

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Verification and In-Flight Experimentation (6)

Author: Mr. Charles E. Cockrell Jr.

National Aeronautics and Space Administration (NASA), United States, charles.e.cockrell@nasa.gov

Mr. James Taylor

National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, United States,
jim.l.taylor@nasa.gov

Mr. Samuel Stephens

National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, United States,
samuel.e.stephens@nasa.gov

Mr. Richard W. Tyson

University of Alabama in Huntsville, United States, richard.w.tyson@uah.edu

Mr. Uwe Hueter

Science Applications International Corporation (SAIC), United States, uwe.u.hueter@nasa.gov

Mr. Alan Patterson

National Aeronautics and Space Administration (NASA), Marshall Space Flight Center, United States,
alan.f.patterson@nasa.gov

SYNERGISTIC DEVELOPMENT, TEST, AND QUALIFICATION APPROACHES FOR THE ARES I
AND V LAUNCH VEHICLES.

Abstract

The U.S. National Aeronautics and Space Administration is designing and developing the Ares I and Ares V launch vehicles for access to the International Space Station (ISS) and human exploration of the Moon.

The Ares I consists of a first stage reusable five-segment solid rocket booster, a upper stage using a J-2X engine derived from heritage experience (Saturn and Space Shuttle External Tank programs), and the Orion crew exploration vehicle (CEV). The Ares V is designed to minimize the development and overall life-cycle costs by leveraging off of the Ares I design. The Ares V consists of two boosters, a core stage, an earth departure stage (EDS), and a shroud. The core stage and EDS use LH2/LO2 propellants, metallic propellant tanks, and composite dry structures. The core stage has six RS-68B upgraded Delta IV engines while the EDS uses a J-2X engine for second stage ascent and trans-lunar injection (TLI) burn.

Both Ares I and Ares V include validation flight testing as part of the qualification programs, which an extensive ground test program leading to flight readiness.

System and propulsion tests and qualification approaches for Ares V elements are being considered as follow-on extensions of the Ares I development program. Following Ares I IOC, testing will be conducted to verify the J-2X engine's orbital restart and TLI burn capability. The Ares I upper stage operation will be demonstrated through integrated stage development and acceptance testing. The EDS will undergo similar development and acceptance testing with additional testing to verify aspects of cryogenic propellant management, operation of sub-systems in a space simulation environment, and orbital re-start of the main propulsion system. RS-68B certification testing will be conducted along with integrated core stage development and acceptance testing.

Structural testing of the Ares V EDS and core stage propellant tanks will be conducted similar to the Ares I upper stage. The structural qualification testing may be accomplished with separate propellant

tank test articles. Structural development and qualification testing of the dry structure will be pursued as part of the design and development process. The Ares V payload shroud will undergo acoustic, vibration, structural qualification, and deployment testing in a space simulation environment. Similar to Ares I, requirements for full-scale structural dynamic testing are being studied.