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Explore. Discover. Understand.

Discovery, crew ready to return Space Shuttle fleet to flight

By Jim Kennedy
Kennedy Space Center Director

SPACE SHUTTLE Discovery rests at Launch Pad 39B as it awaits the Return to Flight mission STS-114.

The time is now! After more than two years of safety modifications and vehicle upgrades, Discovery stands poised for liftoff at Pad 39B, launching NASA and America's Space Shuttle Program back into space.

NASA and our contractors have made improvements across the program, making this the safest Shuttle launch in the Agency's history.

The excitement level here at the Kennedy Space Center is matched only by the pride each of us feels from working so diligently together for a safe Return to Flight. In this special commemorative edition of *Spaceport News*, I want to share that enthusiasm with you.

This issue will provide details on the important 12-day mission and you'll get to know each of the seven astronauts traveling into space aboard Discovery. We'll look at the safety improvements to the Space Shuttle and highlight several key employees who helped to process the flight hardware.

Kennedy Space Center Director Jim Kennedy

It's amazing how far we've come together in so little time, but even more incredible is how much farther we'll go.

The Return to Flight mission to the International Space Station is the first step in the nation's Vision for Space Exploration, which calls for returning to the Moon, then sending human explorers to Mars and beyond.

The major focus of mission STS-114 will be evaluating new safety measures, including new inspection and repair techniques. These include an Orbiter Boom Sensor System that attaches to the end of the orbiter's robotic arm to view the exterior of the vehicle after launch, and Space Shuttle tile and Reinforced Carbon-Carbon repair techniques.

Other elements in Discovery's payload bay are the Multi-Purpose Logistics Module Raffaello, containing racks of supplies, hardware and equipment, and the Human Research Facility-2 rack for delivery to the Station. Also, an External Stowage Platform equipped with spare part assemblies for the Station and a Control Moment Gyroscope to replace one that failed on the ISS will ride in Discovery's payload bay.

Thanks for all you've done to ensure a safe mission and for sharing in the excitement as we embark on this exciting new chapter of NASA history.

THE STS-114 crewmembers from the left are Eileen Collins, commander; James Kelly, pilot; Soichi Noguchi, representing the Japan Aerospace Exploration Agency; and Stephen Robinson, Andrew Thomas, Wendy Lawrence and Charles Camarda, all mission specialists.

Shuttle Program's history boasts many milestones

By Kay Grinter
Reference Librarian

ENTERPRISE WAS the first Space Shuttle to be completed. From February through October 1977, Enterprise was used in the Approach and Landing Test program based at NASA's Dryden Flight Research Center.

In 1972, as the Apollo Program came to a close, NASA issued a contract to design and build a new type of space vehicle. Employing an orbiter resembling an airplane, the Space Shuttle could be assigned up to 100 missions. No longer would a manned vehicle be used for only a single flight.

Enterprise, the first Space Shuttle orbiter off the assembly line, was named after the starship in the popular science fiction television show *Star Trek*. Designated OV-101, the vehicle rolled out of North American Rockwell Corp.'s assembly facility in Palmdale, Calif., on Sept. 17, 1976.

From February through October 1977, Enterprise was used in the Approach and Landing Test (ALT) program based at NASA's Dryden Flight Research Center in Edwards, Calif. The tests successfully demonstrated that the orbiter could fly in the atmosphere like a spacecraft but land on a runway like a glider.

ON SEPT. 5, 1983, Guion Bluford (above) became the first African-American astronaut to fly in space.

Columbia (OV-101), the first orbiter intended for the Shuttle fleet, arrived at KSC in March 1979, but a great deal of work remained to be done. When its first liftoff occurred on April 12, 1981, John Young and Robert Crippen became the first American astronauts to enter orbit in a reusable spacecraft.

Many other milestones have been achieved in the Shuttle Program:

• **The first operational flight** was mission STS-5, launched on Nov. 11, 1982.

• **Challenger** (OV-099) first launched on April 4, 1983, on mission STS-6 to deploy the first Tracking and Data Relay Satellite.

• **Sally Ride** became the first American woman in space June 18, 1983, on mission STS-7.

• On Sept. 5, 1983, **Guion Bluford** became the first African-American astronaut to fly in space on STS-8.

• **The first untethered spacewalks** using a Manned Maneuvering Unit were accomplished by Bruce McCandless and Robert Stewart Feb. 7, 1984, on mission STS 41-B.

• **Solar Maximum** became the first satellite to be repaired on orbit in April 1984 during mission STS 41-C.

• **Discovery** (OV-103) began its first mission, STS 41-D, with liftoff on Aug. 30, 1984.

• **The first launch of Atlantis** (OV-104) took place Oct. 3, 1985, to begin mission STS 51-J.

• Discovery launched Sept. 29, 1988, on STS-26, the **Return to Flight mission** following the Challenger accident.

• Mission STS-30, lifting off aboard Atlantis May 4, 1989, carried the Venus-bound **Magellan spacecraft**, the first planetary probe deployed from the Space Shuttle.

• The **Hubble Space Telescope** was released from Discovery during mission STS-31, which took place April 24-29, 1990.

• **Endeavour** (OV-105) launched on its first mission, STS-49, May 7, 1992, equipped with the first Shuttle drag chute, deployed on landing May 16, 1992.

• Mission STS-92 launched Oct. 11, 2000, aboard Discovery, the **100th flight** in the Space Shuttle Program.

THE FIRST untethered spacewalks using a Manned Maneuvering Unit were accomplished by Bruce McCandless (left) and Robert Stewart Feb. 7, 1984.

ENDEAVOUR LAUNCHED on its first mission, STS-49, May 7, 1992, equipped with the first Shuttle drag chute, deployed on landing May 16, 1992.

Columbia board leads to safer processing, imaging procedures

By Jeff Stuckey
Editor

RETIRED U.S. Navy Adm. Harold Gehman (center), chairman of the Columbia Accident Investigation Board, visits the Thermal Protection System shop at KSC and is briefed by KSC employee Martin Wilson.

After an extensive seven-month inquiry into the February 2003 loss of the Space Shuttle Columbia and its seven-member crew, the Columbia Accident Investigation Board (CAIB) released its report stating the accident was related to NASA's culture.

The actual cause of Columbia's loss was a breach in the Thermal Protection System on the leading edge of the wing, caused by a piece of insulating foam which separated from the left bipod ramp section of the External Tank (ET) at 81.7 seconds after launch. The foam struck the wing around the lower half of Reinforced Carbon-Carbon panel number 8.

The 13-member board, under the leadership of retired U.S. Navy Adm. Harold Gehman, made these conclusions with the help of 120 staff members and approximately 400 NASA engineers. The report concluded with recommendations, identified as necessary either "before Return to Flight" or while "continuing to fly." NASA has already successfully implemented many of these improvements.

In November 2003, NASA encouraged all of its civil servants and contractors to take part in Safety and Mission Success Week. This provided employees an opportunity to reflect on the relevance of the CAIB recommendations and provide feedback on the implementation strategies.

At Kennedy Space Center, NASA has upgraded the tracking cameras around the Center's Launch Pads 39A and 39B, along with those lining the nearby Atlantic Ocean coastline. The addition of nine more cameras will provide unprecedented views of Discovery's launch.

The orbiter's ET camera has been switched from film to a digital model. The digital camera snaps a series of photos as the tank separates from the orbiter, then transmits them back to Earth shortly after Discovery reaches space.

"We will stay focused on our number-one objective of safety, and we will embrace change," KSC Director Jim Kennedy said. "I'm proud to tell the world I have full faith and confidence in the KSC work force."

Stafford-Covey Group, Behavioral Science Technology study NASA culture

By Elaine Marconi
Staff Writer

In June 2003, former NASA Administrator Sean O'Keefe chartered a task group to independently assess NASA's performance of the Columbia Accident Investigation Board's 15 recommendations for Return to Flight.

Members of the Stafford-Covey Task Group, co-chaired by veteran astronauts Richard Covey and Thomas Stafford, were selected for their expertise and knowledge in safety and space flight.

Already, eight of the CAIB recommendations have been approved by the Stafford-Covey board. According to NASA Shuttle Program Manager Bill Parsons, the indications are that the Agency is on track and all the intentions of the CAIB report will be met.

Another finding in the CAIB report addressed NASA's cultural and organizational issues as a contributor to the Columbia accident, in addition to mechanical failure.

NASA met this challenge with the selection of Behavioral Science Technology (BST), Inc. to assist the Agency in developing a plan for transforming the culture and safety climate.

The positive changes that have come about as a result of BST's recommendations have been documented by the Safety Climate and Culture Survey. An interim survey showed there was already significant improvement and that KSC scored the highest of all NASA centers in the majority of categories.

Ensuring KSC's continued dedication to culture change and improvement, Center Director Jim Kennedy appointed Dr. Phillip Meade to lead the Center to excellence. Meade developed the Achieving Cultural Excellence program for KSC. At the program's kick-off meeting in March, he outlined a new roadmap to strengthen KSC's leadership philosophy and improve communication.

THE STAFFORD-Covey Return to Flight Task Group (above) visits the Columbia Debris Hangar. Chairing the task group are Richard Covey (third from right), former Space Shuttle commander, and Thomas P. Stafford (fourth from right), Apollo commander. Below, Center Director Jim Kennedy addresses employees in the Training Auditorium for an all hands meeting about culture change.

Get to know the STS-114 crew

Why do the astronauts who will return the Space Shuttle to safe flight believe human space flight is worth the risk? How has their approach to space flight changed as a result of the Columbia accident? These are among the questions answered by the next Space Shuttle crew, STS-114, in a series of interviews.

MEMBERS OF STS-114: In front (left to right) are astronauts James Kelly, pilot; Wendy Lawrence, mission specialist; and Eileen Collins, commander. In back (left to right) are astronauts Stephen Robinson, Andrew Thomas, Charles Camarda and Soichi Noguchi, all mission specialists. Noguchi represents the Japan Aerospace Exploration Agency.

Mission Commander Eileen Collins

Why is this job worth the risks for you?
When it comes to flying in space, we're taking very small steps. To me, it is very important for humans to get off the planet and go do these things. Because I believe in this so much, I think that yes, there is risk in space travel, but I think that it's safe enough that I'm willing to take the risk.

What are your thoughts about the contributions of everyone involved in returning the Space Shuttles to safe flight?
There have been setbacks over the past two years, and the people that work in the Shuttle Program have taken on those challenges and they've gone and they've gotten it ready. Now is the time for them to see the fruits of their work.

What are your hobbies or interests?
I like to spend time with my family, and that's very important to me. I've flown airplanes around the country, going to different air shows, and I also have telescopes that I enjoy using to look at the night sky.

Pilot James Kelly

What in your career qualified you to be an astronaut?
After high school I went to the U.S. Air Force Academy and majored in astronautical engineering. I flew for the Air Force for 10 years, including Test Pilot School, and picked up a graduate degree along the way in aerospace engineering from the University of Alabama.

As the pilot, what are your primary jobs?
The primary job of the pilot in every flight is to back up the commander. Probably the second biggest job I have for this flight is robotics.

What are your other interests and hobbies?
I've got four kids, so most of my outside activities revolve around the kids. Recently, it's been science fair projects. Just going to events for four children that are all in sports, church, those kinds of things.

Mission Specialist Charlie Camarda

What was it like when you were assigned to your first space flight?
I had been working as an astronaut for almost nine years. It was on Columbus Day, and I was at my desk working. I was really working on engineering problems concerning the Columbia accident.

Assess the improvements to make repairs to the Space Shuttle.
First I want to say that the CAIB commission did us a great service. I was happy to see real engineers looking at ways to figure out what the cause of the problem was and how they would address it.

Whatís it meant to you to meet other members of the NASA team?
To me, that's one of the best parts of my job. I love to work with the engineers. I love to pat them on the back and tell them how much we appreciate what they're doing because they are really the unsung heroes. The real heroes, in my mind, are the engineers, all the people that are out there working on the vehicle, making sure that it's safe.

Mission Specialist Wendy Lawrence

What in your career qualified you to become a NASA astronaut?
I was actually probably more fortunate than most other kids in that my dad was involved in the selection process for the original group of astronauts, so I had some inside information. But his advice to me was, follow in the footsteps of the first several groups of astronauts.
What is going to be your primary responsibilities?
I'm in charge of all the transfer operations. We have a Multi-Purpose Logistics Module in the payload bay that we'll install on flight day four. Then we'll start the transfer operations.
The Columbia investigation cited organizational factors within NASA. Do you see changes for the better in those areas?
We're making progress. I view the changing of the culture here as kind of a two-to-one ratio: for however many years that you had a cultural problem, it's probably going to take you twice that long to fix the problem.

Mission Specialist Soichi Noguchi

What are the goals of this flight, and what are your primary jobs?
In the assembly sequence, there are a couple of flights dedicated to the logistics support. We also have a couple of added tasks to demonstrate our capability to detect possible damage and also possible demonstration of a repair capability.
Youíre the second Japanese astronaut to go to the International Space Station. Describe the excitement your flight has generated.
You are right. Koichi Wakata visited the ISS in STS-92, and he created a lot of interest amongst the Japanese folks about space. Hopefully, all the Japanese will have the same level of excitement as they had five years ago.
Describe the procedure that you will do on the spacewalk.
The first spacewalks will be dedicated to demonstration of the repair techniques. We will open this big box, and inside the box there are tiles with simulated damage. We will shoot the chemical into the grooved area of the tile and see how it cures.

Mission Specialist Steve Robinson

Youíve been in a career with NASA before you were an astronaut.
I'm in my 29th NASA year, so I'm a really old guy with NASA. I went to University of California at Davis and, through their co-op program, began to work at NASA Ames. We were doing the final design of the Space Shuttle at that point. This was in the mid '70s.
What are your responsibilities for STS-114?
My job on this mission is really two separate things. On launch and on entry, I'm flight engineer. I'm responsible for understanding all the systems of the Space Shuttle. Soichi Noguchi and I will do three different spacewalks on the fifth, the seventh, and the ninth days.
What are your other interests when youíre not an astronaut?
I play music and guitar in a rock and roll band, and I play banjo and mandolin and bass and a pedal steel guitar. I've always been active in art, painting and drawing. I have little antique airplanes at home, and I'm always working on them.

Mission Specialist Andy Thomas

Why did you consider becoming an astronaut?
I think for a young kid growing up in Australia in the '60s, the prospects of becoming an astronaut were remote. But I've always believed that the pathway to many interesting experiences can be opened if you have the right kind of education.
What are your thoughts about the contributions of everyone involved in returning the Space Shuttles to safe flight?
People from all over the country have been involved in that engineering and administrative work, I think because people recognize that it is important for this country to get back into the business of human space flight, that we don't want to be stuck on the ground.
What will it be like to be at the Space Station?
From my own perspective, it's actually going to be interesting, because I was at the Space Station four years ago on STS-102 in 2001. One of the things that struck me when I went on the Space Station, especially the Russian segment, was a sense of déjà vu.

Space Shuttle Discovery modificati

By Charlie Plain and Jeff Stuckey

When the crew members of the Space Shuttle Discovery lift off from NASA's Kennedy Space Center, they'll be supported by two years of hard work by tens of thousands of people determined to make the Space Shuttle safer. NASA has upgraded flight hardware, as well as visual tracking and inspection equipment, to ensure the Return to Flight mission is successful.

Among the changes are a redesigned External Tank, enhanced imaging equipment and new sensors in the Shuttle's wings.

The Columbia accident revealed a major problem with the insulating foam that covers the External Tank. Investigators found that foam falling off the tank had damaged Columbia's left wing, letting superheated gases inside.

NASA engineers made dozens of changes to the tank design, including one to a key mechanism that joins the External Tank with the orbiter. Jutting from the upper third of the tank, the "bipod fitting" is susceptible to icing due to the ultra-cold fuel that tank contains. The improved bipod design now excludes using foam and instead relies on electric heaters to keep the area clear.

Discovery itself also received new imaging equipment with the installation of a digital External Tank camera and new "Canadarm" inspection boom. With the new boom, astronauts will take a good look at features like the orbiter's leading wing edges, which are now closely watched by an advanced monitoring system.

On launch day, when the Shuttle's boosters erupt with fiery thrust and shake the Florida sands, the moment will signal the culmination of more than two years of thoughtful planning and hard work to send America's flagship spacecraft streaking back into space.

Discovery specifications
Length . . . 122 feet (37.2 meters)
Height . . . 56.7 feet (17.3 meters)
Wingspan . . . 78.1 feet (23.8 meters)
Weight . . . maximum 242,000 pounds
Cargo Bay . . . 60 feet long (18.3 meters), 15 feet diameter (4.6 meters)

Discovery undergoes 286 modifications

STEPHANIE STILSON is the NASA vehicle manager for Discovery.

While in the Orbiter Processing Facility, Discovery underwent 41 modifications in response to the Columbia accident and the recommendations of the Columbia Accident Investigation Board.

They included the addition of the new Orbiter Boom Sensor System; equipping the orbiter with cameras and laser systems to inspect the Shuttle's Thermal Protection System while in space; and placing sensors in the leading edge of the Shuttle's wings, a new safety measure that monitors the orbiter's wings for debris impacts.

Discovery also completed its Orbiter Major Modification period. Technicians completed 107 modifications to Discovery, 17 of which will be flying for the first time. An additional 138 modifications were performed as well.

"I could not be more proud of the team that spent the last two years working on Discovery," said Stephanie Stilson, NASA vehicle manager for Discovery. "We are excited to reach this point. Seeing the orbiter roll to the VAB is the culmination of all of that hard work. We look forward to a safe Return to Flight."

INSIDE THE KSC Engine Shop, technicians secure the third Space Shuttle Main Engine for Discovery on a stand. Typically, the engines are installed on an orbiter in the Orbiter Processing Facility approximately five months before launch.

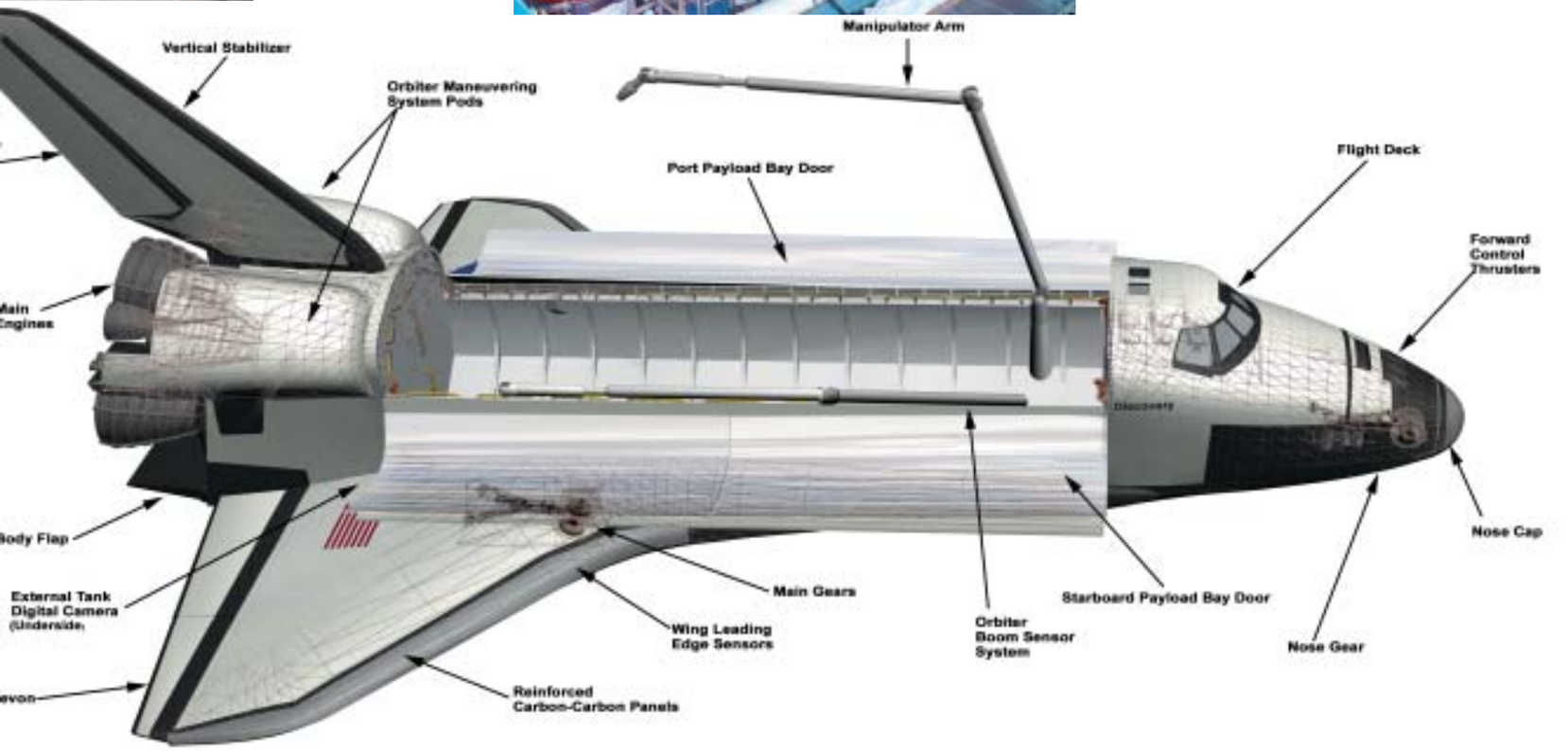
EMPLOYEES OBSERVE installation of the body flap onto the orbiter Discovery. The body flap is an aluminum structure consisting of ribs, spars, skin panels and a trailing edge assembly. It thermally shields the three main engines during entry and provides pitch during landing approach.

EACH OF sensors t also have strength a readings

ons lead to a safe Return to Flight

ONE OF Discoveryís payload bay doors begins closing. Seen in the center and at left are the new Orbiter Boom Sensor System and the Remote Manipulator System, both Canadian-built.

ONCE IN orbit, the visual inspection of Discovery will continue with the help of a new piece of robotic technology. The Canadarm found inside Discoveryís payload bay now includes the Canadian-built Orbiter Boom Sensor System. The boom extension houses a camera and laser-powered measuring device that astronauts will use to scan the orbiterís exterior. The boom attaches to the end of the existing robotic arm and doubles its length to 100 feet. The extra length will allow the arm to reach around the spacecraft for the best possible views.



F Discoveryís leading wing edges are outfitted with 22 temperature o measure how heat is distributed across their spans. Both wings e 66 accelerometers apiece to detect impacts and gauge their and location. The sensors are highly sensitive and take 20,000 per second.

IN THE Orbiter Processing Facility, employees complete the installation of the Reinforced Carbon-Carbon panel on Discovery. The chin panel is the smile-shaped section of RCC directly below the nose cap that provides a thermal barrier during re-entry. It underwent numerous forms of tests, including X-ray, ultrasound and eddy current prior to reinstallation.

Employees 'raise the bar' on safety

Mendoza proud to part of NASA's vision

By Jennifer Wolfinger
Staff Writer

Similar to a medical professional, vehicle processing engineer Alicia Mendoza tracks vital signs related to the Space Shuttle's Return to Flight.

She mainly monitors the pulse of Orbiter Processing Facility Bay 3 activities and resolves processing issues while meeting increasing technical requirements. The NASA civil servant is also involved in operational risk assessments, Process Failure Modes Effects Analysis, college recruiting and outreach, and the occasional speaking engagement.

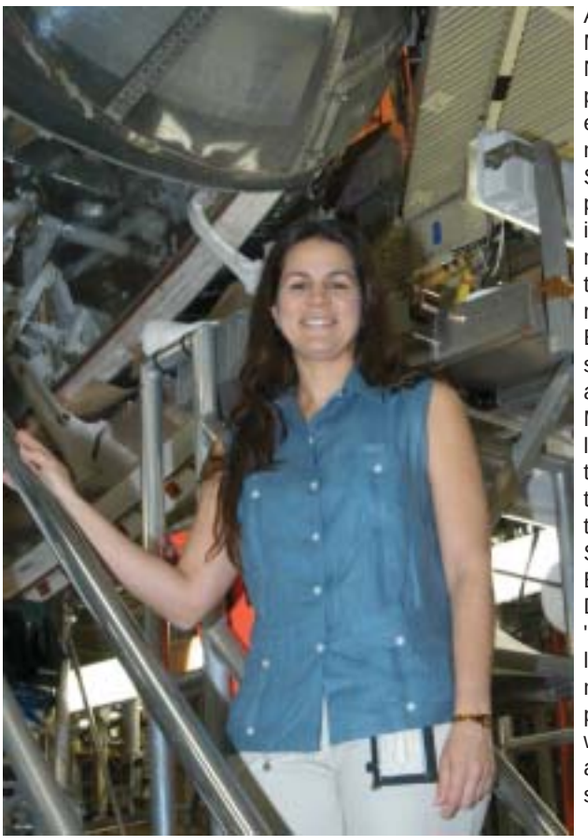
Mendoza supports general public outreach through her involvement in the Kennedy Space Center Display Management Team, as well.

"Childhood dreams of becoming a fighter pilot or astronaut led me down the path of mathematics and sciences," she shared.

Her instincts were reconfirmed when she performed NASA grant research on an orbiter analysis tool as a Florida International University student.

Mendoza eagerly anticipates being at Kennedy for Discovery's launch, so she can feel the sound waves generated by liftoff. And even though Mendoza's excited about the future, she happily looks back on the memory of the installation of the Space Shuttle Main Engines in December.

"Spirits were lifted and the mood around the processing bay was one of accomplishment," she said. "It is a privilege to be a part of this major milestone in the U.S. space flight program to safely return the Shuttle to flight, and begin down the road to the Vision for Space Exploration that will bring us back to the Moon, and beyond to Mars."



ALICIA MENDOZA, a NASA vehicle processing engineer, monitors Space Shuttle processing issues while meeting technical requirements. Even though she's excited about the future, Mendoza happily looks back on the memory of the installation of the Space Shuttle Main Engines in December. "Spirits were lifted and the mood around the processing bay was one of accomplishment," she said.

Villarreal expertly prepares Space Station elements

By Anna Heiney
Staff Writer

Why does Liliana Villarreal need a bachelor's and two master's degrees to work on a suitcase? Because it's the world's most high-tech suitcase: the Multi-Purpose Logistics Module (MPLM), an International Space Station cargo module.

There are three MPLMs, named Raffaello, Leonardo and Donatello. Built by the Italian Space Agency, the components are ferried back and forth to the Station aboard the Space Shuttle. All three 15-by-21-foot modules are in the Space Station Processing Facility, and Raffaello is in the last stages of preparation to fly on the Return to Flight mission STS-114.

LILIANA VILLARREAL (center) discusses the contents of Raffaello with STS-114 astronauts Wendy Lawrence and Soichi Noguchi.

"We fill up the cargo module with racks, and those racks hold experiments, food supplies and clothing for the astronauts," describes Villarreal, an engineer with The Boeing Company, NASA's prime contractor for Space Station processing.

"Anything that needs to go up to the Space Station, or anything that needs to come back from the Space Station, gets installed in the module."

Raffaello will carry 12 large containers called "racks." Although most of the load traveling to the Station will be supplies, the cargo includes the Human Research Facility-2, a biomedical research rack which will expand the Station's capability to support human life sciences research.

Villarreal began working with the MPLM group in 2000, after relocating to Florida from Seattle. "I work for two groups: I work for the Lifting and Handling group, and I'm loaned out to the MPLM group," she explains. For the past year, she has helped prime Raffaello for Return to Flight.

"We did a lot of preparation during the two years that we were not flying," she says. Villarreal quickly ticks off a list of just a few tasks the MPLM team accomplished during that stretch of time: The module's hatch was removed and reinstalled, all of the welds were inspected, and half of the racks were modified to hold more weight.

"I'm definitely going to be out here at the Center watching that launch," she exclaims.

Return to Flight missions ferry equipment to Space Station

By Linda Herridge
Staff Writer

The Return to Flight Mission STS-114, aboard Space Shuttle Discovery, is primarily a test flight mission. Crew members will practice new techniques designed to improve the safety of the Space Shuttle and its crew, including tile and Reinforced Carbon-Carbon repair techniques during a spacewalk.

They will also demonstrate the new Orbiter Boom Sensor System to inspect the orbiter's exterior before docking with the International Space Station. However, Discovery's payload bay will also carry several elements for delivery to the Station, including the Human Research Facility-2 (HRF-2) rack carried inside the Multi-Purpose Logistics Module Raffaello.

After Discovery docks with the Station, Raffaello will attach to the Station to transfer supplies, equipment, hardware and the HRF-2 rack into the Station. Inside the U.S. laboratory Destiny, the HRF-2 rack, comprising additional biomedical instrumentation and research capabilities, will complement HRF-1, which was delivered to the Station in May 2001.

IN THE Space Station Processing Facility, workers prepare to attach the Human Research Facility-2 science rack onto the Rack Insertion Device.

BELOW, AN employee stands by as the Rack Insertion Device slowly moves the Human Research Facility-2 science rack into Raffaello.

Both self-sufficient racks provide structural, power, thermal, command and data handling, and communication and tracking interfaces between the HRF biomedical instrumentation and the U.S. lab.

HRF-1 contains an ultrasound unit and gas analyzer system. HRF-2's biomedical instruments include the Pulmonary Function System for use in conjunction with exercise equipment to measure the astronauts' aerobic capacity and cardiac output.

Also in the HRF-2 are a refrigerated centrifuge to separate biological substances of differing densities, and a Space Linear Acceleration Mass Measurement Device that will help to determine a crew member's mass in weightlessness. An upgraded computer workstation will allow for increased data handling and storage.

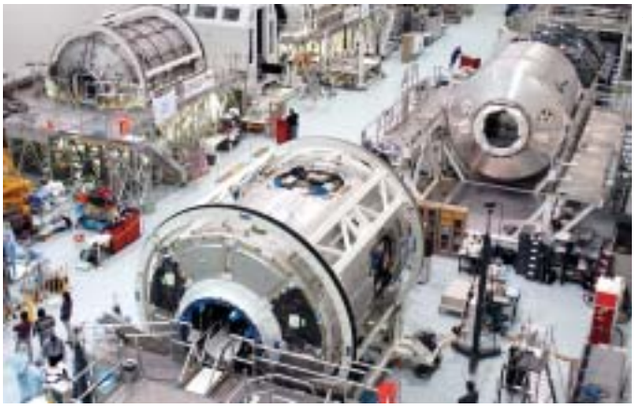
The scientific data collected by the HRF-2 will provide insight into the adaptation of crew members during long-duration spaceflight. The information will also aid in developing countermeasures to ensure crew health and performance for future exploration and return to Earth.

During the next Space Shuttle mission, STS-121, additional science and research elements and experiments will travel to the Station.

These include the Minus Eighty-Degree Laboratory Freezer (MELFI) and the European Modular Cultivation System (EMCS), both provided by the European Space Agency. The MELFI will cool and store samples and perishable materials in four insulated containers.

The EMCS will be used to perform experiments on plants and study early plant development and growth under the effects of various levels of gravity. Human Life Sciences experiments to be used on the Station when delivered by STS-121 include the "Foot/Ground Reaction Forces During Space Flight" experiment that will be used to determine the load on ISS crew members' lower extremities and muscle activity during full working days on the Station. The "Renal Stone Risk During Spaceflight: Assessment and Countermeasure Validation" experiment will test the use of potassium citrate during space flight as a countermeasure to reduce the risk of kidney stones.

AFTER REMOVING its cover, technicians look over the Minus Eighty Lab Freezer for ISS (MELFI) provided as laboratory support equipment.



ALL THREE Multi-Purpose Logistics Modules at the Space Station Processing Facility, including Leonardo, Raffaello and Donatello.

Safety upgrades extend to Space Shuttle Atlantis

By Anita Barrett
Staff Writer

In the course of the past year, the orbiter Atlantis has been processed along with Discovery for a Return to Flight mission. Atlantis is the designated orbiter for mission STS-121, to launch this summer. But it will also be ready to launch within 45 days after Discovery in the unlikely case it is needed in a rescue operation.

Atlantis was designated the first Return to Flight (RTF) vehicle in September 2003, after release of the Columbia Accident Investigation Report (CAIB) that mandated safety requirements. Return to Flight was to have been in 2004. The orbiter was already in processing, undergoing reinstallation of the Reinforced Carbon-Carbon panels on its wing leading edge, wiring inspections, and checks of the Orbital Maneuvering System engines.

During the processing, corrosion was found on the orbiter's Rudder Speed Brake (RSB) actuator gears, requiring extensive repair. Discovery, which was undergoing Orbiter Major Modifications and similar work on its RSB gears, was able to be finished sooner. On Feb. 19, 2004, Shuttle Program management decided to switch orbiters for RTF.

Atlantis was then assigned mission STS-121 to the International Space Station, the second RTF test flight. The mission includes scientific experiments and equipment. The STS-121 crew will conduct further spacewalk testing of Thermal Protection System repair techniques, as well. But Atlantis is assigned another purpose… one that NASA believes unlikely.

IN THE Orbiter Processing Facility bay 1, a Space Shuttle Main Engine (SSME), held by a Hyster fork lift, is maneuvered into place in position number one (upper chamber) in Atlantis. Overall, an SSME weighs approximately 7,000 pounds.

EMPLOYEES INSTALL the left Orbital Maneuvering System (OMS) pod on Atlantis in Orbiter Processing Facility bay 1. The OMS provides the thrust for orbit insertion, orbit circularization, orbit transfer, rendezvous, deorbit, abort to orbit and abort once around.

Atlantis is designated a rescue vehicle. If Discovery is unable to return to Earth, an empty Atlantis with a four-person crew would be launched to the International Space Station. Discovery would be detached and moved away from the Station, allowing Atlantis to dock. Discovery's crew would board Atlantis and the orbiter would return to Earth.

To further prepare Atlantis to meet the safety requirements stated in the CAIB report, all of the upgrades and improvements that Discovery received have also been worked on Atlantis:

- Extensive inspections of the Reinforced Carbon-Carbon panels and nose cap.
- Redesigned bipod attach fitting on the External Tank.
- Installation of a digital still camera on the External Tank to capture images during launch.
- Examination and testing of various seals, such as around the cockpit windows.
- Installation of 22 temperature sensors on each of Discovery's leading wing edges to measure how heat is distributed across their spans. Both wings also have 66 accelerometers apiece to detect impacts and gauge their strength and location. The sensors are highly sensitive and take 20,000 readings per second. This new network of sensors running along the wings provides an electronic nervous system that gives engineers a valuable way to monitor their condition.

UNITED SPACE Alliance worker Craig Meyer fits an External Tank digital still camera in the right-hand liquid oxygen umbilical well of Atlantis.

The latest work on Atlantis includes installation of the orbiter's three main engines and the new Orbiter Boom Sensor System. The launch window for mission STS-121 is July 12 to July 31.

NASA faces forward with renewed vision

By Cheryl Mansfield
Staff Writer

More than 30 years ago, astronauts first walked on the Moon because this nation was given a vision to do so before it seemed possible. Human spirits responded when inspired to greatness; limits disappeared, and Neil Armstrong's foot touched the lunar surface.

Today, our brightest minds are again challenged and inspired by a new vision of what can be achieved in space. As our Space Shuttles once more soar to the heavens, today's visionaries look beyond the Return to Flight with renewed excitement and inspiration. The goals: completing the construction of a fully functional International Space Station, returning humans to the Moon, and exploring further than anyone has gone - to Mars and beyond.

When President George W. Bush announced the new Vision for Space Exploration last year, NASA was in the throws of self-examination. The loss of the Columbia and crew weighed heavily. But as before in space history, the nation sought answers and a new vision for the future.

"The Return of the Space Shuttle to flight is one of the first steps in implementing the nation's Vision for Exploration," says Shawn Quinn, operations and requirements manager of Kennedy Space Center's Exploration Office. "That is one of the key points the president made when he announced the nation's Vision for Exploration last January."

And while the Shuttle's safe Return to Flight is the first milestone on the road to the new vision, that first step won't be complete until Discovery safely touches down on Earth. No one knows that better than Launch Director Mike Leinbach.

"There will be a lot of emotion on launch day, but there will be even more emotion on landing day," Leinbach said. "It's not over until the astronauts come home safely. We've always known that. We know it now, fully, and so now the real celebration for the launch team and everybody in the Agency will be on landing day, when Eileen Collins and her crew come home safely at the Kennedy Space Center."

Resuming Shuttle missions and completing the International Space Station are critical to providing the steppingstones necessary for future exploration.

According to Quinn, "By returning the Shuttle to flight, we'll be able to complete the International Space Station, allowing us to continue conducting important research on the effects of space on the human body. It's important that we have a complete understanding of those effects, so that we can safely prepare for long-duration missions to the Moon and eventually to Mars."

CENTER DIRECTOR Jim Kennedy and Deputy Director Woodrow Whitlow Jr. (center, left and right) talk with Kathy Laufenberg and Tom Roberts, both with United Space Alliance. Both Kennedy, named Center director Aug. 10, 2003, and Whitlow, named deputy director Sept. 8, 2003, have proven their leadership at the Center as NASA returns the Space Shuttle fleet to flight.

As the Shuttle is used to complete the Station, back on Earth the new Crew Exploration Vehicle will take shape. Once again, it will take America's best and brightest people to complete this new vehicle that will carry the next generation of space explorers on missions to explore the Solar System.

A nation founded by explorers stands poised to take the first step toward renewing the dream of men and women exploring beyond the boundaries of Earth.

SPACE SHUTTLE Discovery (above) clears the Launch Pad 39A tower as it soars into the blue sky on mission STS-105 in August 2001.

AT LEFT, Space Shuttle Launch Director Mike Leinbach talks to STS-114 Mission Commander Eileen Collins as they watch the newly redesigned External Tank being lifted in the Vehicle Assembly Building.

NASA's Return to Flight: The next step in the Vision for Space Exploration

SPACE SHUTTLE Discovery, atop the Mobile Launcher Platform, crawls toward Launch Complex 39B for Return to Flight mission STS-114. Launch Pad 39A is visible to the right of the orbiter.

DAYLIGHT ENTERING through the open doors of the Vehicle Assembly Building illuminates Discovery in the high bay, where it was mated to its External Tank and twin Solid Rocket Boosters.

DISCOVERY APPROACHES the Rotating and Fixed Service Structures on Launch Pad 39B after rollout from the Vehicle Assembly Building.

John F. Kennedy Space Center

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