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Ares I Integration Approach
Ares I Elements

**First Stage**
- Derived from current Shuttle RSRM/B
- Five segments/Polybutadiene Acrylonitrile (PBAN) propellant
- Recoverable
- New forward adapter
- Avionics upgrades
- ATK Launch Systems

**Upper Stage**
- 137.1 mT (302.2K lbm) LOX/LH₂ prop
- 5.5-m (18-ft) diameter
- Aluminum-Lithium (Al-Li) structures
- Instrument unit and interstage
- Reaction Control System (RCS) / roll control for first stage flight
- Primary Ares I control avionics system
- NASA Design / Boeing Production

**Stack Integration**
- 927.1 mT (2,044.0K lbm) gross lift off mass (GLOM)
- 99.1 m (325.0 ft) in length
- NASA-led

**Instrument Unit**
- Primary Ares I control avionics system
- NASA Design / Boeing Production

**Upper Stage Engine**
- Saturn J-2 derived engine (J-2X)
- Expendable
- Pratt and Whitney Rocketdyne

**Orion CEV**

**Encapsulated Service Module (ESM) Panels**
Ares Integrated Launch Vehicle Responsibilities

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

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

Main Engine Start
- Time = 126.9 sec

Main Engine Cutoff (MECO)
- Time = 590.7 sec
- Burn Duration = 463.8 sec

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

Launch Abort System (LAS) Jettison
- Time = 156.9 sec
- Altitude = 269,191 ft
- Mach = 7.14

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

Upper Stage Impact (Indian Ocean)

Reference and Design Trajectories
Ares Integrated Launch Vehicle Responsibilities

Aerodynamics
- Wind Tunnel Testing
- CFD

First Stage/Upper Stage Separation Analyses

ADAC-2B 1% Force & Moment Testing

LaRC Unitary Plan Wind Tunnel
Oct 22 – Nov 12, 2007
255 Runs Completed

Boeing Polysonic Wind Tunnel
Nov 26 – 29, 2007
299 Runs Completed

255 Runs Completed

National Aeronautics and Space Administration
Ares Integrated Launch Vehicle Responsibilities

Systems Integration Lab

Communications
Ares Integrated Launch Vehicle Responsibilities

Ascent Risk Assessments, Hazards Controls, FMEAs

Fireball Environment Analysis

Debris Strike Probability Analysis

Blast Overpressure Analysis

High-fidelity CFD Simulations

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

National Aeronautics and Space Administration
Constellation Inter-Project Interfaces

Vehicle Assembly Operation

Orion

Launch Pad Operation
## Ares Project Milestones

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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
www.nasa.gov/ares