

Boeing Defense, Space & Security
P.O. Box 516
St. Louis, MO 63166
www.boeing.com

Boeing Space Exploration



Description and Purpose: Boeing Space Exploration, headquartered in Houston, is a leading provider of human spaceflight and space exploration systems and services. Since the dawn of the Space Age, Boeing has designed, developed, built and operated human and robotic space vehicles as well as supporting hardware. The Boeing legacy began with the X-15, spanned Gemini, Mercury, Apollo and Skylab, and continues with the Space Launch System, International Space Station and Commercial Crew programs. Space Exploration, a division within Boeing Defense, Space & Security's Network & Space Systems business, employs approximately 3,000 people in Alabama, California, Florida, Louisiana and Texas.

Boeing's Space Exploration division continues to work with NASA and its partners on the International Space Station (ISS) program to maximize its utility as a national research facility for the benefit of all mankind. As NASA defines its roadmap for the future, Boeing will apply its 50 years of experience in human spaceflight to assist NASA as it matures the technologies needed, such as a Space Launch System for crewed exploration missions beyond Earth orbit. Boeing is the prime contractor for core stages

and avionics for the Space Launch System (SLS). Boeing is working with NASA to ensure continued U.S. leadership in human spaceflight programs.

Customer: The primary customer for the Boeing Space Exploration business unit is NASA.

Key Programs:

Space Launch System (SLS): NASA has selected Boeing to design, develop and produce the nation's next -generation, human-rated rocket to transport people beyond Earth's orbit, enabling the next step in space exploration. The Space Launch System (SLS) program, managed by Boeing Exploration Launch Systems in Huntsville, Ala., is responsible for the cryogenic stages and avionics for SLS.

NASA announced its acquisition strategy in late 2011, including the intent to modify existing contracts and award the prime contract for first- and upper-stage development and avionics to Boeing. Since then, NASA has granted Boeing authority to proceed and work is under way.



NASA's phased development plan will evolve to the ultimate capability of 130 metric tons to support deep space exploration. Boeing is designing the two cryogenic stages concurrently to maximize affordability of SLS rocket development and operations. The initial flight-test configuration, scheduled to fly in 2017, will provide a 70-metric ton capacity using the first stage only. The complete two-stage vehicle configuration will provide a lift capability of over 130 metric tons, to enable the required 50-metric tons to escape velocity, beyond Earth orbit.

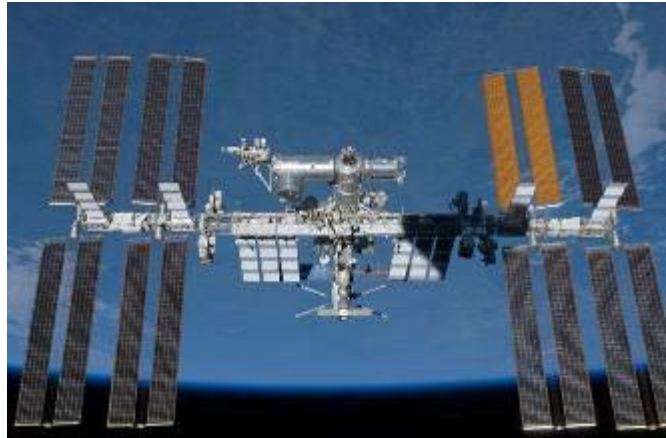
Boeing has been designing its cryogenic stage and avionic subsystem design, and developing innovative manufacturing methods, in partnership with NASA's Marshall Space Flight Center in Huntsville, Ala., since the upper stage and avionics contracts were competitively awarded to Boeing in 2007. These

accomplishments are directly extensible into the SLS and serve to reduce SLS development cost and risk.

International Space Station (ISS): As the prime contractor, Boeing is responsible for design, development, construction and integration of the ISS and assisting NASA in operating this outpost in low Earth orbit. Boeing built all of the major U.S. elements and is responsible for integrating the systems, procedures and components of 15

participating countries in this worldwide enterprise. Today, Boeing performs much of the sustaining engineering for the ISS and continues to lead several modification projects as well as help obtain spare components as needed.

The 2009 winner of the distinguished Collier Trophy, the ISS is the largest, most complex international scientific and engineering space venture in history. With assembly completed in 2011, the ISS is larger than the size of a U.S. football field. The ISS weighs more than 900,000 lbs, the equivalent of more than 320 automobiles, and has an internal pressurized volume of 33,023 cubic feet, equivalent to a Boeing 747 jumbo jet.



A portion of the U.S. segment of the ISS was designated a National Lab in 2005. NASA's research on the ISS directly supports the U.S. Space Exploration Policy, with human life sciences experiments taking highest priority. The ISS also provides a test bed for new technologies and an analog for long duration human space flight operations. Other research includes biology and biotechnology; physical and materials sciences; and Earth and space sciences. Operations of the ISS have been extended to 2020.

Checkout, Assembly and Payload Processing Services (CAPPS): The Boeing Company holds NASA's CAPPS contract which processes payloads for the ISS, expendable launch vehicles and other payload programs at Kennedy Space Center, Fla. Boeing employees provide technical, facilities and engineering support to ensure payload readiness for launch.

Commercial Crew Development (CCDev): NASA's thrust into commercial crew efforts will advance the design and development of a new crew transportation system to destinations in low Earth orbit. Under an initial CCDev Space Act Agreement of 2010, Boeing successfully completed several risk reduction demonstrations and a System Definition Review (SDR) in October 2010, with only \$18 million in government investment. The SDR defined the Crew Space Transportation (CST)-100 spacecraft's system characteristics and configuration and established a baseline design. Under a second \$92.3 million agreement in April 2011, the company will further mitigate program risk and mature the system design of its CST-100 spacecraft. NASA's 14-month CCDev-2 Space Act Agreement builds on the work performed during the first round of CCDev and enables Boeing to further mature its system to a Preliminary Design Review, a critical step that ensures the system design meets all requirements. Boeing also will conduct key demonstrations and development tests. The company plans to gather performance data on the launch abort system and the service module

fuel tank; evaluate vehicle ascent performance in wind tunnel testing; and build on earlier landing air bag and parachute demonstrations with more in-depth investigations.

Boeing's Commercial Crew Transportation System (CCTS) includes the CST-100 spacecraft, launch services and ground systems. The CST-100 is a reusable capsule-shaped spacecraft that has a crew module and service module. The CST-100 relies on proven materials and subsystem technologies and can transport up to seven people, or a combination of people and cargo.



The CCTS will provide safe, affordable access to the International Space Station and other destinations in low Earth orbit, and will enable NASA to focus on deep space exploration missions. In addition to its support to NASA, Boeing also plans to supply the CST-100 to Bigelow Aerospace for that company's inflatable space station. Boeing will also work with Space Adventures to sell unused seats.

Launch Products and Services: The Boeing Launch Products and Services organization, a part of the Boeing Space Exploration business unit, was formed when the United Launch Alliance (ULA) began operations on December 1, 2006. United Launch Alliance, a 50-50 joint venture between Boeing and Lockheed Martin, provides government launches using the Atlas and Delta launch vehicles. Boeing Launch Products and Services comprises three business units: Boeing Commercial Space Company (BCSC), Boeing Launch Services (BLS) and Special Space Products (SSP). BCSC provides payload accommodations and support services to Sea Launch, an Energinia company. BLS markets and provides Delta launch services to the commercial community and is a customer-focused organization that combines business development, sales, contracting and management for Delta commercial launch service customers. BLS procures the launch services from ULA. Special Space Products provides fabrication, assembly, full-scale testing, engineering services and launch site support for Delta launch vehicles.

Boeing Space Exploration Locations:

Huntington Beach, Calif., provides design support for the ISS, having been responsible for the initial manufacture of many ISS components. Huntington Beach also is supporting Boeing's Commercial Crew Development program.

Kennedy Space Center (KSC), Fla., supports CAPPs payload processing activities at NASA's KSC. Boeing also provides site engineering support for the ISS and Commercial Crew Development program.

Houston, Texas, serves as the design center for Boeing Commercial Crew Development program, and the ISS programs. Additionally, Boeing provides engineering, software development, advanced research and light manufacturing support for NASA. Boeing Space Exploration employs about 1,800 people at its Houston site.

Huntsville, Ala., is home to Exploration Launch Systems, encompasses all Boeing Space Exploration programs and functions hosted in Huntsville, most notably the Space Launch System (SLS), and is primarily responsible for interfaces with Marshall Space Flight Center. In addition, Huntsville performs sustaining engineering/advanced studies and provides technology growth for NASA and the U.S. Army and provides engineering and manufacturing support for the International Space Station.

Puget Sound, Wash., performs manufacturing of payload fairings for Sea Launch vehicles. A payload fairing protects the payload during launch ascent.

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Contact:

Susan Wells
Boeing Space Exploration
Office: +1 321-264-8580
Mobile: +1 321-446-4970
susan.h.wells@boeing.com

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