



SPACE CENTER
Roundup

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NASA JSC 2002e38910 photo by Robert Markowitz

Several new JSC technologies were given a trial run in the fifth Remote Field Site Test in September. During this test, JSC's Dr. Dean Eppler evaluates the walking mobility of the MK III suit while being monitored by a 'Bio-vest' developed by Stanford University. See more images from the tests on pages 4 and 5.

George W. S. Abbey announces retirement



George W.S. Abbey recently announced his retirement from NASA, ending a distinguished federal service career that spanned a half-century.

His retirement will be effective Jan. 3, 2003.

Abbey leaves the Agency after a highly decorated aerospace career, which included the Medal of Freedom, the nation's highest civilian award, for his role on the Apollo 13 Mission Operations Team.

In February 2001, Abbey left his post as JSC Center Director when he became the Senior Assistant for International Issues reporting to the NASA Administrator. Subsequently, he was appointed as a Senior Visiting Fellow at the James Baker Institute for Public Policy at Rice University.

"George helped to shape some of NASA's most difficult programs and missions as a true innovator and pioneer," Administrator Sean O'Keefe said. "Throughout his eminent career, George distinguished both himself and the Agency. He leaves behind a legacy of excellence and dedication that the hardworking people of NASA will follow for years to come."

Born in Seattle, Abbey received his bachelor's degree in general science from the U.S. Naval Academy, Annapolis, Md., in 1954, and a master's degree in electrical engineering from the U.S. Air Force Institute of Technology, Wright Patterson Air Force Base, Ohio, in 1959. A pilot in the U.S. Air Force, Abbey had more than 4,000 hours in various types of aircraft before being detailed to NASA. This year, he was selected as a Distinguished Alumnus of the U.S. Air Force Institute of Technology.

Abbey joined NASA in 1964 as an Air Force Captain assigned to the Apollo Program. In December 1967 he left the Air Force and was named technical assistant to the JSC Center Director. In January 1976, he was named Director of Flight Operations, where he was responsible for operational planning and for the overall direction and management of flight crew and flight control activities for all human spaceflight missions.

In 1983, he became Director of the Flight Crew Operations Directorate, where he continued to be responsible for all space shuttle flight crews and Center aircraft operations.

Abbey was appointed Deputy Associate Administrator for Space Flight at NASA Headquarters in Washington in March 1988. In July 1990, he was selected as Deputy for Operations and senior NASA representative to the Synthesis Group. He was charged with defining strategies for returning to the Moon and landing on Mars.

In July 1991, Abbey was appointed Senior Director for Civil Space Policy for the National Space Council in the Executive Office of the President. In 1992 he was named Special Assistant to the NASA Administrator. Then in 1994 Abbey was named Deputy Director of JSC and was subsequently selected as the JSC Center Director in 1996.

"George Abbey dedicated himself to serving his country," said JSC Director Lt. Gen. Jefferson D. Howell, Jr. "He devoted 44 years to this nation's space program, serving at JSC since 1964, and helped strengthen ties between JSC and the local community. He leaves us with a legacy that spans Apollo to shuttle to the space station. We salute his commitment to duty as we continue to reap the benefits of his vision and hard work."



**WHAT
REALLY
COUNTS!**

FROM THE DESK OF LT. GEN. JEFFERSON D. HOWELL JR.

I think that the holiday season is a great opportunity to reflect on what is really important in our lives. The reasons for having these holidays certainly give us a good starting point for this type of review.

In my own life, I have experienced occasional setbacks, which, at the time, made me feel like a miserable failure. However, these experiences forced me to take stock of my situation and realize all the wonderful blessings I enjoyed even during a time of great personal trauma.

I realized that "fame, fortune and professional success" are very fleeting, and gave me only temporary satisfaction and very little fulfillment. I found out that what really counted for me was having a wonderful wife and two children who loved me dearly. What really counted was having loyal friends who would remain so in bad times as well as good. What really counted was being able to look in the mirror and know that I had given my best effort and had kept my honor clean.

When I think about what really counts in my life I realize how incredibly blessed I am. If you give it the same thought I believe you will draw similar conclusions.

HAPPY HOLIDAYS!!

Abbey's numerous honors and awards include the NASA Exceptional Service Medal, the NASA Outstanding Leadership Medal, three NASA Distinguished Service Medals and the 1970 Medal of Freedom, which was presented by President Richard M. Nixon, for his distinguished civilian service in peacetime. In addition, he was the recipient of the Rotary National Award for Space Achievement in 1997.

"George is a demanding leader who rarely accepts compromise," O'Keefe said. "His ability to motivate and inspire his staff to work harder and smarter helped NASA write much of its human spaceflight history. His devotion to the success of America's space program is unquestionable and I wish him the best." ❖



NASA JSC S-69-33873

George Abbey receives an award from then-Center Director Robert Gilruth in 1969.

NASA JSC S84-26245

George Abbey prepares to fly a T-38 in 1984.



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Roundup

A stellar career adds another star

James Graver, an Aerospace Quality Specialist at White Sands Test Facility, has been awarded three NASA Group Achievement Awards, two commendations and three achievement awards, and his name was flown to the Moon by Apollo 11 astronauts.

Recently, the Washington International Group contractor added another prestigious honor to his list. Graver was presented NASA's Mission Accomplished Xtraordinaire (MAX) award and the Star award from the Space Shuttle Program.

NASA bestows the MAX award upon Safety, Reliability and Quality Assurance (SR&QA) professionals who have made significant contributions leading to the success of a recent human spaceflight mission. Johnson Space Center Director Lt. Gen. Jefferson D. Howell, Jr., and Deputy Director Randy Stone select and award this honor to only one individual per mission.

The Space Shuttle Program Office presents the Star awards to individuals who have exhibited initiative and dedication in ensuring successful spaceflight. Recognizable performance is not restricted to crew safety and shuttle operations, but also includes payload activity, extravehicular activity and International Space Station assembly.

So what did Graver do that landed him the awards?

When asked, the soft-spoken Graver said, "I'm just trying to do my job." But in the course of doing his job, he spotted and helped correct a major problem with an Orbital Maneuvering Subsystem (OMS) engine.

"I noticed a problem during routine reassembly of the engine," Graver said. "Bolts in the propellant feedline flanges at several locations on the engine were being tightened but, during the final torque sequence, a bolt snapped off."

"That was alarming by itself," he said. "But when a second bolt was inserted and it too broke when being tightened, it immediately sent up a red flag."

Graver halted the assembly process to make sure that proper documentation of the anomaly was initiated. He then reported the problem to Debra Chowning, a WSTF Quality Engineer.

"Jim's confidence in his awareness of the system and the problem was invaluable in looking at inspection from an independent perspective," Chowning said. "Although there was a shuttle ready to fly within two weeks (STS-110), we knew that the problem had to be fixed. Even if the launch date was impacted, we felt that the shuttle would be safer and more reliable afterwards. The NASA Problem Action Center agreed with us."

An intensive investigation revealed the cause of the anomaly that Graver had spotted. It turned out that, during a redesign of the propellant-joint seals a few years ago, a new high-strength precision bolt was tightened to a higher torque value than the old ones. Then, an assembly-drawing mix-up caused the wrong bolts to be assigned the wrong torque values. The bolts became over-stressed and, as Graver witnessed, snapped off.

Meanwhile, Space Shuttle *Atlantis* was being prepared for STS-110. An exhaustive search of engine assembly documentation and physical inspection of the shuttle's engines found that the incorrect bolts were indeed installed in both engines of the shuttle. A team of engineers and technicians at WSTF developed and demonstrated a technique for sequentially replacing the discrepant bolts without compromising the integrity of the seal. This meant the bolts could be replaced without removing the engines or conducting high-pressure leak checks. Such procedures would have meant a significant delay in the mission.

Technicians at KSC were then able to replace *Atlantis*' bolts right on the launch pad, and the engines were cleared for flight. All other OMS engines throughout the shuttle fleet, including spares, were also inspected. Assembly drawings were updated to ensure that a similar problem did not occur again.

"You just can't top the experienced worker," said Raul Estrada, a Honeywell Test Cell Technician in the WSTF Propulsion Department. "I respect Jim very much."

Graver takes the recognition in stride. However, his stellar 40-year career speaks volumes. He began in 1962 with Grumman Aerospace in New York. Graver worked on the Apollo Lunar Module and several military aircraft programs – including the Navy A-6 Intruder, F-14 Tomcat and E-2C Hawkeye, as well as the Army OV-1 Mohawk – before he arrived at WSTF in 1975. His first job at the test facility was with the Propulsion Test Department.

Graver worked on the Shuttle OMS Engine and Forward Reaction Control Subsystem. He also worked in the Space Shuttle Depot for maintaining and repairing Primary/Vernier Reaction Control Subsystem Thrusters. This varied experience created a wealth of knowledge to apply to his current responsibilities.

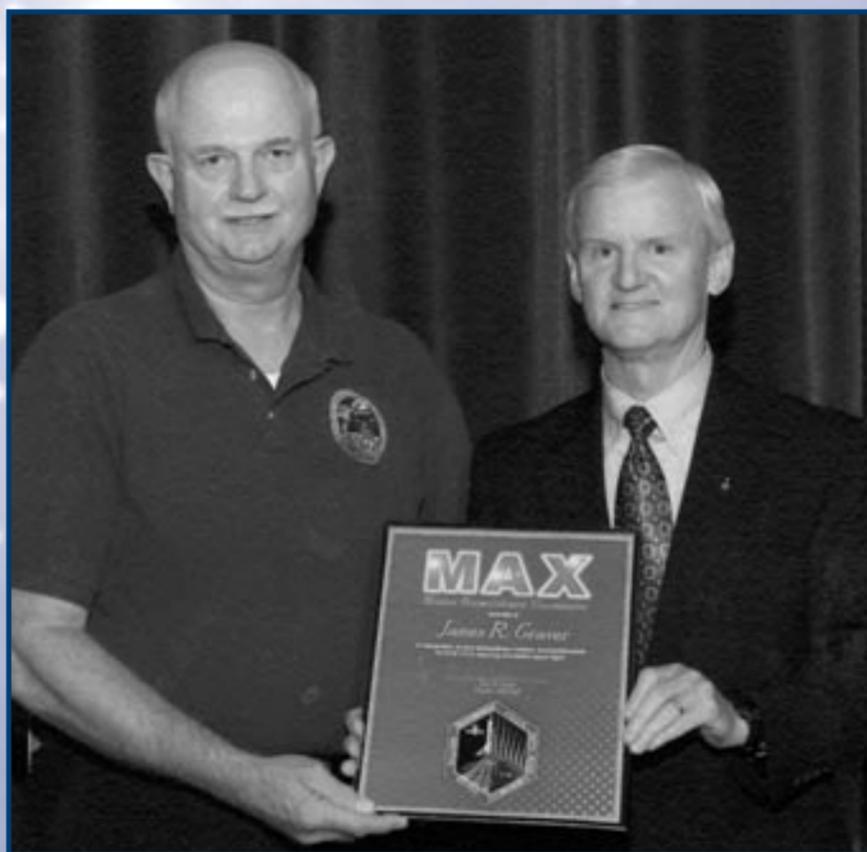
When Graver isn't taking care of rocket engines on the space shuttle, he spends time with his wife Mary Ann, three daughters and six grandchildren.

"Jim's extensive aerospace experience gives him the outstanding ability to identify problems in critical items, processes and tests by asking the right questions when something doesn't seem right to him," said Richard Cummings, JSC/Washington Group International Manager.

Joseph Fries, NASA WSTF Manager, said, "Jim is an outstanding employee who is being recognized for his contributions to the Space Shuttle Program. I am proud of the work that he has done over the years."

Graver believes the key to his success has been simply sticking to the basics. "It takes a lot of dedication to really learn a job," he said. "Concentrate on your job and be the best at what you do. Take the opportunity to learn and, when you learn something

new, share it with your coworkers. I enjoy passing on my knowledge to them." ♦



NASA JSC 2002e 48096

James Graver, left, accepts his Mission Accomplished Xtraordinaire (MAX) award from John Casper, former Director of Safety, Reliability & Quality Assurance.

Remote Field Site Test

By Kendra Ceule

The quiet Arizona desert recently attracted some space invaders. Unusual beings in spacesuits and robots roamed around, and strange lights were seen glowing in the area.

No need to call the *Enquirer* – this was all part of the Remote Field Site Test, a series of tests conducted by JSC spacesuit and robotics engineers. September's test marked the fifth time that JSC technologies were brought to the desert for field testing. The terrain provides a good testing ground for technology designed for use on Mars. Past tests have been held in Death Valley and Silver Lake, Calif.; this is the third such test in Flagstaff, Ariz.

Among the equipment tested were the MK III spacesuit and the EVA Robotic Assistant (ERA). The MK III is an advanced demonstration suit being used to develop elements for future suits. The ERA, as its full name implies, could someday assist astronauts on spacewalks. Both the suit (worn by a test subject) and the robot practiced tasks such as navigating rough terrain and hills and positioning geophones – small devices used to capture seismic data. The suited subject also interacted with the ERA using voice-activated commands.

And what about those strange lights? The cause was a new helmet lighting system, also being tried out. The test crew waited until nightfall to test the Light Emitting Diode system, which passed with flying colors. The suited test subject was able to complete a circuit around a predetermined path using only the new helmet light for guidance. Several other vehicles, devices and communication systems were also given a day in the sun during the 10-day field test.

It takes many people to put together a marathon test session for some of the most groundbreaking technology in the world. Heading up the effort was Joe Kosmo, Senior Project Engineer for JSC's Crew and Thermal Systems Division. Kosmo was joined by scores of other employees from dozens of organizations – from NASA Centers to universities to technology companies.

Will the space invaders ever land in Arizona again? Possibly. Kosmo said there are tentative plans in place to have another field test next year, possibly involving a lunar rover test vehicle that was used to train Apollo astronauts to drive the real lunar rover. ❖

All Photos by Robert Markowitz

- A. A suited test subject deploys geophones, which are used to collect seismic data. This was one of the many tasks attempted by suited subjects during the field test.
- B. SAIC's Dr. Dean Eppler dons the MK III suit in preparation for his test activities. Assisting him are JSC employees (L-R) Jose Ribas, Suit Technician; Amy Ross, Test Conductor; and Joe Kosmo, Test Director.
- C. The ERA robot is given its chance to deploy and retrieve geophones. Pictured with the robot are Joe Kosmo, Test Director; Kevin Groneman, Test Subject; and Jeff Graham, ERA Test Conductor.

D. The ERA robot practices responding to voice-activated commands. Here, it was told to hand a rock to the suited subject.

E. A test subject in the MK III suit traverses the desert near Flagstaff, Ariz., accompanied by the ERA robot.

Background photo: A suited subject in the MK III suit conducts a practice extravehicular activity in the desert. The rough terrain is used to simulate an alien landscape. NASA JSC 2002e38058



NASA JSC 2002e38795



NASA JSC 2002e38762



NASA JSC 2002e40504



NASA JSC 2002e38914



NASA JSC 2002e38760

From the sea to the stars: The NEEMO Project

Barracudas, their prehistoric, menacing teeth glinting in the Atlantic-filtered sunlight, circle beneath a 40-foot-wide yellow life-support buoy. Above them, four divers don their wet suits and air tanks on the deck of a small boat bobbing in the waves off the coast of Key Largo, Fla. The divers splash into the water one by one, then begin a descent of about 60 feet to their home for the next week – the undersea laboratory known as Aquarius.

The divers are not oceanographers but rather Johnson Space Center members of the NASA Extreme Environment Mission Operations (NEEMO) team. They are about to become “aquanauts” and use the laboratory owned by NASA’s sister agency, the National Oceanographic and Atmospheric Administration, to simulate life on the International Space Station.

“Living underwater is the closest parallel to living in space in that they are both extreme environments,” said NEEMO Project Lead Bill Todd.

Todd is a United Space Alliance space shuttle simulation supervisor veteran of 17 years and a member of the first NEEMO aquanaut crew in 2001. He believes strongly in the potential benefits of the project.

“The time frame for missions involves long periods of time away from normal environments and families,” he said. “Communication with others is not always immediate. Because of the fact that in both environments one cannot readily come home, repairs or replacements must be able to be made on the spot, if necessary.”

The NEEMO missions are a cooperative project of NASA, NOAA, the National Undersea Research Center (NURC) and the University of North Carolina at Wilmington (UNCW). The missions utilize Aquarius, the only undersea research laboratory in the world, which is owned by NOAA and managed by UNCW.

The 45-foot-long, 13-foot-diameter laboratory is situated next to deep coral reefs about three miles off Key Largo in the Florida Keys National Marine Sanctuary. Aquarius provides life support systems that allow scientists to live and work in reasonably comfortable quarters.

‘It was a real mission’

Although the aquanauts are only 60 feet underwater, that depth effectively isolates them from the surface. After their mission, Aquarius residents must undergo a deliberate 15-hour decompression process in which their bodies reacclimate to the lower atmospheric pressure on the surface. Without this readjustment period, nitrogen bubbles from their bloodstream could collect in their joints and cause a very painful and life-threatening condition known as “the bends.”

This degree of isolation makes NEEMO training different from other types of training available at JSC.

“Aquarius wasn’t a simulation,” said Astronaut Scott Kelly, who commanded the last NEEMO mission of 2002, and who also piloted STS-103 in 1999. “It was a real mission designed to train us for certain aspects of spaceflight with an extra element of realism you would never get in a simulation. There were real risks involved.”

Living arrangements add another degree of realism to a NEEMO mission. “Living in very confined quarters adds dynamics between individuals and makes it similar to spaceflight,” Kelly said. “The best part is the people you work with; the worst part is being away from your home and family – just like flying in space.”

The training provided by a NEEMO mission can be so beneficial to astronauts that NEEMO may soon be considered “graduate-level” training and leadership experience for first-time astronauts and commanders.

Support from the ground

Four separate crews of aquanauts made their way to Aquarius this year and last year for a combined total of 29 days of life and work inside and outside the undersea lab. As with spaceflight missions, the crews required support from a team on solid ground.

A small core NASA surface support team – Project Lead Todd, Mission Leads Monika Schultz and Marc Reagan, Operations Planner Michelle Lucas and Medical Officer Dan Fitzpatrick – worked out of a NURC-provided condo on the Key Largo marina. The condo provided bunk space for crews and support team members and was next door to the research center’s logistics and communications facility – essentially its Mission Control.

To speak with crews in Aquarius, support team members would go next door and use “undersea to ground” communications loops and wireless data channels similar to those that connect Mission Control to the space shuttle and station. Additional support teams from the Astronaut Office and Space and Life Sciences Directorate gave support as needed.

Similarities to space missions spill into scientific research and educational outreach. NASA’s NEEMO crewmembers conducted human physiology research, remote medicine, and human factors and habitability studies and worked with oceanographic researchers to collect data on the state of coral reefs in the area.

They also practiced space-walking techniques using tools and tethers similar to those used on orbit. And they helped reach out to students through interactive distance learning events, cooperative efforts of JSC’s Distance Learning Outpost and NASA Ames Research Center’s Quest Web project. Aquanauts even answered news reporters’ questions as an analog to interviews and news conferences routinely conducted on spaceflights.

Future missions in the planning stage also are expected to expand participation of

JSC’s Exploration Planning and Operations Center control room, simulating the interactions between astronauts and control rooms.

“We’ve learned in the past year what we really can get out of this facility,” said Schultz, who is the expeditionary training manager in the Astronaut Office, “and we’ve learned it really is the best analog for a true mission.” ❖

To learn more about NEEMO and view the NEEMO 4 Distance Learning Outpost event, visit <http://quest.arc.nasa.gov/projects/space/aquarius/2002/index.html>.



NASA JSC 200236934

A NEEMO mission takes lots of teamwork. The team pictured here is (L-R): Astronaut Scott Kelly, Space Station Support Scientist Jessica Meir, instructor Paul Masaki, Flight Director Paul Hill, Astronaut Rex J. Walheim and instructor Mark Hulsbeck. Kelly, Meir, Hill and Walheim were the crewmembers of NEEMO 4.



NASA JSC 200236931

A sea turtle explores the sea floor near the Aquarius Underwater Research Facility off the coast of Key Largo, Fla.

The NEEMO Missions

NEEMO 1

When: Six days, October 2001

Who: Project Lead Bill Todd and Astronauts Mike Lopez-Alegria, Mike Gernhardt and Dave Williams

NEEMO 2

When: Nine days, May 2002

Who: Astronauts Mike Fincke, Dan Tani and Suni Williams, and NASA Station Training Lead and Surface Support Team Lead Marc Reagan

NEEMO 3

When: Nine days, July 2002

Who: Astronauts Jeff Williams, Danny Olivas and Greg Chamitoff, and Human Systems Engineer Jonathon Dory

NEEMO 4

When: Five days, September 2002

Who: Astronauts Rex Walheim and Scott Kelly, Space Station Support Scientist Jessica Meir and NASA Flight Director Paul Hill

NASA JSC 200236932

Background image: Astronaut Rex Walheim (right) and Space Station Support Scientist Jessica Meir (center) follow the lead of an instructor as they team to inflate a surface signal device during an underwater exercise.

Cooperative Education Students take NASA to the classroom

By Julie Burt

With the help of JSC Cooperative Education Students (co-ops), Humble High School students saw the past and the future of NASA last month.

The co-ops shared Apollo-era space relics with the students and they also shared stories of their JSC work experience. Although they are college students, co-ops still contribute in significant ways that benefit the future of the space program.

As the co-ops spoke, the word “pyrotechnics” brought a gleam to the eye of several students. Also, many young women sat in awe of the female NASA employees, who talked about their work on the Cyclogometer on the International Space Station or their efforts to help design space suits that astronauts may use on future missions.

This event was part of the High School Outreach Program, which is orchestrated each spring and fall by the co-ops at JSC. The co-ops meet during their free time to plan and prepare for the outreach activities.



NASA JSC 2002e47188 Photo by David DeHoyos

“I volunteered for this activity because, even though Houston’s nickname is ‘Space City,’ so few people in Houston know of the opportunities at Johnson Space Center,” said Alicia Baker, a co-op in the Fund Management Division, Resources and Fund Control Group.

“I graduated from a high school 50 miles from JSC,” she said, “and I never knew I could work or research here. I want to make sure other Houston area high school students know.”

All of the high school students had the opportunity to look at and touch some of the space helmets from the Apollo era. They were then challenged to pick up a quarter off their desks using an EVA glove. They saw some of the space food that the astronauts eat, and a few were able to try on an astronaut space suit.

For more information on the co-op program, go to: <http://coop.jsc.nasa.gov>

“We all dream about one day going back to the Moon or onwards to Mars; outreach provides us the opportunity to share our ambitions and enthusiasm for space with the community, getting the spirit of exploration revived.

– Jayleen Guttromson, an Aeronautical and Astronautical Engineering major at Purdue University who works in the Crew and Thermal Systems Division

“The High School Outreach program brings the co-ops together and helps us appreciate the potential we have as college students to make an impact on someone who is exactly where we were a few years ago.

– Kelly Halacka, a senior at Case Western Reserve University who works in the Biomedical Systems Division

University of Houston co-op leads recruiting effort

Reynaldo Guerra, a senior in Mechanical Engineering at the University of Houston, goes beyond the call of duty to help students like him.

Guerra arranges and leads tours of Johnson Space Center each fall for students from his university who are interested in the co-op program. He started the tours in 1999. They have developed into what Co-op Program Manager Bob Musgrove calls the recruiting effort for University of Houston students.

So what made Guerra, the first in his family to attend college and a student very involved with both classes and extracurricular activities, begin this crusade to bring University of Houston students to see JSC?

“I was frustrated because I was the only engineering co-op from the University of Houston,” he said. “There are some extraordinary minds at the University of Houston. I felt NASA and UH were mutually missing out on some valuable opportunities. I was, and still am, frustrated with the level of interest in the space program, especially here in the Houston area.”

Guerra said he hopes that his work will help remind locals of the treasure in their neighborhood. “Maybe because NASA is in Houston’s back yard Houstonians are immune to the truly amazing work that we do here,” he said. “I see the tours as an opportunity to open the eyes of Houstonians, 40 pair at a time. Hey, every little bit helps!”

Thanks to Guerra’s efforts, three engineering students have been hired by JSC. One of them even led the University of Houston tour of JSC one semester while Guerra was back at school. ❖

Read more about Guerra at
<http://coop.jsc.nasa.gov/biography/bios/guerrar.htm>

Above:
A Humble High School student tries on a helmet during the co-ops’ visit.
Right: Another HHS student tries on a glove.



NASA JSC 2002e47176 Photo by David DeHoyos



Reynaldo Guerra, right, leads a tour of Building 9 for University of Houston students.

NASA JSC 2002e47336 Photo by James Blair

On the beat

By Kendra Ceule

Photos by Bill Stafford

JSC SECURITY BIKE PATROL

For the past couple of months, JSC employees may have noticed security guards riding around the Center on bicycles. They are part of the new JSC Bike Patrol, which is the newest of JSC Security's efforts to keep employees safe.

Although the patrol is new – it was launched on Oct. 13 – its worth is already being established. One bike patroller was able to help save a life on site, largely because he was on a bike instead of in a car.

"I was a long way away from where a car could have gotten to it," said Officer Robert Smith, who arrived at the scene in time to revive the individual with CPR and an AED device. "We were actually able to save her life, so I was real pleased with that."

The bike patrol also benefits Center employees in less dramatic ways. Other functions of the patrol include traffic monitoring and responding to incidents around the Center.

One reason the patrol was established, said Chief Rick Hewitt, was so that security officers would be able to better interact with employees.

"The officers are able to be more active in the community," said Hewitt, "and they seem more approachable than officers in cars might."

Currently, the patrol employs two full-time and two part-time officers. Smith encourages employees to get to know the bike patrollers.

"Don't be afraid to stop us and ask questions," he said. "That's what we're there for."

Thanks to the recent addition of a bike patrol to JSC Security, guards on bicycles can now be seen patrolling the campus. JSC Bike Patrollers Fred Taylor, left, and Robert Smith make the rounds at the Center. Bike patrollers perform many of the same jobs that security officers in cars do, such as traffic duties, parking-lot monitoring, badge checking and responding to incidents around JSC.

NASA JSC 2002e44099



NASA JSC 2002e44103

Smith discusses safety issues with IMPASS Safety and Quality Assurance Manager Carl Matthews.



NASA JSC 2002e 44108

Taylor, left, and Smith bike through JSC on their daily rounds.

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For distribution questions or to suggest a story idea, please call (281) 244-6397 or send an e-mail to roundup@ems.jsc.nasa.gov.

Editor Kendra Ceule
Senior Editor Melissa Davis

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