National Aeronautics and Space Administration

Lyndon B. Johnson Space Center

roundup

NASA/SCHROEDER JSC2007E041794

Trick or treat?

OCTOBER 2007 ■ volume 46 ■ number 10

JSCdirector

As we approach the 50th year as a space agency, how are we doing? I'm a natural optimist when it comes to our space program, but despite the occasional criticism, I think my optimism is more than justified.

At the last monthly Strategic Management Council, NASA Administrator Mike Griffin summarized his view of the agency by saying quite simply, "NASA is doing really well." He reviewed our stated agency objectives and how we are doing:

- We operate the shuttle very well, and make the incredibly complex assembly missions look almost routine. At the same time, we work hard to ensure as smooth a transition as possible at the completion of the Space Shuttle Program.
- The International Space Station assembly is on track to be completed in 2010. We have shown our International Partners and domestic stakeholders that we can do what we say we're going to do. We are approaching the time when we can take additional science laboratories to the station and double the crew size, enabling the significant research for which the station was designed. We will translate our International Space Station partnerships into Exploration partnerships in the not-too-distant future.
- The objective of a "balanced program" within NASA is being achieved. NASA's science budget is at an all-time high, both in terms of actual dollar value and as a percentage of our overall budget. Robotic Mars missions and discoveries made by NASA's great space telescopes have captivated the public.
- The Constellation Program is off to a solid start. Contracts have been awarded for Orion, Ares first stage and upper stage, as well as the J-2X engine development. While "the gap" between shuttle and Orion is still worrisome and budget pressures are very real, we are meeting our milestones.
- The commercial partnerships are having mixed success so far, but they are showing tremendous promise for the future.
- NASA has strong bipartisan support from Congress. Both the House and Senate actually added money to the President's budget request for NASA in 2008.

All of you are working extremely well as a "space team," and I congratulate you for the tremendous job you are doing today.

It is also necessary to appreciate the importance of what you do for the future of the nation. Mike Griffin's speech on "The Space Economy" said it better than I can:

"Economic growth is driven by technological innovation. Societies that foster it lead the pack, while others lag behind. The exploration and exploitation of the space frontier is one of the factors that drives technological innovation. The half a cent of the federal budget dollar spent on NASA has resulted in today's $180 billion space economy. If America is to remain a leader in the face of burgeoning global competition, we must continue to innovate, and we must continue to innovate in space. Reaching for the unknown, making our lives bigger and our horizons broader, achieving things never before possible, are the heart and soul of what we do at NASA. By pushing beyond the frontier, by setting for ourselves seemingly impossible challenges, we are transforming our lives for the better here on Earth even as we explore new worlds in space. At NASA we are making the future happen—now."

Not bad for the first 50 years.

On the cover

DLN team members Robin Hart (far left) and Nathan Lang (far right) experience the joys of weightlessness with Doug Goforth, NASA's Reduced Gravity Student Flight Opportunites Progam Manager, aboard the C 9 aircraft.

A new spin on the Constellation Program

by Rachel C. Samples, *NASA Langley Research Center*

Joysticks are used to control all sorts of things—video games, wheelchairs, cranes, elevators and even some lawn mowers.

Instead of using a joystick for games, imagine using one to control the speed of a 20-foot-diameter fan capable of accelerating air from a rest position to 66 mph in a matter of seconds.

Then imagine that you're a NASA engineer conducting a wind tunnel test on a new spacecraft model—a test that could potentially save the lives of astronauts depends upon your skill with the joystick, because you're controlling how fast the tunnel's fan spins.

It's not all fun and games at NASA Langley's 20-foot Vertical Spin Tunnel, also known as the VST. The facility has been used in testing aircraft and spacecraft since 1941.

Today, the spin tunnel is the only operational wind tunnel of its kind in the Western Hemisphere that conducts free-spin research using dynamically scaled, free-flying models. It investigates spinning, tumbling and free-fall characteristics of aircraft and spacecraft. But it's different from most wind tunnels that you might have seen because the air in the test section flows upward rather than horizontally.

"The United States Air Force has one at the Air Force Research Lab at Wright Patterson Air Force Base in Dayton, Ohio," said Mike Fremaux, a research engineer at Langley's tunnel. "They do not do free-spin testing [there] anymore, not since the 1960s."

Fremaux explained that other research-oriented spin tunnels exist in France, Germany and Russia, and are coming soon to China. Some spin-tunnel facilities, such as a location in England, have been turned into recreational complexes for indoor skydiving.

"Although the VST is in its seventh decade of operation, it still plays a critical role in NASA research, national defense and aviation safety. The problems it was designed to deal with, like spins and other out-of-control phenomena, are still beyond reliable prediction by our best computational fluid dynamics codes," Fremaux said.

Currently, the spin tunnel is supporting NASA's Constellation Program. From the initial take-off of the Ares I launch vehicle, to the safe re-entry of the Orion Crew Exploration Vehicle into the Earth's atmosphere, the spin tunnel is involved in design testing. It's also testing the dynamic stability of the Orion Launch Abort Vehicle (LAV), the Crew Module (CM), the Orion Alternate Launch Abort System (ALAS) and the Orion Crew Module drogue parachutes.

"In the LAV, CM and ALAS tests, we have gotten a good understanding of the dynamic stability of the vehicle when it is flying tower-forward, as it will during the initial part of its fight, and heat shield-forward, which it will do just before the tower is jettisoned and the parachutes deploy," Fremaux said.

NASA/SMITH

A NASA engineer prepares to release an Orion crew vehicle scale model into the air stream in the Vertical Spin Tunnel.

Fremaux said that dynamic stability tests examine the tendency of a model or vehicle to perform unwanted motions. These tests observe whether wobbling motions decay or stabilize.

In studying the re-entry of the Orion capsule into Earth's atmosphere, the spin tunnel is testing the drogue parachutes. These chutes will deploy from the capsule to lower the speed of its descent and stabilize the vehicle prior to the main parachutes opening. The results from the tests will help guide designs to create a parachute system that will help Orion land safely.

The VST has been around for a while, but it's still an important resource for testing and evaluating aircraft and spacecraft designs.

Flight of fancy

JSC's Digital Learning Network takes to the skies in the 'Weightless Wonder'

By Catherine E. Ragin

On Aug. 9 and 10, Johnson Space Center's Digital Learning Network (DLN) got the chance to feel the effects of weightlessness—and conduct science—all in one fun trip on NASA's Reduced Gravity C-9 plane. The "Weightless Wonder" allowed the team to conduct a classic physics experiment to illustrate the effects of Earth's gravity, as well as capture images of people and objects in an unnatural, microgravity environment inside the aircraft.

The excitement the team members felt when they learned they were selected for the flight was palpable.

Nathan Lang floats with an apple in the Weightless Wonder.

"I think we found out sometime in mid May that we were going to fly, and I was so excited about it—I couldn't wait to tell my family and friends," said Robin Hart, Education Project specialist. "I ended up sending one of those awful mass e-mails to everyone else in my address book and gave them all kinds of information about the program. Probably more than they ever wanted to know!"

Nathan Lang, Education specialist, also felt a surge of anticipation at the news. "I actually found out before I officially started here at NASA that it would be a possibility to fly with the rest of the DLN crew. I had an adrenaline rush, mixed with feelings of excitement and anxiety. I also felt honored, especially being so new with the team."

Aside from the obvious rewards of getting to fly in the "Weightless Wonder," the team had a mission in mind that would benefit the Education community, teachers and students alike.

"The first objective was the experiment, the pendulum. A pendulum (demonstrates) the effects of Earth's gravity on an oscillating arm. What happens when gravity is 'turned off?' The DLN not only captured amazing footage of a pendulum under the influence of zero-G, but also recorded data to be used for our upcoming module, 'Over the Top,'" Lang said. "This module's intended audience will be NASA Explorer Schools, which will send their teachers through the Reduced Gravity Program to fly their own experiments."

The making of the pendulum experiment was a true team effort that exemplified the NASA spirit.

"We know how a pendulum behaves with Earth's gravity, and that it is gravity that allows a pendulum to work. We questioned what a pendulum would do in the absence of gravity, and we realized that building a pendulum that could work in microgravity was more difficult than any of us could have imagined," former Education Specialist Chris Stein said. "We found that you become so accustomed to gravity that it's hard to imagine how things will work when you take it away. For instance, one big question was how to start the pendulum action. In gravity, it's a simple task: pull back the string and let it go. In microgravity, however, a force is needed to propel the pendulum. In our case, we used a mousetrap. A string was attached to the bar of the mousetrap to allow us to pull it back. We release the string, and the bar strikes the pendulum, propelling it."

NASA/GOFORTH JSC2007E046269

The DLN team, which had the opportunity to expand their horizons on a Reduced Gravity C 9 flight, consisted of (from left to right): Don Caminati, TV director; Nathan Lang, Education specialist; Robin Hart, Education Project specialist; Erin McKinley, Education specialist; and Chris Stein, Education specialist.

For the team, the trip itself in the C-9 is not one they will soon forget, if ever.

"Words cannot describe the sensation of being 'weightless.' In conversations with friends and family, I tried to compare the experience to other earthbound activities, such as a roller coaster, but I would always stop myself and say, 'Well… No… All I can say is that it was amazing!'" Education Specialist Erin McKinley said.

Hart had the same feelings for the one-of-a-kind flight. "Just like everyone else would probably say, it was a totally unique, awesome experience. I was amazed at how quickly we were completing our 50 parabolas! When we were done, I said, 'We're done already? Can we do a few more?' It's one of the neatest experiences I've ever had!"

NASA's DLN, which impacts more than 23,000 students annually via interactive two-way audio and video technology, allows NASA experts to interact and communicate with students all over the world. The learning modules, or videoconference lessons, are integrated educational packages with activities designed for various age groups on different scientific and space subject matters. The JSC team's trip will serve to enhance their future interactions with students and teachers.

"Once brainstorming, hypotheses and experiment testing in Earth's gravity has been completed, students can see the results in microgravity and compare their ground-based findings," Stein said. "The DLN team also gained firsthand experience of what it is like flying on the 'Weightless Wonder.' We (had) talked about the plane and its parabolic maneuvers in our programs often, but never (before) had firsthand experience to share with the students."

"In the future, when students ask about being weightless, our team will have the knowledge to say, 'Well, let us tell you all about it!'" Hart said.

The team's wealth of knowledge reached a new level with the C-9 flight added to their repertoire.

"We can now say that we've experienced lunar, Martian and microgravity," McKinley said, "and can supplement the content that we teach with our personal experiences. Not many people can say that."

NASA/BLAIR JSC2007E042144

Erin McKinley, Education specialist, works with the pendulum experiment in midair.

STS-120 to deliver Harmony Node to the International Space Station

by Brandi Dean

A series of recent shuttle missions have added to the International Space Station's exterior with new elements for its main truss. Now, *Discovery* will take into orbit a connecting module that will increase the orbiting laboratory's interior space.

October's STS-120 mission will bring the Harmony module, christened as a result of a school contest, that will provide attachment points for European and Japanese laboratory modules. Known in technical circles as Node 2, it is similar to the six-sided Unity module that links the U.S. and Russian sections of the station.

"STS-120 is such a cool mission," said Commander Pam Melroy. "Node 2 is the expansion of the space station's capability to bring international laboratories up. It's the expansion of our capability to carry additional people.

NASA/SOWA JSC2007E08830

Astronauts Daniel M. Tani (left), Expedition 16 flight engineer; European Space Agency's (ESA) Paolo Nespoli and Scott E. Parazynski, both STS-120 mission specialists, participate in a training session in one of the full-scale trainers in the Space Vehicle Mockup Facility at Johnson Space Center. Attired in training versions of their shuttle launch and entry suit, the three are seated on the middeck for a post insertion training session.

"It has additional life support equipment that will allow us to expand out beyond a three-person crew. It's this big boost in the capability, which is really exciting," she said.
Built in Italy for the United States, Harmony is a high-tech hallway and tinker-toy like hub. It is a 23- by 14-foot passageway that will connect the U.S. segment of the station to the European and Japanese modules, to be installed later this year and early next year, respectively.

Harmony will be the first new U.S. pressurized component to be added to the station since the Quest Airlock was attached to one of Unity's six berthing ports in 2001.

"It's the gateway to the international partners," Lead Station Flight Director Derek Hassman said. "As the station is configured today, there's nowhere to put all the International Partner modules until we deliver and activate Node 2. That's the piece that makes the rest possible."

Installing Harmony should be straightforward, Hassman said. "But actually opening the gateway will require some shuffling. The shuttle will be docked to an existing adapter port where the node is meant to attach, so Harmony will be installed in a temporary spot on the first connecting node, Unity, until the mission is over. It will be moved by the station crew once the shuttle leaves."

"It's kind of a shell game," Lead Shuttle Flight Director Rick LaBrode said. "We're going to put it on the left side of Node 1, and then, after the mission undocks, we'll robotically remove the port the shuttle docks to from the end of the lab and put it on Node 2. Then we're going to take the Node 2 and put it on the end of the lab."

After that, it'll be ready for the European and Japanese laboratories. But labs require electricity. So Melroy's crew—which includes Pilot George Zamka, mission specialists Scott Parazynski, Douglas Wheelock, Stephanie Wilson, Paolo Nespoli of the European Space Agency, and Daniel Tani, who will trade places with station Flight Engineer Clay Anderson as an expedition crew member— will continue to set up the station's exterior support truss and its power system.

After Harmony is installed, they'll move the truss segment holding the station's first set of solar arrays to a new home. The Port 6—or P6 arrays, as they are known—have been attached to the middle of the truss for the past seven years, positioned vertically to the rest of the station, acting as a temporary power system.

With the addition of two sets of arrays brought to the station on recent shuttle flights, the original arrays can be relocated

These seven astronauts take a break from training to pose for the STS-120 crew portrait. Pictured from the left are astronauts Scott E. Parazynski, Douglas H. Wheelock, Stephanie D. Wilson, all mission specialists; George D. Zamka, pilot; Pamela A. Melroy, commander; Daniel M. Tani, Expedition 16 flight engineer; and Paolo A. Nespoli, mission specialist representing the European Space Agency (ESA). The crew members are attired in training versions of their shuttle launch and entry suits.

during STS-120 to their permanent position at the very end of the left side of the truss. But that has its own trials and tribulations.

"This truss was the one where, when they retracted the solar array in December, they had difficulties," LaBrode said. "Well, we're going to take that during our mission and actually move it all the way outboard. Its tight clearances, and the way that the robotics operations are here, the arm is completely extended out."

In fact, the space station's arm was designed with this move in mind. Engineers knew the arm would never need to reach farther than this segment—or its mirror on the right side—and so they built it to go just that far and not much farther. That creates some challenges. LaBrode compared it to trying to do something with your arm completely straight, rather than bent at the elbow—it limits your flexibility.

"It's the design-limiting case," Melroy said. "It's the maximum capability of the robotic arm's reach, and there are no cameras out there. So our spacewalkers are going to have to be out there going, 'OK, a little bit to the right,' guiding the robotic arm operator."

Hassman said he's confident they can pull it off.

"The good thing about the robotics stuff is the experience we have and all the tools the spacewalkers have allow us to really nail that stuff—knock it flat in terms of the planning," he said.

Astronaut Douglas H. Wheelock, STS-120 mission specialist, uses virtual reality hardware in the Space Vehicle Mockup Facility at Johnson Space Center to rehearse some of his duties on the upcoming mission to the International Space Station.

And this is one case where familiarity does not breed contempt—or even boredom.

"It's funny," LaBrode said. "This is my fourth lead, but I see myself saying this every time. I know all the other ones have been pretty exciting, but this has got to be the most exciting one. They're all completely critical to the success, all the way up to completing our president's vision, going to the next step. But they just seem to get more and more complicated as they go along."

Gentlemen (and women), start your engines!

NASA/TODD JSC2007E19459

Ever wonder what rockets and race cars have in common?

NASA's operations on Earth and in space have a lot in common with the rigors of high-performance competitive driving. Both require reliability and safety under extreme conditions. Add that to the fact that NASA currently holds several Guinness World Records titles for speed, and the connection becomes even clearer. Over the years, NASA has provided a great deal of technology that not only helped the racing world, but also improved conditions for all drivers and has helped to protect the environment.

For the first time ever, NASA participated in the 2007 Grand Prix. JSC developed a nationwide Grand Prix racing campaign that extended NASA's message to racing fans through partnership with other NASA centers. During the campaign we reached events in Houston, Cleveland, San Jose and Wisconsin with the cooperation of NASA Ames, the Glenn Research Center and various volunteers.

The first event took place at Houston's JAGFlo Speedway at Reliant Park in April.The Grand Prix featured a spectacular combination of racing and activities, highlighted by world-class events from American Le Mans Series and Champ Car. JAGFlo Speedway at Reliant Park comprised a temporary, 1.7-mile course constructed around Reliant Stadium and the historic Reliant Astrodome. In addition to the high-speed thrills of world-class racing, a wide variety of entertainment and activities, scheduled for people of all ages, created a spectacular three days of speed and entertainment.

At all of the Grand Prix events, NASA's exhibit displayed an actual shuttle tire, a spacesuit display for photo opportunities and information on how NASA spinoffs have helped the racing industry. Astronauts met the public and signed autographs in conjunction with the event.

NASA/TODD JSC2007E19481

NASA/TODD JSC2007E19466

NASA/TODD JSC2007E19460

NASA

Help Wanted: Seeking intelligent, capable engineers, scientists, educators and pilots willing to sleep in their office in exchange for a great view.

By Brandi Dean

NASA's looking for candidates for its 20th astronaut class. In the past 48 years, NASA has hired 321 astronauts, but this group will have the distinction of being the first class since 1978 to be selected for something other than shuttle flight. Because the selection period won't end until 2009, and because it takes about two years to train to become an astronaut, this new class won't be ready to fly until 2011—a year after the space shuttle program is scheduled to be retired.

Still, the astronaut program thinks it can make applicants an appealing offer: the chance to spend three to six months orbiting the Earth from 200 miles up in the International Space Station.

NASA S116E05968

"The long-duration flights are strenuous and more tedious, and training time is longer," said Duane Ross, astronaut candidate selection and training manager. "But can you imagine being in space for 90 days or six months? It's awesome."

Awesome pretty much describes most of the astronaut experience according to those who have been there and done that. The training is difficult, they say, and the hours sometimes long. But the payoff is worth it, if a little on the surreal side.

"I never thought I'd do a spacewalk," said Danny Olivas, a mission specialist who made a trip to the space station in June. "I never thought I'd be hanging around a bunch of guys who'd been in space before. I never thought I'd be working with moon rock scientists or a bunch of engineers who design space tools. And then when you think about what it all does and where it all goes, and what it all means—that is the best part."

The space station is the largest international scientific and technological endeavor ever undertaken. It's a permanent laboratory in a realm where temperature, pressure, even gravity, can be manipulated in ways impossible on the ground, making it the perfect test bed for the technologies of the future and the best place to learn about living in space—not to mention an exciting place to work.

"We're up there, using the space station to figure out how to go other places in the universe," said Suni Williams, a station flight engineer who recently broke the record for longest spaceflight by a woman after spending 195 days in space. "I think it's something we need to do as we're getting more and more people on this Earth. How to work in a low-gravity environment and how to work in an environment that is not habitable for us—that will take us to the next place."

And speaking of the next place, astronauts selected for the class of 2009 are going to be right in the middle of preparations for NASA's next big adventure.

"What we're doing right now is planning for Constellation, Orion, Ares—going back to the moon," Ross said. "I was here when we went to the moon the last time, and that's really exciting stuff. This class that we select will be here during all that preparation time, all the planning. There will be some really interesting things for them to do and be involved in."

And eventually, when all those preparations come to fruition, members of this class could be among the ones to see them through.

A future full of moonwalks may be a little hard to imagine, but Leland Melvin, who will be taking his first flight into space later this year, would tell you that it's worth giving it a try. As a chemist, he never planned to become an astronaut, or even considered trying, until a friend of his joined the program.

"I applied and came down to Houston for an interview," he said. "And it was all these people, these top gun military pilots and triple Ph.D.s, and I thought, 'Wow.' I went through the whole process not thinking that I'd get in, just kind of a whim thing. And then I got a phone call—'Hey Leland, we want you to come down.'"

To be eligible to apply, you need to be a United States citizen with a bachelor's degree in engineering, biological science, physical science or mathematics, and either 1,000 hours of pilot-in-command time, three years of experience in your field or as a teacher. Advance degrees can be substituted for experience; however, a master's degree counts for one year of experience, and a doctorate counts for three.

You also need to have vision correctible to 20/20—though, for the first time, NASA is accepting applicants who have had refractive eye surgery if one year has passed without problems since the procedure. In addition, your blood pressure should be below 140/90 and your height between 62 and 75 inches.

The astronaut selection board will narrow the pool down based on their applications, and then invite finalists down for a week of medical screenings, personal interviews and orientation. At that point, as Ross explained, if you meet all the medical requirements, the board will be looking for people with a good technical background who are hands-on, practical operators—and who are nice people.

NASA ISS015E08098

"The bottom line is you've got to be a nice person," he said. "You've got to be able to get along with people. If you get assigned a station mission, you're going to be up there for a long time. The thing I'm thinking about is would I want to fly with this person."

And if you aren't selected for the 2009 class, that doesn't mean you should give up. Clay Anderson, who's been living on the space station since June, applied for every astronaut class between 1981 and 1998 before he was finally chosen.

"Mentally it was hard to get that little card that said, 'Thanks, we got your application, but we didn't select you,'" he said. "I wish I would have saved all those cards. But as far as I'm concerned, it's been worth the wait."

Applications are due by July 1, and must be submitted at www.usajobs.gov. More information on qualifications and job responsibilities can be found at www.nasa.gov/astronauts/recruit.html.

NASA S118E06997

Desert RATS test lunar exploration concepts

***As NASA prepares** for future missions to the moon, work is already underway here on Earth to test the planetary rovers, robots and futuristic spacesuits needed for the journey.*

Desert RATS (Research and Technology Studies) highlights the partnership between humans and robots in space exploration. This year's event field tested advanced concepts that may be used for missions to the moon, which NASA plans to begin by 2020. The tests took place in the Arizona desert near a site used to train for the first moon landings during the Apollo Program in the 1960s.

Engineers tested concepts for assembly of a lunar outpost, such as using robots and a lunar rover to perform a site survey and set up solar arrays and cables for power supply.

NASA/STAFFORD JSC2007E046943

NASA/STAFFORD JSC2007E046989

NASA/STAFFORD JSC2007E046956

NASA/STAFFORD JSC2007E046978

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 E. Ragin Staff Writer
Perry Jackson Graphic Designer

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Permit No. 39