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# SPACE CENTER Roundup

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## Shuttle to carry powerful X-ray telescope into orbit

By John Ira Petty

The Chandra X-ray Observatory, the world's most powerful X-ray telescope, will be launched aboard *Columbia* on STS-93. Chandra's mission is to offer new insights into the nature of the universe.

Chandra, formerly called the Advanced X-ray Astrophysics Facility, will join two other great NASA observatories in orbit. In terms of its energy sensing range, it will fall between the Hubble Space Telescope, launched in 1990 to study visible and ultraviolet light sources, and the Gamma Ray Observatory, launched in 1991.

The observatory is named for Subrahmanyan Chandrasekhar, who died in 1995 at age 85. Widely known as Chandra, he was regarded as a leading astrophysicist of this century. The Nobel laureate's discoveries are basic to modern astrophysics.

The Chandra Observatory will be available to U.S. and international scientists. It is designed to determine the nature of celestial objects, from normal stars to quasars, to understand the physical processes which take place in and between astronomical objects. More basically, it's goal is to understand the history and evolution of the universe.

"With greater resolution and higher sensitivity than any previous X-ray telescope, this observatory will provide us with a new perspective of our universe," said Dr. Martin Weisskopf of Marshall Space Flight Center, the project's chief scientist.

Marshall manages development of the observatory for the Office of Space Science at NASA Headquarters.

"We'll be able to study sources of X-rays throughout the universe, like colliding galaxies and black holes, many of which are invisible to us now," Weisskopf said. "We may even see the processes that create the elements found here on Earth."

Among questions the observatory is expected to help answer are the age and size of the universe. It also will probe the nature and amounts of "dark matter," one of nature's great puzzles.

The observatory will allow scientists to see and measure the details of hot gas clouds in clusters of galaxies and to observe X-rays generated when stars are torn apart by the incredibly strong gravity around massive black holes in the centers

of galaxies. It will provide images that will help understand how exploding stars create and disperse many of the elements necessary for new stars, planets, and life.

Cosmic X-rays are produced by violent events such as stars exploding or galaxies colliding. X-rays also are emitted by matter heated to many millions of degrees as it swirls toward a black hole.

The only way to observe

these and other extremely hot astronomical sources is with a space-based X-ray telescope.

Made of glass bought from Schott Glaswerke in Mainz, Germany, the telescope's mirrors were built by Hughes Danbury Optical Systems of Danbury, Conn., and assembled by Eastman-Kodak Company of Rochester, N.Y.

The mirrors are tubular, containing four pairs of hollowed out cylinders of precisely ground glass coated with a thin layer of iridium and

mirrors are the largest ever built. They also are amazingly smooth. If the Earth, with its diameter of almost 8,000 miles, were proportionately as flat, the highest point on the planet's surface would be about six feet above the lowest.

The science instruments were integrated into the science

The satellite will circle the Earth once every 64 hours.

The elliptical orbit takes it beyond the belts of radiation that surround Earth, which can disrupt observations by its sensitive instruments.

During each orbit Chandra will have the opportunity to take 55 hours of uninterrupted observations. It will not take observations during the periods of interference from the radiation belts.

The observatory, more than 20 years in the planning, weighs more than

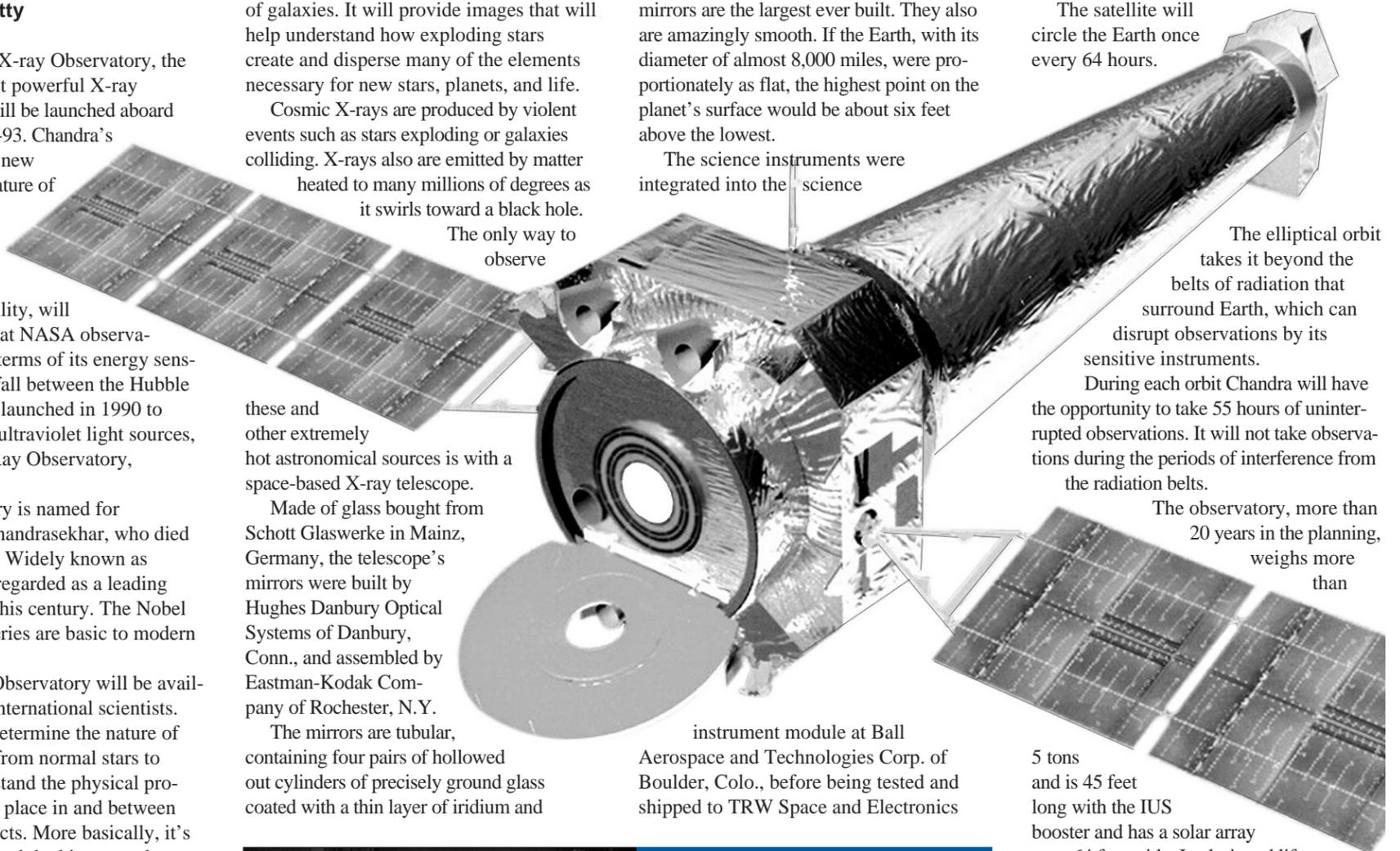
5 tons and is 45 feet long with the IUS booster and has a solar array span 64 feet wide. Its designed life-time is a minimum of five years.

STS-93 will be commanded by Eileen Collins, the first woman to command a shuttle flight. It will be her third mission.

"I am proud to have the opportunity to command this mission," said Collins. "My crew and I have been preparing for more than a year for the challenging task of deploying Chandra with its Inertial Upper Stage booster. We've had the pleasure of working with a fine team of instructors, flight controllers, engineers, scientists, pilots, managers, and all the other key people in this program. This is a very strong and dedicated team. All their efforts will come together as the Chandra X-Ray Observatory brings us closer to understanding this universe we live in."

The pilot is Jeff Ashby, making his first flight. Mission specialists are Steve Hawley, on his fifth flight; Catherine Coleman, making her second flight; and Michel Tognini of CNES, the French Space Agency, on his second flight. The mission is to last just under five days.

A fourth great observatory, the Space Infrared Facility, is scheduled for launch in 2001. ■



JSC Photo S98-10987

*My crew and I have been preparing for more than a year for the challenging task of deploying Chandra with its Inertial Upper Stage booster. We've had the pleasure of working with a fine team of instructors, flight controllers, engineers, scientists, pilots, managers, and all the other key people in this program.*

— Eileen Collins

nested inside one another because of the very short wavelength of X-rays. Flat mirrors would absorb X-rays, but they are reflected if they encounter an angled surface.

The mirrors are aligned to focus individual X-ray photons on a point 30 feet behind them. Weighing about 2,000 pounds, the

Group for final integration into the spacecraft. TRW is NASA's prime contractor for the observatory.

After deployment from *Columbia* at 155 miles above the surface, Chandra will be lifted to an elliptical orbit of 800 by 83,000 miles by an Inertial Upper Stage booster.



Staying a Star, now that JSC is one.

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New ascent flight dynamics officer certified.

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Winston Scott Hall opens at McAuliffe.

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# Staying a Star, now that JSC is one

By Mary Peterson

It's axiomatic among actors in Hollywood that you're only as good (bankable) as your last picture. And so it is with the Voluntary Protection Program Star that JSC so proudly earned, as Occupational Safety and Health Administration VPP representatives announced on May 14.

In a ceremony this fall, the center will receive the coveted VPP Star flag, a symbol of occupational safety and health excellence.

But, what about retaining VPP Star status?

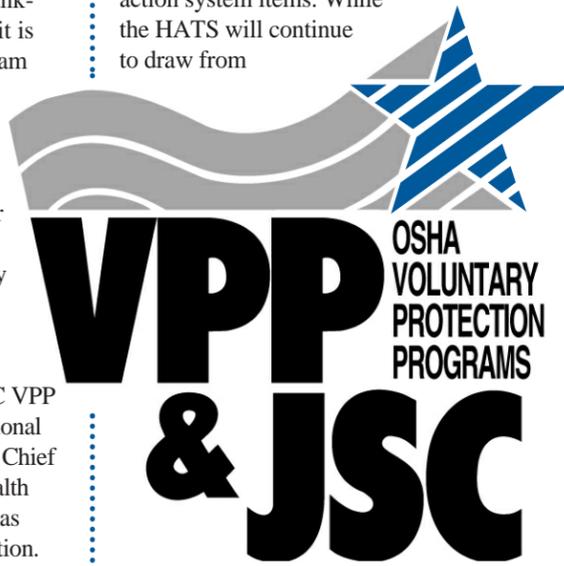
This question was asked of the JSC VPP Coordinator Stacey Menard, Occupational Safety and Quality Assurance Branch Chief Elmer Johnson, and Occupational Health Officer Sean Keptra, each of whom was deeply involved in VPP on-site education.

"We have had many calls from JSC employees since the announcement," said Menard. "They have asked, 'What now?' 'What were the results of the OSHA-VPP visit?' and 'Where do we go from here?'"

"One of the best places to start," Menard said, "is on the JSC Web page itself. Besides a wealth of information about VPP, employees will find the OSHA-VPP On-site Review Team results."

In the weeks to come, employees can expect to see a number of changes and

improvements, including the centralization of the Hazard Abatement Tracking System (HATS) that will also contain corrective action system items. While the HATS will continue to draw from



locations all across the site, the information will be entered into one database that will be accessible by everyone and can be narrowed easily to specific searches.

Plans are to institute, within the year, a "Safety Through Everyone's Participation" course, which will be modeled after the successful Senior Managers' Safety Course.

Employees can also expect quarterly inspections, hazard recognition training, and the investigation of mishaps and first-

aid cases, along with full documentation of these activities.

"The Occupational Health Office will be working much more closely with both the safety people and the hygienists on



*Everything employees have been doing – involvement, participating in JSC Safety Action Team projects, doing safety walkarounds, being safe personally, reporting close calls, reporting things that are not up to speed – these are the things that will keep us a Star.*

– Stacey Menard

mishap and first-aid investigations to be sure these are fully reviewed and documented," said Keptra. "We will be keeping a much more watchful eye on what happens to our many environmental health surveys and studies. We don't want the results of these efforts to wind up in somebody's desk, never to be seen again. We plan to see that notices are posted and

convenient for employee consumption. If there's a problem with the water, for example, we want it known."

Employees will be encouraged to take part in facility inspections. Not only will this give them an insight as to how safe their work area may or may not be, they will learn to recognize what constitutes a real or potential hazard.

"Another thing employees need to be aware of is that we can't 'rest on our laurels' for three years with the attitude that our safety program is in good shape as far as OSHA is concerned," said Menard.

"While three years is the normal review time, we can expect to see OSHA auditors more frequently because many of our contractors are either applying for VPP status or have plans to apply." Because the JSC-contractor relationship is so integrated, OSHA's assessment of mutual safety and health efforts will be also.

Plans are well under way for the VPP Star flag ceremony and celebration. A number of dignitaries will be on hand, including NASA Administrator Daniel S. Goldin.

"Everything employees have been doing – involvement, participating in JSC Safety Action Team projects, doing safety walkarounds, being safe personally, reporting close calls, reporting things that are not up to speed – these are the things that will keep us a Star," said Johnson. ■

## Conservationscape: *protecting the environment*

By Sandra Parker

The conservation landscape or "conservationscape" in front of Bldg. 30 has received an overwhelmingly positive response from JSC employees. During the recent JSC Earth Day event, more than 300 people stopped by for a tour of the landscape by Mark Fox, the landscape designer. In addition, each participant received a native plant seedling and information.

Most employees are interested in the names of the plants, how big they will get, and how often they will bloom. The Conservation Landscape Working Group is developing a sign to be located at the conservationscape and pamphlets to provide more information about each plant and ideas for creating a conservationscape at home. In the interim, a complete list of all the plants along with details about the requirements for growing each plant may be obtained from Sandra Parker of JSC's Environmental Services Office.

The conservationscape is a result of a partnership between JSC and Clean Water for Armand Bayou. Clean Water for Armand Bayou is a cooperative effort among the Texas Agricultural Extension Service, the Texas Soil and Water Conservation Board and neighboring Armand Bayou Nature Center to demonstrate effective techniques for reducing water pollution from contaminated surface water runoff. Clean Water for Armand Bayou contacted the Environmental Services Office to see if JSC would be interested in planting a high-profile demonstration landscape to be used to educate employees about how they can promote clean water by reducing the use of pesticides and fertilizers at home.

As a result, the Conservation Landscape Working Group, a working group of the Environmental Stewardship Subcommittee, was formed. Members include Ivy



JSC Photo S99-05715 by Mark Sowa

Conservation Landscape Working Group members, from left, include John Jacob, Texas Agricultural Extension Service's Clean Water for Armand Bayou; Tom Scarsella, Dyncorp; Colin Shackelford, Clean Water for Armand Bayou; Pat Kolkmeier, Center Operations' Facility Engineering Division; Sandy Parker, kneeling, Center Operations' Environmental Services Office; Jo Kines, Center Operations' Environmental Services Office. Not pictured: Ivy Alexander, project manager, Tolman Grounds/BRSP; Mark Fox, Mark Fox Landscaping.

Alexander, project manager for Tolman Grounds; Pat Kolkmeier of the Facility Engineering Division;

Tom Scarsella, Dyncorp; Parker and Jo Kines of the Environmental Services Office; John Jacob and Colin Shackelford of the Texas Agricultural Extension Service's Clean Water for Armand Bayou project; and Fox of Mark Fox Landscaping. Alexander,

with her extensive knowledge about native plants used at JSC, worked closely with Fox to determine which plants would be appropriate for the landscape. Fox provided the overall landscape design. Shackelford worked with TAES to provide a low-flow irrigation system for the landscape. Shackelford and Jacob are working with Steve Harding, the creator of the signs for the Houston Zoo, to provide a small sign and pamphlets for the conservationscape.

### Plants used in the conservationscape include

- ◆ Florida purslane
- ◆ Florida zamia
- ◆ Adina rubella
- ◆ Goldstrum rudbeckia
- ◆ American euonymus
- ◆ Mexican shrimp plant
- ◆ Nolina texana
- ◆ Lindeheimer muhly
- ◆ Lollie Jackson salvia
- ◆ Sophora tomentosa
- ◆ Texas mountain laurel

For more information on where to find native plants and seeds, Texas Park and Wildlife provides a native plant and seed source list at its Web site: [www.tpwd.state.tx.us/nature/plant](http://www.tpwd.state.tx.us/nature/plant). The Environmental Protection Agency also provides information at its Web site: [www.epa.gov/greenacres](http://www.epa.gov/greenacres). For more information on the conservationscape, contact Parker at x33119.

Clean Water for Armand Bayou has helped to install several conservationscapes in the area. JSC employees are encouraged to visit the Hanson House at the Jimmy Martyn Farm located at the Armand Bayou Nature Center, the Clear Lake Community Center, Krueger Park in the Meadow Green subdivision, and the St. Thomas Apostle School in Nassau Bay for more examples of landscaping with native and resource-efficient plants.

Environmentally beneficial landscaping practices are encouraged at federal facilities. Because the federal government owns and landscapes large areas of land, we can provide the leadership needed to encourage the use of native plants and thereby help to reduce the use of pesticides and fertilizers, while minimizing contaminated storm water runoff. Landscaping practices, such as planting native shade trees around federal facilities, can reduce air-conditioning demands and can also provide innovative measures to comply with the energy consumption reduction goal established in Executive Order 12902, "Energy Efficiency and Water Conservation at Federal Facilities."

The extensive use of concrete and asphalt accelerates storm water runoff and creates flooding and erosion for communities that exist along streams and bayous. It also results in higher temperatures in urban areas. Increasing the use of native plants reduces damage from storm water runoff, reduces temperatures and energy costs, improves water quality and increases wildlife habitat. Data show that combined landscape installation and maintenance costs associated with native landscaping over a 10-year period may be one-fifth the cost of conventional landscape maintenance.

Also, standard lawn maintenance equipment creates a significant amount of air pollution. Did you know that a gasoline-powered lawn mower emits 11 times the air pollution as a new car for each hour of operation? Cost data also show that conventional sodded turf grasses may exceed \$12,000 per acre, while planting native prairie grasses and forbs costs only \$2,000 to \$4,000 per acre. There are several varieties of native grasses in the Bldg. 30 conservationscape for reference. ■

**C O M M U N I T Y N E W S****Bales science students build station mockup**

It's hard for young students to understand abstract ideas just by reading or being told about them. Increased comprehension is gained by researching the ideas and putting them into action.

That was the concept that led to the construction of a nearly 18-meter-long space station mockup. Built in only 9 days by 175 sixth-grade science students at Zue S. Bales Intermediate School in Friendswood, Texas, the mockup features a clear plastic shell that houses panels and signs indicating equipment and facilities that range from experiment racks, to crew living quarters, to an Earth observation deck, to emergency medical areas. The mockup was on display for parents,

teachers, students, and other visitors to view in early May.

The idea behind the project was that of Debbie Shearer, sixth grade science and social studies teacher at the school. And with the help of Vikki Ganske, another science/social studies teacher at Bales, they brought this project to the students.

"The vision was to help the students understand more about the space station," said Shearer. "You can show them pictures of the space station, but that is really abstract to an 11- or 12-year-old. So the project was intended to help them learn about the science that will take place aboard the station and about how the astronauts will live."

Construction of the mockup followed weeks of research. The students watched NASA *Lift-off to Learning* videos of the station and the science done in space to learn more about the outpost and experiments that will be conducted aboard it, and they looked at pictures from a project that another class had done previously and at photos of the actual station.

Next the teachers visited JSC, toured the station mockup and measured it. Following discussions to resolve potential design issues, the students built their own mockup, adhering as closely as possible to the same dimensions within the constraints of their classroom.

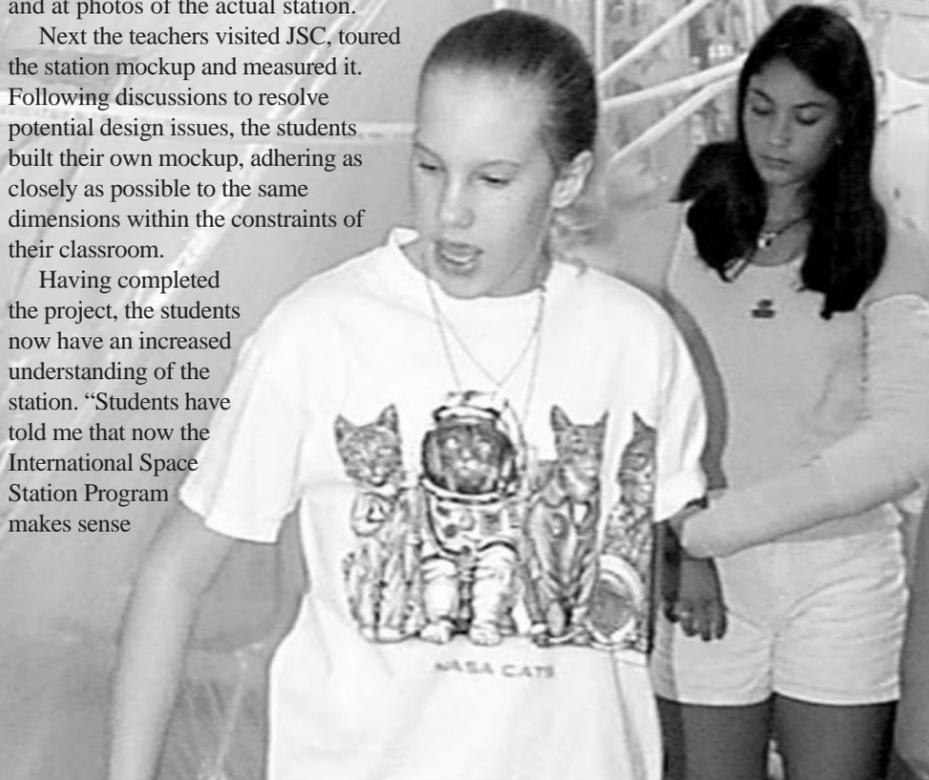
Having completed the project, the students now have an increased understanding of the station. "Students have told me that now the International Space Station Program makes sense

to them. They understand what the astronauts will have to go through and what they will have to do," says Shearer.

The mockup was dismantled at the end of the school year, but some parts of it were kept. Videos and still photos of it were taken for use in teacher workshops and class lessons. ■



JSC Photo P000850 by Juan Galvez

**Urban planners see greener and cooler cities with NASA technology**

By **Nicole Cloutier**

Landsat images, optical data, thermal imaging and remote-sensing data. Although these technological advances from space exploration may not be top-of-mind with the general public, they are the talk-of-the-town for environmental researchers tackling growing urbanization, diminishing rural landscape and global warming here on Earth.

"Our imaging technology is so accurate that we can now identify and monitor how a parking lot in Atlanta affects that city's weather," said Kamlesh Lulla, Ph.D., chief, Office of Earth Sciences at JSC, at a recent workshop focusing on issues related to Houston's climate and environment. "By-products from our Earth sciences technology can be very useful for urban planners and developers to see how all the elements – weather, vegetation and land development – are interconnected and how they influence the climate."

Images and data from NASA's Earth Sciences enterprise are becoming high profile NASA products these days. In addition to a recently announced partnership with the U.S. Department of Agriculture for land management and watershed studies, more and more environmental scientists and urban planners are seeking NASA's astronaut acquired photography to tackle more sensitive problems such as urban sprawl, heat-islands and other climate-related issues.

"As a NASA center, we at JSC are very committed to bringing technological benefits to the community and organizations that can further apply our research," said Lulla. "Our Earth science research is no exception. The information can be used to monitor and model what kinds of activities on a urban scale influence changes that are happening in our own backyard."

To help spread the word about NASA's Earth science resources and how they can contribute to environmental endeavors, Lulla participated in a recent workshop

entitled "Houston Cool & Green – A workshop on climate variability in the Houston region." The workshop was sponsored by the Houston Advanced Research Center, Texas A&M Sustainable Enterprise Institute, and the Houston Environmental Foresight Program.

The hope is that the 130 research scientists, environmentalists, builders, and city planners who attended the workshop are more aware of resources and information already available. They also can help shape how future Earth data from space is gathered and determine how it can be used for future Houston-area planning.

The workshop featured Dr. Dale Quattrochi and Jeff Luvall, NASA MSFC, authors of the widely reported ATLANTA Project. Their ATLANTA study used NASA remote sensing data and information to reveal direct relationships between urban

development and higher temperatures. The data concluded that mechanisms such as strategic tree planting and use of light colored materials for paving and roofing can reduce what is known as "heat-island" phenomenon.

"The presenters, from NASA, EPA Headquarters and American Forests, offered a rich mix of new technologies that will help us effectively demonstrate the economic effects of urban planning decisions that affect us all," said Tina Davies, Ph.D., senior research associate, HARC Center for Global Studies and coordinator

of Houston Environmental Foresight. "Our hope is that the enormous enthusiasm generated by the workshop will soon result in

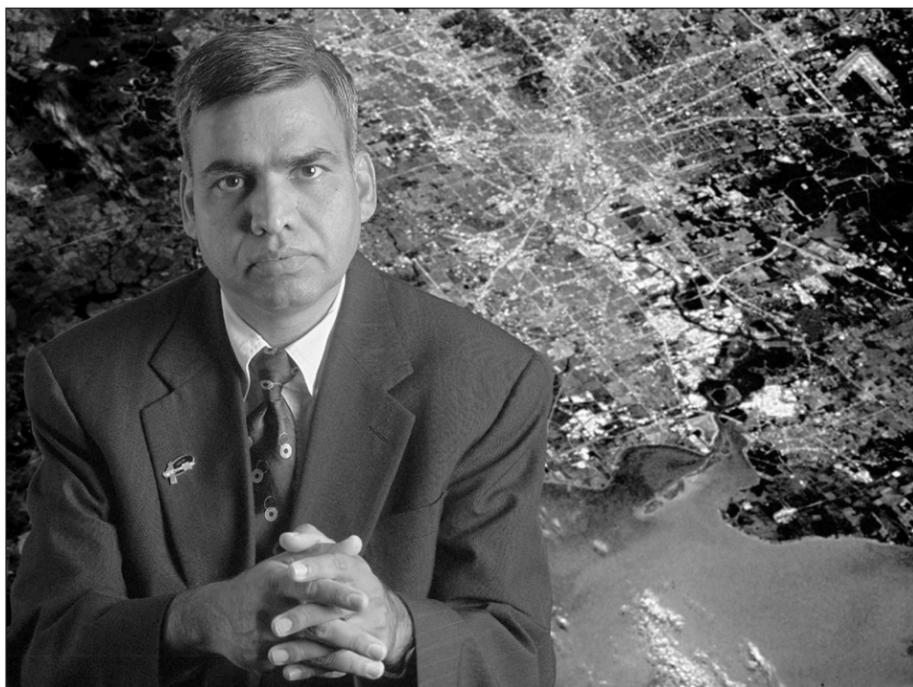
tangible benefits for the Houston community."

JSC's OES manages more than 375,000 global images in the NASA Space Shuttle Earth Observations Photography collection. The imagery, collected from as far back as Gemini and Skylab missions, is available via a public domain Web site (<http://images.jsc.nasa.gov/>) as a resource for other organizations. But Lulla anticipates collection of even more useful data as ISS becomes functional.

To that end, his team is developing three different mechanisms for data collection from ISS:

- ◆ Remote sensing instrumentation from the station's external nodes.
- ◆ A Window Observational Research Facility inside the ISS. This will include a window with a clear aperture 50.8 cm in diameter mounted on the U.S. Laboratory Module, and oriented perpendicular to the Earth's surface most of the time. The WORF will also house observational supplies and provide a stage for sensors and imaging systems.
- ◆ Crew observations and documentation supplemented by hand-held camera photography.

"ISS will serve as an important platform for Earth science research," said Lulla. "And an important aspect of that research will be the crew itself. Part of my job is to make the astronauts 'Earth-smart,' educating them on the planet's geography, geology and weather patterns so they can provide accurate observations from space and we can share in their discoveries." ■



JSC Photo 99e06650 by James Blair

**Dr. Kamlesh Lulla, chief of JSC's Office of Earth Sciences, recently addressed a workshop focusing on issues related to Houston's climate and environment. An image of Houston taken from space is shown in the background.**

**J S C \* S S H I N I N G S T A R****Galvez orchestrates center's audiovisual activities**

By Nicole Cloutier

It's not often that you hear that a love of music brought someone to NASA.

But for Juan Galvez, audiovisual manager for JSC, that's exactly what happened.

Galvez always had an interest in music and even from his days in the high school marching band and rock group, the Honduran native wanted to work behind the scenes. "I wanted to be the one recording the band," recalls Galvez who continues to play the guitar and the drums.

His interest in music was shared by his older sister and in 1981 he moved to the United States to join her at the University of Florida. With a strong interest in radio, he originally sought a degree in audio engineering. However, once he learned video and broadcast production, his interest expanded to television.

He graduated in 1985 with a major in television production and returned to Honduras to open a production studio with his sister, which he still co-owns with her. He also worked for the Honduran Advisory Center for Human Resource Development as manager for production and commercialization of multimedia. It was there that he received a call from a friend at NASA about an opening.

"For someone outside of the United States, just the opportunity to have an interview at NASA was a big deal," said Galvez.

That was in 1991 and he was hired as a technical monitor in NASA's Image Sciences Division. Eight years later, his role has grown to overseeing a team of 15 professionals in the Public Affairs Office to coordinate JSC's audiovisual activities. His team facilitates everything from



Juan Galvez

JSC Photo S99-05535

producing educational space videos, to coordinating live call-in television programs with astronauts, to helping Walker Cronkite conduct a live interview with John Glenn.

"That was a highlight," said Galvez. "It was my five seconds of fame, being on the same stage with Walter Cronkite, and they introduced me as 'Juan Valdez,' the guy in the Colombian Coffee commercials.

*For us, it might be a routine day at work, but for the folks on the receiving end, talking to an astronaut from their classroom through a telephone or computer link is a once in a lifetime opportunity, especially for the kids. They are really inspired after something like that, and that's when I get the most satisfaction from my job.*

— Juan Galvez

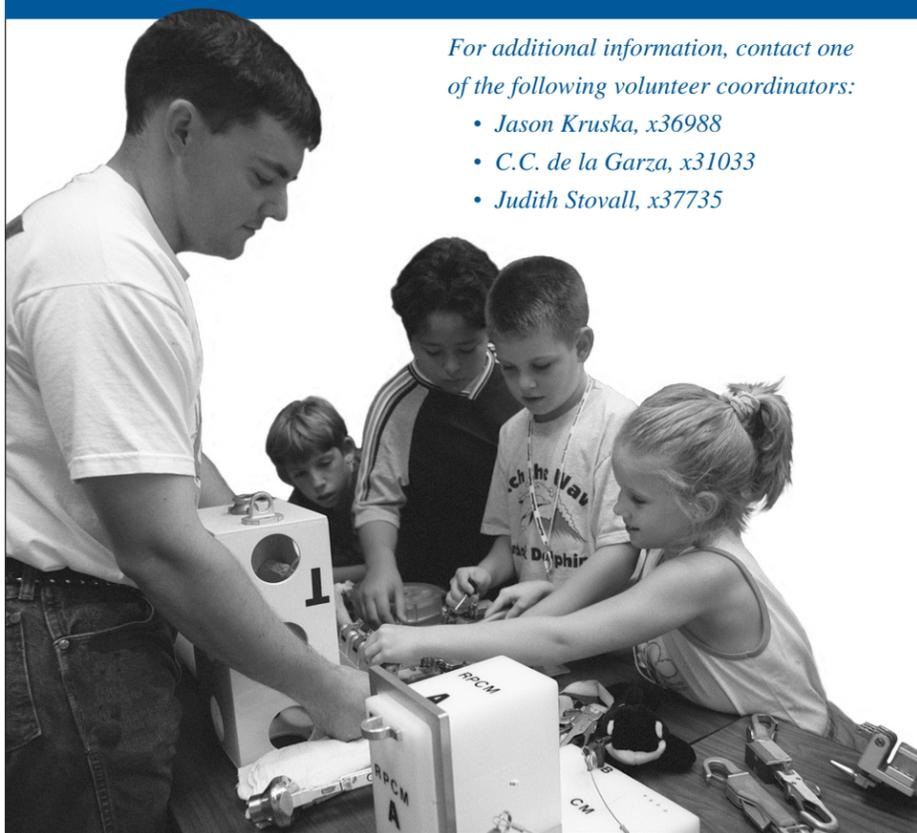
Luckily I made a joke out of that and carried on," said Galvez. "Real-time changes are what live TV is all about."

Galvez isn't frightened by change, a trait he attributes to his Honduran background. "I know how fortunate we are in this country when it comes to products and services, but I'm used to having to do more with less," said Galvez. "My experience overseas obligated me to be resourceful and to learn to be very flexible. And flexibility is a 'must' if you are to survive in a constantly changing environment like the communications industry."

That's probably why Galvez is so suited to the job where projects, deadlines and logistical needs are so fast-paced and dynamic. "That's the part I like most about my job," said Galvez. "It's always challenging and as soon as you complete one project, you'll be working on something completely different the next day."

These days, more and more of his projects are tied-in with the International Space Station. "The space station is going to be fascinating," said Galvez. "It offers a lot more opportunities for us to communicate the work NASA is doing to the public on an ongoing basis, instead of one shuttle flight at a time.

"For us, it might be a routine day at work, but for the folks on the receiving end, talking to an astronaut from their classroom through a telephone or computer link is a once in a lifetime opportunity," continued Galvez. "Especially for the kids. They are really inspired after something like that, and that's when I get the most satisfaction from my job." ■

**Volunteers needed for Open House**

For additional information, contact one of the following volunteer coordinators:

- Jason Kruska, x36988
- C.C. de la Garza, x31033
- Judith Stovall, x37735

The success of Open House will depend upon the participation of volunteers from JSC. More than 250 volunteers are needed.

Volunteers will staff information booths, act as rovers, assist visitors with directions, staff the lost child center, and help keep the cafeterias clean during peak times. All employees and contractors are urged to sign up for this exciting event. There is a special need for bilingual volunteers. To sign up, visit the Open House Web site <http://www4.jsc.nasa.gov/openhouse/Databases/> and select the time and position you would like to work. ■

**Managers to register Web sites across center**

NASA has entered into a "Security Campaign" which has three components: physical security, computer security, and information release management. Recognizing the importance of the Web as both a strategic asset and a potential security risk, JSC Chief Information Officer Jack Garman initiated registration of Web sites across the center. Sites not registered will not be accessible from outside JSC.

The Web, as we know it, did not even exist at the beginning of this decade. In January 1993, the National Center for Supercomputing Applications at the University of Illinois in Urbana-Champaign released the first Web browser, named Mosaic, which was developed by Marc Andreessen. At that time, about two million computer hosts resided on the Internet. The Internet had been around since 1969, but was still mostly an arcane technology known mainly to researchers, defense experts, academicians, and computer experts.

Today, there are more than 43 million hosts on the Internet and the word itself has entered common usage. Andreessen went on to form Netscape Communications Corporation.

At Johnson Space Center, Web browsers are part of the standard software load on computers and have become essential tools in today's workplace. In a remarkably short period of time, the Web has moved from novelty to a good way to

get some things done to a vital strategic asset in accomplishing our mission.

Web site registration is intended to enhance both the quality and security of this valuable resource. NASA managers who register Web sites are, in short, certifying that their sites adhere to quality and security guidelines.

Quality is assured by adherence to basic principles and legal guidelines that have been articulated in NASA and JSC policies. These are accountability, integrity of content, privacy notices, navigation/style, and appropriateness of links to Web pages external to the government domain.

"We have a fairly large investment in internal Web pages that may require additional investments in people's time to maintain the standards of quality and timeliness that JSC needs," said Garman. "By asking both the owners and management of those sites to reassess at what they have, we will help everyone determine where it is best to continue making such investments."

The second area of emphasis in the registration is security and the appropriate protection and release of information via the Web. Web servers which have no Web sites registered will be blocked from access outside of the JSC campus after September 1.

All information pertaining to this exercise is located at the JSC Web site registration home page <http://jsc-cio01.jsc.nasa.gov/webwg/registration/index.htm> ■

# NASA certifies new ascent flight dynamics officer

By Nicole Cloutier

Caping more than a year and a half of intense simulation and trajectory training and seven years as an orbit and entry Flight Dynamics Officer, Lisa Shore, United Space Alliance, has been certified as an ascent FDO. This designation also makes her the first female ascent FDO in NASA history.

"It's been several years since we've certified someone for ascent FDO, so this is a tremendous achievement," said Steve Stich, NASA ascent/entry flight dynamics group lead. "Lisa not only completed her certification, but also paved the way for future ascent FDO certifications through her hard work and dedication in development of an Ascent/Entry FDO Trainer."

The ascent FDO position is considered one of the most difficult positions in the control room hierarchy. FDOs, pronounced "fido," plan maneuvers and monitor shuttle trajectory in conjunction with the Guidance and Procedures Officer. As with other mission control positions, FDO assignments are divided into three mission phases: orbit, entry, and ascent. The ascent FDO is responsible for monitoring the shuttle's trajectory during the critical eight and a half minutes immediately after launch through the orbiter insertion burn at about forty-five minutes into the mission. They also prepare the launch window computations and abort-runway selections as well as manage the multitude of abort options, should a critical problem arise.

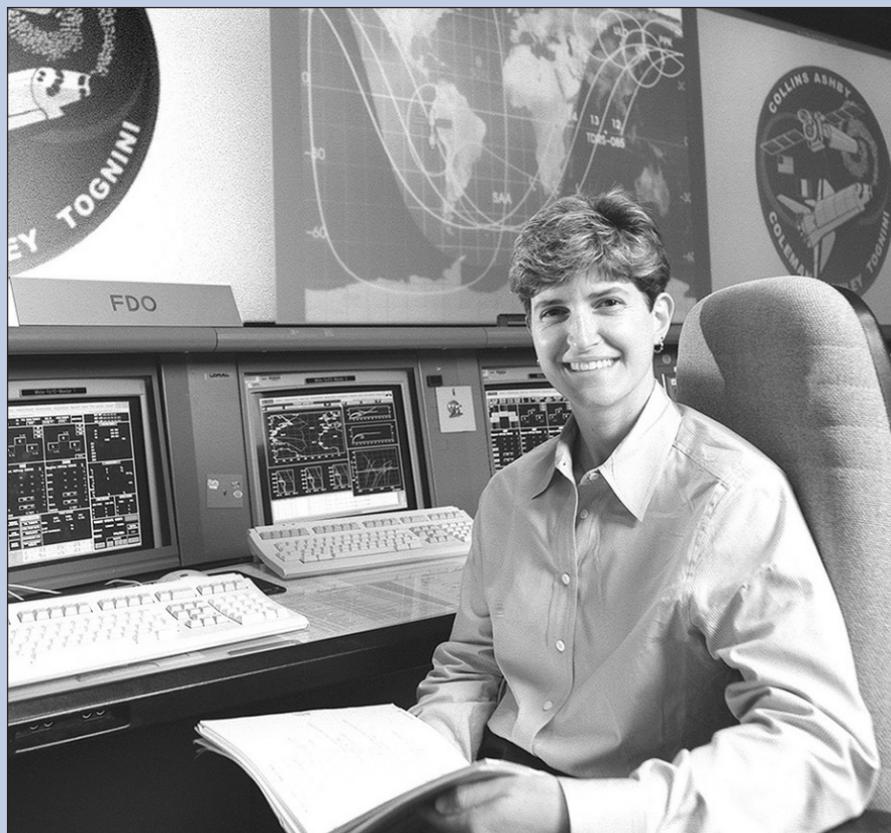
"Ascent is a very complicated time frame," added Keith Fletcher, flight dynamics manager for USA. "It's little more than eight and a half minutes long and decisions have to be made very quickly. You must know what to do without hesitation."

Because the position is so demanding, FDO certification mandates a stringent serial training regimen, starting with orbit FDO training to entry FDO and then to ascent FDO. Training for each FDO position can take up to 18 months and is supplemented by Trajectory Officer training prior to each FDO training phase. The entire process, starting from orbit to ascent FDO, can take several years and is filled with hundreds of hours of integrated simulations.

"Everyone was very supportive," said Shore. "The hardest part was adjusting to everyone's expectations during simulations. They were accustomed to working with a very experienced FDO, but while I was still learning, the whole team and the flight directors were behind me."

Shore also credits the two incumbent ascent FDOs with helping her attain this goal. For the past year and a half, Ed González, NASA, and Carson Sparks, USA, have been the only ascent FDOs certified to support shuttle missions. Despite their strenuous work schedule, they were very supportive.

"I'm delighted that Lisa has joined the ranks of certified ascent FDOs," said González. "She is already contributing greatly to our group by revising console procedures and devising new and



JSC Photo S99-05841 by Robert Markowitz

Lisa Shore will christen her certification as ascent flight dynamics officer with STS-93.

innovative software improvements. Her efforts in leading the completion of our new ascent/entry trainer software will greatly decrease training time for FDOs and GPOs in the future."

Shore, a University of Michigan graduate, started at JSC in 1986 in orbit flight design. In 1990, she was selected to begin training as an orbit FDO in the flight dynamics organization. Since then, Shore estimates she has supported about

30 missions, but says she's most excited about the next one.

"That is what I'm really looking forward to now," said Shore, who will initiate her certification with the launch of STS-93. "I'm ready to join the ranks of the ascent FDOs who have gone before me and make that 'Press to MECO' call with vigor." ■

# Mukai receives international honor



Photo by Gib Kirkham

NASDA Astronaut Dr. Chiaki Mukai was among the winners of the Ninety-Nines' Forest of Friendship Award. Shown here is Mukai with fellow award recipient Capt. Angela Masson, Ph.D., American Airlines (third and fourth from right) with Ninety-Nines of Japan (left to right): Mami Hamano; Mari Tanaka; Yoko Kitano, chairman, Japan Women's Association of Aeronautics; Chickako Idogaki; Noriko Hosoya; Yasuko Ishiyama; Rikako Carpenter, ceremony chair; and Reiko Kawai.

The Ninety-Nines, an international organization of more than 6,500 female pilots, recently honored Astronaut Dr. Chiaki Mukai as a recipient of the 1999 Forest of Friendship Award. The award, presented to Mukai at a ceremony in Tokyo, Japan earlier this year, is given to men and women who have demonstrated a commitment to aviation through leadership, support, friendship, education or through their own pioneering efforts in aviation or aerospace.

A plaque commemorating Mukai as a recipient was installed on Memory Lane on June 19. Memory Lane is a trail of granite plaques for more than 700 distinguished honorees, such as Amelia Earhart, Jeana Yeager, President George Bush and Col. Eileen Collins, that winds through the Ninety-Nines' International Forest of Friendship in Atchison, Kansas. ■

## Ripped from the ROUNDUP

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

1 9 7 0

**C**hanges to be made in the Apollo spacecraft and procedures before the Apollo 14 mission will require postponing the launch to no earlier than Jan. 31, 1971.

The changes and new date were announced June 30 by Dr. Thomas O. Paine, Administrator of the National Aeronautics and Space Administration, following a review of recommendations of the Apollo 13 Review Board, an evaluation of the Board's report by the NASA Aerospace Safety Advisory Panel, and recommendations by NASA's Office of Manned Space Flight.

The Review Board had reported that a short circuit ignited electrical insulation in spacecraft oxygen tank No. 2, causing failure of the tank, subsequent loss of electrical power and abort of the lunar-landing mission 200,000 miles from Earth on April 13.

1 9 7 8

**T**he Space Shuttle's main propulsion system was static fired successfully June 22 in a test lasting almost 40 seconds and reaching 90 percent of the rated power of the engines.

This was the third test of the propulsion system which features a cluster of three main engines installed in an Orbiter aft fuselage section. Liquid hydrogen and liquid oxygen propellants are fed to the engines from a flight-type External Tank

1 9 8 9

**T**he first space shuttle to orbit the Earth – *Columbia* – was towed from its hangar in the Orbiter Processing Facility to the Vehicle Assembly Building early this week in preparation for its return to flight on the 30th shuttle mission.

With the roll out from the hangar shortly after midnight Monday, NASA reached a significant milestone: the first time since 1986 that NASA has had three operational space shuttles in the launch processing flow for upcoming missions.

By 4 p.m. Tuesday, the orbiter was mated to its external tank and solid rocket booster stack atop the mobile launch platform in VAB high bay 3.

## Co-op students tour Stennis, view STS-96 launch

By Kylie Moritz

**O**n May 25, fourteen co-op students set off an adventure of a lifetime. With a 16-hour drive ahead of them, they loaded up their luggage, synchronized their CB radios and departed from Rocket Park. Their goals were to stop in Mississippi for a tour of Stennis Space Center and arrive at Kennedy Space Center in time to watch STS-96 lift off.

Deputy Center Director Dr. Mark Craig and Larry Ellis, deputy director of the Propulsion Test Directorate, greeted the students as they arrived at Stennis on May 26. Together, they embarked on an exclusive four-hour tour of commercial remote sensing systems, the engine assembly building and engine testing facilities. The co-ops were amazed at the technology being used at Stennis and began to realize how much hard work is put into the space shuttle.

"I really enjoyed it because we got up close and personal with the Space Shuttle Main Engines at different stages of assembly. There were a lot of very knowledgeable people there to answer all of my questions. I learned a great deal about the heart of the machine that fuels our careers and the dreams of thousands of people," said Chip McCann, a mechanical engineering co-op from the University of Wisconsin.

Touring another NASA center was a unique learning experience for the co-ops. "It's really great to go to the other NASA centers and see what they do, and to get a better understanding of what they are about. It's an interesting feeling to still be at NASA, but at the same time you're still a tourist," explained Philip Strawser, a computer engineering co-op from Georgia Institute of Technology.

From Stennis, the co-ops resumed their journey to KSC. With a mere three hours left before the launch, they climbed the stairs of the fire escape at the Launch Control Center to wait for the launch. Munching on donuts and positioning their tripods, they watched the sunrise over the Atlantic Ocean.

Egbert Hood, an aerospace engineering co-op from the University of Texas, explained that his favorite part of the trip was "watching the shuttle sitting on the pad at 5 a.m., watching the sun rise,

and then watching the Solid Rocket Boosters glow brighter than the purest gold."

"I think that every single employee of NASA should make an effort to go see at least one launch. Every day we work on our projects – big or small – and we can easily lose sight of the big picture. Seeing that shuttle rise through the clouds and feeling the wave of sound shake your body has got to be one of the most awe-inspiring moments of a person's life," added Strawser.

The launch was indeed an incredible sight. Afterward, the students went to the lobby of the LCC and ate beans and cornbread, which is a tradition at KSC after a launch. With full stomachs and sleepy heads, they found their hotel in Cocoa Beach, Florida, and slept the day away.

On the morning of May 28, the co-ops met Tim Potter, Payload Ground Operations contract manager representative at KSC, for an extraordinary day. The day included a six-hour tour of the Payload Processing Facility, the shuttle landing area, the Orbital Processing Facility, the Vehicle Assembly Building, and last, but certainly not least, Launch Pad 39B. The tour of KSC was definitely a highlight of the trip.

"Walking under *Atlantis* in the Orbiter Processing Facility was the best part. There's nothing quite like looking up and admiring our nation's magnificent spacecraft," said Edgar Medina, an aerospace engineering co-op from the University of Texas.

"I was so surprised to see the Space Shuttle *Atlantis* hiding there behind all that scaffolding," added Casey Kirchner, an aeronautical and astronautical engineering co-op from Purdue University.

Touring the facilities at Stennis and KSC and watching the shuttle launch brought things into perspective for the co-ops.

"I enjoyed seeing the 'big picture' of what it takes to make the shuttle fly," said Christopher Lamoreaux, a mechanical engineering co-op from Tufts University.

After an exhausting trip to the Cape, the co-ops returned to Houston on the afternoon of May 29. How did they keep occupied during the car ride home? Counting Waffle Houses, of course. In case you ever wondered, there are 64 Waffle Houses between Kennedy Space Center and Johnson Space Center. ■

### Gee Whiz Facts that the co-ops learned

- ◆ The VAB is so large that clouds can form and rain inside the building.
- ◆ The fuel pump on the Space Shuttle Main Engine produces a flow rate that is capable of filling six Olympic-sized pools in less than 30 seconds.
- ◆ Half a million gallons of water are dumped on the launch pad within 30 seconds during launch.
- ◆ It takes the crawler 6 to 8 hours to travel from the Vehicle Assembly Building to the launch pad.
- ◆ Stennis technicians and test engineers have to wait several hours after a Space Shuttle Main Engine test firing because the cryogenics make everything in the test stand so cold, rather than the exhaust heating everything up.



Co-op students standing in front of Launch Pad 39B with Tim Potter, Payload Ground Operations contract manager representative at Kennedy Space Center, from left, front, are: Kylie Moritz, Angie Villar, Sarah Brehmer, Casey Kirchner, Christopher Lamoreaux, Potter, Edgar Medina, Ignacio Villarreal, Aaron Swank; back: Kristy Stokke, Egbert Hood, Chip McCann, Tim Graves, Philip Strawser, Jim Westlake.

## Cozumel awaits winner of NASA Exchange-JSC promotional campaign

**O**n July 7, 1999, the NASA Exchange-JSC will launch a new promotional campaign that is sure to capture your interest. It plans to offer a cruise for two to the majestic waters of Cozumel.

Participants will have the opportunity to register for the cruise with the purchase of a classic mission pin from any of the Exchange Stores located in Bldgs. 3 and 11, JSC cafeterias, and Gilruth Center. These vintage pins, featuring various shuttle mission designs, offer a nostalgic

reminder of NASA's past and a glimpse into its future. The pins retail for \$2.50 and make great gifts for those who wish to show off their NASA pride or for the avid NASA collector. Only the JSC Exchange can offer these classic memories along with the opportunity to make new memories of your own in Cozumel.

Classic mission pins are set to arrive on July 7. Visit the Exchange Stores and cafeterias in Bldgs. 3 and 11 and Gilruth Center for more details.

**Eligibility:** NASA civil servants, retirees, contractors, and their immediate family. Exchange employees, NASA Exchange Council members, EAA officers, and their immediate family are not eligible to participate.

**Contest:** Purchase a classic mission pin (retail price \$2.50) for the chance to win a trip for two to Cozumel. Contest begins July 7, 1999, and ends August 13, 1999. Official drawing will be held August 18, 1999. See Exchange stores for details. ■



# Apollo 11 Family Picnic and Reunion set

*'Houston, Tranquillity Base here – the Eagle has landed'*

Those monumental words, first spoken by Neil Armstrong at 4:18 p.m. EDT July 20, 1969, are now legend and a keystone of America's space history. To commemorate the 30th anniversary of the first lunar landing, JSC and Boeing will host an Apollo 11 Family Picnic and Reunion from 4:30 - 8 p.m. July 22 at the Gilruth Center.



best for age 12 and under, and most outrageous. Contest judging will take place from 4:30 - 5:30 p.m. at the event entrance. Prizes will be awarded following the program.

Tickets may be purchased on site at the Exchange Stores in Bldgs. 3 and 11 or at Boeing through Donna Hebert at (281) 244-4980, at the Lockheed Martin Communications Office (281-283-4152), or at the Planet 10 store at United Space Alliance through Bea Alexander at (281) 280-3778. Tickets will be on sale through July 19.

Exhibits and artifacts from the Apollo Program will be on display throughout the buildings at the Gilruth complex during the event. Items that will be on display include a one-third scale Lunar Module, the spacecraft that flew humans to the lunar surface; a lunar surface antenna; the Mobile Equipment Transporter, which allowed astronauts to carry tools around on the lunar surface; lunar surface maps; and assorted magazines and newspaper headlines announcing the landing.

JSC employees who worked during the Apollo program who have or know of artifacts that were tucked away in lockers, cabinets and the like, reunion organizers would be interested in showcasing them at the Rec Center. Contact Louis Parker at x38622 if you have any items to display. ■

Tickets cost \$5 for the first 2,100 sold; remaining tickets cost \$8.85. Each ticket includes a barbecue plate, beer, wine, soft drinks and snacks. Free hot dogs will be available for children age 12 and under. Food will be served from 4:30 - 6:30 p.m. In addition, special Apollo 30th anniversary buttons will be available at the picnic while supplies last. The astronaut band Max Q will entertain from 6 - 8 p.m., following a special program at 6 p.m.

To top off the event, a hat contest will be held. Prizes will be awarded in five categories: best Apollo theme, best use of a cowboy hat, best use of a baseball hat,

## Faces in the crowd

Who is your space hero and why?



**Kamilah Newton**  
NASA Co-op

S99-05815

*"Dr. Mae Jemison because of her accomplishments as an African-American woman. She gave a really good speech at my school that made NASA and space exploration more useful to me. I was also inspired by the fact that she has a diverse career as a doctor who went on to become an astronaut."*



**Luis Rodriguez**  
Muniz Engineering Senior Safety Engineer

S99-05816

*"I consider every single astronaut, man or woman, who has gone to space to be my hero because their jobs and contributions are very important to our youth and future generations."*



**Barbara J. Martin**  
Omniplex International Security Representative

S99-05819

*"My space hero is U.S. Senator and Astronaut John Glenn because he had a lot of courage going back into space at his age. STS-95 will be the most memorable mission for me here at JSC."*



**Kenneth Jones**  
OAO Corp. Field Customer Support Technician

S99-05821

*"Story Musgrave because he had been involved in the space program for such a long time and seems to really enjoy what he has accomplished."*

JSC Photos by James Blair

## Christa McAuliffe Middle School dedicates hallway to Winston Scott



JSC Photo S99-05671 by James Blair

Christa McAuliffe Middle School in the Fort Bend Independent School District honored Astronaut Winston Scott on May 24 by dedicating the school's seventh grade hallway to him. The dedication recognized Scott's visit to the school and presentation to the entire student body on April 1, 1999. Unveiling Scott's crew photo in the school library, from left, are Nubia Acosta, Elizabeth Avila, Christa McAuliffe Middle School Principal Herman Lee, Scott, Sandra Soto, D'Myrian Frederick, and Norman Chaffee of JSC's Public Affairs Office.

# TICKET WINDOW

### Exchange Store hours

Monday-Friday

Bldg. 3 7 a.m.-4 p.m.

Bldg. 11 9 a.m.-3 p.m.

All tickets are nonrefundable.

Metro tokens and value cards are available.

For more information, please call x35350.

The following discount tickets are available at the Exchange Stores:

General Cinema Theaters	.....	\$5.50
Sony Loew's Theaters	.....	\$5.00
AMC Theaters	.....	\$4.75
Fiesta Texas	.....adult ..\$18.25 ..(child under 48") .....	\$15.50
Astroworld One-day Admission	.....	\$21.00
Astroworld Season Pass	.....	\$54.75
(valid at all Texas Six Flags Theme Parks and Water World)		
Water World	.....	\$10.75
Moody Gardens (2 of 6 events)	.....	\$10.75
Sea World	.....adult ..\$27.25 ..child (age 3-11) .....	\$18.25
Schlitterbahn Water Park	.....adult ..\$20.75 ..child (age 3-11) .....	\$17.50
Space Center Houston	.....adult ..\$10.25 ..child (age 4-11) .....	\$6.50
(JSC civil service employees free.)		
Space Center Houston Annual Pass	.....	\$18.75
Splash Town Water Park	.....adult ..\$14.50 (child 48" and under) .....	\$11.50

Houston Comets tickets now available for August 6 and August 18. Limited quantities.

Houston Astros tickets now available for July 18, August 13 and September 12. Limited quantities.

Apollo 11 Family Picnic and Reunion, 4:30 p.m. - 7 p.m., July 22. Tickets on sale until July 19.

Book signing with Gene Cernan, 11 a.m. - 2 p.m., July 14, Bldg. 3 cafeteria.

**PEOPLE** *on the* **MOVE****Key Management Assignments**

*Bill Cowart* was named chief, Mechanical, Civil, and Architectural Branch, Facility Engineering Division, Center Operations Directorate.

*Dave Hickens* was named lead, Environmental Office, Center Operations Directorate.

*Beth Humphries* was selected as chief, Facility Engineering Division, Center Operations Directorate.

*Grady Owens* was named chief, Planning and Integration Office, Center Operations Directorate.

*Bill Roeh* was named chief, Project Management Office, Center Operations Directorate.

*Ron Williams* was named assistant chief, Facility Engineering Division, Center Operations Directorate.

**Additions to the Workforce**

*Miguel Maes* joins the Laboratories Office at the White Sands Test Facility as a test engineer.

**Promotions**

*Carrie Ash* was selected as the acquisition team lead in the Projects Acquisition Office, Business Management Directorate.

*Diane Grizzoffi* was selected as division secretary, Space Flight Training Division, Mission Operations Directorate.

*Martha Wilder* was selected as a secretary in the Space and Life Sciences Directorate.

*Pat Teale* was selected as the division secretary, Earth Science and Solar Systems Exploration Division, Space and Life Sciences Directorate.

**Reassignments Between Directorates**

*Catherine Bole* moves from the International Space Station Program Office to the Mission Operations Directorate.

*Bill Brown* moves from the International Space Station Program Office to the Mission Operations Directorate.

*Mara Pena* moves from the Technology Transfer and Commercialization Office to the Engineering Directorate.

*Steve Guy* moves from the Office of the Chief Financial Officer to the Information Systems Directorate.

*Peggy Halyard* moves from the Space and Life Sciences Directorate to the Office of the Chief Financial Officer.

*Don McCormack* moves from the International Space Station Program Office to the Space Shuttle Program Office.

*Patsy LeBlanc* moves from the Space Shuttle Program Office to the International Space Station Program Office.

*Marty Demaret* moves from the Office of the Chief Financial Officer to the EVA Project Office.

*Kelly Pido* moves from the International Space Station Program Office to the Technology Transfer and Commercialization Office.

*Vicki Nisbet* moves from the International Space Station Program Office to the Human Resources Office.

**Reassignments Between Centers**

*Bill Ramage* moves to Marshall Space Flight Center.

*Irene Bibyk* moves to Goddard Space Flight Center.

**Retirements**

*Carolyn Amm* of the International Space Station Program Office.

*George Nield* of the International Space Station Program Office.

**Resignations**

*Mengo Carr* of the Public Affairs Office.

*Michelle MacFadyen* of the Mission Operations Directorate.

*David Altemir* of the Engineering Directorate.

*Michael Stagnaro* of the Engineering Directorate.

*Bill Bastedo* of the International Space Station Program Office.

**DATES & DATA****July 7**

**Astronomy seminar:** The JSC Astronomy Seminar Club will meet at noon July 7, 14, 21 and 28 in Bldg. 31, Rm. 248A. For more information, call Al Jackson at x35037.

**Communicators meet:** The Clear Lake Communicators, a Toastmasters club, will meet at 11:30 a.m. July 7, 14, 21 and 28 at Freeman Library, 16602 Diana Lane. For details, call Allen Prescott at (281) 282-3281 or Mark Caronna at (281) 282-4306.

**Spaceland Toastmasters meet:** The Spaceland Toastmasters will meet at 7 a.m. July 7, 14, 21 and 28 at the House of Prayer Lutheran Church. For more information, call George Salazar at x30162.

**Spaceteam Toastmasters meet:** The Spaceteam Toastmasters will meet at 11:30 a.m. July 7, 14, 21 and 28 at the United Space Alliance, 600 Gemini. For more information, call Patricia Blackwell at (281) 280-6863.

**July 8**

**Airplane club meets:** The Radio Control Airplane Club will meet at 7 p.m. July 8 at the Clear Lake Park building. For more information call Bill Langdoc at x35970.

**MAES meets:** The Society of Mexican-American Engineers and Scientists will meet at 11:30 a.m. July 8 in Bldg. 16, Rm. 111. For more information, call George Salazar at x30162.

**July 13**

**Aero Club Meets:** The Bay Area Aero Club will meet at 7 p.m. July 13 at the Houston Gulf Airport clubhouse at 2750 FM 1266 in League City. For details call Larry Hendrickson at x32050.

**NPMA meets:** The National Property Management Association will meet at 5 p.m. July 13 at Robinette and Doyle Caterers, 216 Kirby in Seabrook. Dinner costs \$14. For additional information call Sina Hawsey at 36582.

**July 14**

**IAAP meets:** The Clear Lake/NASA Chapter of the International Association of Administrative Professionals (formerly Professional Secretaries International) will meet at 5:30 p.m. July 14 at Bay Oaks Country Club. Cost is \$16. For more information and reservations, call Tami Barbour at (281) 488-0055, x238.

**July 15**

**Directors meet:** The Space Family Education board of directors will meet at 11:30 a.m. July 15 in Bldg. 45, Rm. 712D. For additional information contact Gretchen Thomas at x37664.

**July 17**

**Fun Run:** The 21st annual Lunar Rendezvous Run will take place at 8 a.m. July 17 at the Gilruth Center. Walkers and runners are welcome to participate in the 5k event. Interested parties should pick up registration forms at the Gilruth Center. For more information call Leonard Topolski at (281) 648-9042 or Willie Vanderbrink at (281) 470-6715, or e-mail spacerun99@juno.com.

**July 21**

**Scuba club meets:** The Lunarfans will meet at 7:30 p.m. July 21. For more information, call Mike Manering at x32618.

**NASA BRIEFS****NASA SELECTS 1999 SHARP PLUS STUDENT APPRENTICES**

High school students will live on college campuses and conduct science research at 15 universities this summer through NASA's 1999 Summer High School Apprenticeship Research Program (SHARP PLUS).

NASA and the Quality Education for Minorities Network have selected 300 high school students from 1,200 applicants to participate in this year's program. These apprentices represent 195 high schools and come from 34 states, the District of Columbia, Puerto Rico, Guam and the U.S. Virgin Islands.

The list of high school students, their home states and the participating universities is available on the Internet at URL:

<ftp://ftp.hq.nasa.gov/pub/pool/press-rel/1999/99-069a.txt>

**LUEDTKE SELECTED AS ASSOCIATE ADMINISTRATOR FOR PROCUREMENT**

NASA Administrator Daniel S. Goldin has selected Tom Luedtke, instrumental in many of NASA's new procurement initiatives, as the Associate Administrator for Procurement, effective immediately.

Luedtke has been acting in this position since August.

Luedtke will continue to guide and oversee some of NASA's most far-reaching procurement initiatives. He will represent NASA procurement to the Congress, the White House, other government agencies, industry and international organizations.

"Tom Luedtke brings vast experience, considerable skills and boundless creativity to this position at a time when NASA procurement activities continue to undergo dynamic reform," Goldin said.

**NASA AMES CELEBRATES 60TH ANNIVERSARY**

NASA Ames Research Center, located at Moffett Field near San Jose, California, celebrated its 60th birthday on June 2. As NASA's Center of Excellence for Information Technology, Ames conducts research geared toward creating new knowledge and new technologies in support of NASA missions.

In celebration of its proud 60-year history, Ames hosted nearly 3,500 employees and their families to a free picnic lunch and birthday cake, capped by a free performance by the San Jose Symphony of Gustav Holst's "The Planets." The performance was preceded by brief presentations about Ames' history dating back to the day when Russell Robinson first broke ground on the site December 20, 1939.

"Using the language of science, Ames people have written the poetry of the planets," said Jack Boyd, executive assistant to Center Director Henry McDonald and a long-time Ames employee. Dr. McDonald lauded the center's history and spoke proudly of Ames' role in astrobiology, an endeavor which he said "could and probably will, become the heart and soul of NASA."

**SPACE CENTER Roundup**

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