Taking care of business

Astronaut Piers J. Sellers, STS-121 mission specialist, participates in the mission's third and final session of extravehicular activity.

NASA S121E06583

STS-121 was highlighted by three productive, action-packed spacewalks. During the first, Mission Specialists Piers Sellers and Mike Fossum prepared the International Space Station's Mobile Transporter rail car for restoration and tested the combination of *Discovery*'s robotic arm and Orbiter Boom Sensor System as a platform for orbiter repairs. In the second excursion, Sellers and Fossum restored the rail car to full operation and delivered a spare pump module for the station's cooling system. And during the third, the two astronauts tested a reinforced carbon carbon repair material. Mission Specialists Lisa Nowak and Stephanie Wilson performed the robotics elements of all three spacewalks from within the spacecraft.

Space Center Roundup

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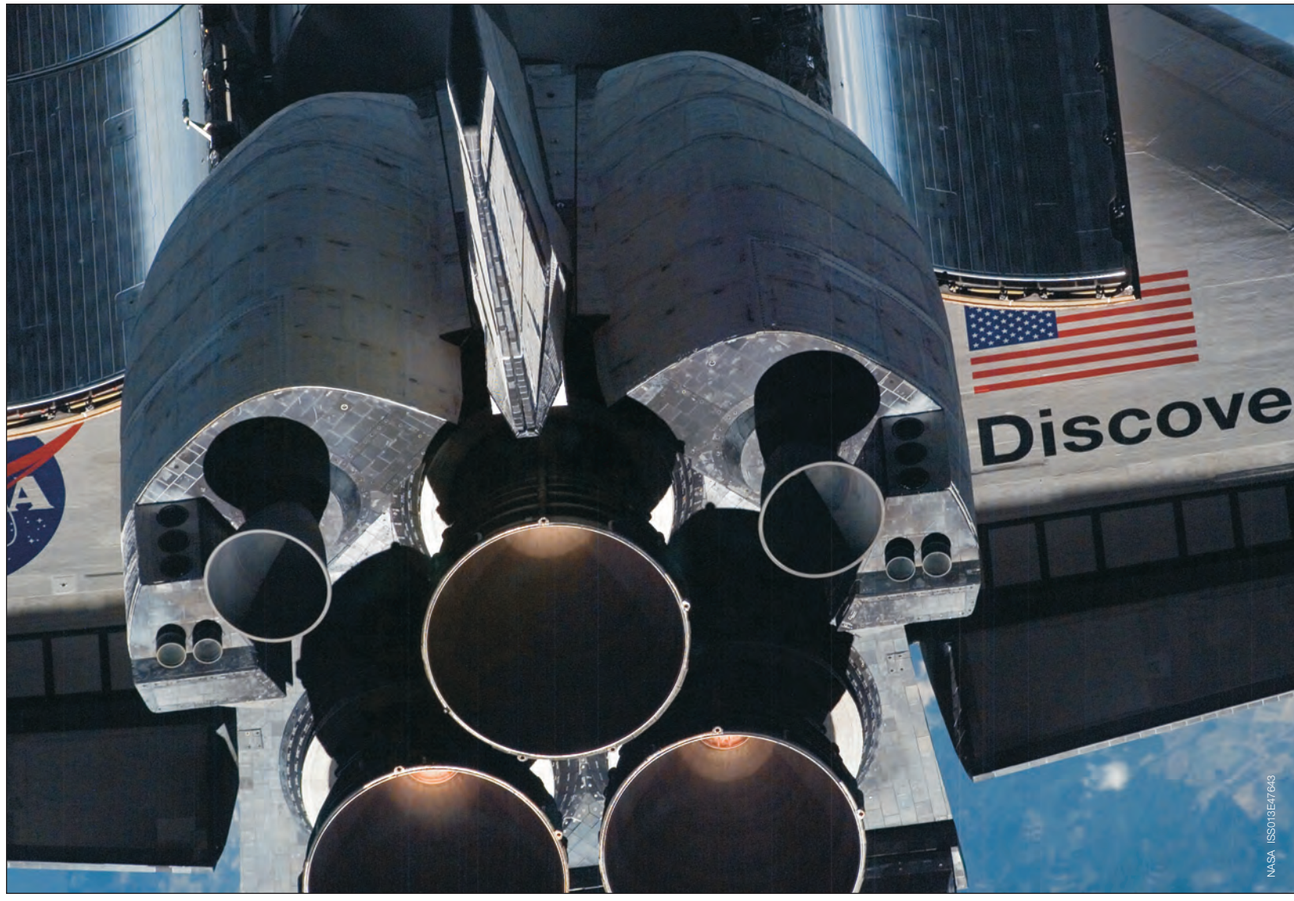


NASA ISS016E47643

'Most photographed' STS-121 returns

Data from more than 100 high-definition, digital, video and film cameras documenting the launch and climb to orbit helped assess whether the orbiter sustained any damage and whether that damage posed any risk to *Discovery*'s return to Earth.

guest column

SPACE SHUTTLE PROGRAM MANAGER WAYNE HALE

Editor's note: Wayne Hale gave the following speech at a recent Space Flight Awareness event. The Roundup *staff felt that it should be shared with the entire center.*

These days, I think it's good to remember why we are doing what we do—why we explore space as an agency, why this nation decided we should go forward on this course. I've tried to run down the list of reasons, then I looked at each of them and tried to justify why we spend long, excruciating hours trying to do this risky business.

Is it because of the great spin-offs in technology and the advancements to our economy? Is it for national prestige? Those are all great, but I don't think they're the real reason. Is it because we're going to learn new things on the frontier? Perhaps they will invent the cure for cancer on the International Space Station, or perhaps we'll mine helium-3 from the lunar surface and discover how to turn it into unlimited fusion energy. Well, perhaps so—the history of exploration is fraught with discoveries that were totally unanticipated at the time that the exploration went forward. There will be new things that we will uncover that are totally unimaginable to us today, but I don't think that is the real reason.

Here is the real reason that I think spaceflight is important: It is because we live in a virtual world. We live in a world where our children are consumed by computer games and where we are enamored with the latest story out of Hollywood or on the video screen. We live virtual lives—it's not real, and when the game's over we can reset it and play it again and it didn't really count for anything.

But what we do is real. It's not made up, it's not computer generated and it's not an artist somewhere with a blue screen making it happen. It's real.

And we're doing something that is hard. We're doing this because it's a challenge and we need a challenge as a people. We would atrophy, we would stagnate and we would fall back into meaningless activities if we didn't have a challenge.

I've been reading a book about the Wright brothers and I came across this quotation. In 1901, Wilbur Wright talked about learning to ride a wild horse, saying that the best way was simply to get on and learn by experience. "It's very much the same in learning to ride a flying machine," Wright said. "If you are looking for perfect safety, you will do well to sit on a fence and watch the birds. But if you really wish to learn, you must mount a machine and become acquainted with its tricks by actual trial." I think that's sound advice.

Another appropriate quotation recently came across my desk. This one came from Shakespeare: "Our doubts are traitors and make us lose the good we oft might win by fearing to attempt."

Despite the doubts and despite the difficulties, we're going to continue on this path of exploration. And because of the hard work of everyone here, I am sure that we will be successful.

Constellation of student programs turns visions into realities

by Debbie Nguyen

The Vision for Space Exploration is employing a stepping-stone approach to get America back to the moon, then on to Mars and beyond. For NASA to make this vision a reality, it needs a diverse, efficient, robust and technical workforce. As the agency transitions from lower-Earth orbit to beyond, who will be the faces of the new frontier?

To help answer that call, NASA has a constellation of student programs aimed at inspiring the next generation of explorers, feeding the pipeline and helping future leaders get their feet in the door of space exploration.

Several employees at Johnson Space Center have used these programs as pathfinders to their careers. The following is a snapshot of where these participants are now and how each program helped launch their dreams.

JONATHAN ABARY

Office of Communications and Public Affairs

Office Education (OE) Program, Education and Training Cooperative (ETC) Program, and NASA's Cooperative Education (Co-op) Program

NASA/Blair - JSC2006E21652

Jonathan Abary

Even though Jonathan Abary is only a sophomore at the University of Houston, he's already spent three years at JSC. He first got his foot in the door when his co-op teacher encouraged him to pursue the OE Program.

"The OE Program is a great way to allow high-school students the once-in-a-lifetime chance to become familiarized not only in a professional environment, but also with NASA as an agency," said Abary, who then transitioned into the ETC Program.

During his time as an ETC student, working part-time and going to school full-time, Abary supported the Astronaut Selection and Awards Office, coordinating center and agencywide awards ceremonies. There, he was introduced to NASA's Co-op Program.

Abary, a business major, wrapped up his first co-op tour in the spring as a contract specialist in the International Space Station Procurement Office. He continues through the pipeline to the Office of Communications and Public Affairs this summer, further broadening his experience.

GENEVIEVE A. JOHNSON

Intelligent Systems Branch

Minority University Research and Education Program (MUREP)

For the past 12 years, Genevieve Johnson has been developing advanced automation and intelligent software systems as a computer engineer in the Automation, Robotics and Simulation Division. Her father, also an engineer, was a major influence early on, but her journey to JSC began right after graduating from Houston's Booker T. Washington High School for Engineering Professions. There, she was selected for the Women in Science and Engineering (WISE) Scholars Program provided by NASA, in partnership with Spelman College in Atlanta.

continued on next page

NASA/Blair JSC2006E21850

Genevieve A. Johnson

Through WISE, Johnson was able to do summer internships at JSC. The program provided her with real-world experience and insight into NASA's inner workings while exposing her to possible engineering career opportunities.

"My internship experiences ranged from maintaining astronaut training files to developing a software data download protocol. The experience provided me at Spelman College was, and will always be, immeasurable," Johnson said, who went on to earn dual bachelor's degrees in physics and electrical engineering from Spelman College and the Georgia Institute of Technology.

BRIAN BUTCHER

Government Furnished Equipment (GFE) Product Engineering Branch

Texas Aerospace Scholars and Co-op Program

When Brian Butcher realized he had a knack for writing computer programs, he never thought his journey would take him to the nation's space program.

"I had never considered working for NASA because I never realized how many different skills it takes to run the space program," Butcher said.

That all changed when he participated in the Community College Aerospace Scholars (CAS) program in 2004 to join other Texas community college students to design a Mars rover. There, he met NASA employees and learned about the agency's Co-op Program.

After returning to JSC to help at the next CAS event, he started his first co-op tour in the Information Resources Directorate in spring 2006. He is now in his second tour, supporting the GFE Product Engineering Branch in the Engineering Directorate.

"I believe that if it were not for the CAS program, I would not be a co-op today," said Butcher.

GINGER KERRICK

Mission Operations Directorate

Summer Internship Program and Co-op Program

Growing up, flight director Ginger Kerrick had two goals: either to become a professional basketball player or an astronaut. A knee injury in junior high led her to focus on becoming an astronaut.

"Even in junior high, I realized that becoming an astronaut was a lofty goal, so I should aim for something that I would truly enjoy if I was unable to achieve that. I knew I wanted to work at NASA," said Kerrick.

After some research, she set her sights on JSC because "it seemed to be the focal point of operations supporting manned spaceflight, and that's what I wanted to be a part of."

It only took her a moment to turn down two other summer internships when she was offered a position in the NASA Summer Internship Program. She started in the summer of 1991 in the JSC Calibration Laboratory, but when she finished her internship, her mentor, Joe Olivarez, recommended that she transfer to the Co-op Program. Kerrick returned the following summer as a graduate co-op.

After spending 14 years at JSC, Kerrick is now a flight director in the Mission Operations Directorate. She is the lead flight director for Expedition 14.

DR. NOREEN KHAN-MAYBERRY

Environmental Factors Division

NASA Fellow

Dr. Noreen Khan-Mayberry had always wanted to discover the unknown and had ambitions to be a scientist at an early age. Like many other young children, she also dreamed of becoming an astronaut. With her parents' encouragement and frequent visits to JSC during her childhood, Khan-Mayberry had all the inspiration she needed.

"When I was in graduate school, I was selected for a NASA fellowship and worked in the Mars High Pressure Laboratory at JSC. After I earned my Ph.D., I heard NASA was recruiting from several universities—two of which were my alma maters—looking for scientists and engineers. I jumped at the opportunity, and here I am today. I love my career and would not trade it," said Khan-Mayberry, who is in her third year as a space toxicologist in the Environmental Factors Branch at JSC.

NASA/Blair JSC2006E21851

Brian Butcher

Her group, Space Toxicology, sets human health standards for chemical exposure aboard spacecraft and evaluates systems and payload materials to determine crew exposure to toxins inherent in the shuttle and station environments. Using lessons learned from the Apollo era, the group is now investigating the possible toxic effects of lunar airborne dust for future trips to the moon.

MICHAEL ZOLENSKY

Space Scientist

National Research Council postdoctoral fellow

At 8 years old, Michael Zolensky had the heart of a scientist. Today, he is a geologist who manages a program at JSC to collect comet and asteroid grains entering Earth's atmosphere in search for clues to the origins of the universe.

Over the past 23 years, he has been part of the science teams for three missions: the Long Duration Exposure Facility, Stardust and Hayabusa—two of which successfully returned samples from space. He has also participated in meteorite recovery expeditions on five continents.

"I didn't set out to work for NASA, but came to JSC after graduate school, where I worked on nuclear waste disposal. In graduate school I became very adept at handling and analyzing microscopic samples, which is essential for my work here at JSC. I came here as a National Research Council postdoctoral fellow and was lucky enough to be working here when they had a need of a new mineralogist/geologist," Zolensky said.

ERIN REED

Mission Operations Directorate, Systems Division

Undergraduate Student Researcher Program and Co-op Program

Erin Reed was hired into the Motion Control Systems Group in May 2006. Since then, she has been training to be an Attitude Determination and Control Officer and will eventually fly the International Space Station from the ground.

However, it wasn't until after high school when she realized what she wanted to do with her life. When she read about the Mars Rover missions, she decided that she wanted to help send people to Mars and began her search for a job at NASA.

"I started in the Undergraduate Student Researcher Program and worked with the Advanced Thermal Group in the Crew and Thermal Systems Division. I was able to get a lot of hardware and analysis experience in that group, and more than anything, I was able to get to know my management and show them what I was able to do," Reed said.

Then she discovered the Co-op Program.

"I knew if I could get into the Co-op Program I would be able to come back several more times. My manager and mentor were very encouraging and supported me every step of the way. Once I was in the program, there was no looking back!"

NASA/DeHoyos JSC2004-00380

Erin Reed

From the spectacular Fourth of July launch to the smooth landing 13 days later, Space Shuttle *Discovery* and its crew made STS-121 look easy. The crew—Commander Steve Lindsey, Pilot Mark Kelly and Mission Specialists Mike Fossum, Piers Sellers, Lisa Nowak and Stephanie Wilson—delivered more than 28,000 pounds of equipment to the International Space Station, as well as a third crew member: European Space Agency astronaut Thomas Reiter. The flight included three spacewalks to test shuttle safety improvements and prepare the station for future assembly missions.

To read more about STS-121, go to: *www.nasa.gov/shuttle*

NASA STS121-S-030

NASA/Shiflett STS121-S-059

NASA/Blair JSC2006E26558

'We had a long but very successful mission.'

That's what a smiling Commander Steve Lindsey said of the 13-day, 5.3-million-mile journey to the International Space Station. "This crew sitting before you were just about as perfect as you can be on a flight. As commander, it was a privilege to be on this crew and serve with them."

Hundreds more photos from all aspects of STS-121, including launch, Mission Control support, spacewalks and landing, are available at www.nasa.gov.

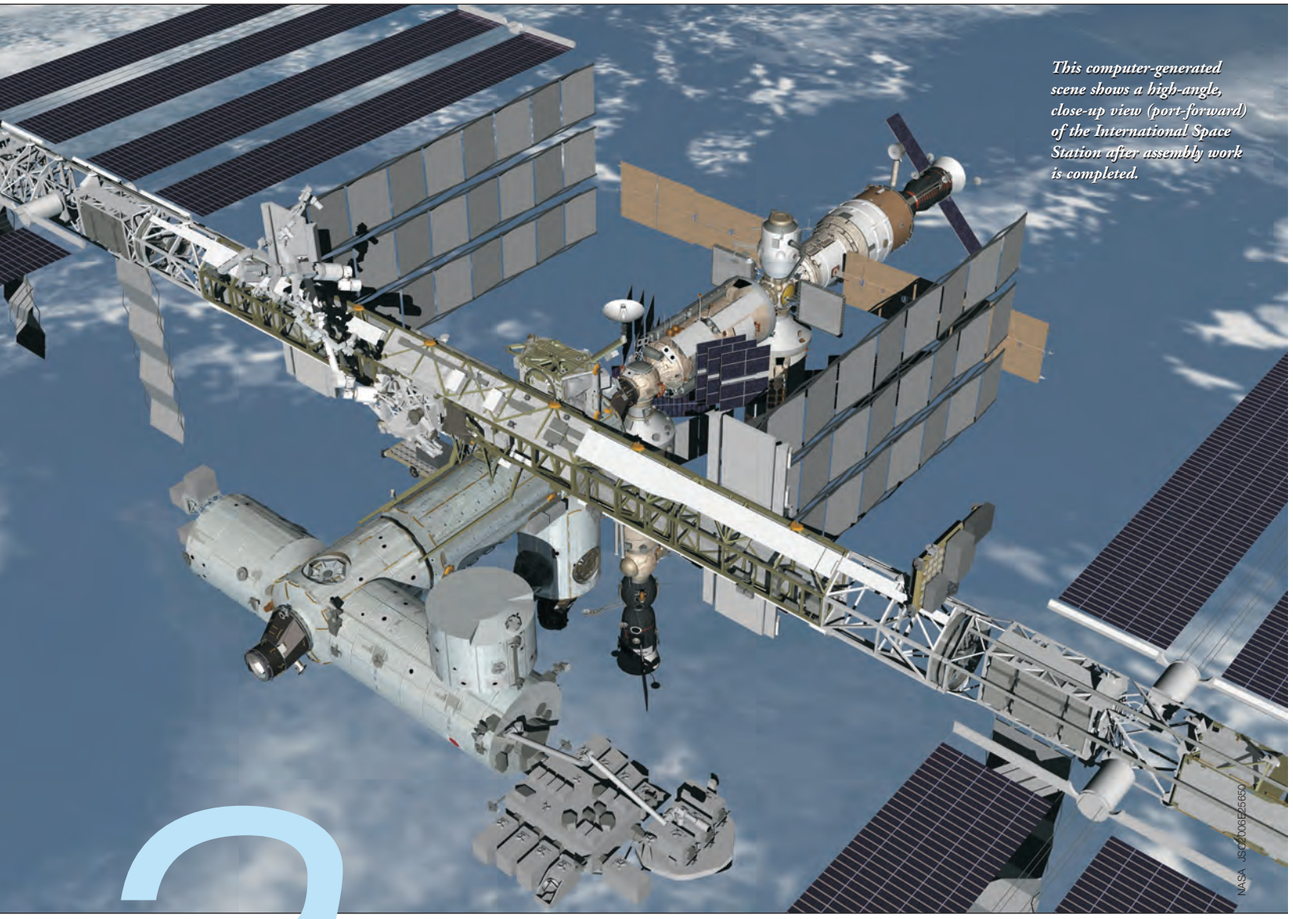
NASA/Shiflett STS121-S-057

NASA STS121-E07386

STATION ASSEMBLY SET TO RESUME

Not your average Tinkertoy®

by Catherine E. Borsché



This computer-generated scene shows a high-angle, close-up view (port-forward) of the International Space Station after assembly work is completed.

NASA JSC2006E25650

As *Discovery* coasted back to Earth, concluding another successful Return to Flight mission, STS-115 began ramping up to begin another milestone—the continuation of International Space Station assembly efforts.

The conclusion of the STS-121 mission psychologically signaled a new phase of the space program. STS-121 astronaut Piers Sellers reflected on the magnitude of the mission's achievements following the crew's first spacewalk.

"There were two things I was expecting: 1) that the shuttle would fly with no problem—we would have a clean vehicle and 2) we would leave the space station in a good station and pick up assembly sequence. We would start again and continue assembly," Sellers said. "We're fixed and ready. We're two for two."

The space station has been in a holding pattern while NASA concentrated on making the shuttle safer to fly after Columbia. It has been a challenge and a learning experience for the International Space Station Program to keep the station operating and ready to resume assembly at any moment, but now there is much hope on the horizon. While NASA continues to test the space shuttle on each mission, it has a bigger mission to carry out along the way.

"Really, (STS-) 115 is the return to the assembly sequence, and I think that's significant," said STS-115 Commander Brent Jett. "We have a mandate to finish the station by 2010 and retire the shuttle. We need to shift from Return to Flight mode back to a more operational assembly sequence."

This next mission will catapult the station into a new era of construction. The 18-ton P3/P4 truss segment to be deployed during STS-115 will greatly change the exterior look of the station and nearly double its power-generating capabilities.

"On the port side (of station), we've already got P1, which is the port number one truss element, and we're going to add the port three and four, which attach to it," said STS-115 Mission Specialist Dan Burbank. "The business end of this truss segment is a set of solar arrays that are much like the ones we already have on the very top of the space station right now, and these will extend out to 240 feet and give you the capability of generating a lot of power from the sun's energy."

In the near term, the station will be getting a much-needed boost of energy, but there are other exciting changes in store for future assembly missions.

In the latter part of 2006 and into next year, shuttle visits will facilitate the building of the station's "backbone" with truss segments and solar arrays. Power and plumbing systems will be rewired to a permanent configuration. The Node 2 module—the piece that will connect the European and Japanese experiment modules—will be delivered. The European Space Agency (ESA) will also launch its first in a series of automated vehicles that can ferry 7.5 tons of cargo to the station.

Once the backbone of the station is well underway, international partners will begin adding their own unique elements to bring the station to another dimension as a research platform.

"We're all chomping at the bit to get this construction going again," STS-115 Mission Specialist Joe Tanner said, calling the station "a house that's only partially built" at this point. Tanner spoke highly of the modules that are scheduled to be launched and installed soon.

"The Japanese module is a beautiful science platform. I've had a chance to work with those engineers and see the module, and it's really magnificent," he said. "The European module, Columbus, is going to be fantastic. Node 2 is sitting at the Cape (Canaveral), ready to go, and needs to be launched. I think it's a great shot in the arm for everybody in the partnership to [say], 'Okay, let's get going again, and let's finish this job that we started out.'"

When ESA's Columbus laboratory module is installed, it will provide room for researchers on the ground, aided by the station crew, to conduct thousands of experiments in life science, materials science, fluid physics and other fields in a weightless environment.

The Kibo Japanese experiment module will provide a storage room for experiments, maintenance tools and supplies, as well as a high-tech laboratory that will focus on space medicine, biology, Earth observations, biotechnology, communications and more. Its Remote Manipulator System, or robotic arm, will allow astronauts to interact with experiments on the outside of the station.

And that is just the tip of the iceberg for the space station, which will more than triple its state-of-the-art research facilities from its current configuration. The volume and mass of the station will also more than double from its current size.

Station experiments and research have already yielded invaluable scientific advances, such as the use of medical ultrasound as an on-orbit diagnostic tool—a development with many applications on Earth.

Not only that, but building this special laboratory can be seen as one of humanity's greatest achievements, especially when considering the international partnerships involved. Even though the program must be prepared to deal with unexpected challenges, NASA is doing all it can to plan for contingencies and maintain a realistic view of the tremendous task at hand. Completing the station will require immense effort and coordination, but the benefits will far outweigh the difficulties along the way.

"The International Space Station is a learning platform for our future exploration goals," said Space Station Program Manager Mike Suffredini. "Once we complete construction on the station, NASA will be able to set its sights even higher and use the knowledge gained from our research to make possible what was previously considered impossible."

NASA JSC2006E40249

The International Space Station U.S. Node 2 module is placed into an Airbus Beluga heavy-lift aircraft. Node 2 will provide a passageway between four space station science experiment modules.

NASA JSC2003E34758

The Kibo Japanese Experiment Module's Pressurized Module, a space station-bound science laboratory, is lowered into a crate in preparation for shipment to Kennedy Space Center. Modules like Kibo will enhance the station's future research capabilities.

Spacewalks essential to STS-115

by Brad Thomas

Astronaut Joseph R. Tanner waves to his cabin-bound crewmates during an STS-97 spacewalk.

NASA STS097-703-011

The STS-115 mission, which will resume the on-orbit construction of the International Space Station, promises to be challenging. Space Shuttle *Atlantis* and its six-member crew will deliver a truss segment and set of solar arrays, increasing the station's ability to create power.

Crucial to the installation of these new components are the three scheduled extravehicular activities (EVAs), or spacewalks. A mixture of veteran and first-time astronauts will make the journey and get the job done.

Commander Brent Jett, who has flown on three previous shuttle missions, will be joined by Pilot Chris Ferguson, a rookie astronaut. Mission Specialists Dan Burbank and Joe Tanner are veteran astronauts with experience at the station. Two more mission specialists—first-time crew member Heidemarie Stefanyshyn-Piper and Canadian Space Agency (CSA) astronaut Steven MacLean—round out the crew.

MacLean, who has one shuttle mission under his belt, will become the first Canadian to operate the station's CSA-built robotic arm. He will use the arm to connect the P3/P4 truss to the P1 truss.

The group has been training since 2002. Much of the preparation has been centered on the mission's spacewalks, which will be conducted by two different teams: Tanner and Piper will perform the first and third spacewalks, with Burbank and MacLean conducting the second one.

The first two spacewalks will occur on back-to-back flight days and will be devoted to preparing the truss for solar array deployment. The spacewalkers will connect power and data cables between the P1 and the newly installed P3/P4 segments and release locks and launch restraints.

Tanner said that the first spacewalk will include tasks similar to activities he performed during STS-97, but that STS-115's second excursion features new tasks.

"Dan and Steve, on EVA 2, have their work cut out for them. These are activities that we've never done before," said Tanner. Everything that we do on EVA 2 is brand new."

On flight day 6, the new photovoltaic solar arrays are scheduled to be deployed. The deployment will take place in six-inch increments to allow for the proper thermal conditioning of the array blankets. Also, the arrays will be deployed at high tension to avoid the motion that occurred when the station's first set of arrays was deployed during STS-97.

"The deploy day is going to be very dramatic—onboard, in the control room and visually, I believe, for the people who watch the station go over at night," Tanner said.

Then on flight day 7, Tanner and Piper will conduct the mission's third spacewalk. The major tasks will be to attach the solar array radiator for deployment, retrieve a material science experiment from the station's exterior and perform antenna installation.

Once fully operational, the 240-foot arrays will increase the station's power capability. The 82 active array blankets contain a total of 16,400 individual silicon photovoltaic cells to convert sunlight into electricity.

The P3/P4 truss also features a device called the Solar Alpha Rotary Joint (SARJ). This new joint will be joined to the end of the P5 truss once it is delivered during STS-116 and the P6 truss after it is relocated during STS-120. The SARJ can rotate 360 degrees to position the P4 and P6 solar arrays to track the sun for electrical power generation.

Tanner said the SARJ will help the station be more efficient in collecting energy.

"The attitude of the station, of course, is adjustable, but some attitudes are more favorable from a propulsion point of view and a control point of view," Tanner said. "You really want the solar arrays pointing at the sun—perpendicular to the sun's rays—so that you can get the maximum collection of energy."

Jett said the addition of the P3/P4 truss and the other segments of the truss are important for the future assembly of the space station.

"The entire reason we are building the truss on the station is to get these power modules up there and to provide the power for the European laboratory module and the Japanese laboratory module," said Jett. "They all link together into finishing the station and meeting our obligations to our international partners."

Once completed, the Integrated Truss Structure will span more than 300 feet and carry power, data and environmental services for the station.

In addition to the truss work, the STS-115 crew is slated to inspect *Atlantis*' heat shield and deliver supplies and equipment to the orbital outpost.

Piper said excitement is building with the launch drawing near.

"I am getting very excited as we're getting closer, especially because of the fact that we've waited for so long for this flight," she said. "Now that we're getting closer and closer it's … sinking in that the job is not training for flight, but the job is actually to go fly. And that's something we are going to do. We are going to go fly."

NASA /Markowitz JSC2002E44130

Canadian Space Agency (CSA) astronaut Steven MacLean

NASA/Blair JSC2002-01927

Mission specialist and veteran astronaut Dan Burbank

NASA /Markowitz JSC2005E13783

First-time crew member Heidemarie Stefanyshyn-Piper