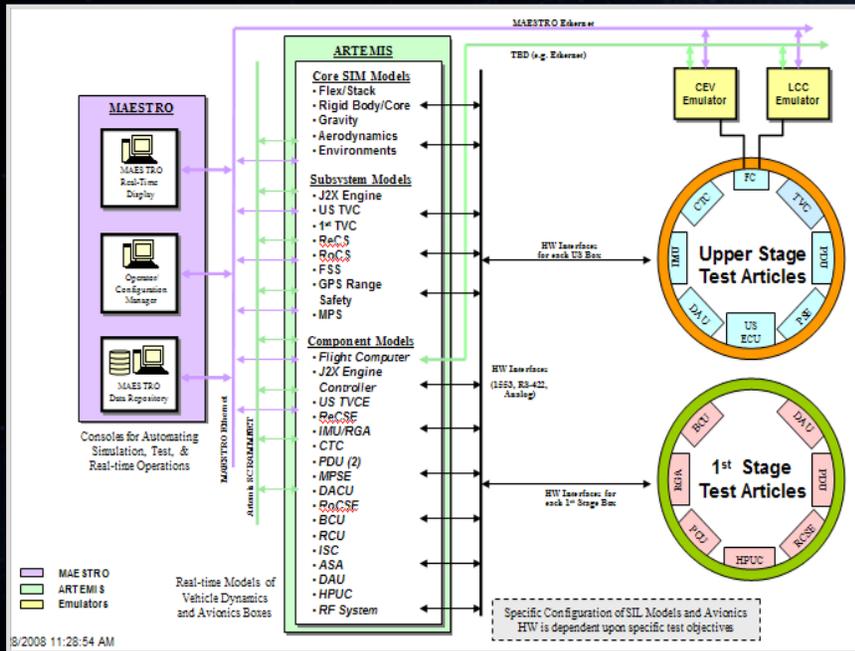


Loads



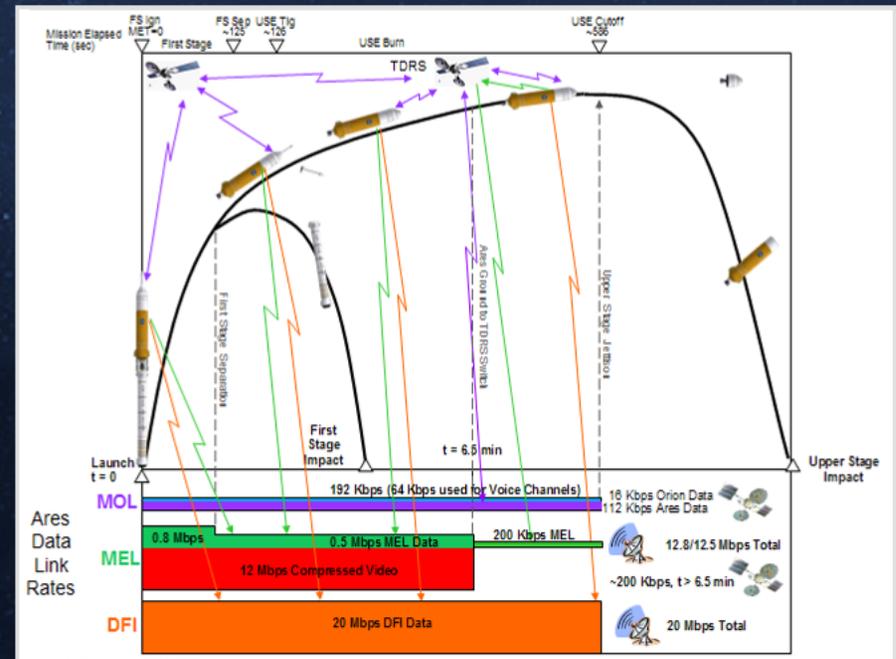
Guidance, Navigation & Flight Control

Ares Integrated Launch Vehicle Responsibilities



Systems Integration Lab

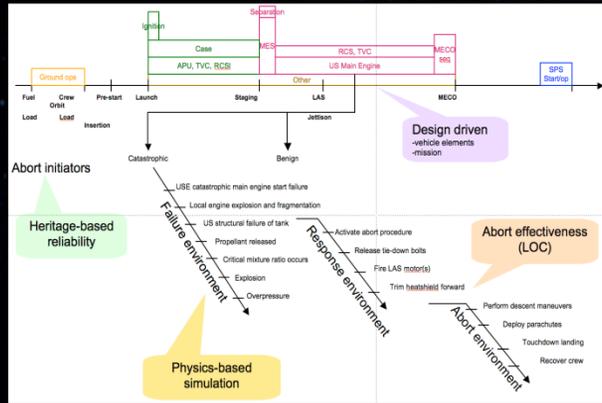
Communications



Ares Integrated Launch Vehicle Responsibilities

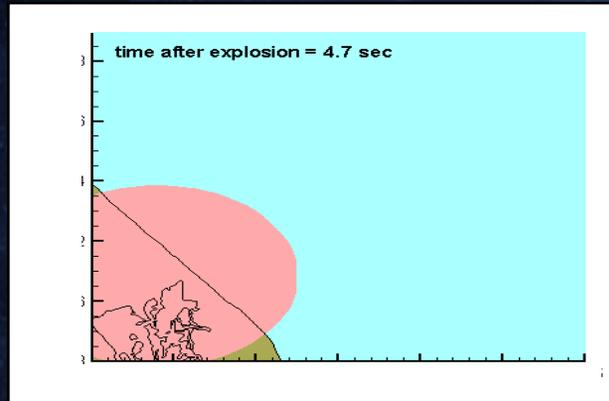


Ascent Risk Assessments, Hazards Controls, FMEAs

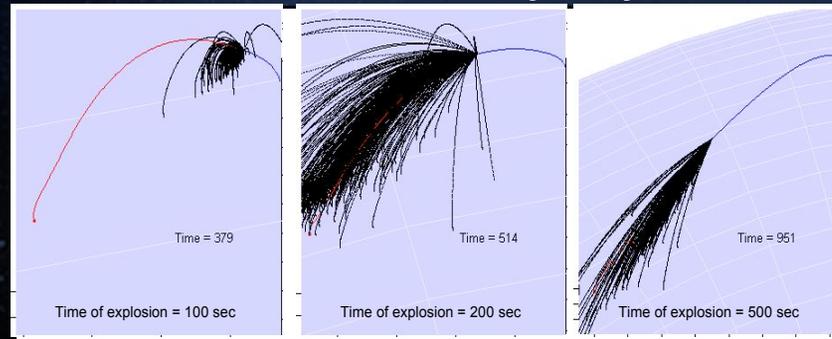


Integrated Ares I Ascent Abort Risk Assessment Model

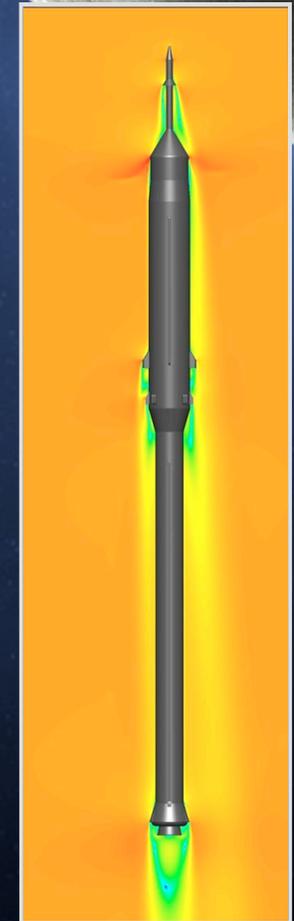
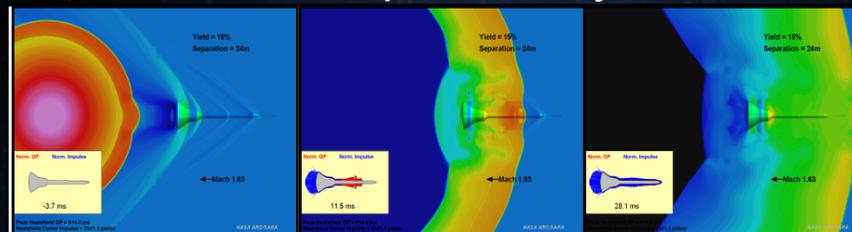
Fireball Environment Analysis



Debris Strike Probability Analysis



Blast Overpressure Analysis

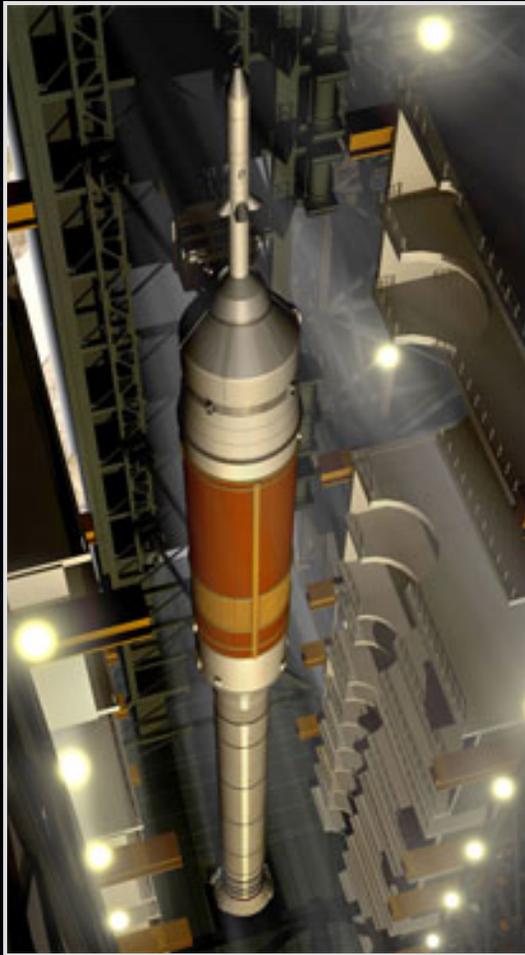


High-fidelity CFD Simulations

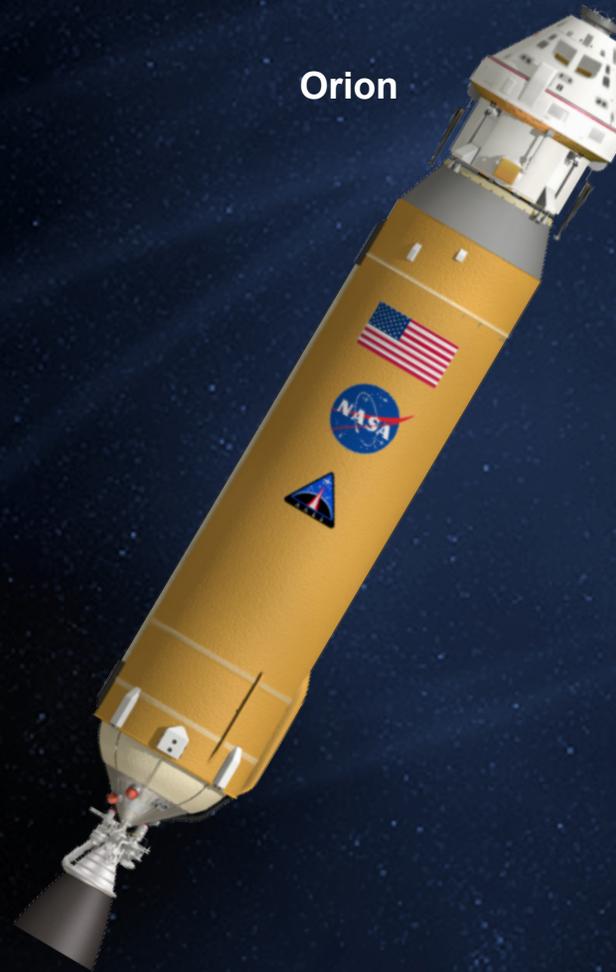
Failure	LOM	LOC (with detection)
Failure 1	2.23E-04	1.52E-04
Failure 2	1.53E-04	1.53E-04
Failure 3	1.36E-04	1.36E-04
Failure 4	1.13E-04	1.06E-04
Failure 5	7.00E-05	1.61E-04
Failure 6	2.58E-05	2.60E-05
Failure 7	2.60E-05	6.24E-04
Failure 8	2.60E-05	1.70E-05
Failure 9	7.00E-06	1.01E-04
Failure 10	7.00E-06	1.03E-04
Failure 11	7.00E-06	1.09E-04
Failure 12	7.00E-06	7.90E-05
Failure 13	6.00E-06	9.50E-05
Failure 14	6.00E-06	4.60E-05
Failure 15	4.60E-05	5.00E-06
Failure 16	3.00E-06	1.03E-04
Failure 17	3.00E-06	3.30E-05
Failure 18	4.60E-05	2.00E-06
Failure 19	5.20E-05	1.00E-06
Failure 20	1.00E-05	1.00E-06
Failure 21	1.00E-05	0.00E+00

Loss of Mission (LOM) and Loss of Crew (LOC) Probabilities for Ares I Ascent

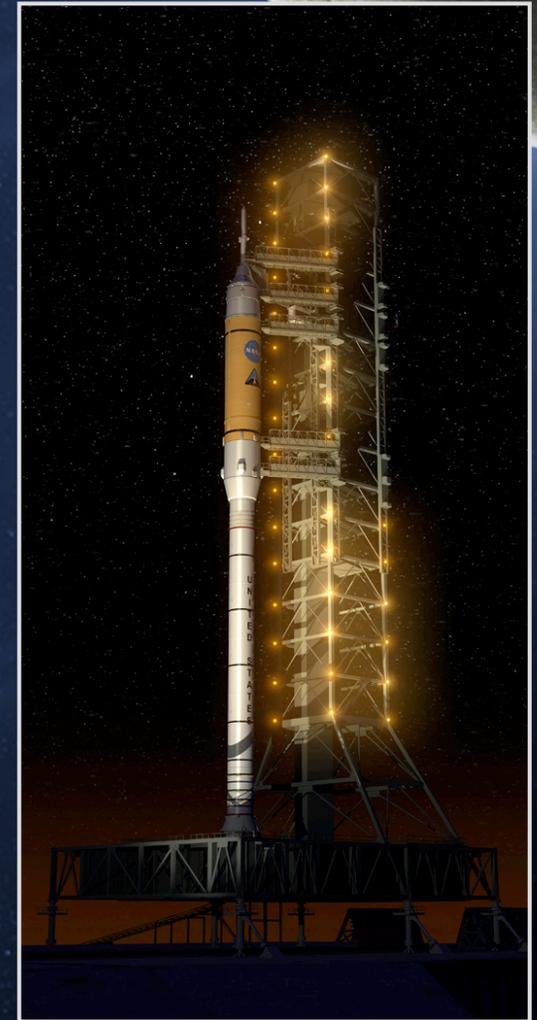
Constellation Inter-Project Interfaces



**Vehicle Assembly
Operation**

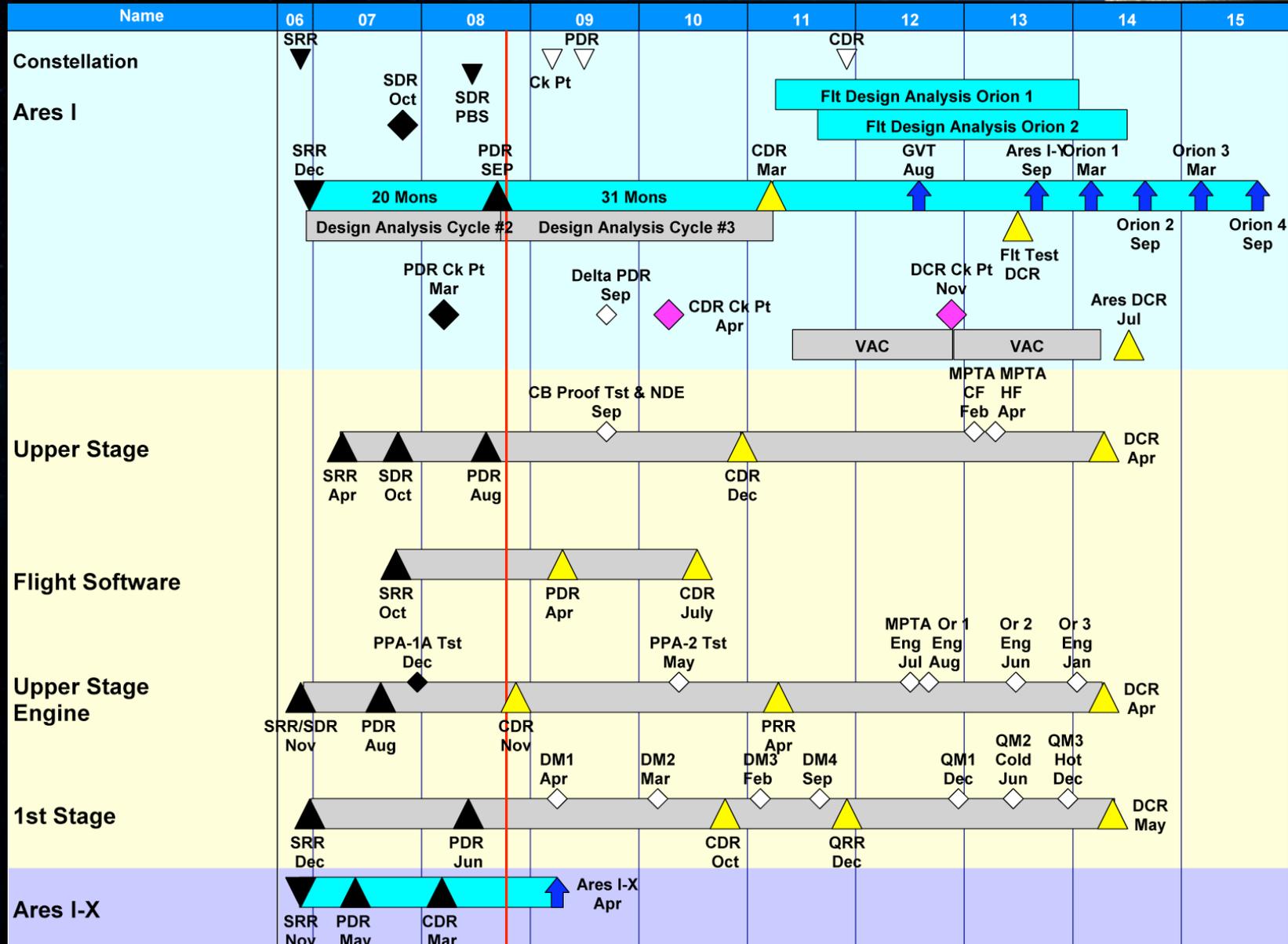


Orion



**Launch Pad
Operation**

Ares Project Milestones

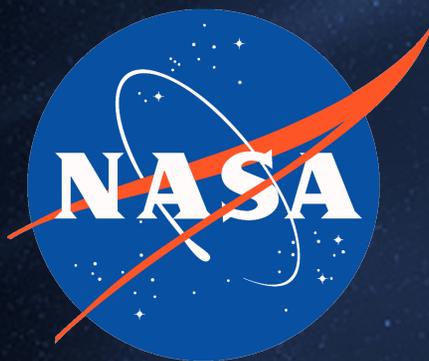


Preliminary Design Review Results



- ◆ Excellent support and participation from across the Agency
- ◆ Significant progress from System Definition Review to Preliminary Design Review:
 - Requirements and their flowdown are stabilizing
 - Products were of high quality commensurate with the design phase
 - Excellent incorporation of safety and mission assurance early in the design
- ◆ Areas for increased emphasis exist:
 - Incorporation of thrust oscillation mitigation into design
 - Environments and staging events have design challenges
 - Interface control and control of analytical models
 - Maturation of integrated test planning
 - Improve fidelity of critical risk mitigation plans
 - Emphasize incorporating additional operability into design

***Unanimous agreement from the PDR Board that
Ares I is ready to proceed to CDR***



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