Cosmonaut Fyodor Yurchikhin (left) and astronaut Shannon Walker worked together on the 2010 Expedition mission.

NASA

Space Station's Legacy

Bolden: 'Peaceful coexistence of formerly bitter enemies is the ISS' crowning achievement'

By Joseph Bennington Castro

AFTER 30 YEARS OF MISSIONS, NASA's space shuttle program officially ended in July 2011, leaving many people to wonder about the future of the United States when it comes to human spaceflight.

But NASA's vision is as ambitious as ever, with two manned deep-space missions already in the works. By 2025, the agency plans to capture, redirect and study a near-Earth asteroid.

"The nation's ultimate goal is to send humans to Mars in the 2030s," said NASA Administrator Charles Bolden.

And many say that as long as the International Space Station remains an orbiting test laboratory, America's presence in space should not be questioned.

> "I believe that the ISS is a strong candidate for a Nobel Peace Prize."
> **—Charles Bolden**

Before commencing these missions and extending the life of others, NASA has much to determine about the safety of living in space, including how the body deals with lengthy space missions and how to develop sufficient life-support systems, Bolden noted.

And the research conducted on the ISS is integral to overcoming these challenges. "The ISS is key to NASA's future plans for deep-space exploration," said David Weaver, associate administrator for NASA's Office of Communications.

For example, in 2015, astronaut Scott Kelly will embark on a yearlong mission aboard the ISS, while his identical twin, retired astronaut Mark Kelly, will remain on Earth. Health comparisons of the brothers throughout the mission will help NASA understand how prolonged weightlessness

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ONBOARD REPAIRS

COSMIC CLOGS ON THE ISS

Sometimes all you need for a high-flying repair is duct tape

If you have a leaky sink, clogged toilet or a squeaky door, and you're not particularly handy, what do you do? Mere earthlings call a repairman. But on the International Space Station, you'd better know how to handle a wrench—or a toothbrush, or duct tape, or whatever it takes.

NASA's can-do attitude toward onboard repairs is inspired by the near-disaster aboard Apollo 13 in 1970, when the astronauts found a way to shunt rising levels of carbon dioxide out of the command module with a lifesaving gizmo made of cardboard, plastic bags, suit hoses and duct tape.

While the majority of space station repairs are not nearly that critical, the most notorious ones generally involve—what else— the toilet.

With an unprecedented 13 people onboard in 2009—six crew members as well as seven astronauts visiting from the shuttle Endeavour—one of the ISS' two toilets flooded and was placed off limits (the Endeavour also had its own commode for crew members). Luckily, the $15 million station toilet was only out of commission for about a day.

In September 2012, astronauts attempting to install a power unit on the space station's exterior ran into a stubborn bolt. During a four-hour spacewalk, they used a pressurized can of nitrogen and tools fashioned from supplies on hand—including a toothbrush—to work the bolt loose, remove the debris that was causing the problem and finish the job.

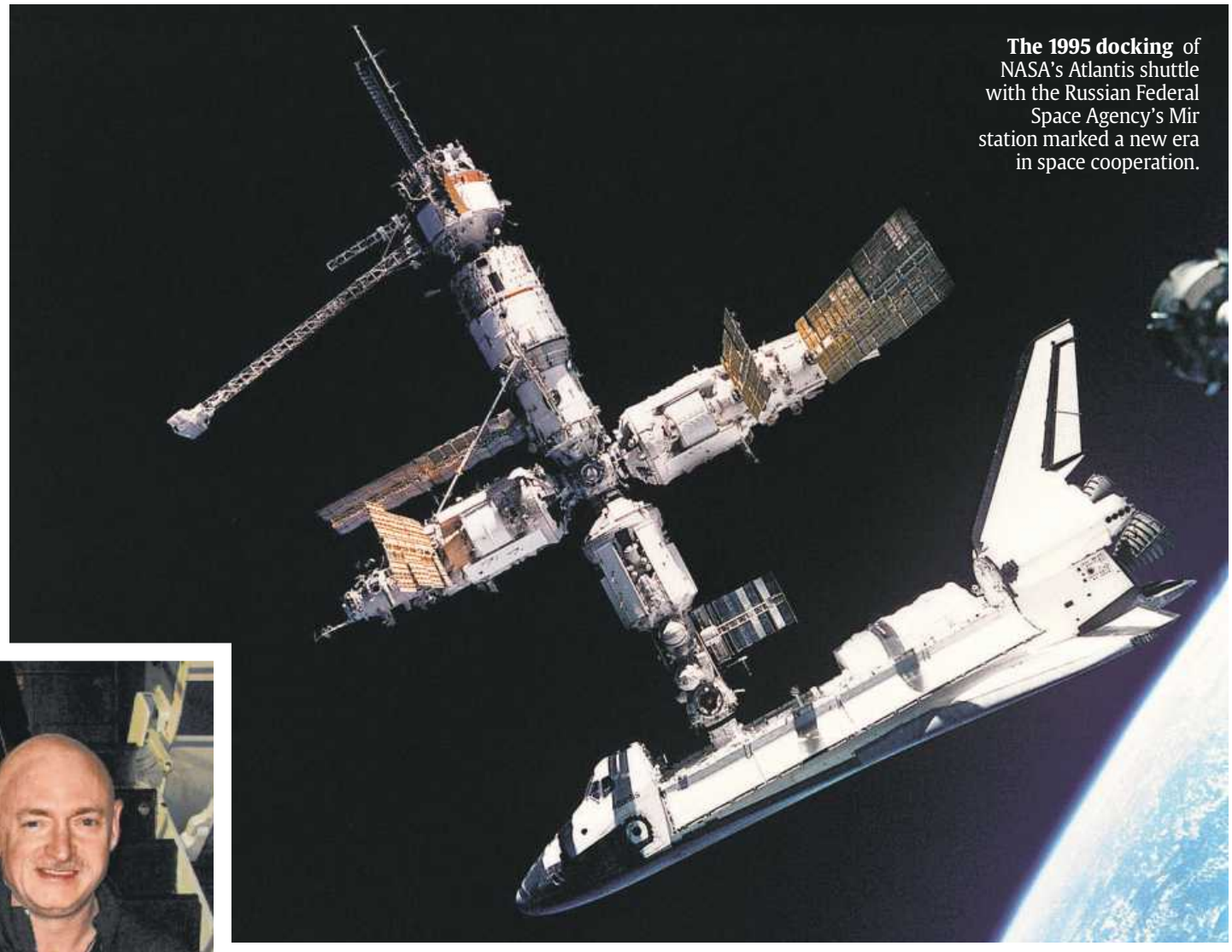
Sometimes, though, the crew has to call home for reinforcements. After Italian astronaut Luca Parmitano was forced to cut a spacewalk short in July because his helmet was filling with water, NASA shipped a spacesuit repair kit to the station on the next resupply mission.

"It's just like when you are working on your house. Sometimes you have to make a trip to the hardware store," NASA spokesman Josh Byerly told New Scientist magazine.

—Elizabeth Neus

PRIME REAL ESTATE IN THE SKIES

Too many upgrades to list! You have to see this $100 billion structure to believe it. Orbiting 240 miles above Earth, the International Space Station measures 357 feet end-to-end and is as big inside as some five-bedroom homes. It has two bathrooms, a gymnasium, an eat-in-kitchen and a magnificent bay window that offers incredible vistas of our universe.



The 1995 docking of NASA's Atlantis shuttle with the Russian Federal Space Agency's Mir station marked a new era in space cooperation.

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NASA plans a yearlong study of astronauts Scott Kelly (left) and his brother, Mark, who has retired.

affects the human body, among other things.

"That one ISS mission will be a huge risk reducer," Bolden said. "We can use the station as a microgravity platform—sort of like a simulation of what it will be like on this 8-monthlong journey to Mars."

The ISS is Earth's largest habitable, artificial satellite, which took more than 10 years and 30 missions to complete. The $100 billion structure is the result of an unprecedented collaboration involving five international space agencies representing 16 countries, including the U.S., Russia, Canada, Japan and many European nations.

Though the first piece of the ISS—the Zarya Control Module—launched in November 1998, the station's real beginnings occurred many years prior.

The most significant milestones for the ISS were the decisions that led to building the station, Weaver said.

In 1959, NASA envisioned constructing a "permanent near-Earth space station." Over the years, however, numerous political and economic issues prevented this from happening.

In January 1984, President Ronald Reagan breathed new life into the goal when he directed NASA to develop a permanently manned space station.

With help from Europe, Japan and Canada, NASA began work on Space Station Freedom. In 1993, Russia joined the program, in part to promote post-Cold War relations between Russia and the U.S.

The nations combined Space Station Freedom and Russia's planned Mir 2 station, giving birth to the International Space Station.

Two weeks after Zarya launched, NASA sent up Unity, America's first ISS module. More than a decade later, in early 2011, the ISS added the final module from the U.S., marking the completion of the station, at least from NASA's standpoint.

Between receiving its first and last U.S. pieces, the ISS has seen many milestones.

For instance, the station welcomed its first crew, consisting of an astronaut and two cosmonauts, in November 2000 and has had continuous human occupation since then. In spring 2001, it received its first non-American or Russian module, making it a truly international structure.

By 2008, astronauts had installed three research laboratories from Europe, Japan and the U.S. that allow crewmembers to conduct experiments in everything from biology to physics.

About the size of a five-bedroom house, the ISS is now bigger and heavier than the now-defunct Mir station, and can accommodate six permanent crewmembers at once.

For Bolden, a major ISS milestone came when Robonaut 2 joined the station in 2011. Technology from the humanoid robot eventually led to the development of the X1 Robotic Exoskeleton, which may be able eventually to help disabled people on Earth walk again. The device will eventually be sent to the ISS to give the weightless crewmembers a way to exercise while they work.

Though many of the station's milestones are technologically based, Bolden thinks its lasting legacy will be more social in nature.

"I am a person who believes the ISS is a strong candidate for the Nobel Piece Prize," Bolden said. "The crowning achievement of the ISS has been the peaceful coexistence of formerly bitter enemies on a cooperative mission to make life better on Earth."