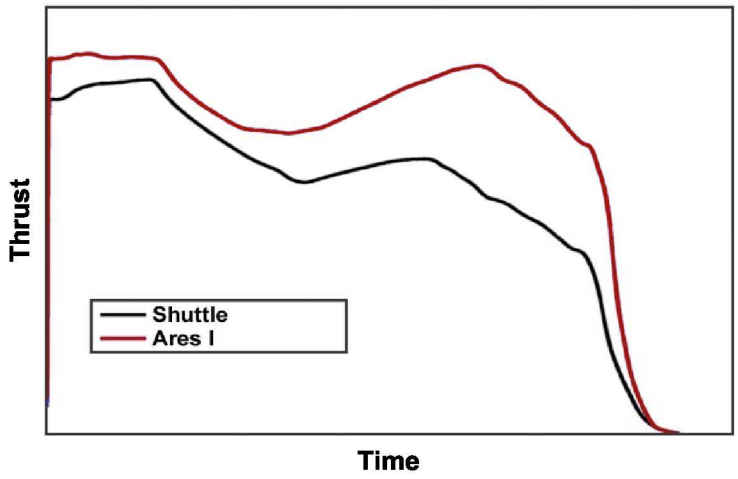
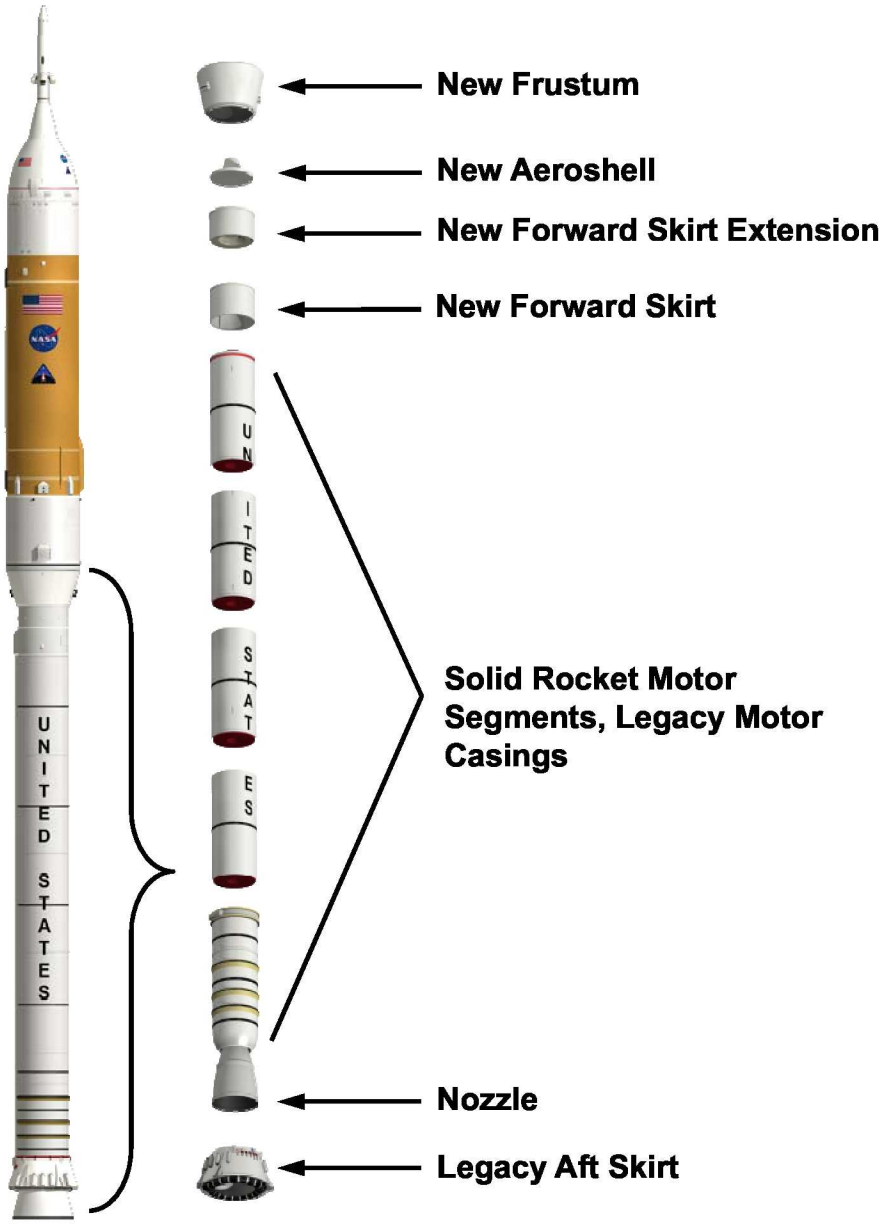
Ares I First Stage Overview

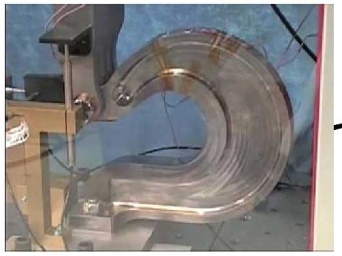
- **Shuttle-Derived Five-Segment Solid Rocket Booster**
  - Increased performance
  - Extensibility to Ares V
- **Metal and Composite Materials**
- **Specs**
  - Mass: 732 mT (1,614 K lbm)
  - Max thrust (vac): 16 MN (3.6 M lbf)
  - Burn duration: 126 sec
  - Height: 53 m (174 ft)
  - Diameter: 3.7 m (12 ft)



Thrust trace comparison: Shuttle versus Ares I



Ares I First Stage

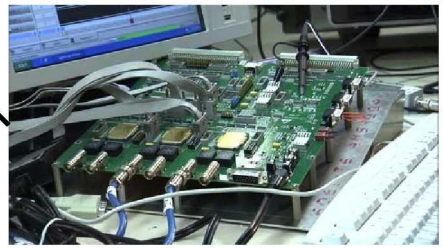


C-Spring isolators

Tumble motors (from Shuttle)

New 150-ft diameter
Kevlar parachutes

Asbestos-free insulation/liner.
Thickness changes will be modified
during Development Motor testing



Modern state-of-the-art electronics

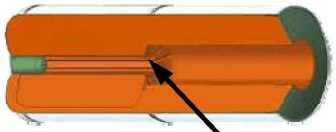
PBAN propellant optimized
for Ares application

Same cases and joints as Shuttle.
O-ring materials change eliminated heaters

Same aft skirt and thrust
vector control as Shuttle

Booster deceleration motors (from Shuttle)

Ares First Stage Upgrades



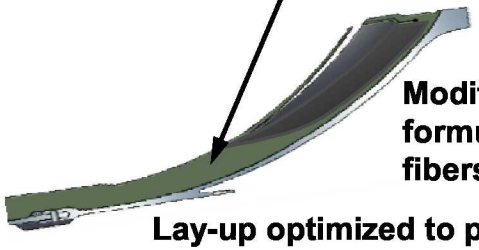
Propellant
- Formulation was modified
- Burn rate lowered to meet Ares I requirements
- New grain design
- 8-year propellant life certification

New Nozzle

Joint O-ring upgrades
Added segment

Propellant chamfers on aft and center segments

Modified height and thickness of inhibitor



Modified insulation and liner formulations to eliminate Chrysotile fibers

Lay-up optimized to provide additional thermal protection

The Avionics System

New State-of-the-art Electronics

- **3-channel single fault avionics system**
- **Six Line Replaceable Units (LRUs)**
  - BCPDU – Booster Controller and Power Distribution
  - DARU – Data Acquisition and Recording Unit
  - ISC – Ignition Separation Controller
  - RCU – Recovery Control Unit
  - HPUC – Hydraulic Power Unit Controller
  - ACU – Actuator Control Unit
- **All use the same chassis**
- **The connector cover plates will each be unique**
- **The LRUs all meet the 45-pound human factor requirement**
- **Subassemblies are removable and testable**

Built Up Data Acquisition System (DAS) Module Used within all Units

Built Up Initiator Firing Circuit (IFC) Module PWB - ISC/RCU

ISC/RCU Interface Module (IRIM) – ISC/RCU

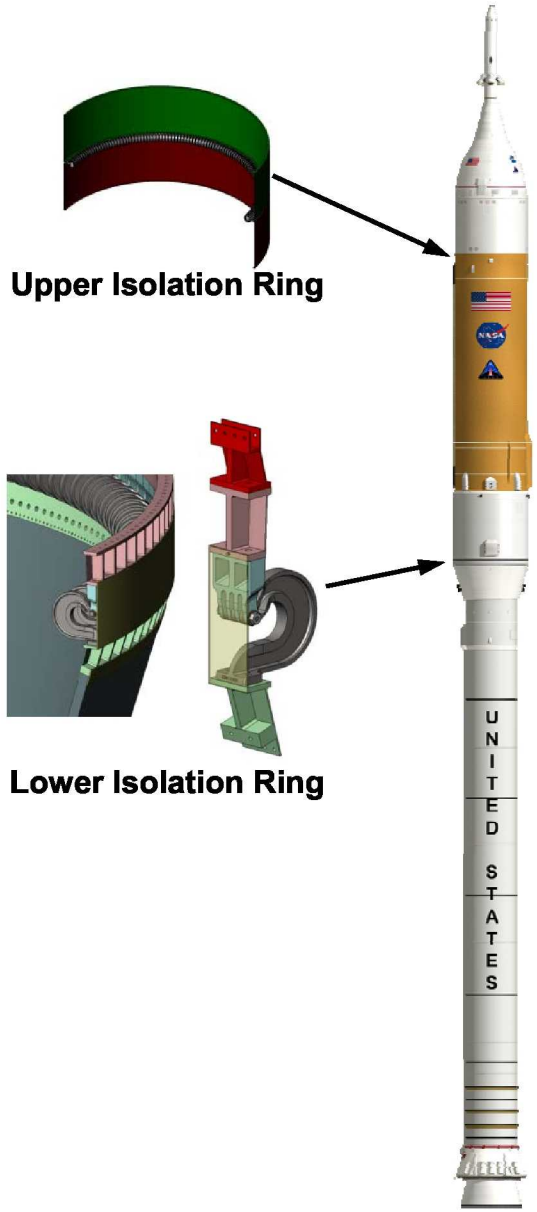
Built Up Excitation Output Module (EOM) PWB - DARU

Avionics Box Mock-up
LRU 1st Generation Engineering Boards

First Stage Thrust Oscillation

Status:

- June Program Review was completed with decision to baseline and implement Dual Plane (DP) Isolation
- Technical Solutions exist for multiple options
- Designs are in testing



Four basic ways to attack problem:

- Reduce forcing function
- Detune system response away from forcing function frequency
- Actively create an opposing forcing function
- Passively absorb forcing function

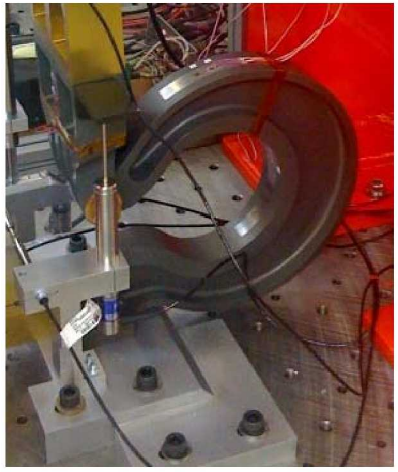
◆ Mitigation Options ◆ Baseline Design

First Stage Testing Accomplishments

Parachute Drop Testing
Yuma Proving Ground, AZ

DM-1 Igniter Test
Promontory, UT

Ares I-X Forward Skirt Extension Separation Test
Promontory, UT



Thrust Oscillation Component Testing

DM-1 Test Conducted on Sept 10, 2009

Promontory, UT

Ares I-X First Stage Accomplishments

Ares I-X Motor En Route to KSC
Corinne, UT

Ares I-X Forward Assembly Transfer to VAB
Kennedy Space Center, FL

Ares I-X
Kennedy Space Center, FL

First Stage Progress to Date

- **Ares I first stage design is robust and progressing rapidly**
  - Avionics
  - Major structures
  - Motor
  - Deceleration system
- **Major test program milestones achieved:**
  - Recovery system testing
    - 7 of 14 parachute drop tests completed to date (Drogue, Main, Cluster)
  - Avionics systems have begun testing
  - First of 4 development motors (DM-1) has been fired
    - Preliminary data looks good and well within expectations
    - DM-2 manufacture underway
- **Ares I-X hardware delivered and assembled at KSC**
  - Completed all Hardware Acceptance Reviews
  - Motor segments were completed and shipped to KSC in March 2009
  - Launch scheduled for no earlier than October 31, 2009

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