

Continuing journey

People have been living and working aboard the International Space Station for a decade—will they be there in 2020?

By Eric Fetters-Walp

Ten years ago this month, on Nov. 2, a Soyuz spacecraft carrying two Russian cosmonauts and one U.S. astronaut arrived at the International Space Station some 220 miles (407 kilometers) above the earth.

It was a significant milestone in the exploration of space—the start of a continuous human presence aboard a laboratory circling the planet at 17,000 mph (27,360 kph).

Once the Expedition One crew had settled into their new home, American astronaut and skipper Bill Shepherd told the world in a live TV broadcast: “There are a lot of people behind us to keep the station going. And we’re just starting a long journey.”

It has been a journey—with many different space station crews—and one that continues today, an achievement Boeing can take great pride in.

Boeing is the prime contractor for the design, development, integration and now sustainment for all the U.S.-built elements of the International Space Station (ISS), which is expected to be structurally completed in 2011. Boeing’s team also developed the station’s critical thermal control, life support, navigation, power, communications and tracking systems, and integrated components provided by the station’s international partners. Additionally, Boeing is responsible for the integration of all ISS payloads.

“Each year, with multiple missions going back to the station and making it grow to where it’s now nearly 1 million pounds [453,600 kilograms] floating in space, it’s been quite an achievement for the team and the company,” said Mark Mulqueen, ISS vehicle director for Boeing. “It’s also a huge, remarkable accomplishment for

the U.S. and international partners to reach this milestone.”

NASA officially accepted the space station from Boeing in March of this year, at the conclusion of a review process that verified the delivery, assembly, integration and activation of all hardware and software required by the contract. The acceptance signified the transition from assembly of the station to utilization.

“The International Space Station is one of mankind’s greatest accomplishments, and we are beginning to make great progress with a six-person crew to increase its utilization,” said Mike Suffredini, NASA space station program manager. “We will be counting on Boeing to help us maintain the station at peak performance levels so the full value of the unique research laboratory is available to NASA, its international partners, other U.S. government agencies and private companies.”

Boeing will continue to be part of the space station’s future, having started a new five-year, \$1.24 billion contract in September to continue as the program’s sustaining engineering contractor. The contract also includes purchasing spare components and modifying current systems. Boeing has more than 1,250 employees and about 1,700 contract employees at four sites—Houston, Huntsville, Ala., Huntington Beach, Calif., and Cape Canaveral, Fla.—supporting the station.

“This is a flagship NASA program, and it has put Boeing in a very unique position to support NASA,” said Rick Golden, extension proposal manager for the Boeing ISS contract. “It also has given us insight and strengthened our human spaceflight

By the numbers International Space Station

Average orbit altitude: 220 nautical miles (407 kilometers), at an inclination of 51.6 degrees to the equator

Length: 170.6 feet* (50.2 meters)

Solar array wingspan: 356.5 feet (108.7 meters)

Weight: 875,847 pounds (397,278 kilograms)

Living and working space: Equivalent to a five-bedroom home

Crew size: Six

Partners: The International Space Station is a partnership among five space agencies representing the United States, Canada, Japan, Russia and multiple European states

* Measurement when completed in 2011

Sources: Boeing, NASA

PHOTO: The bright sun greets the International Space Station in this image taken from the Russian section of the orbital outpost. NASA

core competencies from which to bid on other NASA programs.”

In return, Boeing’s considerable experience in managing complex systems helped to ensure that parts built around the globe all fit together when joined in space. “Boeing’s systems integration expertise is an important piece of the ISS program’s success,” Golden said.

As the station’s crew stays busy in daily operational tasks and scientific pursuits, Boeing’s space station team on the ground helps the NASA flight control team by sustaining and monitoring the systems that keep the station running normally. Additionally, the Boeing engineering team warns and advises NASA and the crew members when problems arise. When an ammonia pump that helps cool the space station failed in August, Boeing’s team was the first alerted to the fault by NASA. The pump was replaced during several emergency spacewalks.

Boeing also assists with the scientific activities that take place within the space station. Amanda Rice, an ISS Payloads engineer in Huntsville, is part of the team that helps coordinate research equipment transported to the station. While 297 research investigations have taken place on the station since 2001, there is plenty of room for more research equipment on board, she said.

“What I’m excited about is now that it’s truly built, it can function as a research lab. It can now do what was intended—provide an ‘out-of-this-world-class’ research laboratory.” Rice said, noting that NASA in 2005 designated the U.S. segment of the ISS as a national laboratory available for use by public and private entities. Unique conditions exist on ISS for research and development in the areas of physics, chemistry and biology. The station’s environment provides microgravity, extreme heat and cold cycles, ultra-vacuum, atomic oxygen and high energy radiation, as well as an incredible vantage point to Earth—a low altitude and orbital path that passes over 90 percent of the world’s population.

Boeing is conducting studies to determine whether the space station’s “life” can be extended well into the next two decades, said Joy Bryant, vice president and program manager for Boeing’s ISS Program. Originally, the station was to be used only until 2015. U.S. President Barack Obama has proposed extending that through at least 2020, an idea that quickly won support from the station’s international partners.

Mulqueen, Boeing’s space station vehicle director, noted the first Russian-built element of the station already has passed a 30-year fatigue test, which began more than three years ago. The newer U.S.-built elements are going through a life-extension analysis. “We do all kinds of scenarios, test all kinds of liabilities to make sure the parts can handle the loads and thermal cycles for years into the future,” he said.

Beyond the question of whether the station’s structure and systems can outlive original expectations—Mulqueen and Bryant are confident they can—other challenges need to be solved. There are logistical questions to be answered about getting personnel and supplies to the station in the long term. Bryant said plans also need to be made for increasing maintenance requirements as the station ages.

“You’re talking about a spacecraft housing six people continuously that’s also the size of a football field,” Bryant said. “It’s not each individual system that makes it complex, it’s the combination of all those systems up there in the harshest environment imaginable.”

PHOTO: STS-119 mission specialists Joseph Acaba (left, inverted) and Richard Arnold work on the space station’s Boeing-built truss during their mission’s third spacewalk in March 2009. NASA

So far, however, space station program managers say the fact that it has operated with few major problems in its first 10 years of habitation bodes well for its long-term future.

Boeing employees working with the space station—winner of the prestigious Collier Trophy in 2009—say they’re proud to be part of the historic program. Bob Levy, an electrical power systems engineer in Houston, said he’s watched the station pass across the sky above Texas many times and even talked recently to an astronaut on board.

“What I like is the fact that when I come up with ideas and present them to NASA, very often they get implemented and new hardware is flown up,” Levy said. “I’m very proud of how well it’s performed, of the work I and the rest of the team have done.”

The value of the scientific experiments performed on board the station, along with the unique opportunity to study how long stays in space affect human beings, can’t be emphasized enough, agreed Rice and Bryant. The lessons learned in sustaining life in the zero-gravity of low Earth orbit could one day be used on long journeys to other planets.

“Not only is it a true engineering marvel—what we went into engineering for—but it’s also human spaceflight,” Bryant said. “With the capabilities the ISS has, I firmly believe that a discovery on the station one day will change how we view life, or how we live it.” ■

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— Amanda Rice, ISS Payloads engineer, Huntsville, Ala.

PHOTO: MICHAEL MCCORMICK/BOEING



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