

Space News ROUNDUP!

VOL. 37 NO. 7

Lyndon B. Johnson Space Center, Houston, Texas

April 10, 1998

In this issue



MCC sends first command to International Space Station hardware on test stand.

Page 2



Space station team provides moral support for co-worker fighting cancer.

Page 3



Excerpts provide glimpse into meat of first JSC Annual Report.

Pages 4-5



In 1964, Houston helped put the first two-person spacecraft in orbit.

Page 6



Two secretaries earn center's top clerical support award.

Page 7



New NASA space flight chief pays JSC a visit; chats with students.

Page 8

JSC employees to get first 'Launch Break'

JSC employees will take their first "Launch Break" for the upcoming STS-90 mission, following up on an employee suggestion with an officially recognized voluntary pause in the workday to watch all shuttle launches.

The suggestion, submitted in September, proposed that employees take a break from their activities to focus on the space shuttle launch as a way of maintaining

heightened awareness and appreciation for this dynamic event. Center management approved the suggestion with a few changes to enable effective implementation.

While the pause is voluntary, JSC managers are encouraged to provide breaks in meetings and other non-critical activities. Center organizations are asked to allow access to conference rooms and other locations equipped with NASA Television.

A primary location for observing the launch will be Teague Auditorium, where the countdown and ascent will be shown on the large screen. A speaker, usually from the Flight Director or Astronaut Office, will provide in-person commentary during the launch and respond to questions afterward. Members of the public attending the Space Center Houston tram tour also will be in the auditorium. Contract employees are

welcome, although JSC is not directing any contractor to institute a similar program.

"The employee suggestion program gives everyone the opportunity to have a voice in improving how we do business. We rely on the good ideas and enthusiasm of the workforce to continually put new energy into the system," said Human Resources Director Harvey Hartman.



JSC Photo 98-03651 by Steve Candler

JSC Director George Abbey, left, meets with international documentation engineer Joella Delheimer, Texas State Comptroller John Sharp and Jim Wade of the International Space Station inside the International Space Station's U.S. laboratory module mockup in Bldg. 9 after Sharp's release of a report detailing JSC's contributions to Texas.

First JSC Annual Report 'healthy'

JSC released its first-ever Annual Report late last month, a 42-page document that chronicles the center's activities during fiscal year 1997 in the areas of management initiatives, operations, research and development, business relations and community outreach.

"Fiscal Year 1997 was another excellent year for the Johnson Space Center," wrote JSC Director George Abbey in his introduction. "We made significant progress in our programs, continued the transition to our lead center responsibilities and strengthened our partnerships with other space-faring nations, other NASA centers and the community."

"Across the Johnson Space Center, we continued to demonstrate the breadth and versatility of our workforce and our facilities," he continued. "We continued to strive for efficiencies in operations, consolidate support activities and demonstrate new and better ways of getting our jobs done. Above all, FY 1997 demon-

strated again the exceptional talent, the unmatched dedication and the unparalleled commitment of our people. Their accomplishments exemplify the spirit of exploration that will carry the nation and the world forward."

The report also includes financial information covering all center activities and 100 percent of the center's budget authority, prepared pursuant to the Chief Financial Officers Act of 1990, the Government Management Reform Act of 1994 and Office of Management and Budget Bulletin 94-01, "Form and Content of Agency Financial Statements."

"There has been substantial change this year in our total program and operating expenses," wrote Chief Financial Officer Wayne Draper. "In FY 1996, these expenses were \$2.9 billion; in FY 1997 they grew more than 10 percent to \$3.2 billion. Even more striking is the growth in Johnson Space Center

Please see **JSC**, Page 8

First station rack slides into module

The first system rack is now inside the International Space Station's U.S. laboratory module, which will be the centerpiece of station research and unprecedented science experiments.

The first rack was installed recently by Boeing technicians in the space station manufacturing building at NASA's Marshall Space Flight Center. The rack is the first of two that will supply electrical power to the scientific racks inside the laboratory module. When the laboratory module is in orbit, it will have a total of 24 racks, 13 of those containing science experiments. The other 11 racks will provide power, temperature and humidity control, air revital-

Please see **RACK**, Page 2



NASA Photo

Technicians with The Boeing Company at NASA's Marshall Space Flight Center carefully slide the first system rack inside the U.S. laboratory module for the International Space Station. The recently installed rack, about the size of a closet and weighing almost 1,200 pounds, is the first of two that will supply electrical power to the scientific racks inside the laboratory module.

Sharp report details JSC's contributions

Texas State Comptroller John Sharp last month released a detailed report describing the prestige and economic benefits JSC bring to Houston and Texas during a visit here.

The details are in the March edition of Sharp's Fiscal Notes, which he released in a March 24 Bldg. 9 ceremony with JSC Director George Abbey. The newsletter featured reports on the importance of the space program to the Houston economy, to Texas schools and universities, and to everyone who uses products developed for the space program—whether they realize it or not.

"Before the arrival of JSC, Houston was not well known internationally," Sharp said. "The space program helped bring worldwide attention and acclaim to the city; and Houston and the rest of the state continue to reap the rewards of having JSC as a neighbor."

"Unfortunately, we in state government sometimes become complacent about the importance of NASA and JSC to the Texas economy," Sharp said. "Whenever a large corporation decides to shop around for a new home, it seems there's no limit to the financial incentives people will offer to persuade that company to stay. But when members of Congress talk about cutting funding for the International Space Station, or focusing NASA's resources on unmanned space programs, we don't hear much from state government. That attitude has got to change."

"The state should do whatever it can to provide the infrastructure, education, and services that JSC needs to thrive and grow," Sharp said. "I am committed to doing whatever is necessary to promote the growth of JSC's presence in Texas. I need the input of the people who work every day here at JSC, and in the Clear Lake and Houston area. There is no question that Texas should be your biggest ally. If we work together to make sure that NASA and officials in Washington have no doubt that this part of Texas will always be the center for space exploration, then the economic potential of this area will be as limitless as space itself."

Sharp reported that since JSC became the command center for NASA's human space flight program in

Please see **SHARP**, Page 8

Shuttle managers select April 16 for Columbia launch

Space shuttle program managers selected Thursday, April 16, as the launch date for the STS-90 Neurolab mission.

The launch date decision came at the conclusion of the traditional face-to-face Flight Readiness Review at Kennedy Space Center by shuttle managers from NASA and prime contractor United Space Alliance, who examined at the readiness of the flight crew, vehicle, launch and mission control flight teams.

Commander Rick Searfoss, Pilot Scott Altman, Mission Specialists Rick Linnehan, Dave Williams and Kay Hire, and Payload Specialists Jay Buckley and Jim Pawelczyk will fly to Florida early next week to receive their final pre-flight briefings and to practice landings at

Please see **STS-90**, Page 2

Thomas concludes one experiment, records space walks

U.S. Astronaut Andy Thomas is continuing his scientific research as his Mir 25 crew mates perform space walks to install handrails and foot restraints on the damaged Spektr module and replace the propulsion system for the Mir's boom jet assembly.

Thomas has finished the immunity experiment, for which he was taking blood and saliva samples. The life science investigation is comparing the human body's ability to produce antibodies to fight illness in a microgravity environment and on Earth. Previous research has shown that some of the body's immune responses appear to be suppressed during long-duration space flight. Astronauts Shannon Lucid, John Blaha, Jerry Linenger, and Dave Wolf also participated in this investigation during their research aboard Mir.

The Australian-born astronaut also continued to troubleshoot the Biotechnology System Co-Culture experiment, designed to grow two different cell types in order to form three-dimensional tissue samples in microgravity. Thomas opened up the hardware in an effort to gain insight into the location of a possible

blockage in the fluid loop. Thomas reported that he found dry, dark-colored matter in one of the tubes of the apparatus.

Thomas processed 12 samples for the material science experiment, the Queens University Experiment in Liquid Diffusion, a joint U.S., Canadian and Russian experiment that uses a special furnace to analyze the slow mixing of materials by the random movement of molecules of one substance into another.

Another "Letter from the Outpost" was posted on the NASA Shuttle-Mir Web (<http://shuttle-mir.nasa.gov>) by Thomas, as well. In it, he discussed setting up his living and working quarters aboard the station and learning about the challenges of long-term life in microgravity as he unpacked books, music cassettes and CDs, plus stationary supplies, and personal hygiene items.

"As I was unpacking and stowing all of these things, I came up against the one thing that makes space flight both interest-

ing and, at the same time, very frustrating, namely zero gravity," Thomas wrote. "It can be a joy to experience, but also can really make your work day difficult. The most frustrating thing is that you are forever losing things. You might be rummaging through a bag to find one item, while all the other contents are floating away, and before you know it, they are gone, and lost.

"They may even be close by to you, but as you look around you tend to focus your gaze only on surfaces, where we are accustomed to seeing things, and not look at the empty space just in front of us. In zero-g you have to learn to change this behavior."

Thomas was in the Mir's Core Module, monitoring the progress of the cosmonauts and shooting video when Commander Talgat Musabayev and Flight Engineer Nikolai Budarin, opened the airlock hatch with no difficulty April 1 and began a six and one half hour space walk. The crew installed handrails

and foot restraints on the Spektr module near the radiator, then moved to its damaged solar array to begin installing a work station but ran short on time.

A second spacewalk to complete the array work occurred April 6. Three more spacewalks are planned April 11, 16 and 21 to replace the propulsion system for Mir's boom jet assembly, known as the "Sofora." The old propulsion system atop the boom which rises from the Kvant-1 module has been operating since its delivery to the station in August 1992, and is almost out of fuel. This replacement work is expected to span four space walks, spaced about five days apart.

"I had the armchair view of it all because I was in the module where I am now looking out the windows that are in this module and watching the whole proceedings unfold," Thomas said, "and it was really fascinating to watch my two colleagues moving around outside in the pressure suits and handling the equipment and doing the work out there."

Thomas is to return to Earth in early June.



STS-90 reflects sophistication, Searfoss says

(Continued from Page 1)

KSC's Shuttle Landing Facility.

"I'm very excited to see continual progress and development in our ability to get world class rigorous science up on orbit," Searfoss said. "We are molding some rigorous scientific requirements to get great data up on orbit with the difficult operational aspect of being in space and doing the job up there."

STS-90 is to last 15 days, 21 hours, 50 minutes. But mission managers are reserving the option of extending the flight one additional day for science operations if shuttle electrical power margins permit.

NeuroLab will study the effects of microgravity on the human central nervous system, and pathways that control the ability to sense location in the absence of gravity, and the effect of microgravity on a developing nervous system. Searfoss said it has set a new standard for inter-agency and external cooperation.

"This mission was developed and designed with the National Institutes of Health firmly involved in the selection of payloads," Searfoss said. "Out of 170 candidate experiments to fly on NeuroLab, it was approved down to 26 based on the ones that were the most promising in terms of scientific return. That process was not done at the NASA level, it was done at an international level with our international investigators, academic institutions as well as the National Institutes of Health."

"We're reaching a new level of detail and sophistication of what we're able to do on orbit to develop some really fundamental how and why aspects of the scientific questions we're asking," Searfoss said. "We're much more on the leading edge to science in the kind of work we do up on orbit these days, and it's exciting to see that."

An April 16 launch and a 16 or 17 day mission would have *Columbia* landing back at Kennedy Space Center on May 2 or May 3.



JSC Photo 98-03937 by Steve Candler

Brian O'Hagan, second from left, transmits the first command to the new International Space Station from the Mission Control Center's Command and Data Handling System, or ODIN, console at JSC with help from Larry Bishop, Kevin Mutz and Craig Davis, from left.

Rack installation another important station milestone

(Continued from Page 1)

ization and other support systems for the science racks.

"The installation of this first system rack represents another major milestone for the space station program," said Steve Goo, Boeing manager for the U.S. lab. "This marks the point where we are actually gathering data and providing power at a total lab level with the racks and module working together. This is significant in terms of driving down technical risks."

The space station racks are about the size of a closet. The first rack installed in the lab weighs about 1,200 pounds. Its exterior is made of graphite composite.

Over the next several months, 10 more system racks will be installed inside the lab. The laboratory module then will be shipped to Kennedy Space Center this August to begin final preparations for its launch,

scheduled for May 1999 aboard the Space Shuttle Endeavour on STS-98, station assembly flight 5A.

When it is launched aboard the shuttle, the laboratory module will have just five of the 11 system racks inside it. Then, on the following shuttle flight, STS-99 scheduled for June 1999, the six additional system racks will be delivered in a smaller module called the Multi-Purpose Logistics Module. The 11 system racks support the 13 interchangeable science racks inside the lab and provide the communication and control capability for the space station.

Another major milestone for the laboratory module currently under way is the beginning of hardware and software integration and a series of qualification tests being performed leading up to the lab's shipment to the Kennedy Space Center in August.

Houston sends first command to station element

The first command from Mission Control to International Space Station hardware—in a test stand at the Kennedy Space Center—was sent at 7:25 p.m. CST March 5 as part of an end-to-end checkout of the station's Early Communication System.

The command was sent by Brian O'Hagan, the flight control team's Command and Data Handling System expert, call sign "ODIN," who has been instrumental in developing the MCC's space station commanding capabilities. Supporting O'Hagan were Larry Bishop, also an ODIN, responsible for development of onboard command and data handling procedures; Craig Davis, ISS command system engineer; and Kevin Mutz, Boeing Development Manager for the flight software.

"ECOMM is a fast-track project being provided to the program as government furnished equipment by Engineering's Avionic Systems Division. The ECOMM system will be flown on STS-88 to provide an early capability for commands, telemetry and two-way videoteleconferencing," said Linda Bromley, ECOMM project manager. The test was performed during the checkout portion of the Launch Package 2A Cargo Element tests being conducted at the Kennedy Space Center.

"I thought it went extremely well," Bromley said, "especially since most communication systems this complex can take four to seven years to develop and fly. But we were given only 18 months to build and fly this one."

Bromley said the members of the project team "basically gave up their personal lives" for a year and a half to develop and test the system. The success of this test was due in particular to the efforts of Mike Cooke, the ECOMM Project's avionics man-

ager; and Tex Ward, the Lockheed engineer responsible for ECOMM testing logistics, she said.

"Between 2A and the time the regular S-band system comes on line in 4A, the only communication we would have had was through Russian ground stations," Bromley said. "That limited the amount of time to about 10 minutes a day that we could have communication with the station. This new communication system goes through the TDRS (Tracking and Data Relay Satellite) system, so it allows nearly continuous monitoring of the status and health of the vehicle, and it allows you to send up commands to some systems without using ground stations. It also allows two-way videoteleconferencing between the crew and mission control or their families."

The first videotelecon between the MCC and the first U.S.-built element of the station that same evening was hosted by STS-88 crew members Jerry Ross and Jim Newman.

"The ECOMM end-to-end test was a significant and successful milestone for the 2A team," said Beth Cerrato, the 2A Launch Package Manager's Team member responsible for coordinating testing. "Actually 'seeing' the results of this test in the videotelecon made it even more rewarding for the entire team. We will be looking forward to seeing this system operational on orbit—it is a valuable addition to our flight both on orbit and on the ground."

"Getting the control center to communicate with our new space station via the Early Comm System was the result of significant efforts by development and operations organizations from across the program," said Mark Kirasich, lead ISS flight director for STS-88. "It was a testament that we are indeed getting ready to fly."

Internet News

By Lori Keith

Using the Internet, NASA is making connections to thousands of classrooms across the country and around the world as part of NASA's Learning Technologies Program.

Space Team Online is one of the projects under way. A K-12 Educational Initiative sponsored by NASA, it began in the spring of 1997, as Shuttle Team Online changing its name in December. The name change is to encompass the involvement of the activities of the International Space Station, as well as shuttle missions.

Space Team Online is an educational World Wide Web site set up for upper elementary through high

school students and teachers to use interactively in the classroom. It's one place that teachers, students, space scientists and others involved in the overall space goal can personally interact.

The majority of experts are from JSC and Kennedy Space Center. JSC hopes to expand its experts list for the volunteer project with participation from more of those involved in shuttle or station missions.

"This project is important, not just because it is a HEDS (Human Exploration and Development of Space) goal, but because our nation's minds are asking for more," said Bill Boyd, acting chief of Engineering's Energy Systems Test Branch. "If we can't

accept that as a challenge, then we are not ready for the challenge of [space] exploration."

A biography is written, sharing some personal and background information, and short journals are periodically submitted detailing a current project, event, problem or day-to-day activities.

Because of time constraints, a journalism student has been recruited to conduct interviews and do the actual writing of the bios and journals, when preferred. Boyd said having an interviewer helps to facilitate the whole process. The must approve the final product before it is put on the web.

"It does take some time, but not

an excessive amount," Boyd said. "An hour for the interview, an hour to review the bio. Perhaps one-half to one hour per week to keep the journals updated. Those are insignificant numbers compared to the gain."

Experts also may participate in web chats, where they are the featured guest and respond to questions in real time on the Internet. Approximately four chats a month are planned. E-mail question and answers are a popular part of the project with more than 1,000 E-mail questions so far.

Kurt Bush, an engineering associate in the Flight Crew Systems Development Program, said, "I think the kids are getting a lot out of this.

Very rarely do I answer questions from adults."

Children ask all kinds of questions, limited only by their imagination and intelligence.

"I always wanted stuff like this when I was a student," Bush said. "Now I have the chance to do it for the other kids—sharing all the neat stuff I wanted to see and know about when I was a kid."

Though participation is voluntary, the goal is to ensure that JSC is well represented. About 45 JSC volunteers are involved so far. Anyone interested in participating in the STO program can contact Lori Keith at x3622. The website is at <http://quest.arc.nasa.gov/space/>.

Community News

Station team holds hair razoring party

Close-knit group gets closer to support coworker with cancer

By Leslie Eaton

Hats are the latest rage in the International Space Station Program's Management and Control Team, but it has nothing to do with fashion—it's just a bit chilly without them.

That's because the entire team is walking around bald beneath the baseball caps that read: "Frank Ambrose 's SMC Support Team."

Ambrose, a Boeing contractor leading the space station command and telemetry effort, was diagnosed with lung cancer and lymphoma four weeks ago. He had his first round of chemotherapy and is going through extensive radiation treatment to reduce the amount of discomfort from a tumor on his spine.

The chemotherapy left Ambrose with such sporadic tufts of hair on his head and beard that he decided to shave it all off. Kevin Window and Mark Wilson, the NASA and Boeing co-chairs for the SMC team, organized a March 13 party for members on the team to shave their heads in a show of support.

"We were hoping that four or five people would join us and it surprised Frank and us that everyone on the team joined in," Wilson said. "This was an opportunity to do something special and we wanted to do something visual to help."

All of the team members attended the party. Two wives who routinely cut their husband's hair "did the honors." The women on the team, who

stopped short of shaving their heads, also came to show support for Ambrose and cheer on the men who did.

All 19 of the men on the team shaved their hair off in support for Ambrose. There were even a few men from other teams who joined in, making the total sheared 23. Ambrose said he was "surprised and moved by the gesture," and added that he feels fortunate to work with the people on the team.

"What those guys did was very special," Ambrose said. "It's emotional for me to talk about it. It's been a tremendous source of support for me."

"We were trying to help him keep his positive attitude," Window explained. "He (Ambrose) came to the party and was the first to get shaved. It sure made me happy to be the lead of this team."

Window had the baseball caps made, and everyone on the team signed the hat that was given to Ambrose. Window says Ambrose wears the hat all the time now.

"Frank has taken a real active and aggressive attitude that the cancer is not going to beat him," Wilson said. "Frank takes his daily radiation treatments and then comes to work," Wilson continued. "We knew we were a close team, but this has solidified it."

Several team members say they plan to continue to shave their heads until Ambrose's hair grows back in to show their continued support.



More than 20 members of the International Space Station Program's Management and Control Team show support for team mate Frank Ambrose by having their heads shaved to look like his. Above: Twenty members of the Frank Ambrose Support Team participate in the hair cutting event at one of the team members' homes. Kneeling from left are Jimmy Williams, Steve Sheffield, Iain Ross, Kevin Window, Mike Surber and Mark Wilson. Standing from left are Tim Runkle, Mike Langan, Dick Carl, Joe Reed, Carlos Valrand, Nate Remmick, Frank Ambrose, Greg Clare, Greg King, George Torres, Scott Haase, David Majchrowicz, Chris Land, and Alex Land. Left: Cathy Haase, wife of team member Scott Haase, left, inspects the hair razoring work of Trish Surber while Quin Shepperd loses his locks to Jeanetta Wilson.

JSC finalizes plans for next week's Earth Day celebration

By Sandra Parker

The Environmental Services Office is finalizing plans for JSC's Earth Day celebration from 10 a.m. - 2 p.m. April 17 at the Gilruth Center. This year, employees will find activities and exhibits in both the gym and the ballroom. The JSC buses have added stops to the Gilruth on Route A between Bldgs. 44 and 32 and Route B between Bldgs. 45 and 419 and between Bldgs. 421 and 45.

Numerous activities and exhibits are scheduled for this year's event to support JSC's theme, "A Good Planet is Hard to Find." Activities include a presentation by the Child Care Program scheduled for 10:30 a.m. in the gym and a display of the first and second place winners of the

Clear Creek Independent School District Science Fair.

The photography contest and the children's original art work coloring contest also will be on display. Contractor and civil service employees are encouraged to submit Earth Day related photos by noon April 13 to Alexis Davis Bldg. 45, Rm. 708. Photographs will be judged by Sue Garman, associate center director; Harvey Hartman, director of Human Resources; James Hickmon, director of Center Operations; and Nick Nelms, photography supervisor from Dyncorp.

The children's coloring page and the photography contest rules can be downloaded from the Earth Day homepage accessible through the

JSC internal homepage at: http://stic.jsc.nasa.gov/collections/COD/earth_day/ED98index.htm. Contest rules also can be found in the March issue of the Earth Day '98 Newsletter.

This year, an information booth with experts on topics such as recycling, growing and caring for roses, and horticulture, will be available to answer questions. Employees can make a pledge to conserve the Earth's natural resources at the conservation pledge booth and receive a free tote bag. Suggestions are listed on the pledge cards and include ideas such as starting a compost pile, recycling motor oil and filters at an approved recycling collection center, and using natural or organic

pesticides. Pledge cards can be downloaded from the Earth Day home page.

Door prizes and free give-aways also are being planned for this year. Astronauts will be on hand to autograph photographs. Employees who complete the scavenger hunt may come by the COD booth to receive a free badge holder. Visit the many exhibitor booths including Armand Bayou Nature Center, Wildlife Rehabilitation, the Native Plant Society, Texas Forest Service, Texas Department of Highways and Transportation, Texas Tortoise and Turtle Society, Army Corps of Engineers, the Coast Guard, U.S. Fish and Wildlife and the EPA to name a few.

The Houston Federal Executive Board's Fun Run is scheduled for 9 a.m. April 18 at the Gilruth Center along with the JSC Earth Day Softball Tournament. For more details, see the Earth Day homepage.

Volunteers still are welcome to help with the many Earth Day events. Interested employees should contact Bob Gaffney at x34249.

Other area events include a Household Hazardous Materials Collection Day on Saturday, April 18 from 9 a.m. - 3 p.m. Area residents may bring used motor oil and other hazardous materials to the University of Houston Clear Lake parking lot and know they will be disposed in an ecologically safe manner.

JSC Safety Alert

Handle Cigarettes Carefully!

What Happened

February 27, 1998, a JSC employee found a cigarette burning on the sidewalk between Buildings 1 and 2. The employee extinguished the cigarette. Close Call Report 98-1243

Results of the Investigation

Although nothing happened, a burning cigarette could be a fire hazard if it rolls off the sidewalk onto dry grass. At the present time, the fire danger is low due to all the rain; however, we do have dry spells in Houston. The fire danger could be higher in a few months.

What You Can Do

Each building should have ashtrays outside.

If you smoke:

Dispose of cigarette butts in ashtrays. Make sure the cigarette is out in the ash-tray before you leave it. The wind could blow it onto the ground.

Black engineers name Barrios' Gordon top young engineer

James Gordon, an employee of Barrios Technology Inc., recently was selected as the Young Engineer of the Year by the National Society of Black Engineers.

Gordon said he knew he wanted to work in mission control when he was 11 years old and took a tour of NASA. "When I spoke about my dream with the tour guide, she informed me that I needed to become an engineer if I wanted to be in the space program, so that became my goal," Gordon said.

Gordon followed his dream through high school and Prairie View A&M University and now works as an engineer on the International Space Station for Barrios Technology.

"As I became more interested in engineering and because I finally realized my dream I think it was a very special circumstance to be able to realize a lifelong goal," he said.

Gordon believes that working in the community gives the Young Engineer of the Year an opportunity to give back what he has learned about engineering to the community. "I joined the National Society of Black Engineers in 1989 while I was

still in college. I like being a part of a program that gives volunteer opportunities—opportunities to learn through technical workshops and opportunities to be a part of community service," he said.

As pre-college initiative chairman, Gordon goes into Houston area schools and talks about what engineers really do as well as what it takes to become an engineer. He serves as a role model to other young students with big dreams. "I tell them, 'You can achieve your goals. My parents didn't go to college so just put your mind to it and you also can achieve your goals,'" he said.

Gordon said he was excited about the honor of being named Young Engineer of the Year because, "It's unusual for people to have dreams and actually get to accomplish those dreams. I know that it is sometimes easier to settle for less, but I wouldn't choose anything else," he said. "It's also exciting to be recognized by my peers and to be entrusted with the honor of being entrusted with the honor of being Young Engineer of the Year."

Aerospace and the Business Communities

The Space Operations Management Plan and Johnson Space Center's role as Lead Center for Space Operations gathered momentum during the fiscal year. The plan, an effort to provide higher quality service at lower cost, calls for NASA to emphasize research and development while outsourcing many operational elements.

Assumption of the Lead Center for Space Operations role has increased the property for which the Johnson Space Center is responsible by almost \$6 billion. Much of the increase reflects the new responsibility for NASA's fleet of Space Shuttle orbiters.

FY 1997 saw enactment of a major outsourcing contract under which a private organization, United Space Alliance, will manage a major portion of the nation's space flight program.

Commercialization of space is another element of the Johnson Space Center's interaction with the private sector. It was the focus of the first Inspection Day in November 1996, designed to showcase space hardware and technology to potential users outside the traditional aerospace sector.

Space Flight Operations Contract

In a groundbreaking agreement, NASA and United Space Alliance signed the Space Flight Operations Contract, naming the company the single prime contractor for space flight operations. United Space Alliance is a joint venture between Lockheed Martin and Boeing. The contract, effective at the beginning of FY 1997, calls for the company to perform all Shuttle processing, ground operations, mission operations and training.

Both NASA and United Space Alliance officials believe the contract will result in more efficient and more cost effective operation of the space flight program ...

Consolidated Space Operations Contract

The Johnson Space Center in May called for proposals from industry to begin consolidating the Agency's human and robotic space operations capabilities. In issuing that request for proposals, the Space Operations Management Office reiterated that the change in the way NASA carries out operations will save money in routine operations ...

Expected to be awarded in 1998, that Consolidated Space Operations Contract is intended to be a multi-year agreement for sustaining engineering, operations and maintenance of networks, control center facilities, and other critical systems. The

eventual value of that performance-based contract is estimated at \$500 million to \$600 million a year for 10 years.

National Space Biomedical Research Institute

Another agreement was signed in January 1997 by NASA and Baylor College of Medicine of Houston, to establish a National Space Biomedical Research Institute. Baylor will lead a consortium of premier academic and research facilities ... to conduct the focused biomedical research necessary to support human health in the exploration and development of space ...

NASA identified the concept of a science institute as a means of maintaining the scientific excellence of its applied biomedical research through a greater involvement of the scientific community in NASA's overall research program ...

NASA-JSC Inspection More than 1,200 top executives from companies in 28 states took advantage of the first NASA-JSC Inspection to learn about the Johnson Space Center's missions, technologies and facilities on November 13 and 14, 1996. Guests came from the manufacturing, engineering, medical, architecture, transportation, petroleum, energy and computer industries ...

The objective of Inspection 96 was to showcase technologies and expertise with potential commercial applications. That was accomplished with more than 120 exhibits and demonstrations in 17 Johnson Space Center facilities. The first Inspection was such a success that the Johnson Space Center scheduled an Inspection 97 ... early in FY 1998 ...



Above all, 1997 demonstrated again the exceptional talent, the unmatched dedication and the unparalleled commitment of our people.

JSC and the Community

The Johnson Space Center has a substantial economic impact on Texas, the Southeast Texas region and the Houston-Clear Lake-area community. Indeed, it is one of the 'big three' along with petrochemicals and world-renowned medical facilities helping propel Houston's economy.

But the impact of the Center stretches far beyond financial considerations. It has a strong and growing relationship with the public which benefits both the Center and its neighbors.

The Center holds an annual open house for the public, the ultimate owners and beneficiaries of the space program. More importantly than being a host to an increasingly popular event, the Johnson Space Center and its people help preserve and popularize the heritage of the area. The Center and its people also have a positive impact on education, from the elementary through postgraduate levels.

The Center shares facilities with the community, including a modern Emergency Operations Center, that could save lives in the event of a natural disaster or other major emergency.

Economic Impact

As FY 1997 began, the Johnson Space Center's workforce on site and near the site totaled almost 15,000, including nearly 3,400 civil servants.

When the effects of money flowing across the region from salaries and Center activities is taken into account, Johnson Space Center activities are responsible for a substantially greater number of jobs.

Texas is second among the states in total NASA dollars received. In work assigned to the Johnson Space Center, almost half the Shuttle program dollars and more than 10 percent of Space Station dollars stay in Texas. Other facts of note as FY 1997 began

- ◆ About 80 percent of the NASA and Johnson Space Center budgets went to the private sector via contracts, compared to about 9 percent of the total federal budget.
- ◆ Average age of Center civil servants was 44; about 84 percent of employees had bachelor's degrees, 23 percent of those had masters and 6 percent held doctorates.
- ◆ Since it was established, Johnson Space Center budgets have totaled more than \$61 billion.

Additional impact is realized from substantial space-related tourism. Much of it results from visitors attracted by the Johnson Space Center and the independently operated visitor facility, Space Center Houston.

Community Interface

The Johnson Space Center Open House on Saturday, August 23, was perhaps FY 1997's most visible and largest interaction with the public. The theme was 'Space ... for all people.' More than 100 exhibits at more than 20 facilities drew an estimated 80,000 visitors. Vital to its success were the 1,600 volunteers - civil servants and contractor personnel - who staffed the exhibits. Among them were astronauts, scientists, engineers and administrators. The event was free, and visitors were able to move around the Center on foot or by using trams to view exhibits of interest.

Nearly every aspect of space flight was featured in the comprehensive line-up of displays, demonstrations, and space hardware. Mission operations, Shuttle and Space Station training and simulations, robotics and virtual reality, manufacturing and fabrication, spacecraft propulsion and energy systems, space communications, life support and space

suits, and a wealth of science investigations were included.

Visitors saw facilities that benefit the community, as well as being resources for the Johnson Space Center. Other less visible facilities and programs also offer substantial benefits to the community ...

- ◆ The modern, 4,000-square-foot Emergency Operations Center is designed to respond to any of a range of emergencies that could affect the Johnson Space Center and neighboring communities. More than a third of the Emergency Operations Center has been reserved to augment community emergency operations ...
- ◆ The Johnson Space Center Educator Resource Center was relocated during FY 1997 to Space Center Houston. The facility contributes to the nation's educational goals by giving teachers the tools to expand and enhance the scientific and technological competence of their students ...
- ◆ Texas Independence Trail Riders and Longhorn Cattle highlighted the Johnson Space Center's 'Go Western Day' February 5, 1997. Dedication of the JSC Longhorn Project, a piece of Texas heritage and Texas' future, was held before about 1,000 people -

among them trail riders, aerospace workers and educators. ... The Longhorn Project will offer students the opportunity to learn about cattle care and breeding, aquaculture, and fruit and vegetable cultivation.

- ◆ More than 225 Johnson Space Center and contractor employees visited more than 350 area classrooms during February, the month (of) National Engineers Week ...
- ◆ A collaborative education venture to locate a Clear Creek Independent School District intermediate school at the Johnson Space Center was announced in late May ... The school will be on about 35 acres on the southwest corner of the Johnson Space Center. It is expected to be completed by the fall of 1999.
- ◆ Twenty-three teams of undergraduate students from U.S. colleges and universities flew with their scientific and engineering experiments on the KC-135 zero-gravity aircraft ...

As impressive as they are, these are only a few examples of the broad range of volunteering, giving and preparation that make the Johnson Space Center a good neighbor and a good friend, in normal times and times of need.

Chief Financial Officer's Statement

I am pleased to present the Johnson Space Center's annual financial report for Fiscal Year 1997. The financial statements describe the Center's financial position and the results of operations for the year - a period of substantial change in the way the Center and NASA as a whole interface with the aerospace industry.

The Space Flight Operations Contract, effective at the beginning of the fiscal year, combined several Shuttle contracts into one prime contract administered at the Johnson Space Center, the lead center for space flight operations. Previously, many of these contracts were administered by other centers. This change, which increased the Center's management responsibilities, is a major step toward outsourcing operations with consolidated contracts. Another contract initiative is the Consolidated Space Operations Contract. In May, Johnson Space Center called for proposals from indus-

try to consolidate the Agency's human and robotic space operations capabilities. This contract, to be awarded next year, will be a multi-year agreement for sustaining engineering, operations and maintenance of networks, control center facilities, and other critical systems.

This contract change reiterates the theme that we plan to change the way NASA conducts operations to enable more of our resources to focus on research and development and on core competencies. A change directly influencing our financial community was the Agency award in September 1997 of the Integrated Financial Management Project contract. Implementation of this contract will change the funda-



Draper

mental procurement, budget, finance, travel, time and attendance, and management information reporting systems for the Johnson Space Center, joining them into one integrated system with the whole Agency.

There has been substantial change this year in our total program and operating expenses. In FY 1996, these expenses were \$2.9 billion; in FY 1997 they grew more than 10 percent to \$3.2 billion. Even more striking is the growth in Johnson Space Center assets, from \$6 billion in FY 1996 to \$12 billion in FY 1997 - a 100 percent increase. This growth is due primarily to the Space Flight Operations Contract and the increase in International Space Station hardware elements.

Fiscal Year 1997 was an exciting year for the Johnson Space Center. The financial state of health at Johnson Space Center is good. We are well prepared for the challenges facing us in the future.

Wayne L. Draper



"Man must rise above the Earth - to the top of the atmosphere and beyond - only thus will he fully understand the world in which he lives."

—Socrates, 500 BC



Director's Statement

Fiscal Year 1997 was another excellent year for the Johnson Space Center. We made significant progress in our programs, continued the transition to our lead center responsibilities and strengthened our partnerships with other space-faring nations, other NASA centers and the community.

Our continued presence on the Russian space station Mir has provided a strong foundation for the International Space Station. We have learned much about living and working for extended periods in an orbiting laboratory. Consistent with our tradition, the difficult times aboard Mir were overcome with hard work, dedication and ingenuity.

The year marked the beginning of hardware delivery for the International Space Station. Planning continued for the launch of the first station element in 1998. The Space Shuttle demonstrated its capabilities with eight very successful launches. The transition of space flight operations to United Space Alliance, the contractor assuming that responsibility, is going very well.

We continued to make significant gains in our advanced technology efforts. Chamber tests demonstrating the feasibility of advanced life support systems, successes of the X-38, advances in robotics and the development of advanced operations concepts are just a few examples of the technical strengths of the Johnson Space Center's people. Our emphasis on multiple applications of our technologies is a significant step toward setting the stage for future exploration initiatives.

Impressive scientific efforts included research aboard Mir and the Space Shuttle. With the establishment of the Space Biomedical Research Institute in March, we formed a powerful partnership that will help us complete the research necessary to put humans in space and on the surfaces of other planets for extended periods.

Across the Johnson Space Center, we continued to demonstrate the breadth and versatility of our workforce and our facilities. We continued to strive for efficiencies in operations, consolidate support activities and demonstrate new and better ways of getting our jobs done. The White Sands Test Facility continued to show its world-class expertise with an outstanding year of performance.

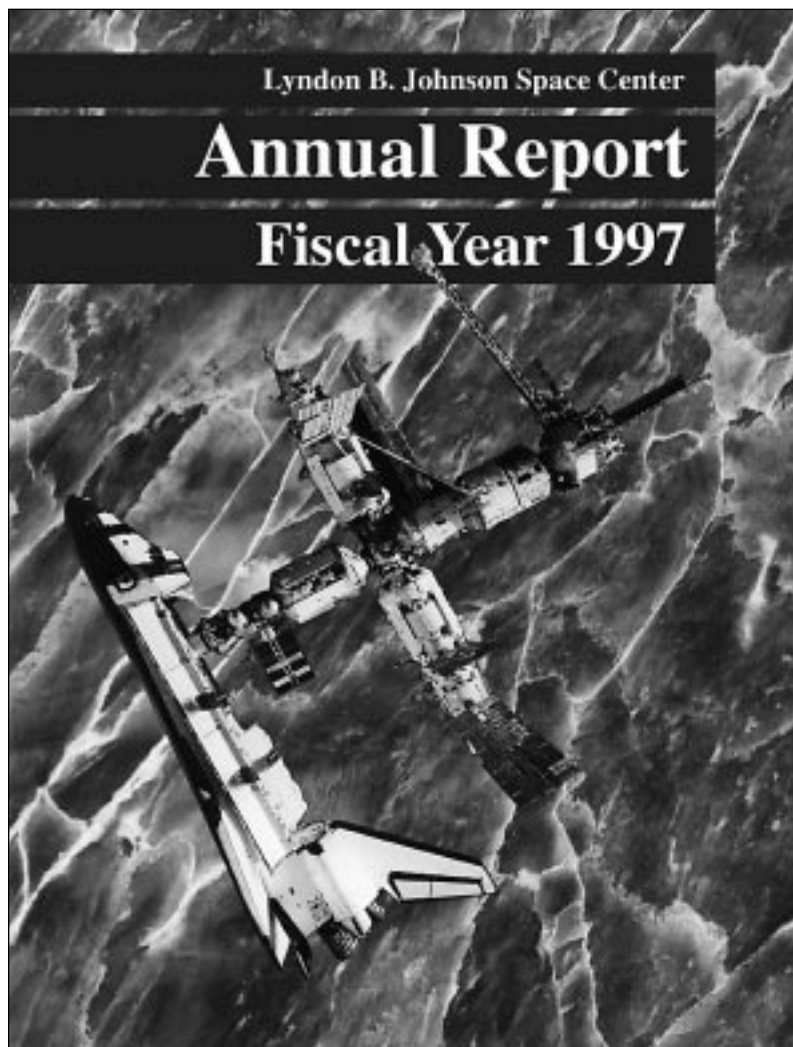
Our efforts to work with the community and to open the center to the public and to business leaders were met with enthusiasm. Our Open House and NASA Johnson Space Center Inspection set attendance records. Our 'Longhorn' cooperative education project reflects the community's past as well as its future. We have made commendable progress, across the board, in our efforts to build mutually beneficial relationships with our constituencies.

We also made a number of internal investments that will pay great dividends. Our efforts to improve safety and our activities to attain ISO 9001 registration are examples of activities that have required hard work and dedication now in return for substantial future benefits.

Above all, FY 1997 demonstrated again the exceptional talent, the unmatched dedication and the unparalleled commitment of our people. Their accomplishments exemplify the spirit of exploration that will carry the nation and the world forward.

I am pleased to present the FY 1997 Annual Report of the Johnson Space Center. The report covers the Center's activities from October 1, 1996, through September 30, 1997. I am proud of the Johnson Space Center's many accomplishments in FY 1997.

George W.S. Abbey



Operations

FY 1997 saw eight successful Space Shuttle launches. They included the fifth, sixth and seventh missions to dock with the Russian space station Mir in preparation for assembly and operation of the International Space Station.

Representatives of the nations collaborating on the International Space Station met in Houston to finalize the station's assembly sequence. The first two U.S. components of the space station were successfully pressure tested, and the first scheduled for launch, a connecting module called Node 1, was shipped to the Kennedy Space Center to begin launch preparations.

Training facilities continued to be upgraded, and the Neutral Buoyancy Laboratory, an underwater, zero-gravity training facility, was formally dedicated.

Space Shuttle

STS-80, the first flight of the fiscal year, was launched November 19, 1996. The eighth launch of FY 1997, STS-86, left the pad September 25, 1997

International Space Station

The International Space Station began moving from the factory floor to the launch site in FY 1997. The first U.S.-built element of the station, a connecting module called Node 1, was shipped from a manufacturing facility at the Marshall Space Flight Center to the Kennedy Space Center to begin launch preparations.

Node 1, scheduled to be launched aboard the Space Shuttle Endeavour on flight STS-88 in 1998, is connected with the Functional Cargo Block, a U.S.-funded control module being built by Russia to be launched a few weeks before Node 1.

Those launches will begin a 45-flight, five-year orbital assembly sequence for the Space Station. Many other station elements passed major construction and development milestones in FY 1997.

In March, milestone critical design reviews were completed for the Functional Cargo Block; Node 1; the Service Module, the first fully Russian

contribution to the station, which will serve as the initial crew living quarters; the Z1 truss, an early exterior framework that will hold communications equipment and gyroscopes; the first solar array module; the Japanese laboratory; and the U.S. laboratory

Astronauts who will build and fly on the Station began training for their missions. The Shuttle crew for Endeavour's STS-88 flight was named early in the year. To allow for much longer than normal training time required to fully prepare for the unprecedented spacewalking work for the Station's assembly, NASA named 12 astronauts who will perform that work on the first six assembly missions. In Star City, Russia, and in Houston, the international crew that will first occupy the Station began training.

Mir

The three Shuttle missions to Mir during FY 1997 were part of a program called International Space Station Phase 1. Begun in March 1995, Mir hosts a series of NASA astronauts as crewmembers. During all of FY 1997, one of the

- ◆ Broadening of the Center's role in space, in the Shuttle-Mir program and especially in International Space Station activities.

- ◆ Advances in a number of technologies, including the concept for the first new crewed spacecraft in more than 20 years and advanced life support systems.

- ◆ An increased focus on commercialization of space, with an increase in interest from the private sector.

- ◆ Outsourcing of operations through consolidated contracts in favor of research and development and core competencies.

- ◆ Adoption of the Johnson Space Center Quality System, based on the ISO 9001 standard and leading to ISO 9001 registration.

- ◆ The annual Safety and Total Health Day emphasizing the Center's safety focus.

crewmembers aboard Mir was a NASA astronaut

NASA and Russian engineers, designers, technicians, and flight crews work together to achieve a common goal by making many practical decisions on a daily basis, melding their different work styles into a unified plan. Shuttle-Mir is a complicated interlocking program incorporating the very different working styles and philosophies of the U.S. and Russian space agencies and their international partners.

FY 1997 saw a number of challenges associated with Mir ... Through cooperation, innovation, dedication and hard work, Russian and U.S. astronauts and ground support personnel worked through those challenges, setting new precedents in international space cooperation.

Astronaut Training

As FY 1997 ended, the selection process for 12 astronauts to begin intensive training in preparation for construction of the International Space Station was in its final stages

Research and Development

Research and development projects at the Johnson Space Center during FY 1997 continued to provide a technological base to carry out the missions of NASA and the Center and to meet the goals of the Human Exploration and Development of Space Enterprise.

Aerospace medicine and biomedical research at the Center covered a wide spectrum, including an advanced cell-culture device mimicking the effects of microgravity, a miniature pump based on technology used for the Space Shuttle's main engines and designed to assist the human heart, and advanced biomedical monitoring techniques.

Among highlights was initial development of the X-38, which could become a crew return vehicle for the International Space Station and perhaps serve as a technological base for development of the first new crewed spacecraft in more than 20 years.

Another project saw volunteers complete a 60-day test of the Advanced Life Support System concept, a human life support system designed to supply food, water and oxygen and operate indefinitely in space without resupply from Earth. Another such test for 90 days was begun in FY 1997 and concluded successfully in December.

Aerospace Medicine and Biomedical Research

A series of ongoing projects use the unique conditions of orbital space

microgravity and the capabilities of Johnson Space Center researchers. Ongoing projects include

- ◆ A system to grow cells in three dimensions, similar to the way they would grow in the microgravity of space, is leading to advances in medical research. Called the Rotating Wall Bioreactor, it could lead to improvements in treatment or prevention of a variety of diseases, including diabetes, cancer and AIDS.

- ◆ Advances in turbopump technology required by the Space Shuttle's main engines have resulted in development of a very small heart pump. Johnson Space Center scientists and a team led by Baylor College of Medicine's Dr. Michael DeBakey developed the Ventricular Assist Device to assist the human heart

- ◆ A compact device for monitoring vital signs from a sensor inside the ear canal is under development. Called the Intra-Aural Probe Possible public uses include monitoring in ambulances, in aircraft or for firefighters.

- ◆ Developed at the Johnson Space Center, Telemedicine was initially used to monitor the health of astronauts during space flight. It is now used to help physicians evaluate and treat patients remotely.

The X-38

Unpiloted flight testing of the X-38, a prototype that could become the first

new human spacecraft to travel to and from orbit in the past two decades, began during FY 1997. The spacecraft was designed by engineers at the Johnson Space Center working toward a vehicle that could become operational at a fraction of the cost of past human spacecrafts.

The innovative X-38 project's goal is to assemble a prototype crew return vehicle for the International Space Station. But the X-38 concept could be modified for other uses, such as a possible joint U.S. and international human spacecraft that could be sent into orbit

Advanced Life Support System

The human life support system could prove to be a vital element in long-duration space flight. The successful 60-day test of the Advanced Life Support System concept and the subsequent 90-day test, also with four volunteers, were parts of what is called the Advanced Life Support Test Project.

The life support system used in the 60- and 90-day tests reuses liquids and solid materials. Only energy is added. It is perhaps the ultimate in recycling and regeneration and could supply crewmembers with food, water and oxygen indefinitely

The TransHab

A new design concept for a habitation element for lengthy space missions was unveiled during FY 1997. The

concept could be developed as a habitation (or perhaps laboratory) module for the International Space Station, used as a vehicle to carry humans on long-duration space voyages to other planets, and used as a habitation module on the surface of other planets or on the moon.

Called the TransHab, it is a hybrid combining a hard central core with an inflatable outer shell. Its volume would be about twice that of the Space Shuttle cargo bay

The TransHab design calls for it to be launched deflated in the Space Shuttle's cargo bay. Once in orbit, it would be inflated to its full volume and its interior configured for its specific mission

Continuing R&D

- ◆ Research on materials in space-like vacuum and temperature extremes
- ◆ Tests of hardware under simulated vibration and acoustic conditions of various phases of space flight

- ◆ Development and tests of spacecraft communications systems in the Anechoic Chamber Test Facility, which simulates the nonreflective electromagnetic environment of space

- ◆ Advanced space suit research
- ◆ Robotics related to human space operations

- ◆ Utilization of resources on bodies like the moon and Mars

34 Years Ago at MSC

First mission termed 'clean and green'

Gemini Program gets off to a successful start

Reprinted from the April 15, 1964 issue of the Space News Roundup.

The first phase of the nation's second manned space program began like a storybook success last Wednesday as a Titan II rocket propelled a Gemini spacecraft into orbit in an almost perfect launching from Launch Complex 19 at Cape Kennedy.

As the unmanned, partly instrumented Gemini spacecraft went into orbit it brought enthusiastic responses from all responsible for the successful launch.

Gemini Program Manager Charles W. Mathews said the flight gave the Gemini team confidence to proceed toward a second unmanned flight and a manned orbital flight this year.

The second flight, set for late August or early September, is to hurl a spacecraft on a ballistic flight to test all systems, atmospheric re-entry and recovery.

Lift-off of the Gemini launch vehicle was only one second behind schedule, but a launching official claimed the range clock must have been wrong because the countdown was completed without even a one second delay.

The countdown started at 6 a.m. EST as planned.

High thin transparent clouds with a few puffy clouds were in the sky with winds of about 12-16 knots and the temperature around 80 degrees.

Lowering of the erector began at about 35 minutes to launch and observation aircraft around the area, some cutting contrails and others low enough to be seen, were there to observe the maiden flight of Gemini.

While the sleek black and white vehicle waited out the countdown, off to the right quietly loomed the pad 14 gantry from which the Mercury orbital pilots flew ... the last flight, that of Cooper just 11 months prior.

It all began precisely as scheduled when at 11 a.m. EST billowing orange smoke belched from beneath the Titan.

Three seconds later, the Titan lifted the spacecraft, slowly at first, then as acceleration increased, a liquid appearing flame trailed after the rocket. Smoke from the flame formed a perfect V beneath the rocket.

A rolling type roar (the noise was louder than the Atlas) that continued as the Gemini-Titan ascended, reached the press viewing site almost two miles away.

Paul Haney, MSC public affairs officer, announced four minutes and 30 seconds after launch, "Everything looks good, couldn't be better."

He made this statement as the spacecraft zoomed over Bermuda. Seconds later, Haney reported from the Mission Control Center, "It looks clean and green." At six minutes after launch word came that "Walt Williams just announced we have an orbit." Two minutes later Haney reported, "This mission couldn't look greener."

He was back three minutes later to tell some 100 reporters and photographers that Williams exclaimed, "This is a beaut."

Shortly after the successful launch, Williams told reporters that the high point (apogee) of the elliptical orbit was 204 statute miles and that the low point (perigee) was 99.6 statute miles, with an orbit time of 89.27 minutes.

All systems, Williams said, were functioning "well within manned tolerances."

The world-wide tracking network was functioning "very well," Williams said.

The plan now is to send an instrumented, unmanned Gemini spacecraft into a ballistic path about 2,000 miles from Cape Kennedy into the Atlantic in August or early September. That spacecraft, unlike the one flown last Wednesday, will be recovered.

An expected life of 3.5 days for the first Gemini, plus or minus one day was predicted.

The only imperfection in the flight last Wednesday was a 14-mile-an-hour excess speed by the Titan II. It reached 17,534 miles an hour instead of 17,520. This sent the spacecraft into a 204-mile-high peak orbital path, 21 miles higher than planned.

Williams said this was well within tolerances and that on a manned flight, extra height easily could be corrected by the astronauts.

After the suborbital launch of the second Gemini, a manned mission with two astronauts aboard will be attempted in November or December.

William B. Bergen, president of the Martin Co., said shortly after the launch, "As an engineer, this was remarkable to me. Not one hold, it all went so well."

One of the country's newest astronauts, Richard Gordon, said shortly after the launch, "The only thing wrong with this one is that we haven't got a crew on it."

Williams told reporters that this successful launch "marks a milestone in the Gemini program and illustrates again the importance of America's space team, NASA, the Air Force and industry."

He told reporters that it would be some time before the information gathered from instruments aboard the spacecraft could be analyzed. These instruments measured heat, vibration and pressure.

On this flight, the second stage that powered the spacecraft into orbit remained connected to it. During a manned flight, the second stage would fall away from the spacecraft after burnout.

Williams, who directed all six manned flights in Project Mercury, bowed out of NASA with last Wednesday's launching. He recently accepted a position with the Aerospace Corp.



NASA Photo 64-21560

OFF TO A SUCCESSFUL ORBIT— In a roaring lift-off amidst billowing orange clouds of smoke the Gemini-Titan vehicle leaves the pad at Cape Kennedy.



MISSION CONTROL CENTER—During a critical moment of the GT-1 mission are (from left) Christopher C. Kraft Jr., Walter C. Williams, and John D. Hodge.

Grissom, Young named as prime Gemini crew

Virgil I. (Gus) Grissom and John W. Young were named Monday as the prime crew for the first manned Gemini spaceflight which is scheduled for sometime in November or December.

The backup crew for the first manned Gemini flight will be Walter M. Schirra Jr. and Thomas P. Stafford it was also announced.

The four astronauts were introduced to the press Monday morning by Dr. Robert R. Gilruth, director, Manned Spacecraft Center, in the auditorium at the Clear Lake site.

During the question and answer period a reporter asked Grissom, "What do you consider to be the hairiest part of the flight?"

Grissom replied with this gem, "The part between the liftoff and the landing."

Grissom, 38, was the second American in space when he piloted his Liberty Bell 7 spacecraft on a suborbital flight down the Atlantic range on July 21, 1961.

Young, 33, is a member of the second group of nine astronauts that entered the space program on September 17, 1962.

Schirra, 41, was the third American to orbit the Earth when he made his six-orbital flight in his Sigma 7 spacecraft on October 3, 1962.

Stafford, 33, was also a member of the second group of astronauts entering the space program.



Virgil I. (Gus) Grissom

John W. Young

Gilruth Center News

Hours: The Gilruth Center is 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.

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, in exact change or by check, at the time of registration. No registration will be taken by telephone. For more information, call x30304.

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.

Weight safety: Required course for employees wishing to use the Gilruth weight room. The next classes are scheduled for at 8 p.m. April 9 and April 23 (must be on time to receive credit for class). Pre-registration is required. Cost is \$5. Annual weight room use fee is \$90. Additional family members are \$50 each.

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

Stamp Club: Meets every 2nd and 4th Monday at 7 p.m. in Rm. 216.

Akido: Introduction to Aikido beginning classes start every month. Class meets Tuesday and Wednesday from 5:15 p.m. to 6:15 p.m.

Ballroom dancing: Classes for beginning and advanced dancers meet from 7-10 p.m. Thursdays. Cost is \$60 per couple.

Country and western dancing: Classes for beginning and advanced dancers meet from 7-10 p.m. Mondays. Cost is \$20 per couple.

Spring Intercenter Run: Competition will start April 6 and will end May 6. You can walk or run a 2-mile or 10K. The time sheet will be at the Gilruth Center. T-shirt orders will be taken at the Recreation office. Cost: \$6 per shirt.

Ticket Window

The following discount tickets are available for purchase in the Bldg. 11 Exchange Store from 10 a.m.-2 p.m. Monday-Thursday and 9 a.m.-3 p.m. Friday and in the Bldg. 3 Exchange Store from 7 a.m.-4 p.m. Monday - Friday. For more information call x35350 or x30990.

Moody Gardens: Tickets are \$9.75 for two of four events

Space Center Houston: Adults, \$10.25; children (4-11), \$7. JSC civil service employees free.

Movie discounts: General Cinema, \$5.50; AMC Theater, \$4.75; Sony Loew's Theater, \$5.

Astroworld Early Bird Ticket (valid through May 31), \$18.50.

Astroworld One-day admission, \$24.25.

Astroworld Season Pass (valid at all Texas Six Flags Theme Parks and Water World), \$57.75.

Sea World adult ticket, \$27.25

Sea World child ticket, \$18.25

Stamps: Book of 20, \$6.40.

JSC Picnic: 11 a.m.-7:30 p.m. April 5 at Astroworld. Tickets are \$23.65.

Metro passes: Tokens and value cards available.

Coming Soon: Splashtown Water Park and Schlitterbahn Water Park.

Meza, Fee earn top secretarial honors

Two JSC secretaries Cynthia Meza and Nancy Fee recently received the top award for secretarial support.

Meza of the Operations Division in the Mission Operation Directorate received the award for creating an office environment where tasks are completed efficiently and effectively.

In nominating her for the award, Randy Stone, director of Mission Operations said, "without Cyndi's demonstrated ability to act with confidence and coolness, the desired climate of office tranquillity could not prevail." Stone also praised Meza for bringing a sense of balance and commitment and an "all-important, ever-present common sense approach to accomplishing the myriad of tasks

which confront us on a daily basis."

Fee, of the Space and Life Sciences Directorate's Medical Operations Division, received the award for exhibiting exceptional initiative during times when the division work load was high and for coordinating multiple tasks efficiently.

John Rummel, acting director of the Space and Life Sciences Directorate, called Fee a "highly effective liaison to the division chief for our flight surgeons in Star City and has been instrumental in setting up telecons and arranging for interpreters for calls between the U.S. and Russia."

Another secretary honored in March, Angie Zavala, was incorrectly identified in the March 13 issue of Roundup. She is in Engineering's Structures and Mechanics Division.



JSC Photo by Benny Benavides

Nancy Fee of the Space and Life Sciences Directorate's Medical Operations Division, accepts the Marilyn J. Bocking Award for Secretarial Excellence from JSC Director George Abbey and Dr. Sam Pool, chief of the Medical Operations Division. In recognition of their excellence in the performance of their secretarial duties, both she and Cynthia Meza Operations Division in the Mission Operation Directorate received a \$750 check and a plaque.

20th annual FOD Chili Cookoff set

JSC will host its twentieth annual FOD chili cookoff from 8:30 a.m.-4 p.m. May 9 at the Gilruth Center.

Any directorate or office or contractor may enter a team. Those interested in entering for a \$40 fee may call Sandy Griffin, x31056.

There will be about 30 entries with trophies awarded for best chili, showmanship, and people's choice. Tickets cost \$3 for adults and \$2 for children (3-12) through May 1. After May 1 prices will be \$4 for adults and \$3 for children. Tickets may be purchased through team captains, the JSC Exchange Store or Griffin.

There will be games, skits and a space trivia contest. Showmanship will be judged on pre-cookoff propaganda and activities in which judges will expect displays of team spirit, unique flyers, unique dress, team skits and decorative storefronts.

People on the Move

Human Resources reports the following personnel changes as of March 28:

Key Management Assignments

Mark Hammerschmidt was selected as chief, Guidance, Navigation, and Control Design and Analysis Branch, Aeroscience and Flight Mechanics Division, Engineering Directorate.

Bill Jordan was selected as manager, Payload Integration Office, Space Shuttle Program Office.

Richard Rodriguez was selected as chief, Crew Station Branch, Flight Crew Support Division, Space and Life Sciences Directorate.

Additions to the Workforce

Rob Kolb joins the Space Station Business Management Office as a contract specialist.

Christopher Gerty joins the Cargo Integration and Operations Branch in the Mission Operations Directorate as a flight controller.

Marilyn Lewis joins the Mission Integration Office in the International Space Station Program Office as a secretary.

Scott Brown joins the Administration Office at the White Sands Test Facility as a contracting officer.

Promotions

Jill Goldstein was selected as a program analyst in the Institutional Business Management Office in the Business Management Directorate.

Steve Guy was selected as a program analyst in the Institutional Business Management Office in the Business Management Directorate.

Jeanette Fanelli was selected as a secretary in the Aeroscience and Flight Mechanics Division in the Engineering Directorate.

Reassignments Between Directorates

Peter Bethke moves from the International Space Station Program Office to the Engineering Directorate.

Dave Whittle moves from the Safety, Reliability and Quality Assurance Office to the Space Shuttle Program Office.

Dalia Riojas moves from the Mission Operations Directorate to the International Space Station Program Office.

Resignations

Bill Wisecarver of the Business Management Directorate.

Employees receive Space Act Awards

Space Act Awards recognize employees in a variety of aspects including NASA Tech Briefs, patent applications, Cosmic software applications and scientific or technical contributions in aeronautical and space activities. These awards are presented to both NASA and contractor employees and are administered by NASA Headquarters. The recipients were honored at a ceremony on March 3 to present the awards.

Tech Briefs Awards recipients include Flight Crew Operations

Directorate's David Wolf; Engineering Directorate's Horacio de la Fuente, G. Dickey Arndt, Patrick Fink, Scott Hankins, Leslie Quiocho, William Schneider, Bernard Rosenbaum and Christopher Lovchik; and Space and Life Sciences Directorate's Eric Christiansen, Jeanne Crews, Steve Gonda and Thomas Goodwin; Space Station Program Office's Alan Holt.

Patent Application Awards were presented to Engineering Directorate's Walter Guy and Joe Kosmo; and Flight Crew Operations

Directorate's Peggy Wilson.

Space Board Act Awards recipients include Engineering Directorate's Dickey Arndt, Thanh Nguyen, Floyd Booker, Mark McDonald, Wayne Peterson, Edward Robertson, Scott Hankins, Patrick McCartney, Leslie Quiocho, David Hamilton, Edgar Castro, Timothy Pelischek, Gregg Edeen, Irene Verinder and James Ackerman; Space Station Program Office's Kornel Nagy; and Space and Life Sciences Directorate's Charles Sawin.

Worker's model airplanes on display at new presidential library

Visitors to the newly opened George Bush Presidential Library on the Texas A&M campus in College Station will find memorabilia on display from the president's years in office and from his previous years of service during World War II.

Among the items is a full-sized TBM "Avenger" torpedo bomber painted in the markings of the actual aircraft flown by President Bush during the war. Additionally, a miniature squadron of scale model World War II aircraft populate the deck of a replica aircraft carrier that provides the centerpiece of the exhibit saluting the president and his colleagues.

Mark Veile, a seven-year JSC veteran and employee of United Space Alliance, constructed the aircraft for this display with a group of local model airplane builders. He's a shuttle simulator instructor in the

Spaceflight Training Division.

A scale model of the USS San Jacinto, the aircraft carrier that President Bush was assigned to during the war, had been on display for several years aboard the battleship Texas. Years of neglect and Texas humidity had taken their toll on the 15-foot model. When the decision was made to refurbish the model in order to place it in the library, the need arose to construct realistic model airplanes. Veile and four other model airplane enthusiasts built the 25 aircraft on the carrier deck to represent the president's bomber squadron, VT-51, and the fighter squadron, VF-51.

Using kits of the 'Avenger' torpedo bombers and 'Hellcat' fighters, books on President Bush's World War II years and war-time photos of the actual planes, Veile devoted about

40 hours to building and painting each model.

Since flight deck space was limited on the carriers' deck, the aircraft were normally stored and readied for flight with wings folded alongside the fuselage. "This presented the biggest challenge and required a major modification to each of the model aircraft. The wings on all of my models were cut off and assembled in the folded position," Veile said.

The first delivery of completed models was made to the library in October 1997. "When I saw the carrier, I was stunned at the size of the model but also at the sense of incompleteness of the empty flight deck," Veile said. "Once I placed my aircraft on the deck along with the others, the scene came alive with the deadly sense of purpose that the aircraft carrier represents."

Dates & Data

April 10

Space society meets: The Clear Lake chapter of the National Space Society will meet at 6:30 p.m. April 10 at the Radisson Hotel, 9100 Gulf Fwy. in the Deer Park room. Mark Pestana, manager of Earth and space sciences in the space station payloads office, will speak on "Space Station Lifeboats: Soyuz and Crew Return." For more information, call Murray Clark at 367-2227.

Astronomers meet: The JSC Astronomical Society will meet at 7:30 p.m. April 10 at the Center for Advanced Space Studies, 3600 Bay Area Blvd. Rita Karl from the Moody Gardens Discovery Pyramid, will speak on "A Layman's Look at the Hubble Telescope." For more information, call Chuck Shaw at x35416.

April 14

NPMA meets: The National Property Management Association will meet at 5 p.m. April 14 at Robinette and Doyle Caterers, 216 Kirby in Seabrook. Dinner costs \$14. For details, call Sina Hawsey at x36582.

Aero club meets: The Bay Area Aero Club will meet at 7 p.m. April 14 at the Houston Gulf Airport clubhouse at 2750 FM 1266 in League City. For more information, call Larry Henderson at x32050.

April 15

Spaceland Toastmasters meet: The Spaceland Toastmasters will meet at 7 a.m. April 15 at the House of Prayer Lutheran Church. For more information, call George Salazar at x30162.

Communicators meet: The Clear Lake Communicators will meet at 11:30 a.m. April 15. For information and location, contact Henry Duke at 281-280-4403 or Melissa Sommers at 281-332-0698.

Spaceteam Toastmasters meet: The Spaceteam Toastmasters will meet at 11:30 a.m. April 15 at United Space Alliance, 600 Gemini. For details, call Chuck Kubricht at 282-3908 or Brian Collins at x35190.

Astronomy seminar: The JSC Astronomy Seminar will meet at noon April 15 in Bldg. 31, Rm. 129.

Dr. Larry Friesen will speak on "Hypervelocity Impact with Light Gas Guns." For more information, call Al Jackson at x35037.

Scuba club meets: The Lunarfins will meet at 7:30 p.m. April 15. For information and location, call Mike Manering at x32618.

April 16

Child care board: The Space Family Education board of directors for the JSC Child Care Center will meet at 11:30 a.m. April 16 in Bldg. 45, Rm. 712D. For more information on this open meeting, call Gretchen Thomas at x37664.

SHPE meets: The Society of Hispanic Professional Engineers will meet at 6:30 p.m. April 16. For details, call Juan Anaya at 587-6824.

April 22

Spaceland Toastmasters meet: The Spaceland Toastmasters will meet at 7 a.m. April 22 at the House of Prayer Lutheran Church. For additional information, call George Salazar at x30162.

Communicators meet: The Clear Lake Communicators will meet at 11:30 a.m. April 22. For information and location, contact Henry Duke at 281-280-4403 or Melissa Sommers at 281-332-0698.

Spaceteam Toastmasters meet: The Spaceteam Toastmasters will meet at 11:30 a.m. April 22 at United Space Alliance, 600 Gemini. For details, call Chuck Kubricht at 282-3908 or Brian Collins at x35190.

Astronomers meet: The JSC Astronomy Seminar will meet at noon April 22 in Bldg. 31, Rm. 129. An astronomy/astrophysics video tape will be shown. For more information, call Al Jackson at x35037.

April 23

NCMA meets: The National Contract Management Association will meet at 11:30 a.m. April 23 at the Gilruth Center. The speaker will be LeRoy Haugh, vice president for procurement and finance, Aerospace Industries Association, Washington, D.C. For information call Nancy Liounis at x31865.

Radio Club meets: The JSC Amateur Radio Club will meet at 6:30 p.m. April 23 at the Piccadilly, 2465 Bay Area Blvd. For more information, call Larry Dietrich at x39198.

April 25

NSBE meets: The National Society of Black Engineers-Houston Alumni Extension is hosting its First Annual Scholarship Luncheon on Saturday, April 25, 1998 at Brady's Landing at 11:30 am. For those that are interested in attending, please contact Sabra Crawford at 333-7028 for tickets.

April 29

Spaceland Toastmasters meet: The Spaceland Toastmasters will meet at 7 a.m. April 29 at the House of Prayer Lutheran Church. For additional information, call George Salazar at x30162.

Communicators meet: The Clear Lake Communicators will meet at 11:30 a.m. April 29. For details, contact Henry Duke at 281-280-4403 or Melissa Sommers at 281-332-0698.

NASA Briefs

Global Surveyor to image 'Face on Mars'

NASA's Mars Global Surveyor spacecraft soon will begin a summer-long set of scientific observations of the red planet. Several attempts will be made to take images of features of public interest ranging from the Mars Pathfinder and Viking mission landing sites to the Cydonia region. "Global Surveyor will have three opportunities in the next month to see each of the sites, including the Cydonia region, location of the so-called 'Face on Mars,'" said Glenn Cunningham, Surveyor project manager at NASA's Jet Propulsion Laboratory.

NASA spawns new pilot safety software

Two new software packages enabling pilots to use laptops to avoid hazardous terrain and find their place on maps are the latest success stories of a NASA program bringing together entrepreneurs and space engineers. Pilots of small planes, for whom such tools have been largely unavailable until now due to cost and the sheer size of bulky hardware, may soon be able to carry onboard the personal computer equivalent of collision-avoidance systems now used by the military and commercial airlines. "TerrAvoid" and "Position Integrity" combine Global Positioning Satellite data with high-resolution maps of the Earth's topography. The packages, designed primarily for military sponsors and now expected to hit the consumer market in coming months, came about as the result of the Technology Affiliates Program at NASA's Jet Propulsion Laboratory.

New class of dust ring around Jupiter

Scientists have found evidence for a new ring of dust that occupies a backward orbit around Jupiter, based on computer simulations and data from NASA's Galileo spacecraft, it was reported in the April 3 issue of *Science* magazine. A team led by researchers at the University of Colorado at Boulder reported that a faint, doughnut-shaped ring of interplanetary and interstellar dust some 700,000 miles in diameter appears to be orbiting the giant planet. Evidence comes from computer simulations that correlate with data collected by a dust detector aboard the Galileo spacecraft has detected this ring by capturing some of its dust. Surprisingly, the researchers say, most of the interstellar and interplanetary dust particles appear to be in a "retrograde" orbit—that is, moving in the opposite direction of the rotating planet and its moons.

NASA starts work on Space Infrared Telescope Facility

NASA Administrator Daniel S. Goldin Thursday authorized the start of work on the Space Infrared Telescope Facility, an advanced orbiting observatory that will give astronomers unprecedented views of phenomena in the universe that are invisible to other types of telescopes.

The authorization signals the start of the design and development phase of the SIRTf project, which is managed by NASA's Jet Propulsion Laboratory. Scheduled for launch in December 2001 on a Delta 7920-H rocket from Cape Canaveral, Fla., SIRTf represents the culmination of more than a decade of planning and design to develop an infrared space telescope with high sensitivity, low cost and long lifetime of at least two-and-a-half to as many as five years.

"The Space Infrared Telescope

Facility will do for infrared astronomy what the Hubble Space Telescope has done in its unveiling of the visible universe, and it will do it faster, better and cheaper than its predecessors," said Dr. Wesley Huntress, NASA's associate administrator for space science. "By sensing the heat given off by objects in space, this new observatory will see behind the cosmic curtains of dust particles that obscure much of the visible universe. We will be able to study fetal stars, detect other solar systems and study the most ancient, distant galaxies at the edge of the universe."

Infrared telescopes also provide the means to study the most distant objects at the edge of the expanding universe. Optical and ultraviolet light emitted from stars, galaxies and quasars since the birth of the uni-

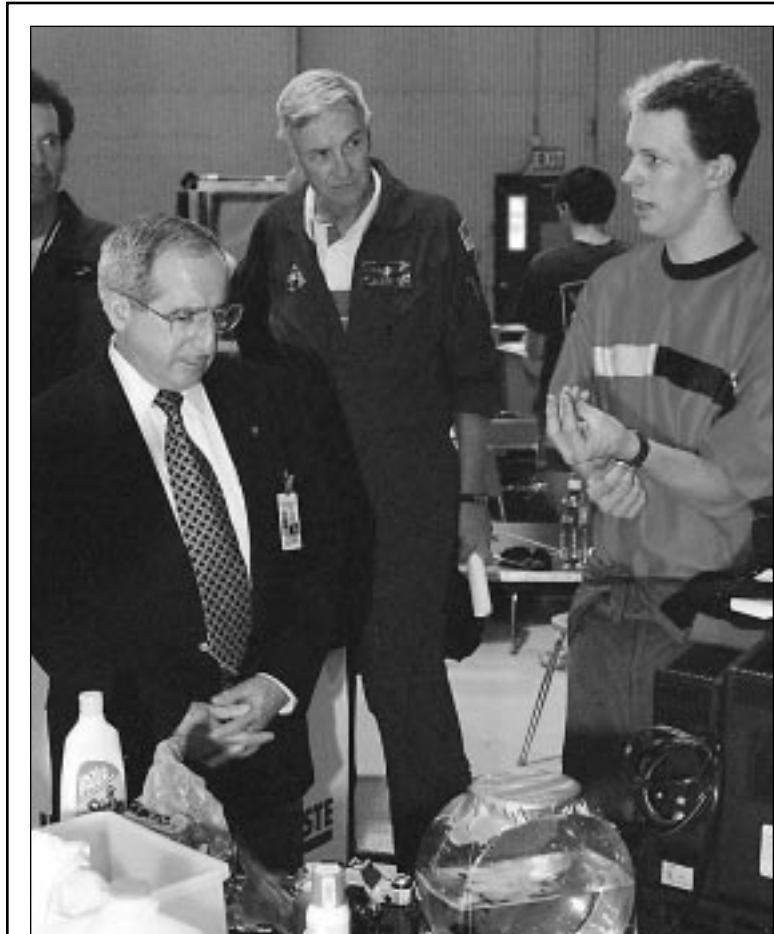
verse has shifted, over time and distance, into the infrared portion of the spectrum. SIRTf will provide important insights into when and how the first galaxies and stars formed.

SIRTf, whose design and development is cost-capped at \$458 million, will be one of astronomy's most advanced telescopes. Its unconventional approach uses new technologies, an innovative mission design and small launch vehicle. It is being developed on a quick schedule that closely integrates the work of the contractor and academic teams responsible for development and delivery. Its design promises high sensitivity and observing capability along with efficiency of operations and long lifetime.

SIRTf is the fourth and final element in NASA's family of complementary spaceborne "Great Observ-

atories" that includes the Hubble Space Telescope, the Compton Gamma Ray Observatory and the Advanced X-ray Telescope Facility. The project also represents a bridge to NASA's new Origins program, which seeks to answer fundamental questions about the birth and evolution of the universe. SIRTf will lay the groundwork for many investigations fundamental to the Origins program, such as studies of the birth and evolution of galaxies, their stars, and searches for planets that orbit some of those stars.

The SIRTf Science Center, at the California Institute of Technology in Pasadena, Calif., will receive the date from JPL and process it, and work with the astronomy community. Astronomers around the world are invited to request observing time on SIRTf.



NASA Office of Space Flight Chief Joe Rothenberg, left, visits with Pomona (Calif.) College student Curt Johanson about JSC's undergraduate zero-gravity research program during a recent visit. Flight Crew Operations' Aircraft Operations Chief Bob Naughton also followed the discussion.

Earth dragging space and time as it rotates

An international team of NASA and university researchers has found the first direct evidence of a phenomenon predicted 80 years ago using Einstein's theory of general relativity—that the Earth is dragging space and time around itself as it rotates.

Researchers believe they have detected the effect by precisely measuring shifts in the orbits of two Earth-orbiting laser-ranging satellites, the Laser Geodynamics Satellite I, a NASA spacecraft, and LAGEOS II, a joint NASA/Italian Space Agency spacecraft. The research, which is reported in the current edition of the journal *Science*, is the first direct measurement of a bizarre effect called "frame dragging."

The team was led by Dr. Ignazio Ciufolini of the National Research Council of Italy and the Aerospace Department of the University of Rome, and Dr. Erricos Pavlis of the Joint Center for Earth System Technology, a research collaboration between Goddard Space Flight Center, and the University of Maryland at Baltimore County.

"General relativity predicts that massive rotating objects should drag space-time around themselves as they rotate," Pavlis said. "Frame dragging is like what happens if a bowling ball spins in a thick fluid such as molasses. As the ball spins, it pulls the molasses around itself. Anything stuck in the molasses will also move around the ball. Similarly, as the Earth rotates, it pulls space-time in its vicinity around itself. This will shift the orbits of satellites near the Earth."

"We found that the plane of the orbits of LAGEOS I and II were shifted about six feet per year in the direction of the Earth's rotation," Pavlis said. "This is about 10 percent greater than what is predicted by general relativity, which is within our margin of error of plus or minus 20 percent. Later measurements by Gravity Probe B, a NASA spacecraft scheduled to be launched in 2000, should reduce this error margin to less than one percent. This

promises to tell us much more about the physics involved."

Einstein's theory of general relativity has been highly successful at explaining how matter and light behave in strong gravitational fields, and has been successfully tested using a wide variety of astrophysical observations. The frame-dragging effect was first derived using general relativity by Austrian physicists Joseph Lense and Hans Thirring in 1918. Known as the Lense-Thirring effect, it was previously observed by the team of Ciufolini using the LAGEOS satellites and has recently been observed around distant celestial objects with intense gravitational fields, such as black holes and neutron stars. The new research around Earth is the first direct detection and measurement of this phenomenon.

The team analyzed a four-year period of data from the LAGEOS satellites from 1993 to 1996, using a method devised by Ciufolini three years ago.

The measurements required the use of an extremely accurate model of the Earth's gravitational field, called the Earth Gravity Model 96. It was developed over a four-year period using tracking data from approximately 40 spacecraft.

LAGEOS II, launched in 1992, from the shuttle *Columbia* and its predecessor, LAGEOS I, launched in 1976, are passive satellites dedicated exclusively to laser ranging, which involves sending laser pulses to the satellite from ranging stations on Earth and then recording the round-trip travel time. Given the well-known value for the speed of light, this measurement enables scientists to determine precisely the distances between laser ranging stations on Earth and the satellite.

LAGEOS is designed primarily to provide a reference point for experiments that monitor the motion of the Earth's crust, measure and understand the "wobble" in the Earth's axis of rotation, and collect information on the Earth's size, shape, and gravitational field.

Blood drive draws 426 units of blood

The second of five JSC On-site Blood Drives in 1998 collected 426 donations in two days.

Dan Mangieri, co-chair of the blood drive committee, said this was, "the best turnout yet outside of those drives we've had on Total Health and Safety Days."

The next blood drive is scheduled for June 2-3 in the Teague Auditorium lobby. For those interested, the blood drive schedule is now posted on the HRO homepage under Employee Activities. Potential donors are encouraged to bookmark the location for future reference.

No appointment is needed to donate whole blood, but appointments are encouraged for those

donating plasma or platelets.

For those who have never donated blood, the process is pretty simple. It starts with a blood sample. Afterwards, one pint of blood is drawn. Drawing whole blood takes seven to 10 minutes, with the overall process usually taking around 45 minutes including screening. The donated blood undergoes several tests, including the tests for hepatitis and HIV. If there are reactive test results donors are notified by mail. All results are kept confidential.

For more information about the JSC on-site blood drive call Dan Mangieri at x33003. To schedule an appointment call Donna Stuart at x33032.

Sharp's full report available on Internet

(Continued from Page 1)

1961, the agency has received \$61 billion in funding, much of which went directly into the Houston-area economy. JSC is the largest of NASA's 11 major U.S. installations, with a budget of \$3.5 billion in 1997. In terms of total dollars spent by NASA, Texas ranks second only to California, Sharp said.

A 1995 study by the University of Houston-Clear Lake's Center for Economic Development and Research estimated that JSC indirectly generates more than 36,000 additional jobs in the Houston area, Sharp said.

"Having NASA and JSC as a neighbor has been a boon to Texas schools and universities. JSC funds education programs at every level,

from elementary school to post-doctoral study. Sometimes students and faculty get to work hand in hand with NASA experts.

At the university level in 1997, he said, NASA spent almost \$40 million in Texas on a variety of research and educational programs, including \$4.5 million at the University of Houston, \$3.9 million at Rice University, \$5.1 million at Prairie View A&M, and close to \$1 million each at UH-Clear Lake, UT Health Science Center in Houston, and Texas Southern University.

Sharp also noted the wide variety of consumer products that have sprung from the space program.

"All-in-all, more than 30,000 earthly uses for space technology have been discovered," he said.

"Discovering commercial uses for space technology helps strengthen the economy and reduces the cost of space exploration to taxpayers."

"The spirit of adventure and the quest for knowledge that have launched Americans into space time and time again have not waned," Sharp said. "We should make certain NASA's spirit of exploration and innovation remains right here in Texas where it belongs. The missing ingredient is a commitment from state and local governments to provide NASA and JSC the support they need to keep this installation strong and growing," Sharp said.

The full text of Fiscal Notes is available on the Internet at: <http://www.window.state.tx.us/comptrol/notes/>



The Roundup is an official publication of the National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Texas, and is published every other Friday by the Public Affairs Office for all space center employees. Deadline for the submission of articles is Friday, three weeks before the desired date of publication.

The Roundup office is in Bldg. 2, Rm. 181. The mail code is AP3. The main Roundup telephone number is x38648, and the fax number is x45165. Electronic mail messages may be directed to kelly.o.humphries1@jsc.nasa.gov or leslie.eaton1@jsc.nasa.gov.

Editor Kelly Humphries
Associate Editor Leslie Eaton

JSC Annual Report shows good health in face of changes

(Continued from Page 1)

assets, from \$6 billion in FY 1996 to \$12 billion in FY 1997—a 100 percent increase. This growth is due primarily to the Space Flight Operations Contract and the increase in International Space Station hardware elements."

"Fiscal Year 1997 was an exciting year for the Johnson Space Center," Draper concluded. "The financial state of health at Johnson Space Center is good. We are well prepared for the challenges facing us in the future."

The full text of the report and the photos used to illustrate center activities are available on the JSC Web at <http://www.jsc.nasa.gov/>.