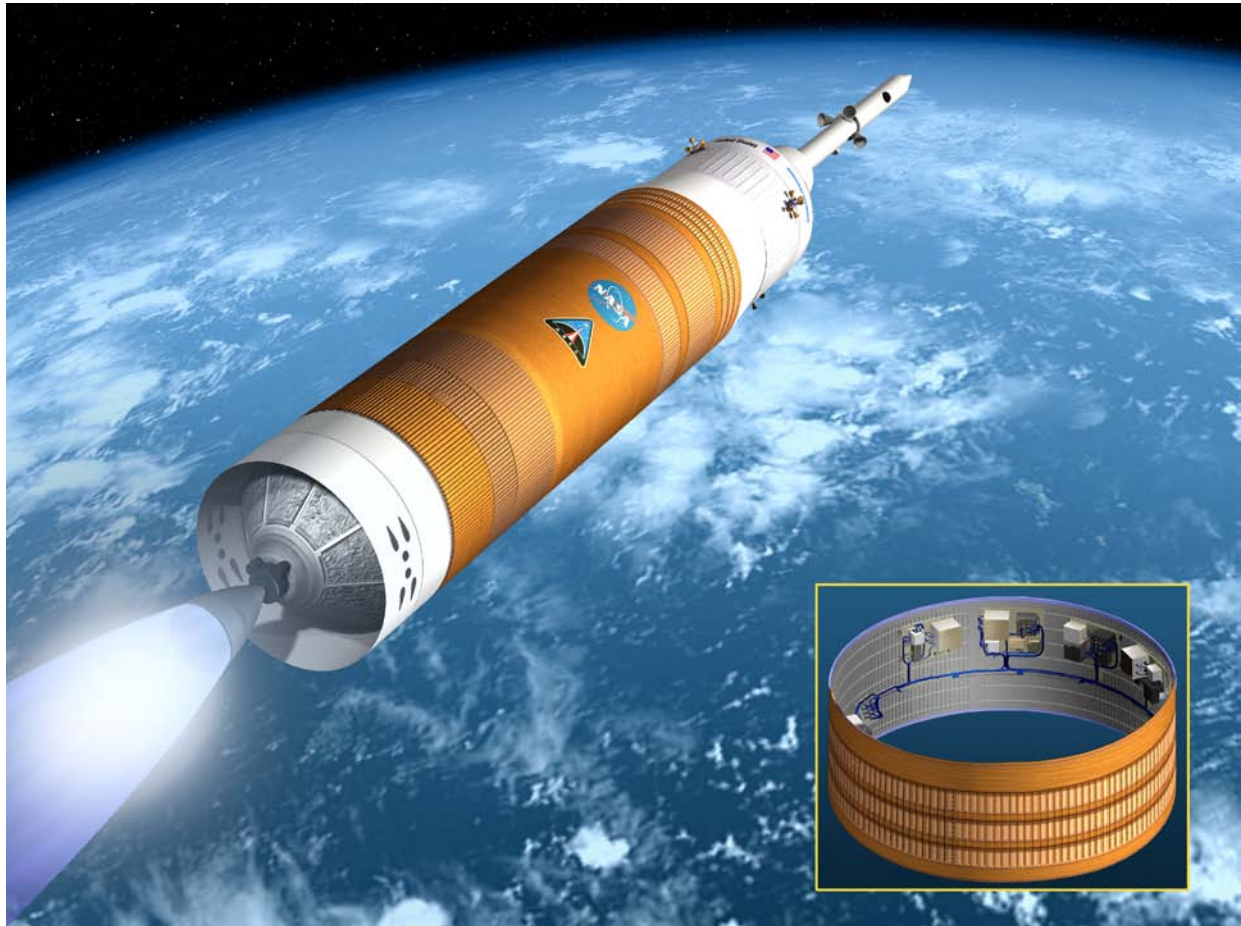




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Space Exploration

Ares I Instrument Unit Avionics (IUA) Backgrounder



Description & Purpose: Ares I is an in-line, two-stage rocket that will carry the crew exploration vehicle Orion to low-Earth orbit. This rocket will succeed the space shuttle as NASA's primary vehicle for human exploration in the next decade. NASA selected Boeing as the prime contractor to produce, deliver and install avionics systems for the Ares I rocket. The selection, announced on December 12, 2007, is the final major contract award for Ares I.

Customer: NASA is the customer for the Ares I Instrument Unit Avionics. The Marshall Space Flight Center in Huntsville, Ala. is leading the overall design of the Ares I crew launch vehicle with Boeing serving as their production partner for the avionics.

General Characteristics:

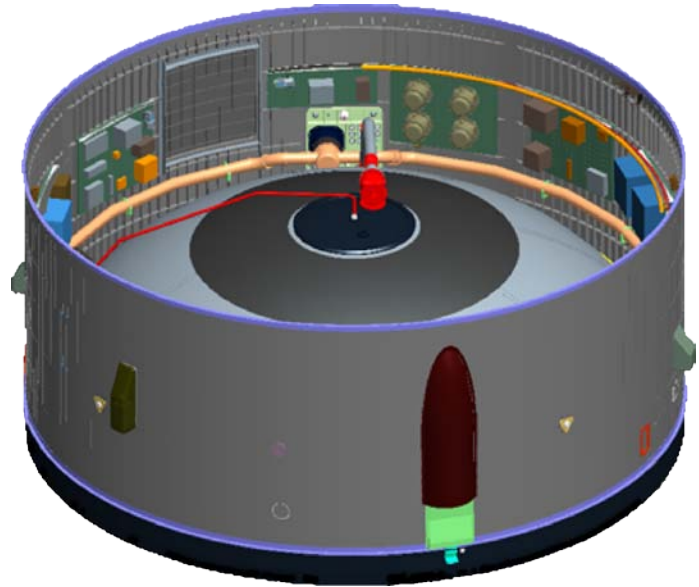
Instrument Unit dimensions:

7 feet tall by 18 feet diameter

Weight: 2,000 pounds

Background

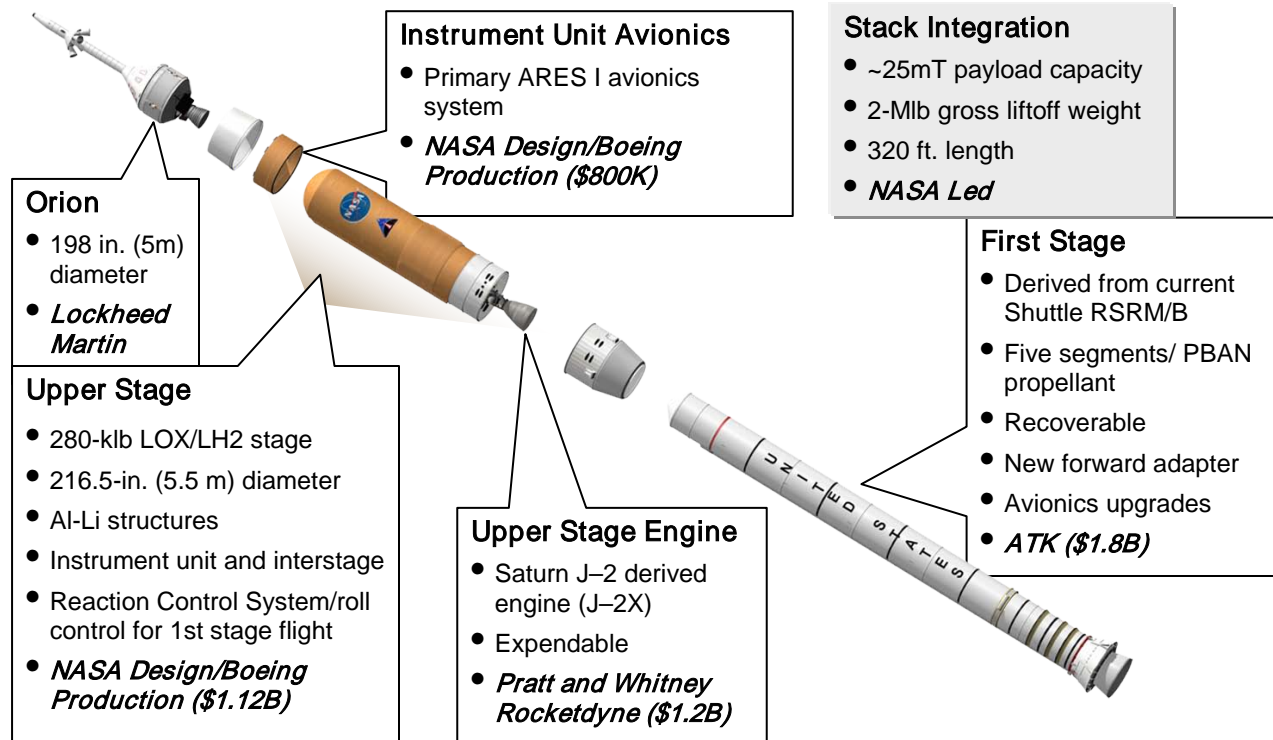
The Ares I launch vehicle is a key component of the Constellation Program, which will send humans to the moon by 2020 to set up a lunar outpost. Boeing will support the NASA design team leading the development of the Ares I avionics components. Boeing will also develop and acquire avionics hardware for the rocket and assemble, inspect and integrate the avionics system components on the upper stage. Boeing suppliers will manufacture components across the country. Final integration and checkout will take place at NASA's Michoud Assembly Facility in Louisiana.



The avionics are the "brains" of the Ares I and will provide guidance, navigation and control for the rocket until it reaches orbit. The avionics system is responsible for managing vehicle health and reporting it to flight controllers based on a sequence of timed events, such as engine shutdown and first stage separation.

The instrument unit contains the bulk of the avionics and is located between the two-stage Ares I rocket and the adapter that joins Ares I to the Orion spacecraft. The system consists of onboard computers, flight controls, communications equipment and other instruments and software for monitoring and adjusting the rocket's speed and position during flight.

Boeing will provide three instrument unit flight test units and six production flight units to support integrated flight tests and missions through 2016. The contract type is cost-plus-award-fee and the period of performance is Dec. 17, 2007, through Dec. 16, 2016. The estimated value for support to the NASA-led design team and production of test and flight units is \$265,489,783. Additional tasks not included in the initial scope of the contract may be acquired up to a maximum value of \$420 million. Additional flight units may be obtained at an estimated cost of \$114,045,292 for as many as



12 additional units. The total estimated contract value is \$799,535,079.

Under the contract, Boeing will employ up to 100 technical personnel in Huntsville to support NASA's Marshall Space Flight Center. Boeing also expects to employ up to 20 production workers at NASA's Michoud Assembly Facility in New Orleans, where the instrument units will be assembled onto the upper stage.

Boeing expertise and its supplier team will assist NASA in producing an affordable, safe and reliable stage. Boeing will use its network of suppliers to find the best prices for NASA for avionics components and will involve their suppliers early in the process to ensure NASA has ample time to flow top-level requirements into their specifications and give them time to iterate design solutions. Our inclusion of a competitive large supplier base and small businesses will assure access to innovation at the avionics box level. Since the NASA requirements are still being developed, it is too early to start picking the suppliers for these avionics boxes. Specific IUA Boeing supplier conferences are expected to be scheduled throughout the program.

Once NASA finalizes requirements, Boeing will then begin the task of lining up suppliers. Although Boeing will work with a large number of companies in our supply chain, no major partners (or teammates) or exclusive arrangements with any suppliers have been made.

With advanced simulation capability, Boeing and NASA can make changes early in the design and producibility assessment cycle, which will help optimize operations, reduce cost and increase efficiency. Boeing will apply lean manufacturing processes to the production of the IUA.

The Ares I first stage will be a five-segment solid rocket booster. The upper, second stage of the rocket will consist of a J-2X liquid-oxygen, liquid-hydrogen main engine, a new upper stage fuel tank, and the instrument unit avionics. The first Ares I test flight is planned for 2009. Crew transportation to the International Space Station is planned to begin no later than 2015. The first lunar excursion is scheduled for the 2020 timeframe.

NASA developed an open avionics architecture, using a reliable, well understood approach with a non-proprietary design. This approach can have direct evolution into the Ares V earth departure stage because it has many of the same functions as Ares I. Although the Ares V is more complex, the fundamental job is similar through the ascent stage. Because NASA has built in an approach that can be upgraded over time, new circuit cards and component boxes can be easily added and even new competitions conducted to find the best price. This approach can serve as a starting point that lends itself to development of the avionics for Ares V. Boeing is committed to providing a safe, reliable and cost-effective avionics system that our nation can be proud of.

NASA's Marshall Space Flight Center in Huntsville, Ala., manages the Ares Project for NASA's Constellation Program, which is based at NASA's Johnson Space Center in Houston.

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