

# The next stage, set to **ignite**

You can't write the history of U.S. space exploration without mentioning Boeing. Here's what the company's doing to ensure it's in forthcoming chapters of the story.



By Eric Fetters-Walp

**W**hen astronaut Neil Armstrong put the first human footprints on the moon 40 years ago, it was the crowning moment in a seven-year, Herculean effort by the U.S. space program to reach that goal.

Boeing-built space hardware was essential to helping astronauts reach their destinations in the Apollo era, as well as throughout the decades of Space Shuttle and Space Station missions that have followed. And the company is poised to do it again as a contractor on the Constellation program, the NASA effort that aims for a return to the moon by 2020. With a proud history of helping the U.S. space program at every turn, Boeing's future role in space is still being written. And the company is pursuing projects, both with NASA and with private partners, to make sure it remains a major participant in spaceflight.

On the immediate horizon is NASA's shift from the Space Shuttle program to Constellation. Although the new NASA administrator nominated by U.S. President Barack Obama may have different views, outgoing administrator Michael Griffin has strongly urged that shuttle flights end by 2010 to focus resources on the Constellation program.

"Our customer, NASA, is transitioning out of the shuttle program after 30 years. With the changes they're going through, we have the opportunity to continue to be a strong provider of the services they need," said Pat Schondel, vice president of Business Development for Boeing Space Exploration, Integrated Defense Systems.

That opportunity resonates with Space Exploration teammates. "Working on the International Space Station has provided the invaluable experience of building and sustaining a highly complex and technical large scale system in space," said Elliot Harik, a mechanical and structural engineer with the Space Station program. "The tools and skills that we are developing will be 'must haves' for support of the next major manned spaceflight program, whatever shape it might eventually take."

The Constellation program will be propelled by a new class of rockets, the Ares I and Ares V, which are designed to launch astronauts and cargo into low-Earth orbit. Boeing in 2007 won a \$515 million contract to produce the upper stage of the Ares I rockets. Eventually, the company could produce 23 upper stages. In addition, Boeing was awarded a contract with a total value of \$799 million to produce the avionics for the Ares I upper stage. (The Ares I rocket includes the Orion crew exploration vehicle, which will be built by Lockheed Martin.) Boeing also is competing to produce the Ares V rocket, a heavy-launch vehicle able to send NASA's large Altair lunar lander and other cargo to the moon, as well as the Altair lander itself. These contracts are expected to be awarded as soon as 2012. Other contracts in the offing include ground and launch support for Constellation.

Meanwhile, Boeing remains focused through 2010 on helping to manage the remaining shuttle missions, which aim to finish construction on the International Space Station, for which Boeing is the prime contractor. Boeing recently secured an extension of its ISS sustainment contract. What happens then, however, will depend on how many Constellation contracts Boeing wins.

"The good thing about the transition is that our highly talented and capable work force will be available to work on NASA's next-



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*— Pat Schondel, vice president, Business Development, Boeing Space Exploration, Integrated Defense Systems*

generation spacecraft for its mission to the moon, Mars and beyond," said Schondel.

With a gap between the end of shuttle missions and the ramp up of the Constellation program, however, there's also worry. The United States won't have its own capability to reach the space station, and NASA contractors such as Boeing may have to trim space-related jobs. "For us, the worry in that gap is what our people will do," Schondel said.

Brewster Shaw, Space Exploration vice president and general manager, said uncertainty is a constant right now for NASA and its contractors. Much will depend on decisions yet to be made by the Obama administration.

"Of course, in all of that uncertainty, there's plenty of opportunity we can pursue," Shaw said.

That's why Boeing is aggressively looking at an array of possibilities in space, near and long term, with and without NASA. High on the list are services that will be needed after the shuttle's retirement and before the first Constellation launches. To that end, Boeing has had dialogue with other companies that hope to ship cargo to the ISS after the space shuttle retires.

Meanwhile, Boeing space managers are studying the potential

**PHOTOS:** Boeing's work in U.S. space exploration efforts includes supporting space shuttle launches. The company is eyeing additional ways to support NASA in its forthcoming activities.

EMPLOYEE PHOTO: BOB FERGUSON/BOEING; SHUTTLE PHOTO: NASA; PHOTO ILLUSTRATION: BRANDON LUONG/BOEING; PAT SCHONDEL PHOTO: BOB FERGUSON/BOEING



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BOB FERGUSON/BOEING

growth of launch services for private cargo and passengers, a sector that already has attracted many startup companies, Schondel said. “We really are at a nexus of understanding the demand that would warrant us going to space on a commercial basis,” he said.

Boeing already has a well-established satellite launch business through the proven Delta II and Delta IV rockets. (United Launch Alliance, a joint venture combining the Delta and Atlas rocket programs of Boeing and Lockheed Martin, provides space launch services to U.S. government entities, including NASA.) “We have had some success in recent years selling our services to customers both domestic and international,” Shaw said.

Paul Eckert, international and commercial strategist for Space Exploration, said there may be commercial opportunities involving the International Space Station, where the zero-gravity laboratory environment is ideal for biotechnology and materials research.

## A 50-YEAR LEGACY

With its involvement in the shuttle and space station programs and their predecessors, Boeing can point to a half-century of experience as it competes to provide key components for the Constellation program. Indeed, the history of U.S. space exploration can't be told without Boeing and its predecessor companies.

Just after World War II, Douglas Aircraft and Boeing pioneered long-range missile propulsion systems that advanced rocket technology for future space missions. North American Aviation introduced the X-15 rocket plane in 1959, which served as a test platform for pre-spaceflight experiments. North American also built the launcher used to test the escape system and heat shield for the first manned Mercury spacecraft. It later built the Apollo space capsules, and North American's spinoff, Rocketdyne, went on to make engines that powered every U.S. space program through the end of the 20th century.

When President John F. Kennedy committed the United States in 1961 to reaching the moon, Boeing President William Allen sent 2,000 executives to NASA to coordinate activities. The company also provided overall systems integration for the entire Apollo project and built the first spacecraft to orbit and photograph the moon in the mid-1960s. Boeing, North American and McDonnell Douglas built all three stages of the Saturn V rocket. In addition,

Boeing designed and built the Lunar Roving Vehicle used on subsequent moon missions to explore the surface.

The hand-in-hand relationship continues today. Boeing is one of NASA's largest contractors, and the company was named the Kennedy Space Center's 2008 Large Business Contractor of the Year and the Marshall Space Flight Center's 2008 Large Business Prime Contractor. Boeing went on to win the NASA agencywide award for 2008.

However, that long track record of success with NASA doesn't guarantee Boeing future space exploration contracts, Shaw said: “We have to resell ourselves each time.”

That's the job of Space Exploration. The mission and reach of this business has always been bigger than its relative size within Boeing, Schondel said: “We're only 3,500 out of 161,000 employees, but the work we do for human spaceflight provides a really powerful image for Boeing.” Schondel added the division has benefited greatly from support across the entire Boeing enterprise in all its efforts.

“The work we do here is some of the hardest that Boeing does. The people who come up in that environment and the skills they



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learn make them highly valuable to Boeing. You can name people all over Boeing who cut their teeth here,” Schondel said. Among these people, according to Schondel: IDS President and CEO Jim Albaugh and Commercial Airplanes President and CEO Scott Carson.

Harik of the Space Station program noted that he’s gained skills that he feels will serve him throughout his career. “One thing you learn very quickly working on a program as large and complex as the International Space Station is the importance of communication and effective teamwork,” he said. “For projects of this scale to be effective, there must be constant communication and a truly team-oriented outlook. Learning how to function and contribute within a team of this nature has been very rewarding.”

Shaw said the work done by Space Exploration is important to more than just the company. “It’s important to our work force. And everybody recognizes the high-tech, cutting-edge business we’re in. It’s important from a brand standpoint,” said Shaw, a former astronaut who flew on three shuttle missions. “But it’s also important because a robust space program is important to the United States.”

In a speech at last year’s National Space Symposium, Albaugh emphasized that point: “We must maintain our technology leadership position in space ... as we send men and women back to the moon and beyond ... as we further connect our world and understand it better ... and as we protect [the United States] by enhancing our space-based ability to watch and warn, protect and respond.” ■

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**PHOTOS: (FAR LEFT)** Apollo 11 commander Neil Armstrong (left) and Apollo 17 commander Gene Cernan (right) toured one of the Altair mock-ups at NASA’s Johnson Space Center in December 2008. The Altair lunar lander, which Boeing hopes to build for NASA, will take human beings to the surface of the moon for the first time since Apollo. In the background are Wayne Ottinger, who worked on the Apollo lunar lander training vehicle, and Jack Schmitt, Apollo 17 lunar module pilot. NASA

**(LEFT)** An artist’s conception of the Ares I rocket. NASA selected Boeing as the prime contractor to produce, deliver and install avionics systems and produce the upper stage for Ares I. NASA

# Space for business

## Boeing is keeping an eye on new growth opportunities far above Earth

Researching new treatments for serious diseases, expanding tourism to the stars and placing solar-power-generating stations miles above the planet may one day spur growing commerce in space.

While Boeing pursues contracts to help NASA explore new frontiers, the company also is keeping a close eye on potential business opportunities up above.

It wasn't long into the rocket age before the commercial uses of space were recognized. In 1962, a rocket built by Douglas, now part of Boeing, placed the first private satellite into orbit to transmit television signals. Since that era, Boeing has built and launched scores of satellites for the private sector.

According to Paul Eckert, international and commercial strategist for the Space Exploration division of Integrated Defense Systems, Boeing's traditional space commerce business has been focused on commercial satellites and their launches, now performed mostly through the United Launch Alliance, a joint venture between Boeing and Lockheed Martin. "The question is, will there be other markets as big as or even more successful than the commercial satellite market?" he said.

Although that question is yet to be answered, plenty of startup firms are betting on new ventures in space, most notably tourism. Virgin Galactic, which plans its first suborbital passenger flights in 2010, says more than 200 people have reserved the \$200,000 tickets. Another firm, XCOR Aerospace, hopes to offer flights at half that cost, and others aim to offer similar services.

Brewster Shaw, vice president and general manager of Boeing Space Exploration, said that Boeing has ongoing relationships or an interest in partnering with a number of small firms that are working on commercial space vehicles or related products.

"We look at each opportunity and see if it's applicable to our core capabilities, to see if we can add value to it," Shaw said, adding that Boeing carefully weighs the risk-payback ratio of potential commercial space ventures. After all, pushing forward into space doesn't make sense if it can't eventually be profitable.

According to Eckert, one relatively low-risk venture is pursuing commercial opportunities, including research, aboard the International Space Station (of which Boeing is the prime contractor). Other less glamorous space services, such as robotic servicing of satellites and basic launch support, also present possible mar-

## It's a real **blast**

Boeing and its predecessor companies have supported the United States' space efforts for more than 50 years. Here's a quick look at some of the notable achievements.

A Douglas Thor-Able rocket launches NASA's Pioneer I spacecraft 79,173 miles (127,416 kilometers) into space, the farthest distance at that time for an Earth-launched object.

NASA selects McDonnell Aircraft as prime contractor for Project Mercury, America's first manned orbital spacecraft. NASA also awards Douglas Aircraft a contract to design and produce the Delta rocket.

A Douglas rocket places Tiros I, the world's first weather satellite, into orbit.

In the first suborbital flight of a Mercury spacecraft, Alan Shepard becomes the first American in space. NASA names McDonnell Aircraft as prime contractor for Project Gemini. North American and Boeing are selected as contractors for the Project Apollo program.

In the first orbital flight of a McDonnell-built Mercury spacecraft, John Glenn becomes the first American to orbit Earth. A Douglas-built Delta rocket launches the first privately built satellite into space.

Boeing starts building a space center in Kent, Wash.

1958

1959

1960

1961

1962

1964

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kets for Boeing, said Eckert. “We’re equal to or better than other companies in all these areas.”

The most prevalent space commerce market, satellite launching services, is getting more competitive as the number of nations with space programs increases. In addition to its own U.S.-based launch operations, Boeing is a 40 percent partner in Sea Launch, a venture that includes partners from Norway, Russia and Ukraine. Sea Launch is scheduled to carry out its 30th commercial satellite launch this month.

As the future of space commerce evolves, Boeing is contributing to the emerging market by organizing and sponsoring industry discussions and space investment summits such as Space Investment Summit 6, a May event in Orlando, Fla., of which Boeing is a major sponsor. Eckert hopes that these events will encourage more private investment into commercialized space services.

“There’s a whole cluster of things, and Boeing has the potential to be involved in all of it,” he said.

– Eric Fetters-Walp



**PHOTO:** Boeing Space Exploration vice president and general manager Brewster Shaw (from left) is shown with senior NASA leaders Doug Cooke, Danny Davis, Steve Cook and Jeff Hanley with a model of the Ares I rocket at NASA headquarters in Washington, D.C. NASA

The McDonnell-built Gemini spacecraft flies for the first time.

The first Hughes Space & Communications Surveyor spacecraft lands on the moon. The Boeing-built Lunar Orbiter sends back the first pictures of the moon.

Launched by the Saturn V, Apollo 8 takes the first astronauts around the moon.

Apollo 11 makes the first manned moon landing.

Astronauts use the first Boeing Lunar Roving Vehicle on the moon.

The McDonnell Douglas Skylab, the first U.S. space station, is launched. The Boeing-built Mariner 10 launches to collect data from Venus and Mercury.

1965

1966

1968

1969

1971

1973

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# After the last launch

## Space Shuttle program teammates prepare for biggest transition in Space Exploration unit

Rich Clifford knows personally the value that Boeing's engineering expertise brings to NASA spaceflight missions. As a former astronaut with more than 600 hours in space, including a six-hour spacewalk, Clifford says the Boeing Space Shuttle team's work is nothing short of lifesaving.

Clifford, now the deputy Space Shuttle program manager for Boeing, also knows that the team's recognized commitment to excellence will be critical to NASA during its biggest transition in decades. Next year, NASA's Space Shuttle program is scheduled to end to make way for the Constellation program, which will take human spaceflight out of low-Earth orbit to the moon, Mars and beyond. Constellation includes a new fleet of spacecraft that will succeed the shuttle and enable the next phase of exploration.

Clifford and other leaders within Space Exploration, part of Integrated Defense Systems, recognize the transition will be a difficult time for employees. "You can't turn on the news and not be worried," said Ed Statham, orbiter engineering manager in Houston. "I have to stay focused on my work, but I can't say my family hasn't expressed concern about the transition, especially during these tough economic times. We've had the discussions."

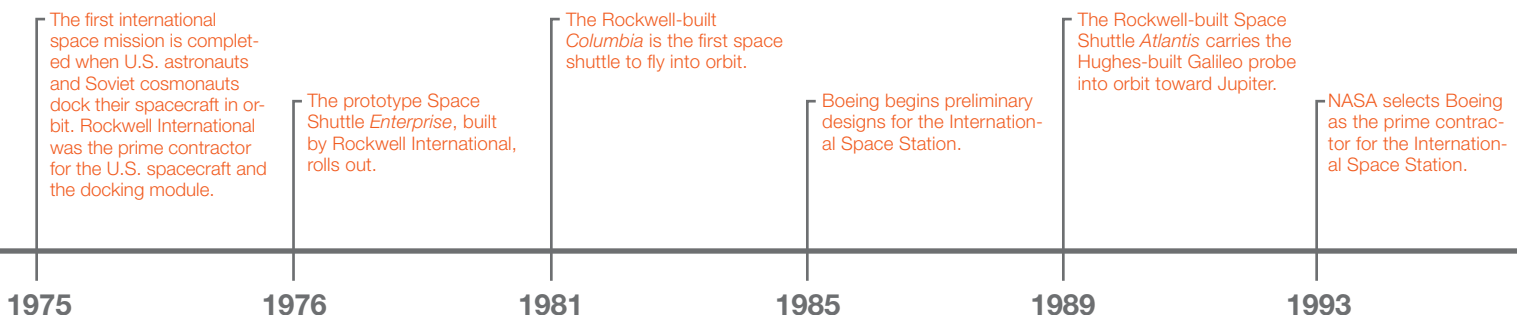
Jeff Goza, who leads the Houston hydraulic group, said he's doing whatever he can, including having earned his MBA degree, to ensure that he has the skills that will be needed.

Boeing is taking a proactive approach to the challenge: Identify what skills will be needed for future work and provide opportunities for employees to develop them. "We have several training opportunities within the engineering function," said Clifford, including classes in systems engineering, avionics and mechanisms. The company also is working to increase productivity and efficiency, in part so that individuals and organizations can take on new opportunities.

Employees who have specific critical skills and who agree to stay with the shuttle program until the last flight will be eligible for a retention incentive plan, which is intended to help them transition to other work after the program ends.

Lynna Wood, a flight software project engineer in Houston, appreciates the company's commitment to retaining skilled workers and to helping them retrain. "I don't know any other company that would go to these lengths," Wood said. "It speaks very highly of Boeing to help its people prepare for the future."

## It's a real **blast** (Continued from Page 17)





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So far, the approach to retaining key staff is working. Even with the shuttle’s scheduled retirement less than two years away, Clifford said the attrition rate is only about 2 to 3 percent, and most of those employees have moved to other Boeing projects or to NASA. “The secret is good communication,” he said. “I’m open about everything—no hidden agendas. I hold open forums, and I answer questions and concerns frankly.”

Wood said she appreciates this openness. “When folks get worried, they want and need information. I think management has recognized that,” she said.

Boeing also has a steady partner in NASA as it moves toward transition. Almost from the day the shuttle’s retirement was announced in 2004, NASA began working with its contractors to plot a smooth transition. NASA and prime shuttle contractor United Space Alliance, a joint venture between Boeing and Lockheed Martin, worked with Boeing on retention incentive packages and agreed to fund them, providing a significant boost to Boeing’s overall transition efforts.

Another facet of Boeing’s transition strategy is a robust effort to win new space exploration contracts under the Constellation program. Boeing engineers already are working on the upper stage

and avionics of the Ares I, the rocket that will launch astronauts into space. In February, Boeing submitted proposals for Ares V study contracts, the heavy-lift launcher for cargo, including the payload shroud, the Earth-departure stage, the core stage, avionics and software. At Kennedy Space Center, Fla., Boeing is pursuing the Exploration Ground Launch Services contract. EGLS will support the Ares I Crew Launch Vehicle, the Ares V Cargo Launch Vehicle, the Orion Crew Exploration Vehicle and the Altair Lunar Lander, beginning with the Constellation ground systems activation and continuing through the International Space Station and Lunar missions. Any of these projects would create new opportunities for the Space Exploration work force.

And in the meantime? “We’re focused on flying the remaining Space Shuttle missions safely, while taking advantage of all relevant training opportunities,” said Goza. “We are going to be ready.”

– Melissa Mathews

**PHOTOS:** Rich Clifford (from left), Lynna Wood and Jeff Goza are among the Space Exploration team members who are supporting future space shuttle launches while preparing for the transition resulting from this program’s end. ELIZABETH MORRELL/BOEING

