Ares Project Status

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Exploration Launch

Ares: The Right Vehicle for NASA's Exploration Mission

- The Ares I Crew Launch Vehicle (CLV) and Ares V Cargo Launch Vehicle (CaLV) are being designed to reduce cost and development time while meeting safety and performance requirements.
- These Shuttle-derived vehicles will also be able to meet the Nation's space goals of establishing a sustained presence on the moon and then go on to Mars and other destinations.
- These vehicles will, literally, extend U.S. stewardship and regular access of space beyond the coastal regions of low-Earth orbit.
- Compared to other vehicle options, such as EELVs, this approach is by far the right one to meet these integrated cost, performance and mission objectives.

An Architecture Selection Grounded in Analysis

Several recent studies demonstrate that a Shuttle-derived architecture makes the most sense for NASA from a life-cycle cost, safety, and reliability perspective.

- NASA Exploration Systems Architecture Study (ESAS) in 2005 recommended this approach based on significant analysis
- Supported in Law through the NASA Authorization Act of 2005 (Section 502)
- Department of Defense (DoD) validated this conclusion in August, 2005 (letter to John Marburger* from Ronald Sega** and Michael Griffin***)
- The October, 2006 Congressional Budget Office report entitled "Alternatives for Future U.S. Space-Launch Capabilities" is consistent with NASA's analysis and decisions.

* *Director, White House Office of Science and Technology Policy*
** *Under Secretary of the Air Force*
*** *NASA Administrator*

Improving on the ESAS Launch Recommendations

- ESAS was a "point of departure" exploration architecture
- Post-ESAS analysis has demonstrated there is a more streamlined way to regain access to the Moon, and based on detailed analysis, NASA decided to reduce the total number of program developments required to enable the Ares family
- Key element: Better focuses the architecture on exploration as the primary mission, vs. ISS then exploration

Improving on the ESAS Launch Recommendations

- **This approach focuses on developing key technologies sooner. For example:**
  - **5 segment stage for Ares I and V**
    - Saves hundreds of millions of dollars
  - **J-2X as the common upper stage engine for both Ares I and Ares V**
    - Saves hundreds of millions of dollars
  - **Use of the commercially developed RS-68 engine as the core engine for Ares V**
    - Saves billions of dollars over the life cycle

Progress made on the Ares I is now a significant and direct "down payment" on the Ares V. Selecting common hardware reduces cost and gets us closer to enabling a lunar transportation system.

Ares: Building on Proven Capabilities

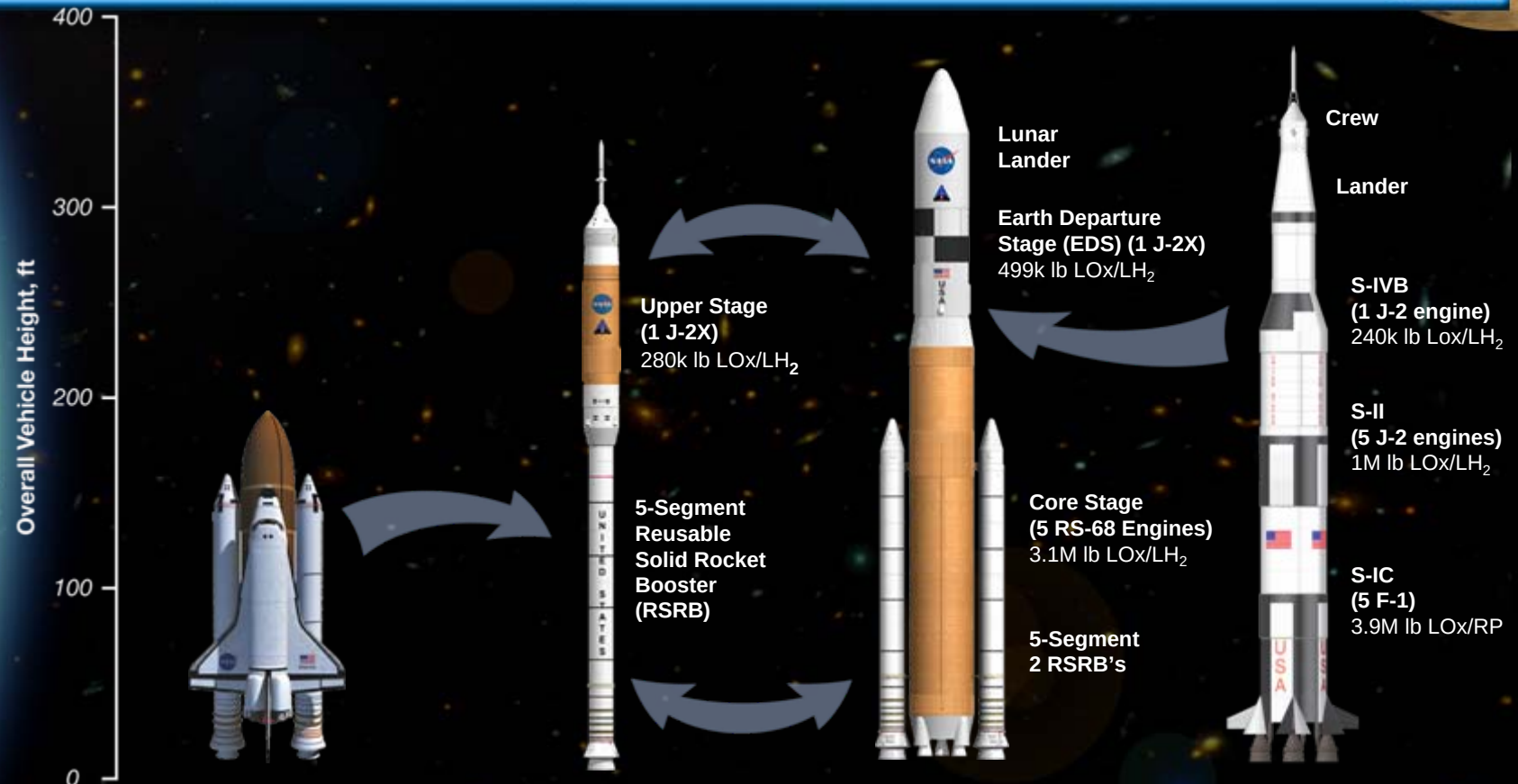
- A 5-segment solid rocket motor was test fired in October, 2003
- The J-2X engine's predecessor made it's debut during the United States' first round of Moon missions, and it's turbomachinery was tested as part of the more recent X-33 program
- The Upper Stage will be assembled at the Michoud Assembly Facility, home of the Shuttle External Tank, using the same materials
- The RS-68 engine, which powers the Delta IV, will boost the Ares V core stage
- Using experienced human spaceflight workforce to process the Ares at the Kennedy Space Center using many Shuttle capabilities, such as booster processing and assembly, the Vehicle Assembly Building, and Launch Complex 39

Using the Experienced Capabilities in a Streamlined Manner

A Robust Development Approach

- **Performance**
  - Ares I: Delivers 22mT to LEO plus ~15% Performance Margin
  - Ares V: Delivers 130mT to LEO / 65mT to Trans Lunar Injection (with Ares I)
- **Flight Control**
  - While Ares is a long and slender vehicle, it is within the control dynamics experience base of previous programs, most notably the Saturn V
    - ~8x margin on the vehicle structural response to control frequency ratio
  - Results indicate a ~2x margin on first stage thrust vector control (angle and rate) and ~1.7x capability over predicted roll torque
- **Weather**
  - Designing for a 95% launch availability
  - Using conservative assumptions for natural environments, such as winds aloft
- **Structures and Loads**
  - Within the design of the existing Shuttle motor case, joints and aft skirt
  - Upper Stage/interstage is being designed for the loads

NASA's Exploration Launch Architecture



Space Shuttle

Height: 184.2 ft
Gross Liftoff Mass: 4.5M lb

55k lbm to LEO

Ares I

Height: 321 ft
Gross Liftoff Mass: 2.0M lb

48k lbm to LEO

Ares V

Height: 358 ft
Gross Liftoff Mass: 7.3M lb

117k lbm to TLI
144k lbm to TLI in Dual-Launch Mode with Ares I
290k lbm to LEO

Saturn V

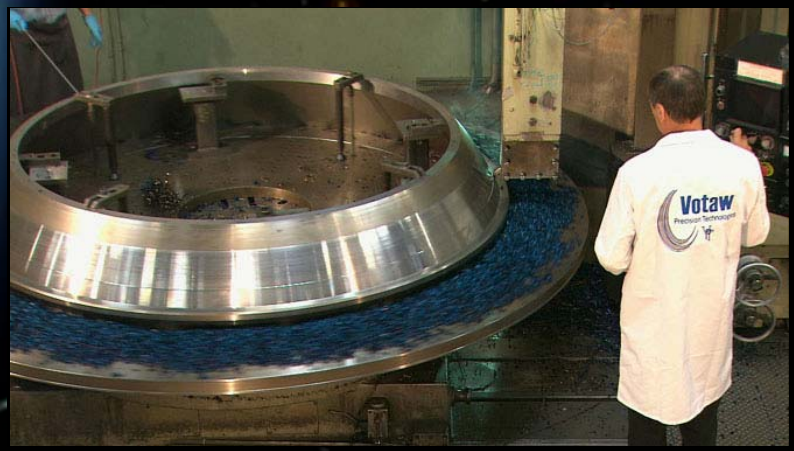
Height: 364 ft
Gross Liftoff Mass: 6.5M lb

99k lbm to TLI
262k lbm to LEO

Making Progress Towards Flight

1st Stage Parachute Testing

J-2X Injector Testing

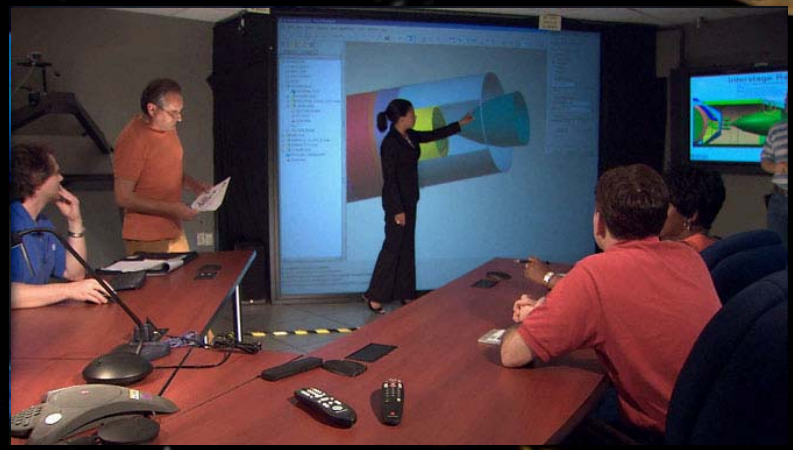


1st Stage Nozzle Development

J-2S Powerpack Test Preparation

Making Progress Towards Flight

Over 1,500 Wind Tunnel Tests



Upperstage Initial Design Analysis Cycle

Fabrication of Ares I-1
Upperstage Mass Simulator

Ares I-1 1st Stage Hardware

NASA's Exploration Launch Approach

- **Provides the best possibility of meeting stakeholder, Congressional law, and customer requirements within the funding available and timeframe desired**
- **Lowest cost and highest safety/reliability for NASA's mission**
- **Maximum leverage of existing, human-rated systems and infrastructure**
- **Leveraged collaboration between the retiring Shuttle program and emerging Constellation projects**
  - Sharing lessons learned
  - Transitioning valuable resources, ranging from a specialized workforce to launch infrastructure
- **A robust capability for access to cis-lunar space and a straightforward growth path to later exploration launch needs (e.g. Mars)**
- **An industrial base for production of large solid rocket systems; high-performance liquid engine systems; large, lightweight stages; and critical, large-scale launch processing infrastructure**
- **Team is making great progress**
- **1st test flight of Ares I-1 in 28 months!**

www.nasa.gov/ares