



IDS Business Support,
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Space Exploration Backgrounder



Description and Purpose: Boeing Space Exploration division, headquartered in Houston, is the leading global supplier of reusable and human space systems and services. Since the beginning of the Space Age, Boeing has designed, developed, built, and operated human and robotic space vehicles as well as supporting hardware. The organization's legacy began with the X-15 spanning to Gemini, Apollo, Skylab and continuing with the space shuttle and International Space Station (ISS). Space Exploration, a division within Boeing Integrated Defense Systems' Network and Space Systems business, employs more than 3,500 employees in Texas, California, Alabama and Florida.

Customer: The primary customer for the Boeing Space Exploration business unit is NASA. United Space Alliance (USA) is also a key customer for Boeing's Space Shuttle Program.

Key Programs:

Space shuttle: America's space shuttle is the world's only operational, reusable launch vehicle capable of supporting human space flight mission requirements. Boeing is the major subcontractor to NASA's space flight operations contractor, USA. As the original developer and manufacturer of the space shuttle orbiters, Boeing is responsible for

orbiter engineering, major modification design, engineering support to operations, including launch, and overall shuttle systems and payload integration services. In addition, Boeing has supported development of upgrades to the shuttle fleet to ensure America safe, reliable and affordable human-rated space access.

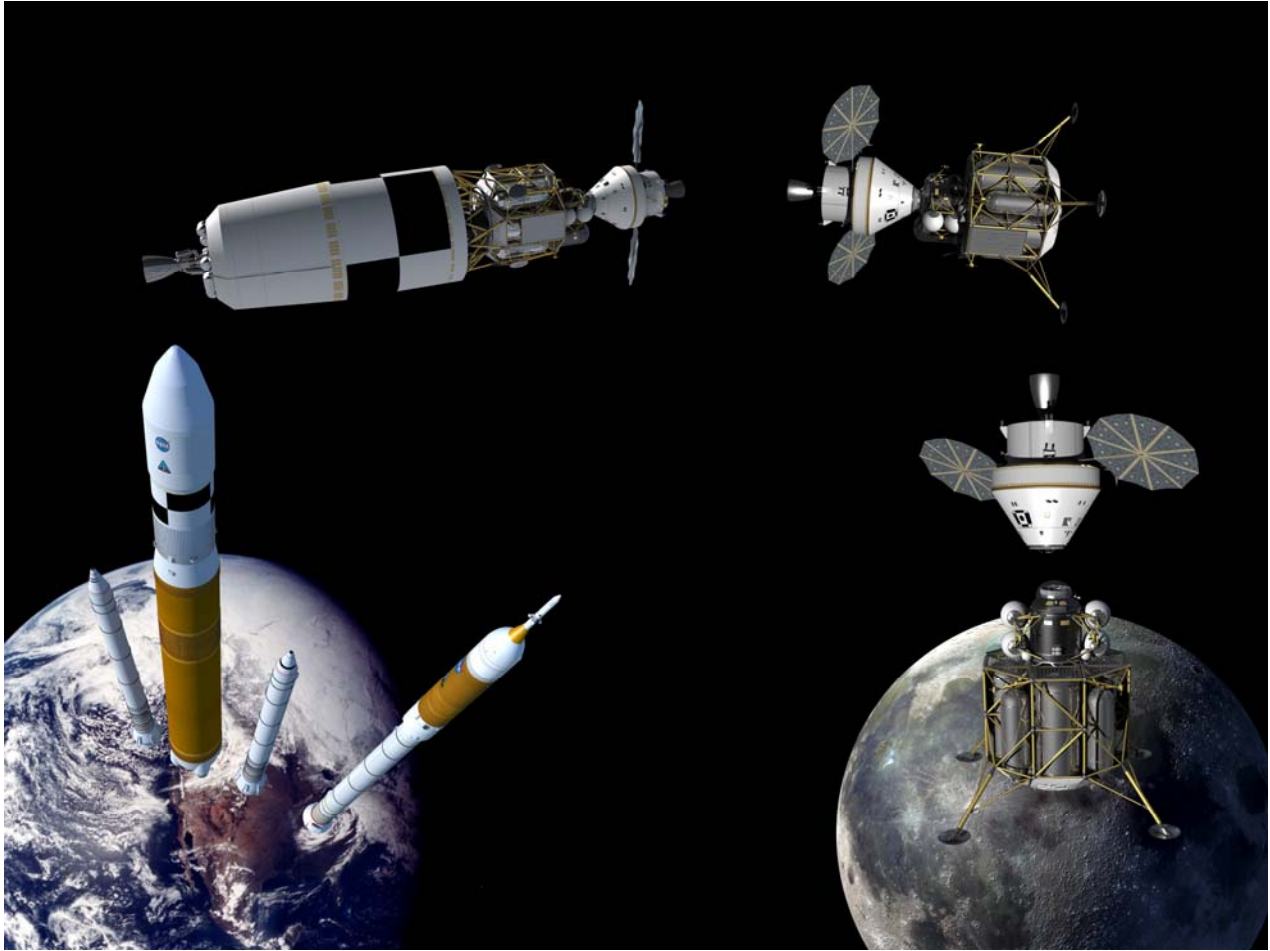
International Space Station (ISS): As the prime contractor, Boeing is responsible for design, development, construction and integration of the ISS and assisting NASA in operating the orbital outpost. Boeing built all of the major U.S. elements. Boeing is also responsible for integrating the systems, procedures, and components of 16 participating countries in this worldwide enterprise. Today, Boeing performs much of the sustaining engineering for the ISS.

The ISS is the largest, most complex international scientific project in history and our largest adventure in space to date. When completed, it will be more than four times as large as the Russian Mir space station, about the size of a football field with the end zones. The ISS will weigh 925,627 lbs, the equivalent of more than 320 automobiles, and have an internal pressurized volume of 33,023 cubic feet, or equivalent to about a Boeing 747 jumbo jet.



Research on the ISS directly supports the U.S. Space Exploration Policy, with human life science experiments taking highest priority. The ISS also provides a test bed for new technologies and an analog for long duration human space flight operations.

Checkout, Assembly and Payload Processing Services (CAPPS): The Boeing Company holds NASA's CAPPS contract which provides payload processing for the space shuttle, 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.

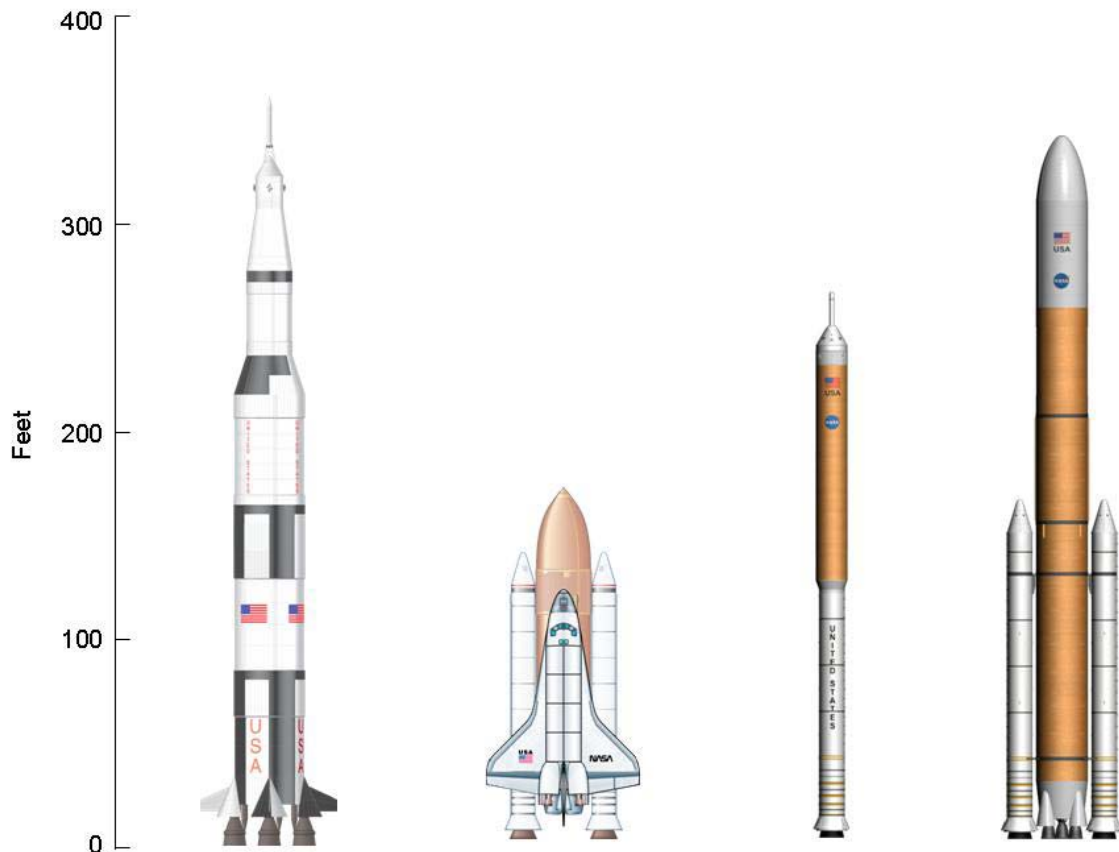


Constellation: As NASA implements Constellation's sustained and affordable human and robotic space exploration program, Boeing Space Exploration is drawing on the company's defense and commercial aviation engineering and manufacturing best practices to help execute the program. Boeing's participation in Constellation ensures a safe transition of the engineering experience and skills of the Space Shuttle and ISS programs combined with leading edge technologies and approaches.

The Boeing Company was awarded in August 2007 a NASA contract to produce the upper stage of the Ares I crew launch vehicle, the second element in NASA's Constellation project. The vehicle's upper stage provides navigation, guidance, control and propulsion required for the ascent of the second-stage Ares I into low-Earth orbit. In December 2007 Boeing was also awarded the NASA contract to produce the launch vehicle's instrument unit avionics (IUA). The IUA provides the guidance, navigation and control hardware for the new Ares I, serving as the "brains" behind the rocket's ascent.

The Ares I launches the Orion crew exploration vehicle, which will be joined with other elements of NASA's Constellation program to help propel astronauts to the moon by 2020. Boeing's Constellation program supports NASA's implementation of a sustained and affordable human and robotic exploration program. The nearly 50-year partnership forged by NASA and Boeing has led to advancements in enabling technologies for robotics, satellites and human transportation systems. From autonomous maneuverable satellites to precision landing and hazard avoidance, Boeing continues to lead the aerospace industry in advancing the U.S. Space Exploration Policy.

Within NASA's planned Constellation framework, Boeing plans to pursue the *Ares V* heavy lift vehicle, the Earth Departure Stage (EDS) and Altair, the lunar lander module. and as NASA's production partner for *Ares I* Upper Stage, Boeing is investing in technologies that will give that will give the *Ares V* heavy lift vehicle the performance it will need to launch the other Constellation elements necessary for exploration of the solar system.



Exploration Launch Systems: The Exploration Launch Systems office, located in Huntsville, Ala., supports NASA on strategy and policy on Space Exploration programs procured by the NASA Marshall Space Flight Center (MSFC). This office, established in April 2006, will lead the proposal capture and program execution teams for the *Ares I* and *Ares V*, EDS and *Altair*. Exploration Launch Systems also provides overall leadership and integration of programs and functions in Huntsville for Space Exploration.

Under the NASA awarded *Ares I* upper stage contract, Boeing is providing producibility engineering support to the NASA design team at MSFC in preparation for production of the upper stage components and final manufacturing at the NASA Michoud Assembly Facility (MAF) in New Orleans, La. Boeing will produce from two to six upper stages a year during regular production, depending on NASA requirements. The initial phase of the contract calls for several flight-test production units. If all options of the cost-plus performance contract are exercised through 2017, Boeing could produce as many as 23 upper stages.

Boeing will also produce three IUA flight test units and six production units, with an option to produce four additional units per year from 2014 to 2016. The company will employ technical personnel to support MSFC. The NASA center will lead the design for the upper stage and instrument unit avionics for Ares I while Boeing provides production and engineering support. The IUA will be added to the upper stage at the MAF.

Using shuttle-derived elements such as a single solid rocket booster, *Ares I* will deliver a lunar *Orion* to low-inclination Earth orbits required by the exploration architectures and will also deliver *Orion* configured for crew and cargo transfer missions to the ISS. Also using shuttle-derived components, *Ares V* will lift heavy payloads (up to 125 metric tons) to meet lunar and Mars exploration cargo requirements. The EDS ignites sub-orbitally and delivers the Altair lunar lander to low-Earth orbit. After the crew spacecraft docks with this system, the EDS performs a trans-lunar injection burn, which starts the vehicle's journey to the moon. When the burn is completed, the EDS is discarded.

Launch Products and Services: The Boeing products and Services organization was part of Launch Systems, which ceased to exist when the new United Launch Alliance (ULA) was formed in 2006 and most of the Delta program moved to it. Boeing Launch Products and Services is responsible for two Boeing subsidiaries: Boeing Commercial Space Company (BCSC) and Boeing Launch Services. BCSC provides the payload accommodations and launch services to the Sea Launch Company, a multinational company in which Boeing is a 40 percent owner. The products and services markets and provides Delta launch services to the commercial community. Boeing procures these services from ULA.

Transformation and Integration (T&I): Established in April 2006, T&I plans and directs Space Exploration business transformation from current programs (space shuttle, space station, and payload services) to transformational programs, including organizational infrastructure, to enable program integration among transitional programs (*Ares I*, *Ares V*, EDS, etc.) and transformational programs (future growth). T&I also leads an integrated Space Exploration people, process and tools architecture to ensure the transfer of best practices across all Boeing Space Exploration program teams and provides highest quality, lowest cost products for the customer. Specific responsibilities of the T&I function include assessment of resources, requirements planning, and alignment of intellectual capital with existing program requirements and future program needs. The T&I function also directs an overarching strategic approach for shuttle, ISS and payloads transition and long-term program integration and evolution, including integrated program and functional requirements across all programs and disciplines. T&I develops and executes evolutionary, strategic roadmaps charting the course to successfully sustain the shuttle program through ISS completion and ongoing ISS activities, ensuring strategic capabilities growth in CAPPS while leveraging Space Exploration's unique experience to win new program opportunities.

Space Exploration Locations: In addition to its headquarters in Houston, Space Exploration also operates in these following locations:

Huntington Beach, Calif. provides design support for space shuttle development and improvements as well as the U.S. Space Exploration Policy. Huntington Beach also supports the ISS and was responsible for initial manufacture of many ISS components.

Kennedy Space Center (KSC), Fla. supports CAPPS payload processing activities at NASA's KSC. Boeing also supports site engineering support to the ISS and space shuttle.

Houston serves as the headquarters for the Boeing Constellation, Space Shuttle and ISS programs in Houston. Additionally, Boeing Houston employees provide engineering, software development, advanced research and light manufacturing support for NASA. Intra-company support to other Boeing programs such as Future Combat Systems is also performed in Houston. Boeing Space Exploration employs about 2,000 people at its Houston site.

Huntsville, Ala. 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. Huntsville is also the location of the Exploration Launch Systems office, which has responsibility for competing for Ares V and EDS work.

Palmdale, Calif. performs some orbiter parts manufacturing and space shuttle supply functions.

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