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Station Program passes major readiness milestone

Atlantis, Houston. You are 'Go' to perform critical activation of the U.S. lab.

NASA KSC Photo KSC-99PP-0263

In the Space Station Processing Facility, Marsha Ivins, a mission specialist on the STS-98 crew, inspects the U.S. laboratory with members of the laboratory's processing team. (above)

Paul Felker of Barrios Technology monitors operations during the tests. Felker is an ECLSS (Environmental Control and Life Support System) operator in the Mission Operations Directorate. (below left)

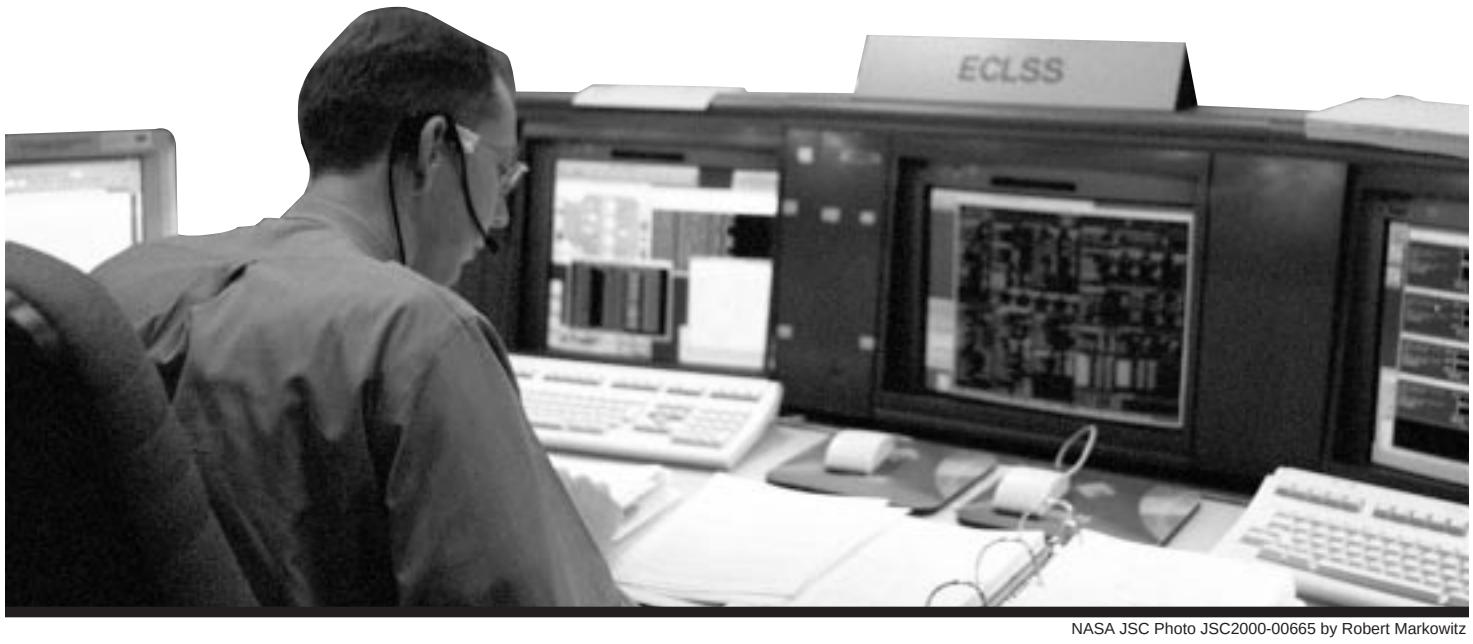
A team in Houston, Kennedy Space Center, and around the country recently completed the most comprehensive series of tests in the human space flight program since the first shuttle was tested before its initial flight. The successful results pave the way for the next station elements now on the ground to be launched this year.

"The test was unbelievably successful," said NASA Administrator Daniel Goldin at the conclusion of a February 7 press conference at NASA Headquarters. "This gives us confidence that we're really ready to build the station. We're ready to go and we're going to be launching this year."

Safely housed in the Space Station Processing Facility at the Kennedy Space Center, the software, equipment, and systems of three of the next major station elements, the Z1 and P6 truss elements and Destiny, the U.S. laboratory module, were joined together for an extensive set of flight-readiness testing with the space station Mission Control Center in Houston and the Payload Control Center at the Marshall Space Flight Center. Tying the station spacecraft to the control centers was the Tracking and Data Relay Satellite communications network.

"This has been a major accomplishment for the International Space Station Program in preparing for the assembly and operation of these key space station components on orbit and it passed beyond our expectations," said NASA STS-98 Lead Flight Director Rob Kelso. "This was the biggest interface test conducted between the MCC and a spacecraft since the late 1970s when we tested the space shuttle before STS-1. We could not be prouder of the results."

Two tests were conducted that involved hundreds of personnel at many NASA centers: Johnson Space Center, White Sands Test Facility, KSC, MSFC, and Goddard Space Flight Center. The first test, following the extensive Multi-Element Integration Test, was an end-to-end test to verify the ability of the MCC to command, control, and operate the combined three station elements. The second test was to conduct a "walk-through" of the planned STS-98 mission to verify both ground and crew procedures, which will be used in activating these three elements during flight.



NASA JSC Photo JSC2000-00665 by Robert Markowitz

"We wanted to 'fly' the U.S. laboratory mission on the ground in conditions as close to flight as possible," said Kelso. "The launch of the U.S. laboratory ties all the other U.S. station elements together. It becomes the heart and brains to the U.S. systems, and thus it is one of the most critical flights in the early assembly of the space station."

With flight control teams directing the operation from Houston for this mission sequence walk-through, Astronaut Bill Shepherd, commander of the first ISS flight crew, and members of the STS-98 crew headed by Astronaut Ken Cockrell participated exactly as they would in flight by operating the flight elements at KSC. At the conclusion of the

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Texas Academy of Science to honor three JSC planetary scientists

By Ann Hutchison

The Texas Academy of Science has named three members of the team that first reported possible signs of fossilized life in a meteorite from Mars as Distinguished Texas Scientists for their pioneering research.

Named as recipients of the year 2000 Distinguished Texas Scientist award are JSC scientists Dr. David McKay, Dr. Everett Gibson Jr. and Kathie Thomas-Keprta. They will be honored at the academy's 103rd annual meeting March 9 at Texas A&M University's campus in Kingsville.

"Their contributions to science, science education and to the state of Texas are immeasurable and truly appreciated," wrote Dr. David R. Cecil, vice-president of the academy, in announcing the award. The honor is awarded "in recognition of distinguished contributions to science through research and publication that bring recognition at the national and international level."

NASA JSC Photo JSC2000-02521 by James Blair

MARS METEORITE RESEARCH TEAM — JSC scientists Dr. Everett Gibson Jr., Kathie Thomas-Keprta, and Dr. David McKay have been named Distinguished Texas Scientists of the year.

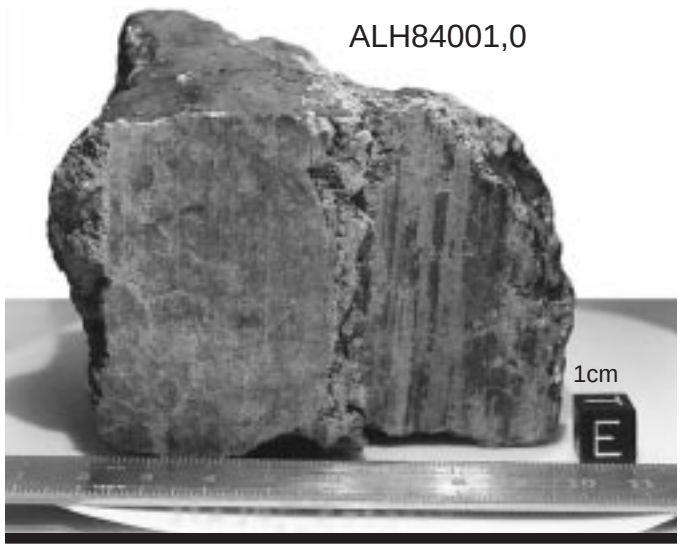
> ***Just as Columbus discovered the New World, we must continue to explore our own solar system and the cosmos beyond. Our exciting results, if they do hold up under scrutiny, may be only a precursor to discoveries that will be made from the study of Mars, comets and Europa in the future.***
>
> – Dr. Everett Gibson

McKay, Gibson and Thomas-Keprta were the co-leaders of the team that included scientists from Stanford University, the University of Georgia and McGill University. They believe the meteorite, known as ALH84001, contains evidence that strongly suggests primitive life may have existed on Mars more than 3.6 billion years ago. In 1996, the NASA-funded team reported finding the first organic molecules believed to be of Martian origin, several mineral features characteristic of biological activity, and possible microscopic fossils of primitive, bacteria-like organisms inside the ancient Martian rock that fell to Earth as a meteorite.

"The search for life on Mars is the most exciting science quest of the new millennium," McKay noted. "This search has certainly struck a resonant chord with the American public." He added that major new theories in science, such as the once-new theories of plate tectonics and the extinction of the dinosaurs by a large cometary impact, might take years before they are accepted. In both of these cases, he said, the scales were tipped by the discovery of a "smoking gun" decades after the original hypotheses. "We have not yet found the 'smoking gun' to prove without a doubt that life existed on Mars, but we are looking for it."

The awardees will discuss their research, which has been the catalyst for the formation of the new interdisciplinary research field of astrobiology, at the academy's annual meeting.

In addition to its impact on the infant field of astrobiology, the research fascinated the public and the news media. "The search for life on Mars and within Martian meteorites has captured the interest of many people, from schoolchildren to those in the research lab," Gibson said. The search, however, has just begun, according to Gibson. "Just as Columbus discovered the New World, we must continue to explore our own solar system and the cosmos beyond. Our exciting results, if they do hold up under scrutiny, may be only a precursor to discoveries that will be made from the study of Mars, comets and Europa in the future."



This 4.5 billion-year-old rock, labeled meteorite ALH84001, is believed to have once been a part of Mars and to contain fossil evidence that primitive life may have existed on Mars more than 3.6 billion years ago. The rock is a portion of a meteorite that was dislodged from Mars by a huge impact about 16 million years ago and that fell to Earth in Antarctica 13,000 years ago. The meteorite was found in Allan Hills ice field, Antarctica, by an annual expedition of the National Science Foundation's Antarctic Meteorite Program in 1984. It is preserved for study at the Johnson Space Center's Meteorite Processing Laboratory.

"Our work has generated interest not only in the search for extraterrestrial life on Mars, but also in the search for unique organisms on Earth in sizes much smaller than previously recognized," Thomas-Keprta observed. "In order to contemplate the types of organisms that could be on other planets or moons, we need to understand as much as possible about terrestrial microbes. This search is essential prior to the return of the first samples from Mars."

The three scientists have received countless honors and awards, including the National Space Society's Space Pioneer Award, *Popular Science* magazine's 1996 Greatest Achievement in Science and Technology Award, *Time* magazine's 1996 Best Science Award and The Planetary Society's 1996 Outstanding Accomplishment in Planetary Science Award, among many others. The findings also were named one of *Discover* magazine's Top 200 Scientific Discoveries of the 20th Century. The JSC scientists have given nearly 1,000 interviews about their research since 1996.

McKay, the principal investigator for JSC's Astrobiology Institute, specializes in scanning electron microscopy and the study of the evolution of planetary soils. He has more than 300 peer-reviewed publications.

Gibson is a principal investigator in JSC's exobiology program and directs the Light Element Analysis Laboratory. Specializing in the study of volatiles and their compounds in terrestrial and extra-terrestrial materials, he has more than 200 peer-reviewed publications to his credit.

Thomas-Keprta is a senior scientist with Lockheed Martin who specializes in the analysis of extraterrestrial particles at the atomic scale. She has more than 140 peer-reviewed publications.

"This is an exciting time to be one of the lucky researchers examining materials from other planetary bodies," Gibson said as he summarized the feelings of all three scientists about their work. ■

President proposes $435 million boost to NASA budget

President Clinton is proposing a $435 million increase for NASA, raising the agency's budget to $13.6 billion for the 2001 fiscal year.

The 2001 budget request to Congress includes $2.11 billion for the International Space Station, $3.16 billion for the Space Shuttle Program, $2.39 billion for the Office of Space Science, $1.4 billion for NASA's Earth Science Enterprise, $1.19 billion for the Aero-Space Technology Enterprise, and $302 million for the Office of Life and Microgravity Sciences and Applications.

The proposed budget would also provide money to hire 500 new employees and replace 1,500 current workers who are expected to retire or leave the agency.

"Over the past seven years, we were challenged to operate more safely, more efficiently and at higher levels of performance," NASA Administrator Daniel S. Goldin said during a February 7 press conference. "The NASA team delivered and will continue to improve."

The increase to the NASA budget is the first in seven years. Goldin said that the NASA budget would continue to increase in the years ahead, adding that in 2005 it "will be $2 billion higher than this year's budget."

Funding for the ISS Program allocates $300 million for the Russian Program Assurance budget to provide contingency activities and backup capabilities in response to concerns about the impact of the Russian government's fiscal problems in meeting its station commitments.

In spring 1997, NASA embarked on the initial steps of a contingency plan to provide U.S. capabilities to mitigate the impact of Russian delays. NASA purchased an Interim Control Module from the U.S. Naval Research Laboratory to provide attitude control and reboost functions for continuation of the ISS assembly sequence without the Russian Service Module. The ICM is being prepared to support a launch as early as December 2000. Provided the Russian Service Module is successfully launched this summer, the ICM could be ready for launch as a backup propulsion capability 12 months later.

The president's budget also calls for an increase in research funds for the space station from $394 million to $455 million.

Goldin announced that the proposed budget for the space shuttle safety program would increase from $600 million to $2.1 billion over the next six-year period. Shuttle upgrades will improve reliability and ensure continued safe operations of the system into the next century. Examples of upgrades include advanced health monitoring of the shuttle's main engines and improvements to the Auxiliary Power Units and the Solid Rocket Booster system. Studies for upgrading the avionics and cockpit areas of the Orbiter to provide for reduced crew procedures during ascent are also under consideration. An external, independent review panel will determine the priority of the upgrades. The upgrades are targeted for completion by 2005.

NASA plans to invest $6 billion over the 2000 to 2005 period in developing the next generation of reusable launch vehicles. "Even as we upgrade our shuttle fleet, we are aggressively investing an even larger sum of money in our number one development priority, the next generation of 'revolutionary' reusable launch vehicles," Goldin said.

The president also proposed an increase in NASA funding for academic programs from $7.3 million to $10.3 million.

According to Goldin, the budget will allow NASA to "continue to do what it does best: develop breakthrough technologies." He said that three key technologies will take NASA where it wants to go: biotechnology, nanotechnology and information technology. "Over the past decade there have been tremendous scientific breakthroughs. And now, we are ready for our technology to move out and incorporate that knowledge," Goldin said. ■

PEOPLE AT WORK

Keeping an eye on the Earth

By Ann Hutchison

NASA JSC Photo JSC2000-01176 by Benny Benavides

JSC Office of Earth Science team members receive JSC Group Achievement Awards in recognition of their outstanding contributions toward astronaut candidate training in Earth Sciences. Recipients, from left, are: Robert Payne (Lockheed Martin), Kimberly Willis (Lockheed Martin), Susan Runco (NASA), Dr. Julie Robinson (Lockheed Martin), Dr. Justin Wilkinson (Lockheed Martin), Dr. Kamlesh Lulla (NASA), Dr. Cynthia Evans (Lockheed Martin), and Joe Caruana (Lockheed Martin). Not pictured: Dr. Pat Dickerson (Lockheed Martin).

Tucked away on the second floor of Building 31, JSC's Office of Earth Sciences goes quietly about its work of studying the Earth from outer space.

For nearly 40 years, since the Mercury missions began America's human space program, astronauts have photographed the Earth below. "For many years, astronaut photography of the Earth with hand-held cameras has provided scientists around the world with a valuable tool to study our planet," said Dr. Kamlesh P. Lulla, chief of the OES. "These photos are important in documenting changes in the Earth's atmosphere, monitoring environmental changes and providing updated data for mapping the Earth's surface."

The Earth observation photographs taken by astronauts also complement data from meteorological and other satellites. And the Earth observation effort over a period of many years "facilitates the detection of various changes, such as coastal shoreline and lake levels, on the Earth's surface," Lulla said. They also contribute to our understanding of how events such as volcanic eruptions, El Niño and other natural phenomena impact the planet.

The Office of Earth Sciences is part of the Earth Science and Solar System Exploration Division in the Space and Life Sciences Directorate. With a small but active staff of civil servants and Lockheed Martin contractor employees, the office carries out an ambitious, multifaceted program in support of NASA's Earth sciences effort. The office's scientists, who support the Human Exploration and Development of Space program, represent expertise in a wide array of areas, including remote sensing, geology, Earth sciences, ocean and weather phenomena, planetary geology and ecology.

Lulla's office has three primary functions: training astronauts and astronaut candidates (ASCANs), supporting space shuttle and International Space Station science operations, and public education and outreach. Every ASCAN is trained in scientific observation of geological, oceanographic, environmental and meteorological phenomena, as well as in the use of photographic equipment and techniques.

"Our objective is to make the astronauts Earth-smart," Lulla said. "ASCANs come from very diverse backgrounds," he explained, "so our goal is to give everyone the same level of knowledge."

In addition to classroom instruction in a variety of Earth sciences disciplines, the training includes two field trips during which ASCANs get hands-on experience. "Field trips offer an integrated view of how geological history, climate and human presence have impacted the Earth," Lulla noted.

ASCANs get hands-on experience during a 1-day visit to the Galveston Bay area.

The first field trip is a 1-day visit to the Galveston Bay area, during which groups of 8 to 10 ASCANs get to see for themselves the interactions between various Earth processes and human activities. Later, they journey to New Mexico for a 3 1/2 -to 4-day trip to observe the processes that have created these landscapes. They also receive training in exploration techniques to prepare them for possible future missions to the moon or Mars. Once astronauts are assigned to particular missions, the OES provides training in mission-specific payloads and equipment. Well-trained astronauts contribute much to the program's success, Lulla said, by making informed, real-time decisions about which areas and phenomena to photograph.

JSC's Earth scientists also support science operations during and after shuttle missions. During a mission, an Earth sciences expert identifies "targets of opportunity" for hand-held camera photography. Using a map of the Earth and a ground track chart, scientists pinpoint either features of interest (such as lakes or mountain ranges) or natural or human-induced activities (hurricanes or oil fires, for example). A list of these targets is uplinked to the crew each day of the mission as part of the execute package. Lulla said crewmembers do as much photography as they can fit into their schedule, although Earth observation photography is not part of the crew's timelined activities.

After the mission, the scientists and crewmembers get together to review the successes and issues that occurred during the mission. This also gives the crew an opportunity to view the photos taken during the mission. The images from each flight are cataloged and archived, and some are put into an on-line database accessible to anyone with Internet access (http://eol.jsc.nasa.gov). Lulla said that more than 95,000 people from 63 countries log on to this site each month.

OES's database now includes more than 400,000 images, most of them taken by space shuttle astronauts since the program began in 1981. Astronauts and cosmonauts on the Russian Space Station Mir took an additional 22,000 photographs during flights between March 1996 and June 1998. These long-duration flights also allowed the development of refinements in the study of phenomena such as forest fires, dust storms, floods and the impact of El Niño in 1997/98. In addition, photography of the Earth from space helped scientists further develop tools and approaches for Earth science operations on the ISS, while also providing insights into such areas as window quality and the use of various types of film on orbit.

With construction of the ISS now underway, OES is preparing for a new era in Earth observation. While continuing to train crewmembers assigned to fly on the space station, the office has assumed a new role: coordinating the science and applications research from the Window Observational Research Facility. Located in the U.S. Laboratory Module, the 20.3-inch-diameter WORF will be perpendicular to the Earth's surface most of the time to facilitate observation of the Earth below. It also will be the highest optical-quality window ever flown on an inhabited spacecraft.

The WORF will provide a stable platform for a variety of Earth science studies and it will support both remotely controlled research and hand-held photography by the ISS crew. A rack system installed around the window will provide attachment points, power and data transfer capability for cameras, scanners and other instruments to be mounted in the window. The racks, which are designed to allow rapid changes of equipment by the crew, also will allow multiple instruments to be mounted at the same time.

"The ISS will be especially well-suited for Earth observations," Lulla noted. It will cover most of the world's coastlines and heavily populated areas.

The OES also has a third focus: public education and outreach. According to Lulla, the American public supports NASA's Earth observation studies, as evidenced by a 1998 *Space News* poll that reported that 92 percent of American taxpayers want NASA to monitor Earth's environment from space. Because this research is of such interest to so many people, "We are committed to getting vital Earth observation science information into the public domain," Lulla said. An increasingly popular way of disseminating information and images is over the Internet. In addition to the site listed above, images and information also are available at the following sites:

http://earth.jsc.nasa.gov

http://nix.nasa.gov

Working with classroom educators is another way of spreading the word about the importance of Earth observations. Lulla and other scientists work each summer with teachers who visit JSC as part of their continuing education and enrichment programs. One of the most successful ventures to date occurred in the fall of 1998, after Lulla spent four hours talking about NASA Earth sciences to a group of teachers from Oklahoma. Not only did the teachers design lesson plans that incorporated what they had learned at JSC, but they also persuaded the local newspaper to produce an insert for the Sunday paper devoted solely to NASA's astronaut Earth photography. That insert, which included articles, photographs and references, reached some 40,000 homes.

"Just think of the return we got on our investment of just four hours of our time," Lulla said. "Many teachers use only 5 percent or 10 percent of what they learn here, but the Oklahoma teachers did an outstanding job of spreading the word about astronaut Earth photography, and in the process reached thousands of students."

"We consider these astronaut photographs of the Earth to be a national treasure," Lulla continued. "But we also realize the importance of making these images available to scientists, educators and to the interested public. They provide important new insights into how nature and humans are changing planet Earth."

In April, the OES will take another step toward making public more astronaut photographs of Earth, when John Wiley & Sons, a major publisher of science and engineering books, plans to publish a collection of more than 110 astronaut Earth photographs and articles summarizing the results from imagery analysis. Astronauts and cosmonauts on Mir took the color and black-and-white photographs between March 1996 and June 1998. The book – *Dynamic Earth Environments: New Observations from Shuttle-Mir Missions* – was edited by Lulla and Lev Desinov, Ph.D., of the Institute of Geography of the Russian Academy of Sciences in Moscow. Associate editors were Drs. Cindy Evans, Julie Robinson and Pat Dickerson, senior scientists in the OES.

The continuing contributions of the OES were acknowledged recently when the office was honored with a Group Achievement Award for "outstanding contributions toward Astronaut Candidate training in Earth Sciences." Additionally, individual members receiving recognition included Lulla, Evans, Robinson, Dickerson, Susan Runco, Dr. Justin Wilkinson, Kim Willis and Joe Caruana. ■

KSC facilities:

Last (Earth) stop for space station components

Some very special items are making final stops for processing and checkout at Kennedy Space Center before being launched to begin orbital life as parts of the International Space Station.

Those stops are at KSC's Space Station Processing Facility (SSPF) and the Operations & Checkout (O&C) Building.

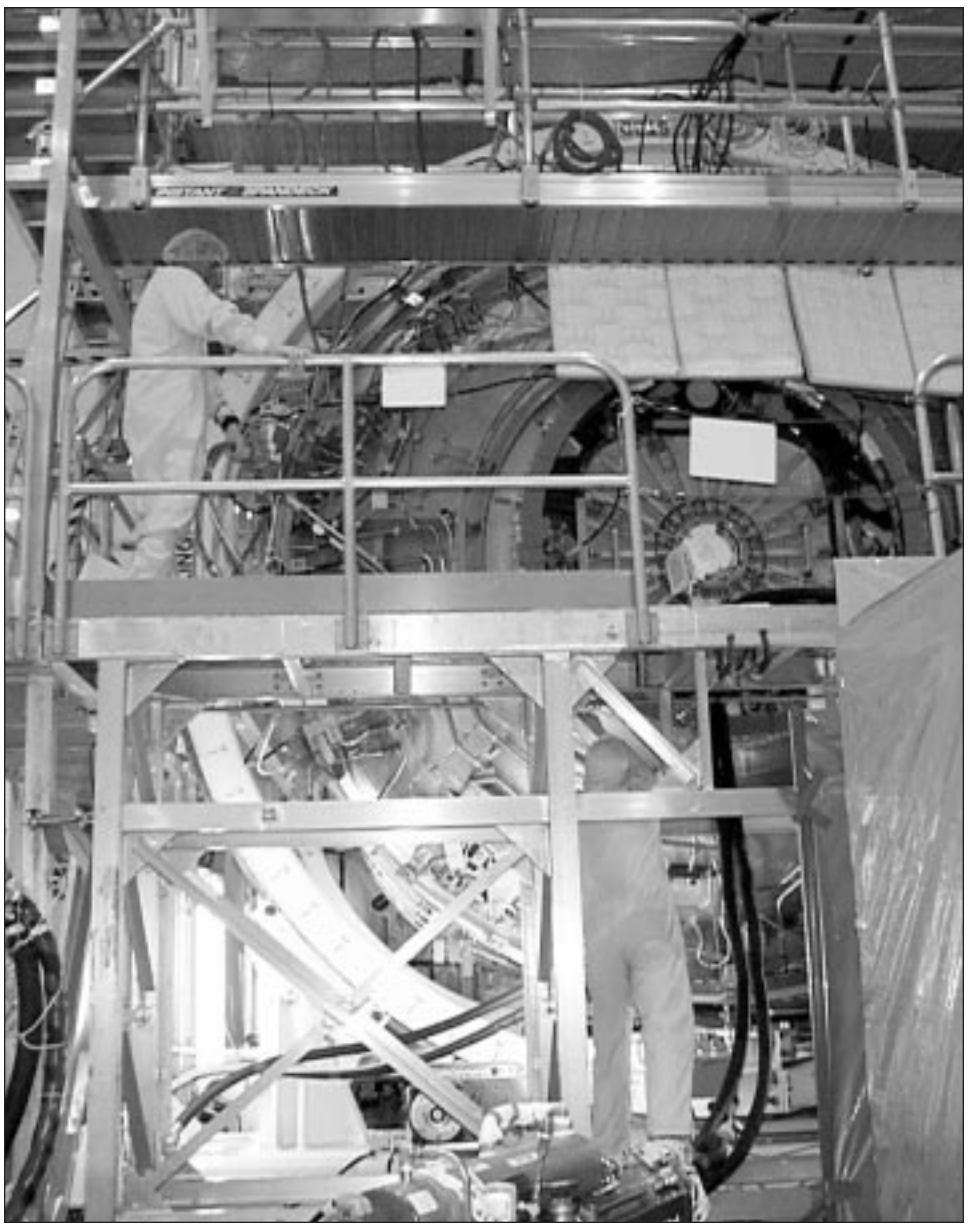
The three-story, 457,000-square-foot SSPF is in KSC's industrial area. It includes two processing bays, an airlock, operational control rooms, and laboratories for non-hazardous station and shuttle payloads. Pressurized and some non-pressurized ISS elements are undergoing assembly and testing there. The SSPF also boasts logistics areas, office space, and a cafeteria.

The five-story, 605,000-square-foot O&C Bldg. contains laboratories, astronaut quarters and hardware processing areas. Previously used in the Spacelab program, it has been converted to support ISS operations. It will host assembly and testing of most of the station truss elements.

When ready for launch, ISS elements will be transported from the SSPF to the launch pad, via the payload transfer canister, for installation into the Orbiter.

Engineers and technicians from NASA, Boeing, the European Space Agency, the National Space Development Agency of Japan, the Canadian Space Agency, the Russian Space Agency and firms in other station partner nations work together to prepare station hardware for launch aboard the space shuttle.

"We have a lot of experience at the Cape when it comes to testing and processing payloads," said Joe Delai, NASA payload processing/testing engineer for the Space Station Hardware Integration Office at KSC. "So one of our goals is to get the station hardware here early, take off our badges, and work together as a team to get the job done. There is no NASA, no Boeing. We all work together to get the job done. This has worked out tremendously."



Technicians prepare Destiny for acoustic testing. Nearing its final stages of completion, the U.S. lab next will get outfitted with Kevlar and aluminum debris shielding.

The 300-foot girder-like truss will house critical electronic equipment, including gyroscope systems that eventually will replace thrusters to maintain the station's stability as well as communications equipment.

"The basic purpose of the station truss system is to serve as a support structure for the power segment," said Ben Jimenea, NASA truss test and project engineer at KSC. "It provides a support structure for all of the power cables of the International Space Station – the radiators and the solar arrays."

When new truss segments are added to the ISS, ready-to-latch indicators show astronauts that the next segment is ready to be attached. Once the truss elements are mated, the space-walking astronauts will connect the electrical and fluids lines.

Undergoing tests in the SSPF are Leonardo and Raffaello, identical pressurized Multi-Purpose Logistics Modules (MPLMs) that will serve as the space station's "moving vans," carrying laboratory racks filled with equipment, experiments and supplies to and from the station aboard the space shuttle.

The reusable modules will function as cargo carriers and space station modules. Mounted in the space shuttle's cargo bay for launch and landing, they will be berthed to the station using the shuttle's robotic arm after the shuttle has docked.

The logistics modules also include some life support, fire detection and suppression, electrical distribution and computer equipment. Built in Italy, they are owned by the U.S. and were provided in exchange for Italian access to U.S. research time on the station.

Each cylindrical MPLM is 22 feet long by 15 feet wide. Each weighs about 9,000 pounds and can carry 20,000 pounds of cargo. Leonardo was delivered to KSC in August 1998 and will be launched on shuttle mission STS-102 with equipment and supplies for the U.S. laboratory module. Raffaello arrived at KSC in the summer of 1999. It is scheduled for launch aboard space shuttle mission STS-100. The third, Donatello, should arrive at KSC in October.

With some station elements already on orbit and others still on the ground, engineers had to devise a way to ensure that when things like fluid lines and cables are mated on orbit, they will fit and work. Engineers and technicians designed mock-ups of these elements called test aids, high-fidelity representations of station elements already on orbit to which flight elements still on the ground can be connected.

Reborn vacuum chamber to test space station parts

View of inside the vacuum chamber

A vacuum chamber once used to check Apollo spacecraft for leaks will do similar tests on International Space Station components.

The two vacuum chambers in the Operations & Checkout Building at Kennedy Space Center date back to the Apollo era. The right chamber was used to perform leak tests on the Apollo Command and Service Modules, while the left one was used for the Lunar Excursion Module. The chambers simulated up to an altitude of 250,000 feet.

After 1975, following the conclusion of the Apollo-Soyuz Test Project, the chambers were almost removed in favor of additional storage and processing space. Designation as a national archive saved them, but the vacuum pumps were removed in 1985.

Early in the 1990s, NASA looked into the possibility of using the Russian Soyuz as an Assured Crew Return Vehicle for the space station. The Russians have always used vacuum chambers for their space hardware to do leak tests to verify pressure integrity and produce leakage rates. So they approached NASA with the idea of reactivating one of the vacuum chambers to test the Soyuz modules. But that idea went away with the demise of the Space Station *Freedom* Program.

Once the Russians were brought on board for the ISS Program, they asked how pressurized station elements would be leak checked. In 1997, funding was raised to reactivate one of the altitude chambers.

The right chamber was refurbished in 1998 with all new equipment. Its pumps are computer controlled. It can be pressurized with helium in about 6 1/2 hours to do gross leak checks. It now performs very close to its original performance during the Apollo era and meets the space station requirement for leak checking elements.

But there was one problem: station elements are processed horizontally, but the chamber is vertical – a requirement from the Apollo project. So technicians had to have the capability to rotate the elements to be able to put them into the chamber vertically.

Each station payload to be tested is picked up with a 2-crane lift, rotated to the vertical position, raised above the chamber and lowered into it. Once it is bolted inside the chamber, the payload is derigged and the 27-ton lid is placed on top of the stainless steel chamber so testing can begin.

Five U.S. station elements (Destiny, airlock, Nodes 2 and 3, and the propulsion module) are to be tested in the chamber. The Science Power Platform, a Russian element that will be launched on the space shuttle, and the Columbus Orbital Facility also may be tested in the chamber.

Boeing will test the U.S. elements. Negotiations continue with the Russians and the Europeans about testing of their elements. ■

"The concerns we have are that the cables and fluid lines may not be long enough to reach between elements, and/or they may not be lined up correctly," said Mike Haddad, NASA structural and mechanism engineer. "Test aids help ensure that the fit will be precise."

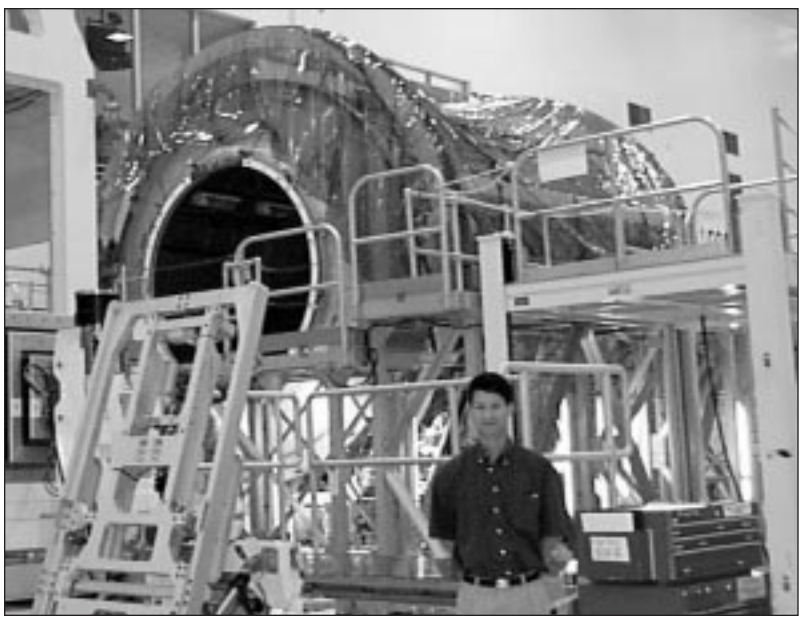
The shuttle can carry station elements three ways. Large elements (such as the truss structures) are placed directly into the payload bay. Other elements that need a 1g atmosphere environment may be shipped up to the station in the MPLMs. Smaller items, such as the Pressurized Mating Adapters, are placed on a Spacelab pallet.

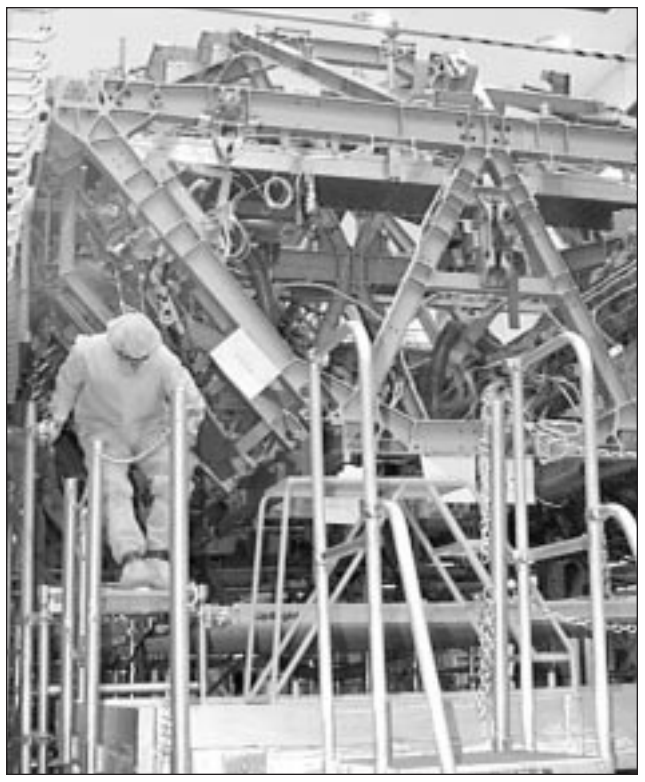
Destiny, the U.S. laboratory module, is in the SSPF. It has undergone tests since it arrived at KSC November 16, 1998.

Some equipment has been updated and some wiring and insulation work on fluid lines on the inside has been completed. Remaining tasks include outfitting Destiny with Kevlar debris shields, and aluminum primary debris panels atop them.

Not only space station elements, but many years of planning and hard work are coming together at KSC.

"I've been working on this program for three years," said Bill Dowdell, NASA manager of the 3A and 4A Space Station Hardware Integration Office at KSC. "Getting this hardware built and transported to KSC has been a monumental task." ■





The Mobile Transporter (top left) sits protectively wrapped, primed and ready for its turn through processing. The MT, a high strength, stiff aluminum structure that can handle loads up to 46,000 lbs., will be attached to the truss (above) providing mobility to relocate the MSS to other station worksites.

Glenn Chinn, (left) NASA lead engineer, Multi-Purpose Logistics Modules and Nodes 2 and 3, stands in front of one of the Italian-built MPLMs.

NASA JSC Photos by Nicole Cloutier

New Canadian arm to flex muscles on space station

A new double-ended Canadian robotic arm will play a big role in International Space Station (ISS) assembly and maintenance. The arm can ride along the station truss or it can "walk" around the ISS, securing first one end and then the other as it moves.

Called the Space Station Remote Manipulator System (SSRMS), the arm is part of the Mobile Servicing System (MSS) that Canada will contribute to the ISS.

Unlike the shuttle's Canadarm, which is owned by NASA, Canada will retain ownership of the MSS including the SSRMS.

Stephen Mozes, manager, Canadian Space Agency Liaison Office at Kennedy Space Center, said the Canadarm was originally designed in 1973 by Spar Aerospace Ltd. It was sponsored by the National Research Council of Canada. NASA ordered five arms for about $600 million.

The Canadarm has flown more than 50 shuttle missions and has been successful every time. Lessons learned from it were applied to the new ISS arm.

The total Canadian station contribution comes in four basic parcels: the SSRMS, the Mobile Remote Servicer Base System (MBS), the Special Purpose Dexterous Manipulator (SPDM) and the Artificial Vision Unit.

The arm has seven degrees of freedom. It is a re-locatable system of the MSS that normally will operate from a Power Data Grapple Fixture (PDGF) located on the MBS. It also has the capability to be located on a PDGF positioned on the ISS. During typical operations, the arm will be mounted on the MBS.

There are two ways for the arm to move on board the station. It can ride along the truss or it can walk via 10 grapple fixtures placed strategically across the ISS. "If you can imagine, the grapple fixtures are like the wall outlets in your house only they are elegant data, power and video lines running through one portion of the space station to other designated points," says Mozes.

The arm, folded and wrapped up, is in the Space Station Processing Facility at the Kennedy Space Center. Since it cannot hold its weight in 1 g, it is counterbalanced by weights. In orbit, it can move about 100,000 kilograms – about the weight of a loaded Orbiter. "You get all of this operating on the power that it takes to turn on seven light bulbs," Mozes said.

The MBS will be mounted on the Mobile Transporter. The Mobile Transporter will provide the physical and electrical interface between the MBS and the space station truss for translational mobility of the MSS.

The SPDM is a small, two-armed robot capable of handling the delicate assembly tasks currently handled by astronauts during space walks. It provides an on-orbit maintenance and servicing capability, including manipulating, installing, and removing small payloads such as batteries, power supplies and computers as well as operating ISS robotic tools including specialized wrenches and socket extensions to be used for delicate maintenance and servicing tasks; manipulating, installing, removing and inspecting scientific payloads; and providing lighting and closed-circuit TV monitoring for work areas.

The arm will be delivered to the station on Flight 6A (STS-100). It will be launched folded, hinged in the middle of each boom so it can fit across the shuttle's payload bay. Canadian Astronaut Chris Hadfield and Astronaut Scott Parazynski will do a space walk to deploy the arm. Hadfield will be the first Canadian space walker.

The new double-ended Canadian robotic arm is shown folded and wrapped up in the Space Station Processing Facility at the Kennedy Space Center. In orbit, it can move about 100,000 kilograms – about the weight of a loaded Orbiter operating on the power that it takes to turn on seven light bulbs.

Built at a cost of about $1 billion (U.S. dollars), the MSS has already generated some $4 billion (U.S. dollars) in spin-off benefits, having found applications in medicine and the nuclear power industry.

"There will come a time when the space station cannot be built without the Mobile Servicing System," said Mozes. "Until that point is reached, the shuttle arm is being used as well as space walks. So it is a great privilege to be able to contribute this necessary element to the ISS Program."

The SSRMS is scheduled for launch no earlier than July 2000. The MBS is set to fly no earlier than May 2001, while the SPDM is scheduled for no earlier than summer 2003. A revised assembly sequence is under development and review with all ISS partners. ■

Ripped from the ROUNDUP

Ripped straight from the pages of old Space News Roundups, here's what happened at JSC on this date:

1965

The first major piece of actual flight-type hardware for America's human lunar exploration program, Apollo, underwent its shakedown test February 5 at the NASA Manned Spacecraft Center's White Sands Operation in New Mexico.

The flight-weight Service Module segment of the Apollo spacecraft was fired for 10 seconds in the Propulsion Systems Development Facility (PSDF) at White Sands.

The static firing of the Service Propulsion Subsystem (SPS) engine began a test series designed to help determine the flight readiness of a similar Service Module programmed for the first test of the flight-type Apollo hardware from Cape Kennedy next year.

1985

NASA is donating a 26-meter antenna located at the Orroral Valley Tracking Station in Australia to the Australian University of Tasmania. The Orroral Valley Station ceased operations in December 1984.

The antenna had been used in a variety of NASA and international programs including the Skylab Program, the Apollo-Soyuz Test Project and the Space Shuttle Program.NASA has offered to provide assistance for the dismantling and transfer of the antenna to Hobart, Tasmania, Australia.

The University of Tasmania's Physics department, one of Australia's major center's for astronomy and astrophysics, will use the antenna as part of its teaching and research activities.

1995

Over the Pacific Ocean in the void of space, two 100-ton spacecraft orbited within 37 feet of each other Monday as the Space Shuttle *Discovery* and the Russian Space Station Mir completed a historic rendezvous.

The rendezvous and flyaround set the stage for the linkup of *Atlantis* to Mir four months from now in the first of seven planned dockings as part of the first phase of a joint cooperative program between the U.S. and Russia.

LeBlanc, Moser get Secretarial Excellence Awards

Patricia LeBlanc of the International Space Station Program Office and Kathleen Moser of the Mission Operations Directorate each recently received the Marilyn J. Bockting Secretarial Excellence Award in recognition of their exceptional contributions to the effective operation of JSC through professional competence and personal dedication.

LeBlanc was recognized in December for her outstanding organizational and leadership skills when transitioning from the Space Shuttle Program Office to the ISS Program Office. As the lead secretary in both of these dynamic program offices, she effectively and efficiently coordinates program-level schedules and manages priorities to ensure that all critical requirements are met and conflicts are resolved. Her job often requires her to handle multiple requirements simultaneously and coordinate activities for a program office in which everyone's requests are the "most important." She is an outstanding secretary who can be depended on to get the job done no matter what it takes and is a tremendous asset and a valuable team member.

Moser was recognized in January for her contributions as secretary of the Mission Integration and Schedule Management Office. She provides essential support to the core production work for which MISMO is responsible. The office provides station flight integration, preparation, and production schedule services to internal (MOD) and external customers.

Moser is responsible for making time-critical updates to technical briefings, reports, and schedules that are presented to senior JSC and ISS management teams on a weekly basis. The outstanding quality of the MOD weekly review package is a testament to her knowledge, skill and dedication.

Moser is responsible for using PowerPoint to maintain graphically formatted integrated production schedules. In addition to the integrated schedules, she maintains 25-30 other weekly charts and tables. During the past nine months she has used her extensive production experience to help the office choose a new software tool. This tool, which she is learning to use, will provide significant automation of manual tasks, thereby significantly reducing schedule production times.

Active in the MOD Secretarial Working Group, Moser supports the Public Affairs Office during space shuttle missions and the JSC Educational Outreach Program as an elementary school tutor. ■

NASA JSC Photo by Bill Stafford

Patricia LeBlanc

NASA JSC Photo by Bill Stafford

Kathleen Moser

GILRUTH CENTER NEWS

Sign up policy:
All classes and athletic activities are on a first-come, first-served basis. Sign up in person at the Gilruth Center and show a yellow Gilruth or weight room badge. Classes tend to fill up two weeks in advance. Payment must be made in full, cash or by check, at the time of registration. No registration will be taken by telephone. For more information, call x33345

Gilruth badges:
Required for use of the Gilruth Center. Employees, spouses, eligible dependents, NASA retirees and spouses may apply for photo identification badges from 7:30 a.m.-9 p.m. Monday-Friday and 9 a.m.-2 p.m. Saturdays. Cost is $10. Dependents must be between 16 and 23 years old.

Open from 6:30 a.m.-10 p.m. Monday-Thursday, 6:30 a.m.-9 p.m. Friday, and 9 a.m.-2 p.m. Saturday. Contact the Gilruth Center at (281) 483-3345.
http://www4.jsc.nasa.gov/ah/exceaa/Gilruth/Gilruth.htm

Nutrition intervention program: Six-week program includes lectures, a private consultation with the dietitian and blood analysis to chart your progress. Program is open to all employees, contractors and spouses. For details call Tammie Shaw at x32980.

Defensive driving: One-day course is offered once a month at the Gilruth Center. Pre-registration required. Cost is $25. Call for next available class.

Stamp club: Meets every second and fourth Monday at 7 p.m. in Rm. 216.

Weight safety: Required course for employees wishing to use the Gilruth weight room. Pre-registration is required. Cost is $5. Annual weight room use fee is $90. The cost for additional family members is $50.

Exercise: Low-impact class meets from 5:15-6:15 p.m. Mondays and Wednesdays. Cost is $24 for eight weeks.

Step/bench aerobics: Low-impact cardiovascular workout. Classes meet from 5:15-6:15 p.m. Tuesdays and Thursdays. Cost is $32 for eight weeks. Kristen Taraszewski, instructor.

Yoga: Stretching class of low-impact exercises designed for people of all ages and abilities in a Westernized format. Meets Thursdays 5-6 p.m. Cost is $32 for eight weeks. Call Darrell Matula, instructor, at x38520 for more information.

Ballroom dancing: Classes meet Thursdays from 6:30-7:30 p.m. for beginner, 8:30-9:30 p.m. for intermediate and 7:30-8:30 p.m. for advanced. Cost is $60 per couple.

Country and western dancing: Beginner class meets 7-8:30 p.m. Monday. Advanced class (must know basic steps to all dances) meets 8:30-10 p.m. Monday. Cost is $20 per couple.

Fitness program: Health-related fitness program includes a medical screening examination and a 12-week individually prescribed exercise program. For details call Larry Wier at x30301.

Aikido: Martial arts class for men and women meets 5-6 p.m. Tuesdays and Wednesdays. No special equipment or knowledge is needed to participate. Aikido teaches balance and control to defend against an opponent without using strength or force. Beginning and advanced classes start each month. Cost is $35 per month.

TICKET WINDOW

The following discount tickets are available at the Exchange Stores

General Cinema Theaters	$5.50
Sony Loew's Theaters	$5.50
AMC Theaters	$5.00
Moody Gardens (2 events) (does not include Aquarium Pyramid)	$10.75
Moody Gardens (Aquarium only)	$9.25
Space Center Houston . . . . . adult . . $11.00 . . . . . child (age 4-11) . . . (JSC civil service employees free.)	$7.25
Space Center Houston annual pass	$18.75
Postage Stamps (book of 20)	$6.60
Clear Lake Coupon Books	$30.00

Please bring your driver's license to pay by personal check.

Exchange Store hours

Monday-Friday
Bldg. 3 7 a.m.-4 p.m.
Bldg. 11 9 a.m.-3 p.m.

- All tickets are nonrefundable.
- Metro tokens and value cards are available.
- Franklin Planners now available.

For additional information, please call x35350.

Employees judge student exhibits during annual Science Fair

It's time again for the Science Fair. The Science Fair is the traditional way students in our community (and across America) are able to integrate what they have learned in school with observations about how the world works.

The exhibits demonstrate both the "old school" sciences of biology, physics, and math and the "newer" consumer and Earth sciences. Students use the scientific method to develop a hypothesis, create an experiment, test their hypotheses, record results and report on what they have learned. Sometimes the findings and presentations are just as interesting as the means they choose to prove or disprove their hypothesis.

Science Fair judges for intermediate and grade schools used to be provided by the area's high school science teachers. Because of budget cuts and increased class sizes, the area high schools are no longer able to support the science fairs in the lower grade levels. So the schools turned to the Johnson Space Center's scientific and administrative community.

For the last several years, JSC civil service and contractor employees have been judging science fairs at many local elementary, intermediate and high schools. Judges come from all disciplines across the center. Engineering, medical sciences, legal, ISO 9000, and many other offices sent representatives to help our local schools and students.

The volunteers who served as judges were organized and coordinated by Robin Hart, who works for InDyne, Inc. in the Public Affairs Office.

"The Education Outreach Program greatly appreciates the efforts of the volunteers who participate in the Science Fair judging activities," said Hart. "The volunteers' support results in a wonderful and exciting experience for each of the students involved."

Hundreds of students worked on their individual projects, which are separated by grade level and grouped into several broad categories for judging purposes. The schools and students work hard to show off their best efforts. Judges evaluate the student's work in the categories of Scientific Method, Methodology, Creativity and Presentation. Points are assessed, the findings discussed among the judges, and then points are tallied to determine the winners in each category. The judging effort lets the students know that the JSC community cares about their efforts.

The exhibits also tell the judges a little bit about what makes the students dream and grow. The quality and effort put into the exhibits show more than just the student's knowledge of the subject. Some exhibits show an intense interest in a particular hobby or theme. They also express the student's interest in putting together their best work over just getting the job done.

The students all demonstrated their abilities, skills, hidden talents, hobbies and interests. From rockets to robots, volcanoes to voltmeters, M&Ms to Mobius strips, the exhibits were all interesting.

The Science Fair reminds us of how we saw the world when we were kids and of what we did with our own dreams and visions. It also teaches us what the engineers, scientists and visionaries of tomorrow are thinking about today.

According to Hart, there are several volunteer opportunities available for future educational outreach events.

"There are still many requests for judges that we are looking for participants to fulfill, as well as requests for career shadowing hosts, career day speakers, and guest presenters," said Hart. "The Education Outreach Program relies on the support and dedication of JSC's employees, and we are always hoping to expand our program to include new participants." ■

For more information on the Education Outreach Program, contact Robin Hart at x34754.

NASA JSC Photo JSC2000E01427 by James Blair

NASA-JSC Photo JSC2000E01428 by James Blair

JSC's Sharyl Butler, aerospace engineer, and Charles Gott, chief, Simulation and Graphics Branch of the Automation and Robotics Division, take notes while judging student exhibits at the McWhirter Elementary School Science Fair.

The Argonauts are coming!!!

Education team prepares for JASON XI

For months, hundreds of teachers have been visiting JSC getting a crash course in everything from physics to mock space walks. They've been preparing for JASON XI "Going to Extremes," this year's version of the annual JASON Project that soon will have more than 5,000 students inundating JSC to watch space scientists and deep sea divers via distance viewing technology.

Behind the scenes, orchestrating this immense project year after year, is a small team of individuals who themselves have JASON down to a science. Angelo Casaburri, Oklahoma State University, aerospace education specialist; Delicia Slaughter, IMPASS, education outreach coordinator; and Lori Wheaton, OSU, administrative assistant, are part of that team and make up the powerhouse behind the teacher training component of JASON. The team spends countless hours each year, including many Saturdays, coordinating with teachers, researchers and JASON Project reps around the country to bring science to life.

"Preparation for JASON is quite challenging," said Casaburri. "But the feedback from teacher participants who return each year is the best reward."

Wheaton agrees but says, "On the other hand, to see the students' expressions when something unexpected happens during the live broadcast, whether it's dinosaur ants, spiny lobster katydids or a tarantula crawling up a student's arm, is equally gratifying."

JASON Project is an 11-year-old education endeavor started by Dr. Robert Ballard, the scientist who discovered the *Titanic* wreckage. Every year, the project shares exotic scientific adventures with a growing following of schoolchildren and teachers around the world. This year, the JASON Project concentrates on the comparisons of exploration in a deep sea environment with that of deep space. Students have been studying various exploration and science concepts in support of this theme all year. The highlight will be the JASON interactive event next month when students will watch, some in person, as divers with the National Oceanic and Atmospheric Association and NASA shuttle flight crewmembers share their experiences in exploration.

"Space is not always covered in textbooks, so teachers are yearning for all the information they can get," said Slaughter.

To help ensure that teachers have all the tools they need to prepare the students, the JASON Project develops detailed curricula for each year's theme. The teachers are provided with a plethora of study guides, lesson plans and activity sheets. They also are encouraged to participate in teacher training workshops.

JSC is one of the 36 primary interactive network sites for the teacher training and just wrapped up the last of 14 sessions this January. More than 450 teachers from as far as Brownsville participated in the daylong training seminars.

"Since teachers in the state of Texas are mandated to have at least 30 hours of professional development training each year, a lot of teachers choose JASON teacher training year after year because they are so interested in the diverse topics," added Slaughter.

With the teacher training behind them, at least for JASON XI, the team is now preparing for the pinnacle of the JASON Project – the interactive event – which takes place Feb. 28 - Mar. 10 in Teague Auditorium. Organizers anticipate a record attendance for the broadcast shows, which will run five times a day, 60 minutes each.

JSC employees may notice lots of production and video teams infiltrating the center late February as they arrive to prepare for JASON XI. ■

Continued from Page 1

Station Program passes major readiness milestone

test, Cockrell said from inside the laboratory, "This has been a tremendous test, and it gives me greater confidence that lab activation will go well for us on orbit."

"The purpose of the mission sequence test was to demonstrate that the actual timeline could be executed with the crew on board and the flight controllers in the control centers," added Mark Kirasich, a member of the Flight Director Office who participated in the tests. "The test was a resounding success."

The Z1 segment containing control moment gyros and critical communications equipment will be launched during STS-92 (3A), followed into orbit by the P6 solar array and power segment on STS-97 (4A). These two flights will be followed with the STS-98 (5A) launch of Destiny. Following this set of testing on the ground, these three station elements will be separated to begin their individual launch processing for flight and will not see each other again until they reach orbit.

The launch of the U.S. laboratory module will bring to life new systems capability in environmental control, attitude control, flight computers/software, high-rate communications, and thermal control to the station. Ten enhanced computers will be launched in the U.S. laboratory module to the station, inclusive of three command and control computers, which take over control of the station from the software in computers on board Unity. The laboratory also will bring two guidance, navigation and control computers that control the operations and attitude control of the control moment gyros. They also provide pointing data for the solar arrays and high gain antennas. High data rate S-band is added with the launch of the laboratory that will bring air-to-ground communications capability between the ISS and the MCC in Houston. Additionally, internal water thermal control systems in the laboratory will be connected to interface with the external ammonia thermal control systems on the P6 segment.

These two significant tests proved the ability to process video from the ISS, communicate over the new voice systems, and provide attitude control, life support, high data rate telemetry, active thermal control, and more.

"Launch day of these elements just became a lot closer to us all," said Kelso. "We can't wait till they get there." ■

DATES & DATA

February 28

Alzheimer's support group meets: The Clear Lake Alzheimer's Caregiver Support Group will meet at 7:30 p.m. in the first floor conference room, St. John Hospital West building, Nassau Bay. For more information contact Nancy Malley at (281) 480-8917 or John Gouveia at (281) 280-8517.

Modelers meet: The Galveston Bay Area Scale Modelers Association will meet at 7:30 p.m. at the House of Prayer Lutheran Church. For additional information call John Rivers at x41108.

February 29

Space workshop: Lockheed Martin Astronautics will host a Human Space Transportation and Exploration Workshop February 29 through March 1 at Moody Gardens Hotel, Galveston. For details visit http://www.jsc.nasa.gov/aiaa/hstew.html.

March 1

Spaceteam Toastmasters meet: The Spaceteam Toastmasters will meet at 11:30 a.m. March 1, 8, 15, 22 and 29 at United Space Alliance, 600 Gemini. For more information contact Patricia Blackwell at (281) 280-6863.

March 2

Communicators meet: The Clear Lake Communicators, a Toastmasters International club, will meet March 2, 9, 16, 23 and 30 at 11:30 a.m. Please note the new meeting location at Wyle Laboratories, 1100 Hercules, Suite 305. For details contact Allen Prescott at (281) 282-3281 or Richard Lehman at (281) 280-6557.

Warning System Test: The site-wide Employee Warning System will perform its monthly audio test at noon. For additional information contact Bob Gaffney at x34249.

OUT&ABOUT★

JSC Radio Control Club members hold some of their recently built model planes. Shown, left to right, are Brendon Montz, Herman Burton, Don White, and Ron Madsen. The next club meeting will be March 9 at 7 p.m. at the Clear Lake Park building. For more information contact Bill Langdoc at x35970.

March 7

ASQ meets: The Bay Area section of the American Society for Quality will meet at 6 p.m. at the Ramada King's Inn on NASA Road 1. No reservations are required. For details contact Ann Dorris at x38620.

March 8

IAAP meets: The Clear Lake/NASA Chapter of the International Association of Administrative Professionals will meet at 5:30 p.m. March 8 and April 12 at Bay Oaks Country Club. Cost is $16. For details contact Tami Barbour at (281) 488-0055, x238.

March 9

★ **Airplane club meets**: The Radio Control Airplane Club will meet at 7 p.m. at the Clear Lake Park building. For more details contact Bill Langdoc at x35970.

MAES meets: The Society of Mexican-American Engineers and Scientists will meet at 11:30 a.m. in Bldg. 16, Rm. 111. For more information contact George Salazar at x30162.

SSQ presentation: The Society for Software Quality presents "Licensure as a Professional Engineer in Software Engineering" by Dr. Chuck Hoffman of Barrios Technology. The brown bag will be at noon at Barrios Technology, 2525 Bay Area Blvd., Suite 300. For reservations contact Renne Peterson at 281-282-4392 by March 6.

March 10

Astronomers meet: The JSC Astronomical Society will meet at 7:30 p.m. at the Center for Advanced Space Studies, 3600 Bay Area Blvd. For more information contact Chuck Shaw at x35416.

March 12

Westside NSS meets: The "Westside" group of the Clear Lake area chapter of the National Space Society will meet at 2 p.m. at Silicon Graphics, 11490 Westheimer, Suite 100. For more information contact Murray Clark at (281) 367-2227.

It's rodeo time again

Laura Vincent gets a roping lesson from Houston Rodeo Speaker Committee members Dick Hudgins and Sparkles the Clown outside Bldg. 3, at right. The Texas Independence Trail Riders made their way through JSC February 8 on their way to the Houston Livestock Show and Rodeo. The JSC Circle Riders and Precinct 8 mounted patrol met them as they entered the center, below.

NASA JSC Photos JSC2000-01177 and JSC2000-01269

NASA BRIEFS

CALIFORNIA FIRM SELECTED TO DEVELOP AIRCRAFT TECHNOLOGIES

In an effort to increase the research capabilities of high-altitude Earth science missions, NASA's Dryden Flight Research Center has selected General Atomics Aeronautical Systems, Inc., (GA-ASI) San Diego, Calif., to begin negotiations to demonstrate technologies expanding the capabilities of uninhabited aerial vehicles.

The task under NASA's Environmental Research Aircraft and Sensor Technology (ERAST) program jointly sponsored research agreement is to expand technical performance to meet the scientific requirements and to demonstrate operational capabilities required by the emerging uninhabited aerial vehicle (UAV) industry. GA-ASI will develop the new Predator B series of UAV, including an enlarged and upgraded version, to meet these requirements. As joint partners in the project, GA-ASI will contribute $8 million and NASA's Office of Aero-Space Technology will invest more than $10 million.

The ERAST program has operated for approximately six years with a number of industry partners to develop UAV capabilities. The program has concentrated on developing aerodynamic propulsion and control system technologies for future high-altitude, long-endurance UAVs designed for government or commercial uses.

BREAST CANCER SCREENING AID CLEARED FOR DIAGNOSTIC USE

The war against breast cancer has a new weapon, thanks to an advanced sensor developed at NASA's Jet Propulsion Laboratory.

The device, called the BioScan Syste, was developed by OmniCorder Technologies, Inc., Stony Brook, NY. OmniCorder received clearance to market the system from the Food and Drug Administration in December 1999.

Studies have determined that cancer cells exude nitric oxide. This causes changes in blood flow in tissue surrounding cancer that can be detected by the sensor. The BioScan System is sensitive to temperature changes of less than .027 degree Fahrenheit and has a speed of more than 200 frames per second. It causes no discomfort to the patient and uses no ionizing radiation.

"Clearance for use of this noninvasive diagnostic tool is an important milestone for us," said OmniCorder President and CEO Mark Fauci, who noted that the device has also been cleared to be marketed for other applications.

The sensor, called the Quantum Well Infrared Photodetector, was invented by Dr. Sarath Gunapala, principal engineer of JPL's device research and applications section. The digital sensor detects the infrared energy emitted from the body, thus "seeing" the minute differences associated with blood flow changes. Earlier versions of QWIP had potential applications, such as locating hot spots during fires and observing volcanoes.

"It is a great pleasure to see something I invented being used for public benefit," said Gunapala, "especially in medicine and even more so in the early detection of cancer."

SPACE CENTER Roundup

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