An Up-Close Look at Ares I-X

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On October 28, 2009, one day later than the originally planned launch date, the Ares I-X suborbital test flight roared into the Florida sky. Flying its preplanned parabolic arc over the Atlantic, the development test vehicle for the Ares I crew launch vehicle performed as advertised, executing a perfect liftoff, 90-degree roll maneuver, ascent, and separation before its upper and lower stages descended into the ocean 150 miles downrange. This test flight, while carrying no astronauts, marked a major milestone for NASA, which had not flown a test launch of a human-rated rocket since the first flight of the Space Shuttle in 1981.

Ares I-X at T+10 seconds, was already nearly 1,000 feet (304 meters) above Launch Complex 39B.

During the flight, over 700 sensors collected over 900 measurements, which NASA will apply to validating the engineering models they used to design the vehicle in the first place. That data, telemetered to the ground and stored in a flight recorder onboard, was the primary "payload" of the mission.

The rocket generated a “halo effect” when moisture was pushed off the front end of the crew module and condensed in the aft air flow.

The mission was not without drama. The first four-hour launch window on October 27 was crowded with challenges ranging from stray ships wandering into the range to a stuck sensor cover to “triboelectrification,” a static phenomenon created when the rocket flies through clouds, which could have interfered with transmissions to and from the vehicle. Ares I-X was able to reset quickly and be ready for flight the next morning, even after thunderstorms produced lightning overnight.

There was an equal amount of drama on October 28, as the NASA team waited for a good weather report free of triboelectrification-producing clouds. The weather officer finally found a break in the clouds at 11:30 a.m. Eastern Time, and the “Go!” was given for launch before the window closed.

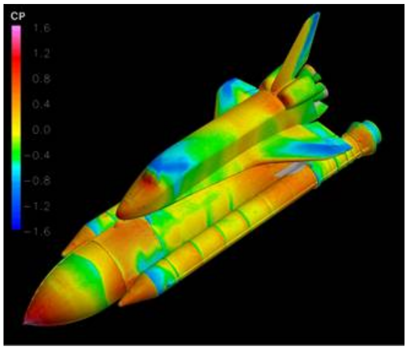
The Ares I-X flight test vehicle was powered by a four-segment solid rocket booster (SRB) from the Space Shuttle program and included a live roll-control system using engines from decommissioned Peacekeeper missiles. The primary flight-control systems were avionics from the Atlas V Evolved Expendable Launch Vehicle (EELV), which interacted with the Shuttle-based systems on the SRB an the engineering sensors collecting data. The rest of the vehicle structure was simulator hardware.

At liftoff, the Ares I-X flight test vehicle weighed 1.8 million pounds (816,466 kilograms) and was the first in-line rocket design to be stacked in Kennedy Space Center's Vehicle Assembly Building since 1973.

The Ares I-X team is expected to deliver a final report to NASA 90 days after the mission, but the flight test will be providing useful returns to the agency for months and years to come because as good as computerize math models and wind tunnel tests have become, they are no substitute for flight data collected from a full-size vehicle. Engineers at Marshall Space Flight Center and Langley Research Center will evaluate the actual flight results against their predicted models to determine what changes need to made to make the models even better. Bob Ess, the Mission Manager, called Ares I-X "the world's biggest wind tunnel test," and explained at the L-1 briefing that "the only true failure would be not to learn from the test."

The only serious anomaly (NASA-speak for an unexpected event) during the flight was the failure of one of the first stage main parachutes, and even then the booster splashed down in one piece, though with a couple dents in the side from the hard landing, rather like a soda can being smacked onto the ground. NASA teams are in the process of investigating the parachutes, and might have found an answer by the time this article goes to print. With all of the major objectives of the flight achieved, it is hard not to see Ares I-X as a complete success.

Still, with NASA's plans to send humans to the Moon and eventually Mars under review, questions have been asked as to whether the $445M Ares I-X is still a relevant part of NASA's future space plans. This might seem to be especially true if the President accepts the recommendation by the Human Space Flight panel led by Norman Augustine to cancel Ares I if the space agency cannot get fully funded.



Space Shuttle Pressure Model Image Credit: Arnold Engineering Development Center

Perhaps the most important thing that should be kept in mind is that whatever rockets NASA is eventually tasked to build, the engineering models improved by Ares I-X will contribute to that effort. And models based on actual flight data are always inherently more accurate than models based on mathematical assumptions alone. New launch vehicles always draw upon the most recent fact-based models and simulations. Analyses for Ares I-X, for example, depended upon flight models developed for the Space Shuttle. It would not be far-fetched, then, to see Ares I-X data to continue paying dividends for aerospace engineers years after the current questions about the Constellation Program are answered.

Finally, while only a suborbital test flight, Ares I-X is an important change for NASA. After years of doing “paper rocket” studies like the National Aerospace Plane, the Space Launch Initiative, X-33, the Orbital Space Plane and others, the Ares Projects have managed to take a design from conceptual design to actual flight hardware on a relatively short timeline (three and a half years). As NSS Executive Vice President Greg Allison observed, “NASA is definitely back in the rocket technology development business,” a skill that will be necessary regardless of what vehicles eventually replace the Space Shuttle.