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John F. Kennedy Space Center

Columbia: Flagship of the Shuttle Program



Left: The crew of Columbia poses outside the orbiter during pre-launch training for mission STS-107. Clockwise from top are Mission Specialist Kalpana Chawla, Commander Rick Husband, Mission Specialists Laurel Clark and Dave Brown, Pilot Willie McCool, Payload Specialist Ilan Ramon and Payload Commander Michael Anderson.

Far left: Columbia launches on its last mission, Jan. 16, 2003, at 10:39 a.m. EST. Its inaugural launch 22 years earlier proved that NASA could create a Space Transportation System for a series of missions in low Earth orbit.

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Special Issue

This commemorative issue of *Spaceport News* is dedicated to the memory of Space Shuttle Columbia and her achievements, as well as the tireless workers who brought her home. As we prepare to return to flight, we also salute the employees of Kennedy Space Center who have supported the investigation.

From April 12, 1981, with the crew of Bob Crippen and John Young, until Feb. 1, 2003, with the crew of Michael Anderson, Dave Brown, Kalpana Chawla, Laurel Clark, Rick Husband, Willie McCool and Ilan Ramon, the Space Shuttle Columbia flew 28 missions and set NASA on a new course of exploration.

It arrived piggyback on a 747 at Kennedy Space Center on March 24, 1979, to a team who had never worked on this type of spacecraft.

Former Shuttle Launch Director Bob Sieck credits the first Space Shuttle with training the program team that is in place today: "It wasn't just the technicians. . . who managed the operations and checkout. It was the project managers, the program managers, it was NASA,

the NASA contractor team. Columbia trained us how to run a reusable vehicle program."

Shuttle Commander Rick Husband talked about his favorite moments on STS-107: ". . . watching everyone perform as a team. I really love seeing a team come together, and the bigger team who makes this entire mission possible is the team on the ground."

As part of that team at Kennedy Space Center we have seen the worst of times and the best of times. Our team shows their spirit, their excellence, their toughness and their competence for space travel – anytime, anywhere.

This commemorative issue of *Spaceport News* is dedicated to the history of Columbia and the events surrounding its demise over the skies of East Texas.

Debris recovery team experiences compelling events

By Kathy Hagood

Kennedy Space Center workers who supported the Columbia recovery efforts in East Texas often found the tour of duty to be a life-altering experience.

While the volunteers from NASA, United Space Alliance, Boeing and Space Gateway Support worked long hours and faced physical difficulties, the honor of helping bring Columbia home and uncovering the cause of the accident outweighed the burdens, they said.

The warmth and dedication of the East Texans, the U.S. Forestry Service workers, other support personnel and the public in general reaffirmed many KSC workers' faith in humanity and changed their world view.

A reunion for the recovery group was held at KARS I on Merritt Island May 30.

Workers shared their stories with each other and expressed how much the experience meant to them.

Debbie

Awtonomow, a NASA engineer who served as lead for the Hemphill site for a total of six weeks, said she and other space program workers appreciated the hospitality of the restaurant owners and townspeople of Hemphill.

"The restaurants gave us free food, the school children made us care packages with personal notes, and so many people baked cakes and casseroles for us. It was a homey touch, which meant so much when you're far from home,"

said Awtonomow.

"Many of the townspeople volunteered for the first weeks of the search before the Forestry Service came in. They gave 200 percent and didn't ask for any recognition."

Doug Gray, Boeing Payloads Operations manager for Space Station, found his work as the Boeing ground operations team lead at the Corsicana site to be so compelling that he volunteered for an extended tour of duty from February 1 through May 1. A number of other KSC managers and workers were similarly moved to service.

"I felt I needed to be there. It was difficult, but extremely rewarding," said Gray. "I saw people pull together in a way I've never seen before in my life.

People didn't care about titles or about bureaucratic procedures, they just got things done. They did whatever it took. Everyone was

dedicated to a single purpose."

NASA Quality Inspector Dennis Sparks flew on air operations missions with Forestry Service workers near the Palestine site. The air operations helicopters hovered five to 10 feet above the ground and just above the tree tops to search out areas within the grid sites.

Sparks was impressed by a fellow recovery worker who was determined to make sure the team



NASA engineer Debbie Awtonomow served as lead for the Hemphill debris collection site for six weeks. She greatly appreciated that city's hospitality: "It was a homey touch, which meant so much when you're far from home."

didn't miss any debris.

"One day we saw a crater in a pond that looked as if it could have been created by the impact of Shuttle debris," said Sparks. "Unfortunately the crater couldn't be seen at ground level and the ground team was unable to locate it.

"Finally, Brian removed his flight suit, then pulling a row boat with us in it, waded out to the crater feeling the muck with his feet. Unfortunately, although Brian searched the area, he wasn't able to find anything. I had to hand it to him though for going the extra mile.

"Everyone we met out there had a deep sense of dedication to finding as many pieces of debris as possible so that we could find out what went wrong and get

flying again."

KSC Space Shuttle Logistics Engineer Lamar Russell served at the Lufkin Command Center as the NASA team lead for closing debris sighting reports outside Texas. He also worked with the initial response team at Barksdale AFB, spending a total of 10 weeks supporting the recovery efforts.

"The public was magnificent concerning reporting sightings of Shuttle debris. We were able to coordinate the search of the ground track for debris west of Texas through combining information from public calls with air traffic control system radar analysis," said Lamar.

"The whole recovery experience showed us all how you can successfully face a huge challenge when everyone pulls together."

"I saw people pull together in a way I've never seen before in my life."
— Doug Gray



NASA Kennedy Space Center engineer Lamar Russell, who served as team lead for debris sighting reports outside of Texas, points out to his Lufkin Command Center team a location targeted for a grid search.



A reunion for workers who helped recover Columbia was held at KARS I May 30. The group shared stories about their experiences in East Texas and Louisiana.



Members of the Recovery Management Team at KSC in the Operations Support Building, from left around the table are: Don Maxwell, safety, United Space Alliance (USA); Russ DeLoach, chief, Shuttle Mission Assurance Branch, NASA; George Jacobs, Shuttle Engineering; Jeff Campbell, Shuttle Engineering; Dave Rainer, launch and landing operations; and the two co-chairs of the Response Management Team, Denny Gagen, Landing Recovery Manager, and Chris Hasselbring, Landing Operations, USA. Above, recovery workers scour the fields in East Texas.

Coordinated recovery efforts key to return to flight

By Jeff Stuckey

In what is being called the single largest organized ground search ever carried out, the Columbia recovery efforts show what the human spirit can do to solve a problem. More than 130 different federal, state and local agencies participated in the effort and more than 30,000 people helped recover 84,000 pieces of debris totaling 85,000 pounds.

At first, estimates were that only a small portion of the spacecraft would be recovered. The Federal Emergency Management Agency (FEMA), who was in charge of all recovery operations, estimates that more than 4,000 persons were searching each day with a total of 16,500 personnel participating in the ground search.

"The Columbia mishap was a great tragedy for NASA and for our nation, but it did bring forth one really wonderful thing. Its recovery has proven that our government agencies – federal, state and local – are an absolutely terrific team," said Kennedy Space Center Director Roy Bridges Jr.

Organizing a response team fell, in part, on the shoulders of Ed Mango, KSC launch manager and recovery director, and Denny Gagen, Shuttle landing recovery manager and co-chair of the Response Management Team along with United Space Alliance's Chris Hasselbring.

Responsible for management of all recovery duties in which Kennedy resources were required,

Mango managed the tasks and personnel in the field and at the camps in Corsicana, Palestine, Nacogdoches, Hemphill, the Command Center at Lufkin, and the Barksdale operations.

"The early estimates were that we would only get 5 percent of the spacecraft back, but in reality we got 40 percent," said Mango. "Eventually it became obvious that most of the effort was going to be stationed out of Lufkin, so we created three teams of six people each to go search there. We thought that was going to be enough."

Meanwhile back at KSC, Gagen and the Response Management Team's primary responsibility was to support the deployed teams with whatever they needed to do the job. That involved the replacement of the personnel who were deployed, working the transportation to and from the site and setting them up with the right arrangements.

"We didn't know the magnitude of the task or the magnitude of the people that were going to be required, so it was trying to be prepared for whatever eventuality came to pass," said Gagen.

"For the first four days, we ended up moving a total of 215 people out there from KSC. We had to get the people together to brief them as to what they would be involved with and to keep it as smooth as possible."

In all, 870 personnel were deployed from KSC over the three-month recovery operation. The local flight operations group

at Patrick Air Force Base supported the deployment with approximately 40 flights on NASA-4.

When Mango first arrived at the Lufkin Command Center, there were hundreds of personnel from the U.S. Forest Service, state troopers from Texas, FEMA, EPA and more, and NASA owned three tables in the convention center.

There were many concerns with the local and state government who wanted to make sure the schools in the Nacogdoches County area could be cleared of Shuttle debris, so that became Mango's first

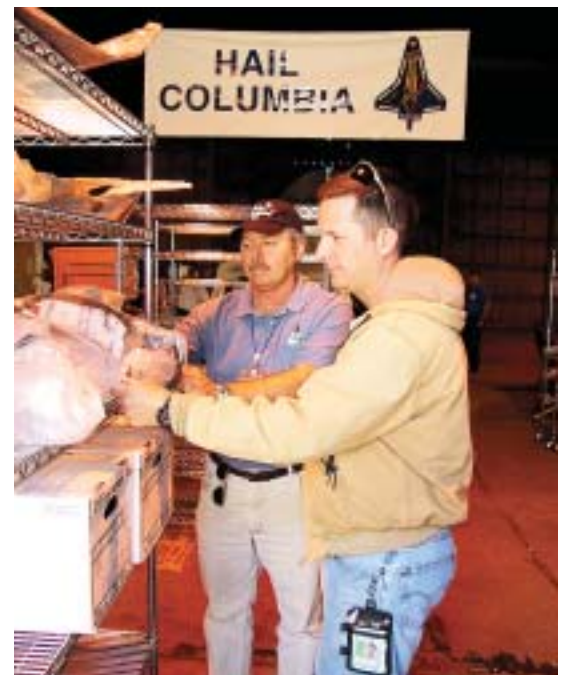
priority. A number of Army Blackhawk helicopters arrived, so Mango and a crew took some overview flights to see what they were up against.

"I took one of those flights just east of Nacogdoches and Lufkin, and there was so much debris that we were up there for an hour and a half and we logged 40 items," he said.

"In the process, since I was a Kennedy employee and most of the resources were from here, it was determined that I would take over the operation in Lufkin from a KSC standpoint."

Between week three and four, recovery teams completed 85 percent of all the call-in pickups from citizens. That shifted phases from pickup to searching. The Texas Forest Service suggested to treat it the way they treated a forest fire search. The search groups didn't know what to look for, nor the hazards, so a NASA employee was added to each search team.

"One thing was very clear," Mango said. "Our senior management at NASA greatly supported the personnel out in the field."



Dean Schaaf (left), Barksdale site manager and NASA KSC Shuttle Process Integration Ground Operations manager, and Elliot Clement, a United Space Alliance engineer at KSC, inspect bagged pieces of Columbia at the Barksdale Hangar site.

Columbia reconstruction efforts at KSC will help Shuttles fly again

By Linda Herridge

Almost immediately following the Center's Feb. 7 Columbia Memorial Service, NASA, United Space Alliance and Boeing workers started the labor intensive task of preparing the Reusable Launch Vehicle (RLV) Hangar for the arrival of Columbia debris. According to Steve Altemus, NASA-KSC reconstruction director, one of the reasons KSC was selected was because of the experienced workforce of engineers, technicians and quality inspectors who knew the vehicle "inside and out."

Debris reconstruction preparations in the RLV Hangar, now known as the Columbia Hangar, included reconfiguring equipment and areas to make room for a 110 percent scale grid of the outer structure. Areas were arranged around the hangar's inside perimeter accommodating tool storage, debris analysis systems, work stations, sorting areas and storage of non-crucial debris.

The first truck carrying recovered debris arrived at KSC from Barksdale, La., Feb. 12.

Lisa Huddleston, a contract engineer with Spherion Corp. for USA, worked to identify part numbers and placement of various pieces of wing leading edge RCC.

"Looking at that collection of scattered parts on the hangar floor and realizing that it was once the orbiter in which I had spent several years of my life was a

sobering experience. It is something that I will never forget," said Huddleston.

As debris was processed, it was tagged with a bar code and an identification number and the information was entered into the Columbia Reconstruction Database. The database was developed within the first week of the accident and used when the debris first arrived at KSC. Reconstruction processes included receiving debris, identifying pieces, sorting and cataloging pieces, grid placement and performing forensics studies.

Pat Floyd, USA grid manager, worked with the team to maintain accurate placement of all pieces including critical left wing debris.

"The effort was superb on everyone's part," said Floyd. "Even those who designed the Space Shuttle and are now retired worked on the grid on their hands and knees, teaching many of us that passion for this program has no age."

Approximately 75 engineers and technicians were in the hangar at any given time. The team worked six days a week, in two eight-hour shifts, from Feb. 7 through the end of May to identify 84,000 recovered pieces from as large as landing gear to as small as a quarter. They processed 85,000 pounds of debris representing 38 percent of the dry weight of the orbiter.

Tools used to assist in identification and placement on the grid



The floor of the Columbia Hangar is full of pieces of Shuttle debris delivered from the search and recovery efforts.

included real-time X-ray and 3-D laser scanning.

"We started 3-D scanning about three or four weeks after the accident," said Jon Cowart, NASA reconstruction engineer. Virtual Reconstruction was used for visualization and parts identification, providing off-site personnel a tool to visualize what the team at KSC saw inside the hangar.

Engineers identified more than eight pieces of the RCC using this method.

During the reconstruction efforts a positive attitude was needed in order to get the job done. Woody Woodworth, USA reconstruction engineering lead, said, "We saw debris in all shapes and sizes, but a piece of debris in the shape of a phoenix reminded us that we will rise from this and fly again."

All the managers of the reconstruction effort praised the level of professionalism and focus their workers exhibited.

As manager of Columbia Reconstruction for USA, Jim Comer said, "This is a tribute to the spirit of our workforce. I'm very proud to be a part of this team."

"The reconstruction of Columbia was a monumental and painstaking effort. Imagine a giant puzzle that you're trying to put together," said Altemus. "This team by far was probably the closest, well-adapted team I've ever seen. Being part of the reconstruction process helped to give us all a sense of closure in some ways."

"I have been associated with

many teams in my 18-plus years at KSC and the Columbia Reconstruction Team is without a doubt the most courageous, creative and compassionate group of folks I have ever had the privilege to know and work with, bar none," said Shuttle Launch Director Mike Leinbach, who gave countless tours of the Hangar to visiting dignitaries.

KSC Director Roy Bridges concluded, "Bringing Columbia home and learning what happened from her remains were missions of love from those of us at KSC. Her remains spoke volumes about what happened and those answers will get us back to flight. A 'well done' to our KSC team."



United Space Alliance technician Woody Woodworth identifies pieces of Thermal Protection System tile from the left wing of Columbia recovered during the search efforts in East Texas.



Members of the Columbia Reconstruction Project Team seek to place a piece of debris from Columbia on this replica of the leading edge of the left wing.

Space Station elements prepared for flight

By Kay Grinter

As NASA and the Kennedy Space Center workforce prepare to implement the recommendations of the Columbia Accident Investigation Board, a flurry of activity is ongoing in the Space Station Processing Facility (SSPF).

Tip Talone, director of International Space Station/Payloads Processing, and his team have been busy reevaluating their level of effort and shifts worked in order to build as much economy as possible into the processing schedule.

"Not only did work not come to a halt after the accident, but it actually picked up because of where we are in the manifest," Talone reports.

"Whatever the delay until the next flight is, we've got plenty of work to do, and that's helped keep morale up."

One reason for all the activity – two major components of the International Space Station (ISS) arrived at the SSPF in June, including NASA's Node 2 and the Pressurized Module component of the Japanese Experiment Module (JEM).

Node 2 is the next pressurized module scheduled to be installed on the Station. It was built for NASA by the European Space Agency (ESA) in Italy. Once in place, it will increase the living and working space on the ISS to 18,000 cubic feet.

JEM is Japan's primary contribution to the Station. When complete, it will include an exposed platform for space environment experiments, a robotic manipulator system and two logistics modules. These components will be assembled over the course of three Shuttle missions.

The Italian-built module will provide passageway to the U.S. Destiny Lab, the JEM, the European Columbus Laboratory and the Centrifuge Accommodation Module. It will also provide connecting ports for the Multi-



Space is at a premium in the Space Station Processing Facility high bay. In the top center is the S6 Integrated Equipment Assembly. The hardware includes, on the left from top to bottom: the P3/P4 truss; the U.S. Node 2; the S6 truss Long Spacer; the P5 truss; the S5 truss; and the Utilization and Logistics Flight-1 Multi-Purpose Experiment Support Structure Carrier. On the right, from top to bottom, are the S3/S4 truss; the Japanese Experiment Module (JEM) Pressurized Module; the Utilization and Logistics Flight-2 Multi-Purpose Logistics Module; and the Utilization and Logistics Flight-1 Multi-Purpose Logistics Module Raffaello.

Purpose Logistics Modules, the Japanese H-IIA Transfer Vehicles and the Pressurized Mating Adapter 2.

Another reason – additional processing tasks are necessitated by the delay until Shuttle flights resume.

One example is the recertification of the remaining solar arrays. The oldest array in the processing flow was installed on the P4 truss, the next completed in April 2002.

A concern arose that the silicon used to

protect its wiring may allow the wing to stick to itself if compacted in its container for several years. In space, this additional force could make it difficult to deploy.

Another task is the de-integration and reconfiguration of the Multi-Purpose Logistics Module (MPLM) slated to fly on the next mission. The manifested supplies and equipment to be stowed on the MPLM will be adjusted, requiring the racks to be reconfigured to accommodate the cargo.



In the Space Station Processing Facility, Executive Director of NASDA Koji Yamamoto (center) gets information about the facility while on a tour of KSC. Behind the group is the Japanese Experiment Module (JEM) pressurized module.



The U.S. Node 2 is lowered onto a workstand in the Space Station Processing Facility.

Columbia was the first Sp

By Kathy Hagood

She was named after a small sailing vessel that operated out of Boston in 1792 and explored the mouth of the Columbia River. The name was also shared by one of the first ships of the U.S. Navy to circumnavigate the globe and the command module for the Apollo 11 lunar mission.

The name Columbia has been used poetically as the female personification of the United States. The Orbiter's initial launches fittingly inspired the nation and proved the operational concept of a winged, reusable spaceship.

Former Shuttle Launch Director Bob Sieck remembers Columbia being built in Palmdale, Calif. "It was impressive and interesting to watch these pieces being put together, being inspected, knowing that this vehicle was going to be different than anything us rocket scientists had been involved with before," he said.

The vehicle, also known as OV-102, was a revolutionary departure from the one-time-use capsules of the Mercury, Gemini and Apollo programs.

After Columbia's completion at Palmdale, the Orbiter was delivered to Kennedy Space Center.

Tonya Witt, Thermal Protection System Operations lead at Kennedy, remembers her introduction to Columbia. She was one of thousands who watched for the vehicle as it was flown in.

"The first time I saw Columbia is when it first came piggyback on the 747. It was March 24, 1979, and the reason I remember that is because it was a day before my son was born. And little did I know that two-and-a-half-months later I'd be working on Columbia."

Because of the demand for Shuttle program technicians, Witt was one of many hired to receive on-the-job training in the early program. Columbia was a new type of space vehicle and the

processing procedures were all new.

Months of painstaking processing procedures paid off. Columbia first lifted off Pad A in the Launch Complex 39 area at KSC April 12, 1981. The orbiter landed for the first time April 14 at Edwards Air Force Base, Calif.

The successful launch of Columbia proved that NASA could create a Space Transportation System for a series of missions in low Earth orbit.

For the first six Shuttle launches, Columbia served as a proving ground for program workers.

"I credit Columbia with training the program team that is in place today. It wasn't just the technicians and the floor work or the engineers who managed the operations and checkout," said Sieck.

"It was the project managers, the program managers, it was NASA, the NASA contractor team. Columbia trained us how to run a reusable vehicle program."

Mission achievements for Columbia included the recovery of the Long Duration Exposure Facility satellite from orbit during mission STS-32 in January 1990, and the STS-40 Spacelab Life Sciences mission in June 1991, the first manned Spacelab mission totally dedicated to human medical research.

Eileen Collins took the helm of Columbia as the Shuttle Program's first female commander on STS-93. Collins' mission focused on the deployment of the Chandra X-ray Observatory.

For the technicians, engineers and managers who worked with Columbia many years, the ship took on a unique personality.

"The orbiter almost takes on a feeling of being alive. She's like a family member," said Witt. "You work on her everyday, you see her everyday, you learn all her little quirks. After every mission, you knew what happened during the flow before, so you knew what to look for to see how things went, and how to go about fixing the problems she had. Each



Top left: Col

Below left: S pad.

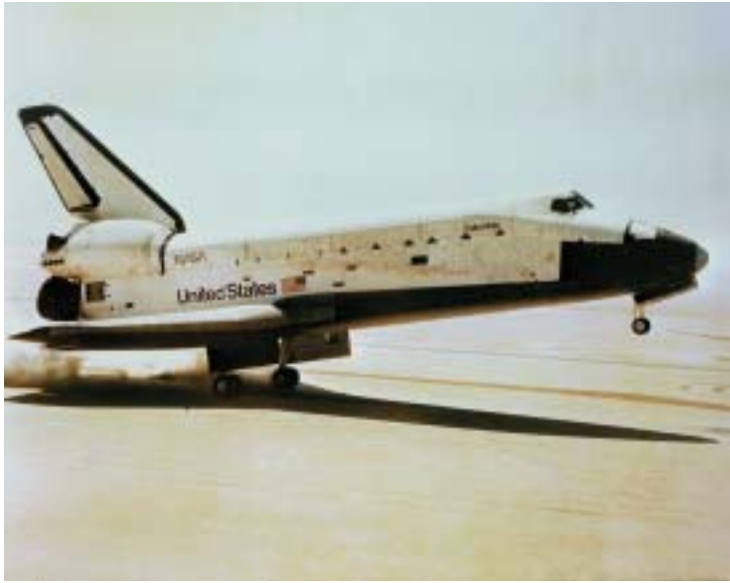
Below: Colu

Above: After Calif., April

Right: Colu Pad 39A.



Space Shuttle to launch



"I credit Columbia with training the program team that is in place today."

— BOB SIECK

Columbia arrives at KSC on the back of a modified 747 jet.

Space Shuttle Columbia leaves the Vehicle Assembly Building for the launch

Columbia launches on STS-1, April 12, 1981.

For a successful two-day mission, Columbia lands at Edwards Air Force Base, Jan. 14, 1981.

Columbia launches on its last mission, STS-107, Jan. 16, 2003, from Launch



vehicle is different, they all have their different personalities, and Columbia definitely had her own personality. It was like one of your children, growing up with them for the past 24 years."

Columbia was called the "big girl" of the fleet because she was the heaviest orbiter. Columbia was designed to carry extra sensors and wiring to gather early flight data, and the other orbiters benefited from the lessons learned from Columbia's manufacture.

"Having watched all those pristine parts being put together in Palmdale, and then visiting now is obviously a sad occasion,"

said Sieck.

"But when I look at those parts, and you look at the last mission that flew, Columbia flew well. Its systems were operating just fine, and it fought being torn apart at the end.

"The information that has been revealed since the tragedy, all those orbiter systems that were so reluctant to get off the ground were working just fine, even though the forces of re-entry were tearing at the structure of that vehicle as it was trying to come home. But the orbiter was doing its job right through the end. I'll always remember that."





United Space Alliance technicians continue the processing of Space Shuttle Discovery. Discovery is undergoing its Orbiter Major Modification, a regularly scheduled structural inspection and modification downtime, which began in September 2002.



Retired Navy Admiral Harold W. Gehman Jr. (second from left), chairman of the Columbia Accident Investigation Board, and other board members are given a guided tour around Space Shuttle Discovery as it undergoes its Orbiter Major Modification.

Modifications to Discovery may provide clues to Columbia accident

By Jeff Stuckey

Discovery, the third orbiter to become operational at Kennedy Space Center, was named after a ship used by the British explorer James Cook in the 1770s during voyages in the South Pacific that led to the discovery of the Hawaiian Islands. The Shuttle is currently undergoing its periodic maintenance and safety upgrades at KSC, and may offer researchers some clues into what happened to Columbia.

"To support the investigation, we have had components of Discovery that were used for analysis, such as the Reinforced Carbon-Carbon (RCC) panels and the Leading Edge Support Structure (LESS) carrier panel assemblies from the wing," said Stephanie Stilson, NASA vehicle manager for Discovery.

"With those RCCs removed, there may be further evaluation that was not required prior to the accident. We're anxious to hear what the board recommends and what the Agency levies upon us as requirements."

Based on the accident, there is extra work being done to Discovery's nose cap. It was already at the vendor and initial evaluations came back positive.

The RCC panels off the wings' leading edge were removed prior to the accident in order to perform

structural inspections. Once the panels are off, technicians perform an extensive examination looking for any type of corrosion, small pits or bubbling, that is not visible to the naked eye.

Discovery is commonly referred to as Orbiter Vehicle-103. Its empty weight was 151,419 pounds at rollout and 171,000 pounds with main engines installed. At rollout, its weight was about 6,870 pounds less than Columbia.

Last year, the Agency decided to move Orbiter Major Modifications (OMM) to KSC from the Palmdale, Calif., manufacturing facility after the Office of Space Flight evaluated the flight schedule, workforce skills and experience, facility utilization and other factors. The current modifications on Discovery started last September with official power-up of those changes scheduled for Sept. 1. It won't be operational until next year.

"Work is going very well," said Stilson. "We've had our share of challenges along the way, but things look real good for us to make our power-up in September and at that point we will run through all our systems testing."

The biggest change will be the Multifunctional Electronic Display Subsystem (MEDS) or 'glass cockpit.'

MEDS is replacing the cockpit's four cathode ray tube screens, mechanical gauges and instruments with full-color flat panel displays like those currently in use on modern military aircraft. The previous electro-mechanical devices were becoming obsolete and more expensive to maintain.

Other transformations include a cooling and power modification to support future missions to the Space Station. The Multi-Purpose Logistic Module (MPLM) Heat Exchanger, a power modification to improve mid-deck experiments for payload customers, and the MMU (Mass Memory Unit) modification to convert the electronics to a solid-state system will also improve activities on

future flights.

Wire separation and redundancy is a combined modification that looks to find wire harnesses that have multiple critical wires in the same bundle. The team separates those critical wires and runs them down opposite sides of the Shuttle so that if, by chance, one bundle malfunctioned, there would be dual redundancy in another bundle.

Approximately 80 modifications will be performed on Discovery, not to mention any changes that result from the Columbia Accident Investigation Board report.

"Normally we have about 4,000 requirements in a standard flow for power-up testing, but this time we will have about double that," said Stilson.



Discovery is pictured in the Vehicle Assembly Building (VAB) before its move to the Orbiter Processing Facility for its Orbiter Major Modification (OMM) period.

What is the future of space travel for NASA?

By Anita Barrett

NASA's vision "to extend life to there" implies the presence of humans in space. But what will get them there beyond the current fleet of orbiters? New methods of space transportation are needed, both manned and unmanned.

NASA's Integrated Space Transportation Plan (ISTP) includes Space Shuttle technology upgrades, the Orbital Space Plane (OSP) Program, and the technology development program known as Next Generation Launch Technology (NGLT). Advanced technologies developed by NGLT will enable new programs to develop space launch vehicles capable of carrying payloads for NASA, commercial and military missions, as well as to fly crews to and from the International Space Station (ISS).

Satellite delivery and future ISS support are the primary set of requirements for the new system and will lead to crew transfer vehicles, reusable launch vehicles and orbital transfer systems.

Orbital Space Plane

The Orbital Space Plane (OSP) is a crew transport rescue vehicle designed to be launched on either an expendable launch vehicle or a second-generation RLV, when available. Significant will be its ability either to land on a runway or use Apollo-style parachutes and flotation bags to "land" on the water. That ability expands safety

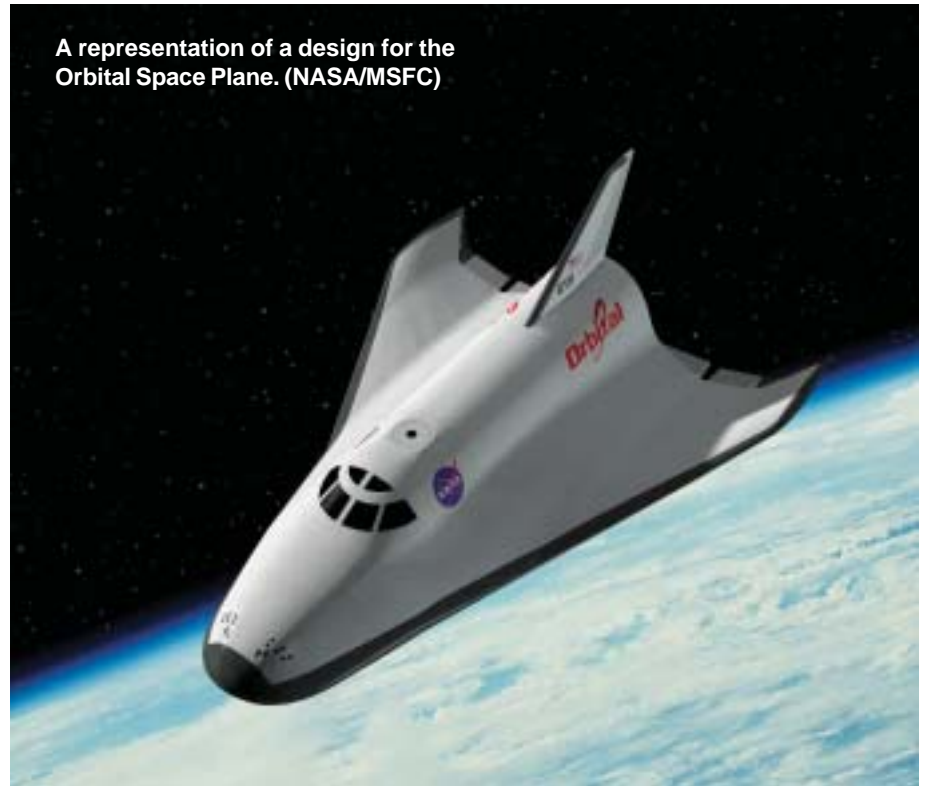
measures and escape possibilities during ascent or as a crew escape system while on-orbit. The OSP would also be used for cargo transfer.

Center Director Roy Bridges recently gave an update on plans for the OSP: "We do expect that the Orbital Space Plane will launch on one of the expendable launch vehicles that will be launched here on the coast of Florida. We think the Orbital Space Plane is a near-term program and we expect to launch it as a rescue vehicle by 2010 and as a transport vehicle by 2012.

"It's up to the contractor community to provide alternatives to NASA to determine the appropriate design based on the requirements. We haven't decided if this will be a capsule or winged vehicle, whether it will be expendable or reusable."

Three system design contractor teams — The Boeing Company of Seal Beach, Calif.; Lockheed Martin Corp. of Denver; and a team including Orbital Sciences Corp. of Dulles, Va., and Northrop Grumman of El Segundo, Calif. — have been awarded contracts to design potential candidates for the Orbital Space Plane vehicle or vehicles, ground operations and all supporting technologies needed to conduct a mission to and from the Space Station.

A representation of a design for the Orbital Space Plane. (NASA/MSFC)



In June, NASA Administrator Sean O'Keefe fast-forwarded the timeline for OSP. "NASA will accelerate development of a new space station crew rescue vehicle by two years. The space agency now will work to have the proposed Orbital Space Plane ferrying Station crews by 2008 instead of 2010," said O'Keefe.

Next Generation Launch Technology

The first step of identifying technologies needed to create new, safe, cost-effective launch systems is to generate an integrated technology plan.

The NGLT Program has combined previous Space Launch Initiative research and development efforts — focused on rocket propulsion — with advanced space-transportation programs developing air-breathing propulsion technologies to achieve speeds of Mach 10-12. The resulting NGLT program is intended to increase the safety, reliability and cost-effectiveness of the nation's next-generation reusable launch vehicle. The program will place emphasis on reusable, kerosene-fueled rocket engine designs and, in concert with Department of Defense initiatives, on a variety of other launch system technologies, including development of air-

breathing hypersonic propulsion systems.

NGLT is pursuing four significant technology areas:

- rocket propulsion, especially a reusable liquid-oxygen/liquid-kerosene rocket booster engine;
- hypersonic, air-breathing propulsion and airframe systems;
- cross-cutting launch vehicle system technologies intended to support a broad variety of launch and flight vehicle architectures;
- analysis activities to guide program investment and to ensure an appropriate fit not just with NASA's needs, but with those of NASA's civilian and government customers.

Civil-based commercial efforts

In addition, 24 entrants from seven countries are seeking a piece of the RLV space action through the St. Louis-based X PRIZE Foundation to encourage development of space vehicle concepts for routine human spaceflight that will reduce the cost of space travel.

The \$10-million prize will go to the first team that launches a vehicle able to carry three people on a suborbital trajectory to a 62-mile altitude and be repeated within two weeks in the same vehicle.

One SLI concept (NASA/MSFC)





Above, co-op student Amber Marek (left) and Claudette Beggs, XA team member, change out posters and mementos sent by groups across the country. Up to 50 posters are being circulated around KSC. Right, Pat Christian, External Relations and Business Development office, displays the "bouquet of hands" created by pre-school children from Bethany Lutheran Sunday School, Cranston, R.I.



Inspirational messages and information requests flood KSC offices

By Jennifer Wolfinger

The first bouquet of flowers arrived at NASA's Protocol Office at the Kennedy Space Center Visitor Complex a few hours after the loss of Columbia, and months later it's overwhelming what that single compassionate act prompted.

Pat Christian, External Relations and Business Development's (XA) business office, began handling condolence arrivals.

"It became the most rewarding and self-healing experience of my life," said Christian. "I guess I was in the right place at the time when I was needed the most."

With XA co-op student Amber Marek's assistance, thousands of e-mails were individually answered with a statement from the NASA and STS-107 crew family. Many messages were in different languages, including French, Italian, German and Korean. All were replied to in each respective language.

More than 500 institutions, including schools, sent heart-warming tokens, including cards, letters, drawings, paper doves and Space Shuttle models.

Claudette Beggs, XA team

member, now rotates roughly 50 contributed posters throughout KSC buildings for display.

In six weeks, more than 600 condolence cards arrived and several still arrive weekly. Additionally, KSC redistributed hundreds of cards intended for Johnson Space Center (JSC) and NASA Headquarters (HQ).

Mourners also sent unique gifts such as handmade flags, quilts, books, music and poems. All were sent to crew families at JSC. Also, nearly \$1,000 sent to KSC was given to HQ for disbursement.

"The most precious and touching gift received was a 'bouquet of hands' by pre-school children from Bethany Lutheran Sunday School of Cranston, R.I.," said Christian.

A portion is displayed in the hallway outside KSC's HQ room 3321. These sympathetic gestures are documented in a remembrance file and acknowledged with a card on behalf of the NASA and STS-

107 family.

Not only does incoming correspondence need managing, but information going out requires organization as well.

KSC received numerous requests from the public and media for Columbia-related records pursuant to the Freedom of Information Act (FOIA). FOIA provides access to federal agency records, unless protected from release by FOIA exemption.

As of mid-May, NASA received 432 requests. Many single FOIA requests seek dozens of documents, involving

hundreds of pages, making the total requests quite substantial. HQ, JSC, KSC and MSFC received most requests to date, with KSC welcoming 61.

KSC employees also respond to requests for Agency records from the Columbia Accident Investigation Board (CAIB). This situation placed a strain on NASA resources not seen since the Challenger accident.

In response, NASA searched

for, collected and reviewed a truly massive amount of Columbia-related records. Sought-out records are not only for Columbia STS-107, but for prior Shuttle missions dating back to STS-1.

Most media queries seek expedited processing under FOIA to inform the public about this compelling event. To quickly respond and eliminate duplicate processing, NASA immediately decided to make all Columbia-related FOIA records publicly available via the Columbia home page (www.nasa.gov/columbia).

Key people supporting this ongoing KSC effort include Geoff Swanson, KSC legal counsel to NASA's FOIA legal team; Amber Hufft and Tracy Lee Crittenden, legal counsel; Henry Schwarz, NASA-PH; Bob Eddy, USA; InDyne's Repro Department and Kay Grinter, KSC FOIA curator.

"I have experienced first hand how the Agency responded as One NASA through this process," said Penny Myers, KSC's FOIA manager.

"This has truly been a team effort to locate, review and provide a voluminous amount of records to the public as quickly as possible. Weekly coordination meetings continue at KSC to close out the remainder of these requests."

"I have experienced first hand how the Agency responded as One NASA through this process."
— Penny Myers

Students encouraged to carry on Columbia legacy

By Jennifer Wolfinger

Kennedy Space Center is reaching out to educate communities about the loss of Columbia and offering outlets for remembrance ensuring everyone understands the need for exploration to continue.

“The KSC Education office was overwhelmed with cards, letters and phone calls received from students and teachers expressing their condolences and support after the Columbia accident,” said Pam Biegert, chief, Education Programs and University Research Division. “We have also received numerous posters made by students and other items like the beautiful quilt we received from Deerwood Elementary School students.”

“We have tried to share these items with workers in all areas of KSC. While they were all saddened by Columbia, both the students and the teachers were very positive in wanting NASA to continue our quest for exploration.”

Many schools have visited KSC’s Visitor Complex to honor the lost STS-107 crew and are encouraged to fulfill the crew’s unanimous hope – continuing space exploration despite challenges.

Sixth grade classes from Columbia Elementary School, Palm Bay, Fla., greeted Kristie McCool Chadwick, STS-107 Pilot William “Willie” McCool’s sister Feb. 21. Educator Resource Center Representative Laura Colville explained aerospace career paths



Students from Columbia Elementary School in Palm Bay place flowers in front of the Astronaut Memorial Mirror at the KSC Visitor Complex.

and presented science demonstrations for the 100 students. The group later remembered the crew by placing red, white and blue carnations at the Astronaut Memorial Mirror and observed a moment of silence.

After a solemn first trip Feb. 3, Orlando’s Deerwood Elementary fourth- and fifth-grade gifted students returned April 21. After writing letters to the astronauts’ families, President Bush, and NASA employees and Administrator Sean O’Keefe, the group contributed something everlasting – a memorial quilt. Two teachers assembled the fabric squares, which were decorated by each student.

“Teachers are going through a

revival of interest in teaching space-related topics, so as they reach the kids, the kids are reaching out to us for more information,” said Education Program Manager Patricia Gillis.

Gillis represented KSC when she visited Idyllwilde Elementary in Sanford for the STS-107 Memorial Garden dedication May 20.

“Teachers expressed that [the Columbia tragedy] was one of those events you can look back on in 10 years and remember exactly where you were when you heard the news,” said Gillis.

“They were very excited someone from NASA would come to their small school. The students wanted to know if I was really a

NASA employee and how they could work here. I stressed the need to study hard in the mathematics and science areas.”

Bennie Bell, Speakers Bureau team member, ensures KSC representatives are equipped to handle Columbia questions, regardless of where they are or the languages encountered.

“I sent information with several speakers on the recovery team to Texas to hand out to folks there,” she said. Bell also sent a video that KSC’s Press Site made with a Spanish introduction to a group in Puerto Rico for a special dedication ceremony for the STS-107 crew.

KSC engineers often venture to schools to describe their personal and professional NASA experiences.

Welmon Speed, Customer Integration manager, joined third through fifth-graders at a St. Cloud elementary school career day session May 16. “I spoke specifically on what was believed to be the main contributing cause of the [STS-107] tragedy. I asked students what they thought NASA did,” he said.

“I proceeded to share the main goals of NASA and some of the challenges we face concerning space travel. I also talked on the issues we have to overcome in the future if we travel to Mars.”

Shuttle fuel cells engineer Amy Houts Gilfriche encourages all KSC employees to exert a little effort to help the public understand NASA’s missions and clarify misconceptions.

“Several people said they had no idea what we do in space, or if there were benefits from space exploration. We have a chance to encourage and inspire students to pursue their dreams,” explained Gilfriche, who recently spoke at two schools.

“Space exploration is students’ dream too – they want reassurance we are still building their future. It inspires them to know the STS-107 crew believed in the benefits of this science enough to accept the risks of spaceflight. That’s a huge motivation to students, and this usually generates a great discussion about careers in math, science and engineering,” said Gilfriche.

Students from Deerwood Elementary School in Florida present a quilt to KSC in memory of the Columbia crew. Pam Biegert (third on left of the quilt), chief, Education Programs and University Research Division, accepted the gift.



Columbia remembered with inspirational memorials

By Amber Marek

Following the Columbia tragedy, memorials were formed and overflowed with banners, flowers, cards and many other condolences.

Kennedy Space Center's memorial service was held on the morning of Feb. 7 at the Shuttle Landing Facility. Taking part in the ceremony were NASA Administrator Sean O'Keefe, former astronaut and KSC Director Robert Crippen and Gov. Jeb Bush. The sky was dark and the mood was somber, especially when the missing man formation flew over the service.

A memorial service was also held at Johnson Space Center Feb. 4. Taking part in the ceremony, among others, were Administrator O'Keefe and President George Bush. "Their mission was almost complete and we lost them so close to home," said President Bush. "The men and women of the Columbia had journeyed more than six million miles and were minutes from arrival and reunion."

The National Cathedral in Washington, D.C., held a memorial service for NASA Headquarters two days later. Vice President Richard Cheney, Brig. Gen. Charles Baldwin and Rev. Stephen McWhorter were among those presiding.

"The men and women aboard the Columbia were driven by a fierce determination to make life better here on Earth by unlocking the mysteries of space," said Cheney.

"Every great act of exploration involves great risk. The crew of Columbia accepted that risk in service to all mankind."

Plans are underway to memorialize the seven Columbia astronauts who lost their lives. The Astronaut Memorial Foundation is currently raising funds to engrave the names of the Columbia astronauts into The Astronaut Memorial, or Space Mirror, to build a biographical wall in honor of these astronauts and to construct a memorial park in their honor. Contact Lora Singer at (321) 452-2887 ext. 5148 or e-mail her at singer@amfsc.org for information.

Jim Singer is carving the astronauts' names into the granite for the memorial. "A lot of people can't say they've done something like this," said Singer.

He recently finished the first piece containing the names Kalpana Chawla, Laurel Clark and Ilan Ramon. Singer is now starting on the second slab with the names of Rick Husband, Michael Anderson, David Brown and William McCool.

Each of the slabs weigh 600 pounds and are as wide as a dump truck. They will be placed in the wall soon and covered until the dedication ceremony in late October.

"A memorial to honor the astronauts' doomed Space Shuttle Columbia will be built in the Arlington National Cemetery near the marker honoring Shuttle Challenger's crew," said Administrator O'Keefe in April.

A national memorial in the nation's capital will serve as a reminder about what the crew of Columbia stood for: bravery, honor and the quest for knowledge. President Bush authorized \$500,000 for the memorial.

In addition, a 13,980-foot mountain peak in Colorado has



Following the tragic loss of Columbia and crew on their return to Earth, current Center Director Roy Bridges (left) and future Director Jim Kennedy placed a wreath in front of the Astronauts Memorial Space Mirror at the KSC Visitor Complex. The mirror is a national tribute to the earlier 17 American astronauts who also gave their lives to the quest to explore space.



NASA Administrator Sean O'Keefe speaks at a memorial service at KSC. Also among the speakers was Florida Gov. Jeb Bush (second from right).

been named in honor of Columbia. The mountain peak, located in Colorado's Sangre de Cristo Mountains, was named Columbia Point in a ceremony at the Interior Department.


"Columbia Point will forever commemorate the Space Shuttle mission," said Interior Secretary

Gale Norton, who presided over the naming ceremony with Administrator O'Keefe.

The peak is one of three in the mountain range that commemorates American explorers of the past and present. The northwest peak is named in honor of the Shuttle Challenger.

President George W. Bush speaks to mourners at the Johnson Space Center memorial service for the crew of Columbia.





John F. Kennedy Space Center

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