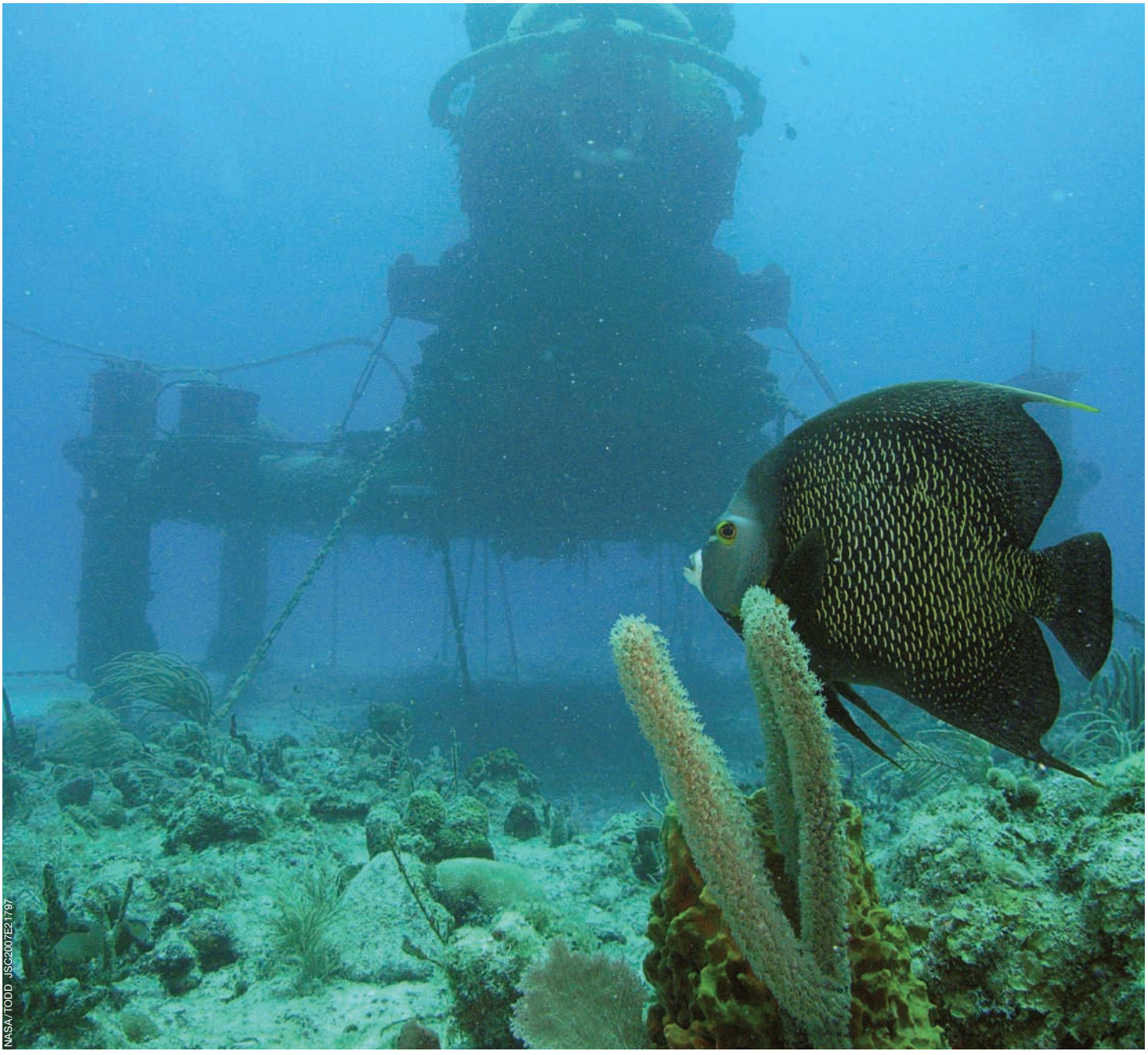
National Aeronautics and Space Administration

Lyndon B. Johnson Space Center

roundup



NASA/TODD JSC2007E21797

Exploring the ocean depths

SEPTEMBER 2007 ■ volume 46 ■ number 9

JSCdirector

As a result of the tragic events of the past seven months, we have been asked to provide interviews and statements in support of numerous investigations and lessons-learned activities.

I have heard complaints from quite a few of those interviewed that they were misquoted, their comments taken out of context and misinterpreted, or were promised confidentiality only to have statements released publicly.

It is not my intent to discourage any employee from speaking up or speaking out, and yet I feel I have to address the concerns you have expressed to me.

Let me make the following points:
—With the exception of the few classified subjects we deal with, everyone should feel completely free to speak to anyone they desire. Since the *Columbia* tragedy, we have done everything we can think of to encourage all our employees to speak up and speak out whenever they have a concern. As space professionals, we each have a responsibility to seek out and respect dissenting and alternate opinions. We are all proud of our space program and should be proud to talk about it.
—When you talk to interviewers, investigators, reporters, etc., you have a responsibility to stick to the facts. Personal opinions, guesses and speculations often will be reported as fact.
—One thing we've all learned over the last several months is that confidentiality can very rarely be guaranteed, despite what the best-intentioned investigator or interviewer may promise. The best advice I can offer is to assume anything you say may quite possibly turn up on the front page of the newspapers.

We have had an unprecedented series of distractions this year, and I would like to express my appreciation for the way everyone is dealing with them. Our priority is to operate the space shuttle and International Space Station safely and get the Constellation Program off to a solid beginning, and this team of space professionals is performing beautifully.

You have my respect and appreciation for the dedication you bring to the job every single day. The work we do here is important to the nation and to our future, and you should take pride in your achievements.

Mike

On the cover

The undersea habitat "Aquarius" is featured in this image photographed by a NEEMO 12 crew member during a training session for the NASA Extreme Environment Mission Operations (NEEMO) project.

July 21, 2007

To my NASA family,

It is hard to believe that yesterday marked the three-month anniversary of David's tragic death. I have to share with you that I have been a bit overwhelmed at times (as I think some of you have been, as well). Invariably, at a low point, someone in the NASA family sends a note, gives me a call or stops by the house just to stay in touch. I know your prayers and thoughts also continue to lift me up.

There are a lot of things that I haven't gotten on top of yet, including thanking you for being so kind and thoughtful from that fateful day through today. Donations in David's memory, flowers, cards and letters, calls, food and other gifts have been so generous, and I thank you for all that you have done, both individually and agency-wide. Your outpouring of care and compassion is astounding and deeply appreciated.

I can't even begin to describe what the NASA family has meant to me during the past three months. I feel enveloped in love and support and will always be grateful that you have taken me into your hearts.

Warmly,

Linda Beverly

NASA S118E09771

Space Shuttle *Endeavour* crew returns home after successful mission

by Joanne Fontenot

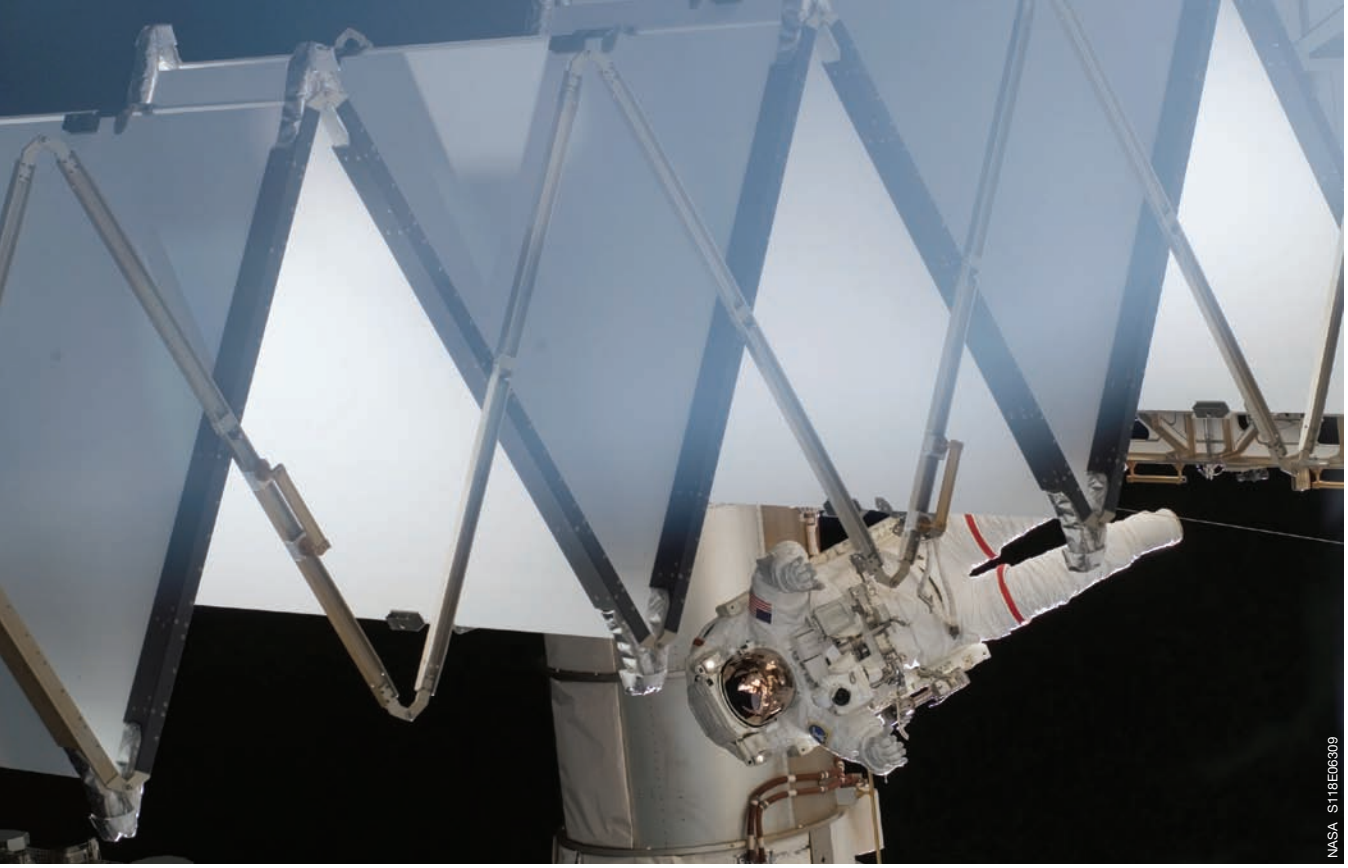
The Space Shuttle *Endeavour* and its crew are home after completing a 13-day journey of more than 5.2 million miles in space. *Endeavour's* STS-118 mission successfully added another truss segment, a new gyroscope and external spare parts platform to the International Space Station.

Endeavour's Commander Scott Kelly, Pilot Charlie Hobaugh and Mission Specialists Tracy Caldwell, Rick Mastracchio, Barbara R. Morgan, Alvin Drew and Canadian Space Agency astronaut Dave Williams landed at NASA's Kennedy Space Center in Florida on Tuesday, Aug. 21, at 11:32 a.m. CDT.

Williams, Mastracchio and station Flight Engineer Clayton Anderson, with the help of their crewmates, made four spacewalks to accomplish the construction tasks. The spacewalkers also completed work in preparation for upcoming assembly missions, including the relocation of an equipment cart and the installation of support equipment and communication upgrades.

During the mission, a new system that enables docked shuttles to draw electrical power from the station to extend visits to the outpost was activated successfully.

NASA S118E06993



Astronauts Rick Mastracchio and Canadian Space Agency's Dave Williams (out of frame), both STS-118 mission specialists, participate in the mission's first spacesalk. During the six-hour, 17-minute spacewalk, Mastracchio and Williams attached the Starboard 5 segment of the station's truss, retracted the forward heat-rejecting radiator from the station's Port 6 truss and performed several get-ahead tasks.

Because the system worked, two additional days were added to *Endeavour's* mission.

STS-118 was the 119th space shuttle flight, the 22nd flight to the station, the 20th flight for *Endeavour* and the second of four missions planned for 2007.

Although managers addressed several issues with *Endeavour's* heat shield, including a small gouge in the protective tile on the orbiter's belly, inspections in orbit revealed no critical damage. *Endeavour's* Thermal Protection System was declared safe for reentry on Monday, Aug. 20. The orbiter will be processed immediately for its next flight, targeted for February 2008.

With *Endeavour* and its crew safely home, the stage is set for the next phase of International Space Station assembly. Preparations continue for Space Shuttle *Discovery's* scheduled launch in October of the STS-120 mission, which will deliver the pressurized Node 2 connecting module to the station.

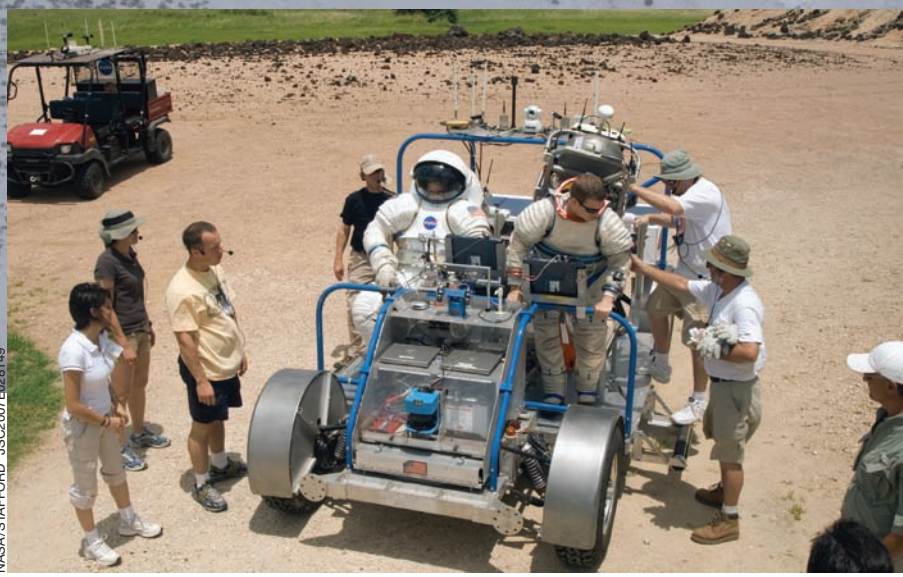
For more on the STS-118 mission and the upcoming STS-120 mission, visit: *http://www.nasa.gov/shuttle.*

Endeavour *landed at Kennedy Space Center on Tuesday, Aug. 21 at 11:32 CDT*

While anchored to the foot restraint on the Canadarm2, astronaut Dave Williams, STS-118 mission specialist representing the Canadian Space Agency, participates in the mission's second spacewalk as construction and maintenance continue on the space station. During the six-hour, 28-minute spacewalk, Williams and astronaut Rick Mastracchio (out of frame), mission specialist, removed a faulty control moment gyroscope (CMG-3) and installed a new CMG into the station's Z1 truss. The failed CMG will remain at its temporary stowage location on the station's exterior until it is returned to Earth on a later shuttle mission. The new gyroscope is one of four CMGs that are used to control the station's attitude in orbit.

Not your average

by Catherine E. Borsché



NASA/STAFFORD_JSC2007E28149

Many adults can fondly recall memories of trekking in their playground sandbox, wielding little plastic warriors through the muck and mire to complete their make-believe, glory-filled missions. Johnson Space Center has its own "sandbox," on a much grander scale, in the form of the Lunar Crater Project—a simulated lunar landscape located on site.

"The Lunar Crater Project is an expansion phase of the current NASA JSC Extravehicular Activity (EVA) remote-field demonstration test site, originally constructed to enable engineers and scientists (to work) on developing planetary exploration prototype spacesuits, life-support systems, EVA ancillary-support hardware tools, robotic systems and scientific equipment," said Joe Kosmo, senior project engineer in EVA.

The lunar test bed will also be used to develop technical requirements and mission operation scenarios used in the planning phases for the further exploration of our solar system.

The lunar-simulated landscape is representative of planetary surface terrain, "coupled with the strewn rock surface area and large hill structure with various slopes and grades, which had been previously developed to represent more of a Martian environment," Kosmo said. "The Lunar Crater Project incorporates three large crater structures, and that adds another degree of planetary surface reality."

The revamped landscape fills a greater purpose with NASA's cosmic goals.

"We have a unique need," said Amy Ross, Pressure Garment Subsystem lead for the Constellation Spacesuit Project. "Not many people need to practice walking on the moon or Mars. There are places in the world that are good emulations of otherworldly landscapes, but my manager frowns at travel requests to Iceland, Hawaii, Chile and Antarctica."

The simulated landscape at JSC is perfect for exploration-hardware development, training and conducting dry-run activities for projects such as Desert Research and Technology Studies (RATS).

"This practice arena is unique to NASA because it provides the terrain features that could be encountered on the moon or Mars in a local, easy-to-access test location," Barbara Romig, Desert RATS coordinator and spacesuit engineer, said. "Some of the terrain features include strewn rock and volcanic-ash fields, meteor-crater ejecta blanket, lunar craters, undulating hills, plains, gullies, slopes, outcrops and more. Engineers and scientists are able to learn (about) the effects of field conditions (such as) dust, wind, sun, humidity, light levels and repeated use on their hardware before exposing the hardware to the rigors of remote-field testing."

Desert RATS practice tests are routinely conducted in the landscape.

"These dry runs prepare the Desert RATS team for the terrain that we encounter on a much larger scale at remote-field test locations such as Cinder Lake or Meteor Crater in Arizona," Romig said.

In other words, the practice activities conducted at JSC are the run-throughs…before the bigger tests…before the real deal in other worlds beyond our blue marble.

"Those are all elements of the integrated testing. We have the life support systems, the backpacks, the spacesuits and all the various ancillary-support hardware, like mobility aids, specific tools, roving vehicles and robotic systems," Kosmo said. "There's going to be interaction between robotic systems and the human

playground

The lunar simulated landscape, located on site at JSC, features a realistic planetary terrain that is perfect for testing future exploration equipment such as the Science Crew Operations and Utility Testbed (SCOUT) vehicle and new spacesuit hardware.

Suit test subject Brian Daniel demonstrates a technique for planetary dust mitigation using a vacuum system in a representative minimum volume airlock mockup. This exercise is in support of Desert RATS field test activities.

NASA/STAFFORD JSC2007E043352

NASA/MARKOWITZ & GEESEMAN JSC2006E47777

and whatever scientific equipment is going to be necessary for doing the exploration activities. Coupled with that, you've got to evolve it into some sort of operational procedure.

"So you get the mixed bag of everything, and you have the opportunity to access and evaluate the various technologies and the concepts behind doing all these activities to see if indeed it functions properly. It's more of a reality check, and from that you can derive the specific requirements that you need," Kosmo said.

The landscape is used throughout the year and can be used on a weekly, even monthly basis for those wanting to participate in Desert RATS activities or test equipment in the distinctive environment. Other centers, such as the Jet Propulsion Laboratory, have used the landscape to test space vehicles on the large hill.

Ross indicated that the landscape has already proven beneficial to the Constellation Program. "I have already utilized the lunarscape in the development of requirements for Constellation spacesuits. It is extremely helpful in getting my team thinking about walking on the moon, to imagine that we are there and to think about what features the spacesuits should have."

The idea for the additional lunar landscape was conceived in 1997.

At the time, there were "really no firm exploratory plans for planetary surface operations, although people talked about going to Mars. But with the shift toward exploring the lunar surface first before we go to Mars, we needed some representative surface so we could do testing here, and that's when we started developing the lunar site," Kosmo said.

While future exploratory missions cannot be practiced primarily in outer space, NASA has created many types of environments to get the job done.

"You can have a laboratory environment, where you're simulating vacuum and thermal conditions, or you could have one in a virtual reality sense, where you're simulating some sort of planet," Kosmo said. "Ours is a physical terrain feature that represents what we believe is a planetary surface environment, be it the moon or Mars."

And with planetary surfaces being hard to come by without jumping into a spaceship, JSC has produced the next-best thing to aid in exploring the cosmos.

NASA/STAFFORD JSC2007E028112

Wearing spacesuits, Brian Daniel (shown) and Dustin Gohmert (partial view) drive the SCOUT vehicle during a recent dry-run in support of Desert RATS.

NEEMO 13

by Joanne Fontenot and Kathy Major

NASA/TODD JSC2007E041597

NEEMO 13 crew members from left are Constellation Program Aerospace Engineer/aquanaut Christopher Gerty, astronaut/aquanauts Richard R. Arnold II, Nicholas J. M. Patrick (commander) and Japan Aerospace Exploration Agency's Satoshi Furukawa. Habitat technicians Jim Buckley and Dewey Smith can be seen through the port in the background. The crew spent 10 days, Aug. 6-15, on an undersea mission aboard the National Oceanic and Atmospheric Administration's Aquarius Underwater Laboratory.

Three astronauts and a Constellation Program aerospace engineer began a 10-day NASA mission in the ocean depths off the Florida coast on Aug. 6 as part of NASA's Extreme Environment Mission Operations (NEEMO) 13.

During the mission, the crew conducted a variety of undersea "moonwalks" to test concepts for future lunar exploration using advanced navigation and communication equipment from their home base aboard the National Oceanic and Atmospheric Administration (NOAA) Aquarius Underwater Laboratory.

Similar in size to the International Space Station's living quarters, Aquarius is the world's only permanent underwater habitat and laboratory. The 45-foot-long, 13-foot-diameter complex is located three miles off Key Largo in the Florida Keys National Marine Sanctuary, about 62 feet beneath the surface. A buoy provides connections for power, life support and communications, and a shore-based control center monitors the habitat and crew.

The NEEMO project sends groups of NASA employees and contractors to live in Aquarius for up to three weeks at a time. For NASA, Aquarius provides a convincing analog to space exploration, and NEEMO crew members experience some of the same tasks and challenges underwater as they would in space.

Veteran space flyer and aquanaut Nicholas Patrick led the undersea mission. NASA astronaut Richard Arnold, Japan Aerospace Exploration Agency astronaut Satoshi Furukawa and Systems Integration Engineer Christopher Gerty completed the crew.

"This crew will work much more independently from the mission control team than on previous missions," said NEEMO Project Manager Bill Todd of United Space Alliance at Johnson Space Center.

NASA Extreme Environment Mission Operations (NEEMO) 13 crew members take a moment to pose for a crew photo during preparations for their stay inside their undersea habitat. Astronaut/aquanaut Nicholas J. M. Patrick (right) leads the crew for the 13th NEEMO mission. Constellation Program Aerospace Engineer/aquanaut Christopher Gerty (second right), astronaut/aquanaut Richard R. Arnold II and Japan Aerospace Exploration Agency's astronaut/aquanaut Satoshi Furukawa round out the crew.

"This autonomous mode of operation will encourage the crew to make real-time decisions about daily operations similar to what we think will be necessary for lunar and Mars missions. The idea is to show how procedures and training for future missions can be adapted, considering the reduced direct communication with Mission Control those crews will encounter."

During extended undersea-simulated moonwalks, the crew constructed a communications tower, practiced techniques for lunar sample collection and manipulation and performed a series of tasks investigating future spacesuit design. The crew participated in research designed to answer questions on the physiology and human behavioral aspects of living in extreme environments.

David F. Dinges, Ph.D., a professor in psychiatry at University of Pennsylvania School of Medicine, is team leader of the National Space Biomedical Research Institute's (NSBRI) Neurobehavioral and Psychosocial Factors Team portion of the NEEMO projects. Dinges and his colleagues are gathering data from NEEMO 13 that will help develop tools to assess stress, fatigue and cognitive fitness in preparation for performing critical mission tasks.

"The NEEMO environment is similar to lunar and other exploration missions in many respects," said Dinges. "There is isolation, confinement to a small habitat and work area, the need to work together as a team, Extravehicular Activities and no immediate rescue in the event of an emergency."

The project uses several methods to gather the necessary data.

"The crew takes a three-minute test that measures vigilance, attention and psychomotor speed. We've learned from laboratory experiments that the test is sensitive to fatigue and other factors that impact a person's ability to pay attention to a task and respond quickly," Dinges said. "The test is taken at least four times a day – on waking, before and after simulated moonwalks, dives and habitat experiments and before bed."

The Psychomotor Vigilance Test, or PVT, was developed through Dinges' work with NSBRI, NASA, the Department of Defense and the National Institutes of Health. The user watches for a signal and responds when it appears, allowing the measurement of reaction times.

The crew also wears a wristwatch-sized device, called an Actiwatch®, that measures the sleep and wake cycle. The aquanauts provide saliva at various times each day, including when they awake, before and after performing experiments and simulated moonwalks and before going to bed.

"With the saliva samples we measure cortisol, a hormone that provides information on their stress levels," Dinges said. "Cortisol is normally high in the morning; it's a means of getting you going each day. If we see elevated cortisol after performing a high-level task, it would indicate some type of stress occurred during the activity."

continued on page 10

Astronaut/aquanaut Nicholas J. M. Patrick (commander) descends in SL17 during training.

NEEMO 13 team

The crew fills out brief questionnaires about how hard they are working so researchers can get a sense of their physical and mental workload. Another questionnaire focuses on mood and interpersonal interactions between the crew as well as with Mission Control personnel.

"Day in and day out, long-duration astronauts are never out of the work environment. With the type of complex, high-performance demands of the job, it will be helpful for individuals to quickly assess how they are doing relative to fatigue and stress," Dinges said. "The test would give immediate feedback and solutions, if needed, to counter whatever is affecting performance. That might be to get some sleep, take motion sickness medicine or any number of things."

Jim Buckley and Dewey Smith of the University of North Carolina at Wilmington provided engineering support for the submerged habitat. The university operates Aquarius on behalf of NOAA as part of NOAA's Undersea Research Program. The NEEMO missions are a cooperative project among NASA, NOAA and the university.

Aquarius was built in Victoria, Texas, in 1986. Originally, it was deployed in the U.S. Virgin Islands but was later moved to its current location in the Florida Keys. The laboratory has hosted more than 200 scientists representing more than 90 organizations, including NASA and universities from the United States and several foreign countries. Aquarius scientists work to understand the changing ocean and the condition of coral reefs, which are threatened locally, regionally and globally by increasing amounts of pollution, over-harvesting of fisheries, disease and climate change.

Read more about NEEMO missions at *http://www.nasa.gov/mission_pages/NEEMO.*

Astronaut/aquanauts Nicholas J. M. Patrick (left) and Japan Aerospace Exploration Agency's Satoshi Furukawa participate in an undersea training session for the 13th NEEMO mission.

Grand opening for restored Saturn V rocket

by Debbie Sharp

The impressive Saturn V rocket was instrumental in getting the Apollo program off the ground.

Johnson Space Center hosted the grand opening of a restored Houston landmark and national treasure, the immense Saturn V rocket, on July 20, 38 years to the day after humans first walked on the moon.

The 30-story-tall rocket, which rests on its side at the space center gate, is part of the Smithsonian National Air and Space Museum collection and one of only three such rockets in existence.

Speakers at the ribbon-cutting ceremony included astronauts and moonwalkers John Young and Alan Bean, as well as astronauts Walt Cunningham, who flew on the Apollo 7 flight in Earth orbit, and Joe Kerwin, who flew in an Apollo spacecraft to the Skylab space station. Apollo-era Flight Director Chris Kraft, Curator of the Apollo collection at the National Air and Space Museum, Allen Needell, and JSC Director Mike Coats also participated.

Kraft said the anniversary brings back a number of memories.

"Each time this date rolls around, the landing of men on the moon seems to become more surreal," Kraft said. "At the time, it seemed the start of a fantastic voyage to the stars."

The Saturn V is one of the largest and most significant artifacts in the Smithsonian's National Air and Space Museum collection. It has been on loan to JSC since 1977. The rocket is made up of parts from launch vehicles originally designated for Apollo 18 and 20.

Many NASA celebrities from the Apollo era were in attendance at the Saturn V ribbon-cutting ceremony.

The Saturn V remains the most powerful rocket ever built, and it was launched 13 times from 1967 to 1973, carrying 27 Apollo astronauts into space. Eight of the missions it launched traveled to the moon, and six landed there. The final Saturn V launch in 1973 put Skylab, America's first space station, in orbit.

"I have to say there was genius behind the design of this thing," said Bean. "Behind the hardware were thousands of men and women that were able to imagine this vehicle to begin with, and they were able to design and manufacture it."

The Saturn V at JSC had been exposed to the elements for more than 20 years while on display. The exposure had caused extensive corrosion and degradation.

"It was in poor condition and getting much worse," said Needell. "It was to the point where if we didn't intervene now, future attempts to save it would require replacing a lot of the original materials. We wanted to save as much of the original material as possible."

In order to save the Saturn V, the National Air and Space Museum applied for a grant in 1999 to preserve the rocket through the Save America's Treasures Program, the centerpiece of the White House National Millennium Commemoration. For the preservation, the museum received funds from Boeing, Lockheed Martin, Houston Endowment, Halliburton and other sources. Matching funds were provided by the National Park Service. The preservation work was performed by Conservation Solutions, Inc. of Washington, D.C.

The goal was to return the rocket to a condition matching as closely as possible the way it would have appeared on the launch pad. The project team erected a climate-controlled building to house the rocket, designed and executed a testing program to evaluate the effectiveness of cleaning and repair treatments, developed a data management system for recording and retrieving information gathered and stabilized and conserved the Saturn V to arrest its deterioration and make it suitable for display. The restoration ensures the Saturn V will remain on exhibit to inform and inspire many generations of visitors to come.

The facility is now open daily from 9 a.m. to 6 p.m.

India Fest was held at George R. Brown Convention Center on Aug. 18, celebrating India's 60th year of independence. This year's event honored Indian-American women who have made valuable contributions to Houston. Among those honored at the event was astronaut Sunita Williams, who was the flight engineer on Expedition 14. Johnson Space Center staffed an exhibit at the festival, where volunteers spoke to visitors throughout the day about NASA's vision and the future of space exploration. Williams also stopped by the exhibit for a short autograph session before leaving town for another appearance.

Astronaut Sunita Williams (bottom row, fifth from the left) was recently honored at this year's India Fest in Houston.

Astronaut Sunita Williams signs an autograph for one of her young fans.

Guests peruse the spacey literature at the exhibit booth, learning about NASA's future exploration goals.

One visitor becomes an astronaut in a matter of seconds at the JSC exhibit.

Space Center Roundup

The Roundup is an official publication of the National Aeronautics and Space Administration, Johnson Space Center, Houston, Texas, and is published by the Public Affairs Office for all Space Center employees. The Roundup office is located at 2200 Space Park Drive, Rm. 220. The mail code is AP22. Visit our Web site at: http://www.jsc.nasa.gov/roundup/online/
For distribution questions or to suggest a story idea, please call 281/244-6397 or send an e-mail to jsc-roundup@mail.nasa.gov.

Joanne Fontenot Editor
Catherine Borsché Staff Writer
Perry Jackson Graphic Designer

PRSRT STD
U.S. POSTAGE
PAID
WEBSTER, TX
Permit No. 39