

National Aeronautics and Space Administration



Roundup

LYNDON B. JOHNSON SPACE CENTER

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Lead Human Exploration

Lead Internationally

Excel in Leadership, Management and Innovation

Expand Relevance to Life on Earth

JSC Director

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NASA/PHOTO



IT'S A TREMENDOUS HONOR to be asked to lead Johnson Space Center and represent all the talented people here who make human spaceflight happen. Mike Coats has been a terrific mentor to me, as well as a wonderful leader for JSC, and I've been able to experience every aspect of the job of director over the last several years. Mike and I have the same big-picture focus as leaders: accomplish the mission and take care of our people.

We have defined our mission in the JSC vision and mission statements that we presented a year ago.

- JSC vision (declaration of our future): JSC leads a global enterprise in human space exploration that is sustainable, affordable and benefits all humankind.
- JSC mission (our value proposition): JSC provides and applies the preeminent capabilities to develop, integrate and operate human exploration missions spanning commercial, academic, international and U.S. government partners.

In our communications going forward, including in this edition of *Roundup*, you'll see one or more of our four goals listed by our activities and accomplishments in order to show the connection and help us keep our focus.

The first goal, lead human exploration, is our priority, stating unequivocally what we do for the agency and country. It encompasses the three areas of International Space Station operations and utilization, the commercialization of low-Earth orbit (LEO) and human exploration beyond LEO. We must do these right—safely, effectively, and as promised—for us to continue to be given the responsibility to lead human spaceflight.

The other three goals (lead internationally; excel in leadership, management and innovation; and expand relevance to life on Earth) emphasize what it will take to make human space flight sustainable and affordable, as well as benefit humankind over the longer term. The more progress we make in these areas, the better our chances of getting humans headed to destinations that get us closer to Mars.

Because the human spaceflight environment has changed incredibly over the last few years, we must respond to that environment and anticipate future changes. What doesn't change are the values that have made NASA successful throughout our history: teamwork, excellence, integrity and safety. That's what JSC embodies when we do our finest work, and they not only lead to accomplishing the mission, but they are the values that lead to taking care of our people—making sure we have people with the right skills and training, who work together safely and who respect each other and listen to alternate views.

Our emphasis on innovation and inclusion is part of living our values and focusing on what it takes to accomplish our goals. Continued emphasis on those values and on our can-do spirit is what will lead to amazing achievements in the years to come.

Ellen Ochoa



On the cover:

The center's programs and projects fulfilled all areas of the JSC Strategic Implementation Plan in 2012, and we will continue to do so in 2013.



NASA EARTH OBSERVATORY/NOAA NGDC

Photo of the month:

Scientists unveiled an unprecedented new look at our planet at night. A global composite image, constructed using cloud-free night images from a new NASA and National Oceanic and Atmospheric Administration satellite, shows the glow of natural and human-built phenomena across the planet in greater detail than ever before.

2012 International Space Station research and discoveries

THIS LAST YEAR has been a busy one for the International Space Station (ISS). With a plethora of new investigations, facilities, researchers, data and results, the ISS Program Science Office has much to share.

With the next decade in the life of the station focusing on research, major themes identified for investigation are benefits to life on Earth, future exploration and basic discovery.

This knowledge expansion provides benefits for future exploration and Earth benefits.

Plant-growth studies are often on the menu, as the ability to grow plants in microgravity would allow for fresh food, oxygen generation and carbon dioxide removal, along with improved crop production on the ground.

Crew Earth Observation studies look at changes involving pollution,

sea levels, urban sprawl and population growth, climate and temperature, along with storms, floods, fires, volcanic eruptions and other dynamic events. These images provide researchers with data important to understanding the planet from a different perspective, and a way to track these changes over long periods of time. The studies also enhance our understanding of Earth science.

NanoRacks continues to provide ways to make microgravity research more attainable, providing solutions for experiments to be flown quickly and inexpensively by students, commercial companies and other U.S. government agencies.

Several new facilities delivered to the space station allow for an array of new research projects. The Japanese Experiment Module Small Satellite Orbital Deployer (J-SSOD) changes the way mini satellites can now be deployed to their optimal orbit, allowing for greater flexibility,

operational control and significant monetary savings.

The Aquatic Habitat has received its first inhabitants, translucent Medaka fish, allowing for easy observation of their skeletal systems, which gives more insight into bone and muscle atrophy (medical issues for astronauts and the aging population) and radiation effects.

A Gravitational Biology Lab was also delivered to station. The centrifuge allows for biological experimentation in artificial gravity—from zero gravity to twice Earth's normal gravity—for prolonged periods of time. This new facility provides environmental control, lighting, data transfer, commanding and observation of experiments in Mars and moon gravity conditions, as well as mimicking Earth's gravity. This is useful for biological organism research and could lead to advances in medications and vaccines, agricultural controls and discoveries in genetics—all beneficial to those of us on Earth.

The Center for the Advancement of Science in Space (CASIS), the

(continued on page 11)

NASA/photo iss033e009285



Several tiny satellites are featured in this image by an Expedition 33 crew member on space station. The satellites were released outside the Kibo laboratory using a Small Satellite Orbital Deployer attached to the Japanese module's robotic arm on Oct. 4.

"This has been an amazing year for the International Space Station," said ISS Program Scientist Julie Robinson. "We have achieved and exceeded our research goals for the first year of full research use."

Human research studies have shown that using the Advanced Resistive Exercise Device (ARED) for high-intensity workouts while living aboard the orbiting lab, in combination with a proper diet, helps astronauts lose less bone density during their stay. This countermeasure also aids in rebuilding their bones once the astronauts return to Earth. This study could have profound effects on future space exploration, as well as the aging population on Earth.

Researchers identified possible causes for the vision problems documented in astronauts and are continuing to broaden this research.

Education investigations, like the YouTube Space Lab competition and others, are part of every expedition working to inspire students of all ages.

Physical science investigations continue—crystal growth, colloid and flame investigations—with each study adding to the knowledge database.

Programs and projects

Commercial Crew Program

The year 2012 was the busiest yet—but not yet the busiest—for the Commercial Crew Program (CCP). Three American companies with three very different spacecraft and rocket combinations have begun the next phase toward returning astronauts to low-Earth orbit (LEO) and International Space Station launches from U.S. soil.

Boeing, Sierra Nevada Corp. and SpaceX are now forging ahead on design and development of new U.S. crew transportation systems by mid-decade as part of the program's Commercial Crew Integrated Capability (CCiCap) agreements.

As CCiCap was announced in early August, NASA and industry transitioned from the previous phase that allowed companies to partner with the agency to mature their preliminary designs. As Blue Origin, Boeing, Sierra Nevada, SpaceX, United Launch Alliance, Excalibur Almaz, Inc. and ATK wrapped up their Space Act Agreements with NASA, the early fall transition toward CCiCap called for maturation of integrated designs and performance of hardware testing, with designs referring to spacecraft, launch vehicle and mission and ground operations.

In the next few months, in parallel with CCiCap work, NASA will award

the first phase in certification called the Certification Products Contract, which will focus on alternate standards, hazard analysis, verification and validation, as well as a certification plan. This will ensure commercial missions are held to the agency's safety requirements and standards for human space transportation system missions to the space station.

CCP and its partners are transitioning quickly to this next phase.

Milestones are already being completed as Boeing, Sierra and SpaceX move forward with NASA to develop these new crew space transportation systems.

"It is amazing what

we have accomplished this year, and the momentum we are creating is tremendous," said CCP Manager Ed Mango. "We are creating a spaceflight capability not only for NASA, but also for a potential commercial space transportation industry to (LEO), which could eventually flourish as the airline industry has done."

Commercial Orbital Transportation Services

This past year, NASA and the private sector proved there is more than one way to get the job done.

Under the Commercial Orbital Transportation Services (COTS) program,

2012 saw the completed development and demonstration of the SpaceX Falcon 9 launch vehicle and Dragon spacecraft, culminating in a successful mission to the space station in May.

The virtually flawless mission began May 22 with launch from Cape Canaveral and station fly-by two days later. On May 25, Dragon rendezvoused with and was berthed to the orbiting outpost. After six days at station, Dragon separated, splashed down near California and was recovered.

SpaceX then transitioned to operations under the International Space Station Commercial Resupply Contract with a successful first mission in October.

In the words of NASA Administrator Charles Bolden, "We've demonstrated that American industry is ready to step up to the plate and meet our needs for transport to (LEO). This work will transform our relationship to space, save money and create jobs."

Meanwhile, NASA's other COTS partner, Orbital Sciences, made major strides toward completion of its COTS program. Orbital, which will launch its Cygnus spacecraft atop the Antares launcher, completed first-stage assembly in September. That was the last milestone before its maiden flight, after which Orbital will conduct a demonstration mission to station.

Astromaterials Research and Exploration Science

Scientists in the Astromaterials Research and Exploration Science (ARES) Directorate continue to support Mars Science Laboratory operations as Surface Operations Working Group chair; lead for the Chemistry and Mineralogy Experiment (CheMin) instrument command sequence uplink/downlink; and analyze and interpret Chemistry and Camera (ChemCam), CheMin and Sample Analysis at Mars (SAM) measurements using flight-like instruments within Johnson Space Center laboratories.

NASA received the first set of asteroid samples from the Japanese Hayabusa mission for curation and are ready to allocate a portion to researchers.

The first "field test" of the touch-and-go sample acquisition mechanism for the OSIRIS-REx mission was completed aboard the NASA reduced-gravity aircraft.

In addition, the initial interstellar dust candidates from NASA's Stardust mission have been allocated to researchers.

Coring of the Hubble Space Telescope Wide Field Planetary Camera-2 radiator resulted in 479 samples of impact features for determining



NASA PHOTO

The SpaceX Dragon commercial cargo craft is grappled by the Canadarm2 robotic arm at the space station. Expedition 31 Flight Engineers Don Pettit and Andre Kuipers grappled Dragon at 8:56 a.m. CDT and used the robotic arm to berth Dragon to the Earth-facing side of the station's Harmony node at 11:02 a.m. on May 25.

NASA EDGE/RON BEARD



The Dream Chaser model with its Atlas V launch vehicle undergoes final preparations at the Aerospace Composite Model Development Section's workshop for buffet tests at the Transonic Dynamics Tunnel at NASA Langley Research Center. The scale model is being tested as part of NASA's Commercial Crew Program. The lifting body reusable spacecraft would carry as many as seven astronauts to the space station. Sierra Nevada is developing the craft under a Space Act Agreement with NASA.

composition and characteristics of the micro-meteoroid orbital debris environment.

Advanced Exploration Systems

NASA's Advanced Exploration System program made strides in a wide array of areas, developing prototype systems and demonstrating key capabilities and concepts for future human missions beyond LEO.

The Morpheus project started 2012 with a retrofit of the vehicle and a comprehensive series of tests, including three with the Autonomous Landing and Hazard Avoidance sensor suite. The vehicle was lost during a test flight at Kennedy Space Center, but two more vehicles are being built to continue the test programs in 2013, implementing key lessons learned from the loss.

The Analog Missions Project tested features of future human space exploration missions. NASA Extreme Environment Mission Operations simulated a mission to an asteroid using an undersea laboratory; the In-Situ Resource Utilization Field Test simulated a robotic mission to the moon searching and drilling for water; and Research and Technology Studies integrated tests utilizing the outfitted Multi-Mission Exploration Vehicle simulated an asteroid mission to understand system-level interactions and operations concepts.

Other teams led work in new technologies and innovation, especially in the critical area of waste processing and treatment, improved water reclamation and the consolidation and repurposing of trash waste in orbit. The Deep Space Habitat team evaluated concepts for habitats allowing humans to travel to an asteroid or Mars. Additionally, the Radiation team developed improved, lightweight radiation sensors that are being tested on station and will fly on the Orion Exploration Flight Test-1 in 2014. The team also developed prototypes for radiation storm shelters to protect crews from bursts of radiation during solar storms.

As recognized in *Time* magazine, impressive work continued with the newest spacesuit prototype, the Z-1. The team also developed and tested two suitport concepts allowing for more rapid spacewalks on planetary surfaces while developing an improved life-support system. It's the first time in nearly 40 years that the Primary Life Support System is being redesigned from scratch to reduce costs and improve operational lifetime.

Human Health and Performance Directorate

The Space Life Sciences Directorate reorganized this year into the Human Health and Performance (HH&P) Directorate to align its core capabilities into functional divisions of operations, research and hardware/software development to facilitate the mitigation of human system risks for spaceflight. HH&P began 2012 with the development of its current strategy, which is aligned with the JSC 2012 Strategic Implementation Plan, and built upon its successful 2007 strategy.

HH&P developed and implemented requirements for commercial spaceflight and made great progress on an emerging spaceflight risk of visual and intracranial pressure changes, the mitigation of which is important for space station and future missions. They expanded the NASA Human Health



Spacesuit Engineer Richard Rhodes demonstrates the Z-1 prototype exploration suit in the Advanced Suit Lab.

NASA/ROBERT MARKOWITZ

and Performance Center (NHHPC) and conducted a national workshop on mobile health with participation from U.S. Chief Technologist Todd Park, the National Institutes of Health, U.S. Food and Drug Administration and startup companies.

Membership in the NHHPC increased to more than 115 members across academia, industry, government and nonprofits. The Center of Excellence for Collaborative Innovation (CoECI), directed by NASA Headquarters and supported by HH&P staff, was established in November 2011 to provide open innovation support for NASA and other government agencies. CoECI conducted two workshops in 2012, and eight engagements are underway with other federal agencies.

Office of the Chief Technologist

The Office of the Chief Technologist (OCT), represented at JSC by the Center Chief Technologist (CCT), continued its drive to sponsor innovation and exciting technology development. Guided by their priority to foster an environment of creativity at the center while ensuring that JSC's technology competencies align with agency needs, the CCT allocated resources from Center

Innovation Funds to support a substantial portion of JSC's portfolio of novel technologies for NASA missions. More than 50 individual projects received funding in 2012, coming from JSC's Engineering, ARES, HH&P, the White Sands Test Facility, Mission Operations, and Safety and Mission Assurance Directorates. Three levels of project awards were used, including center-level Internal Research and Development (IR&D) projects, directorate-level IR&D projects and Innovation Charge Account (ICA) studies. Awards were given based on the maturity and scope of the proposed project, with center-level IR&D typically receiving \$100,000 to \$250,000, while more nimble ICA projects traditionally received less than \$10,000 full cost to allow individuals or small groups to pursue creative ideas.

The CCT worked with JSC management and created spaces engineered to foster creative thinking. Areas like the Building 3 Collaboration Center, Innovation Day's "Creative Café" and the Innovation Design Center are available to all JSC team members as the CCT continues its mission of encouraging a culture of creativity and innovation here at JSC.

For more information on the JSC's CCT, visit:
<http://www.nasa.gov/centers/johnson/technologyatjsc>

Education

JSC continued to inspire young women to pursue careers in science, technology, engineering and mathematics (STEM) fields with Women in STEM High School Aerospace Scholars (WISH). The Education Flight Project Office and the JSC Office of Education offered 84 high school junior girls in 29 states an extraordinary experience at the center. Through WISH, students learned about STEM careers and worked on a human Mars exploration mission with NASA subject-matter experts.

The Space Lab Challenge was a partnership between NASA, Google,



Former JSC Director Mike Coats and Director of Strategic Opportunities and Partnership Development Office Yolanda Marshall wield oversized scissors for the ribbon-cutting ceremony at the Innovation Design Center

NASA/BILL STAFFORD

(continued on page 11)

History in the making

NASA/ISS030E020707



JAN. 4, 2012:

Expedition 30 Flight Engineer Don Pettit is pictured among stowage bags in the Harmony node of the space station. The bags, containing trash and excess equipment, will be transferred to the docked Progress 45 spacecraft for disposal.

NASA/ISS030E148260



MARCH 14, 2012:

Controlled by teams on the ground, R2 holds an instrument to measure air velocity during another system checkout.

MAY 25, 2012:

With rays of sunshine and the thin blue atmosphere of Earth serving as a backdrop, the SpaceX Dragon commercial cargo craft is berthed to the Earth-facing side of station's Harmony node. Dragon became the first commercially developed space vehicle to be launched to the station to join Russian, European and Japanese resupply craft that service the complex.



NASA/ISS030E148260

NASA/BILL INGALLS



AUG. 5, 2012

NASA Jet Propulsion Laboratory ground controllers react to learning the Curiosity rover had landed safely on Mars and begun to send back images to Earth.

JAN 2012

FEB 2012

MAR 2012

APR 2012

MAY 2012

JUNE 2012

FEB. 15, 2012:

Robonaut 2, nicknamed R2, shakes hands with NASA astronaut Dan Burbank, Expedition 30 commander, in station's Destiny laboratory. This event made history with the first human/robotic handshake to be performed in space.

NASA/ISS030E074065



APRIL 27, 2012:

The Soyuz TMA-22 spacecraft is seen as it lands with Expedition 30 Commander Dan Burbank and Flight Engineers Anton Shkaplerov and Anatoly Ivanishin in a remote area outside of the town of Arkalyk, Kazakhstan.

NASA/201204270002HQ



JUNE 22, 2012:

Two bowling-ball-sized free-flying satellites called Synchronized Position Hold, Engage, Reorient, Experimental Satellites Zero Robotics (SPHERES ZR) are pictured during a test session in station's Kibo laboratory.

NASA/ISS031E140672



SEPT. 14, 2012:

U.S. Navy Lieutenant Commander Paul Nagy, USS Philippine Sea, and Carol Armstrong, wife of Neil Armstrong, commit the cremated remains of Neil Armstrong to sea during a burial at sea service held aboard the USS Philippine Sea (CG 58) in the Atlantic Ocean. Neil Armstrong, the first man to walk on the moon during the 1969 Apollo 11 mission, died on Aug. 25. He was 82.

NASA/BILL INGALLS



2012 Crews

NASA PHOTO ISS030-S-002



EXPEDITION 30

NASA PHOTO ISS031-S-002



EXPEDITION 31

NASA PHOTO ISS032-S-002



EXPEDITION 32

NASA PHOTO ISS033-S-002



EXPEDITION 33

NASA/ISS032E020683



AUG. 20, 2012:

Expedition 32 Commander Gennady Padalka continues outfitting the station during a spacewalk. Padalka and Russian cosmonaut Yuri Malenchenko (out of frame), flight engineer, moved the Strela-2 cargo boom from the Pirs docking compartment to the Zarya module to prepare Pirs for its eventual replacement with a new Russian multipurpose laboratory module. The two cosmonauts also installed micrometeoroid debris shields on the exterior of the Zvezda service module and deployed a small science satellite.

NASA PHOTO



OCT. 7, 2012:

That's one giant "scoop" for mankind, as this "bite mark" shows where NASA's Curiosity rover picked up some Martian soil. The first scoop sample was taken on the 61st sol, or Martian day, of operations.

NASA/ISS033E017915



NOV. 1, 2012:

Expedition 33 Commander Sunita Williams spacewalks outside the space station to support ground-based troubleshooting of an ammonia leak. Williams was joined by Japan Aerospace Exploration Agency astronaut Aki Hoshide (out of frame).

JULY 2012

AUG 2012

SEPT 2012

OCT 2012

NOV 2012

DEC 2012

SEPT. 19, 2012:

Space Shuttle *Endeavour* is ferried by NASA's Shuttle Carrier Aircraft (SCA) over Houston on the way to her final home at the California Science Center in Los Angeles. NASA pilots Jeff Moultrie and Bill Rieke are at the controls of the SCA.

NASA/SHERI LOCKE



OCT. 28, 2012:

A SpaceX Dragon spacecraft splashed down in the Pacific Ocean on Oct. 28, a few hundred miles west of Baja California, Mexico. The splashdown successfully ended the first cargo delivery flight contracted by NASA to resupply the space station.

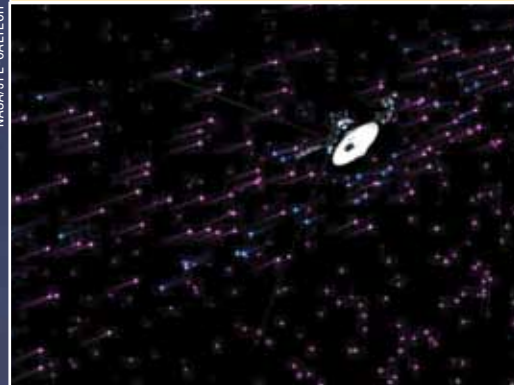
PHOTO: SPACEX



DEC. 3, 2012:

NASA's Voyager 1 spacecraft has entered a new region at the far reaches of our solar system that scientists feel is the final area the spacecraft has to cross before reaching interstellar space. Voyager 1 and 2 were launched 16 days apart in 1977, and at least one of the spacecraft visited Jupiter, Saturn, Uranus and Neptune. Voyager 1 is the most distant human-made object, about 11 billion miles away from the sun.

NASA/JPL - CALTECH



NASA/PHOTO ISS034-S-002



EXPEDITION 34

Orion continues building toward our human spaceflight destiny

IN 2012, ORION continued to take shape, with parts arriving from suppliers and manufacturers across the country and tests being conducted on land, in the air and on the (simulated) sea.

At the end of 2011, the team at Michoud Assembly Facility in New Orleans had just completed welding on the crew module cone for Exploration Flight Test-1 vehicle. Over the first several months of the year, they added the backbone that will distribute the intense loads the vehicle will see during landing across the vehicle and the crew module barrel, one of the primary pieces of the pressure vessel. By June, the entire pressure vessel structure of the spacecraft was complete and on its way to Kennedy Space Center (KSC). Its unveiling in Florida was attended by a senator, NASA's deputy administrator and 450 others.

The team wasted no time resting on its laurels, however. Outfitting of the crew module in the Operations and Checkout Facility—KSC's spacecraft factory—began in July, and it underwent its first round proof-pressure testing in October.

Meanwhile, at the Integrated Test Lab in Denver, work began on Orion's heat shield. The 176 titanium stringers that form the interior structure of the

flight heat shield were delivered and mated to the heat-shield skin in October. That, of course, will protect the bottom of the capsule, which will experience the most intense heat. To protect the rest of the vehicle, KSC also began work this year on the 1,300 thermal protection system tiles that will cover the vehicle cone.



NASA PHOTO

The NASA team at the Michoud Assembly Facility in New Orleans completes the final weld on the first space-bound Orion capsule in late June.

As the vehicle itself comes together, its design continues to be tested in a number of ways across the country. Its parachutes were deployed during falls from 25,000 feet above the Arizona desert five times this past year. The tests were part of the human-rating process for Orion vehicles to come, and looked at both the expected parachute performance and potential malfunctions to ensure that even if everything doesn't go as planned, Orion's future crews will land safely.

And because it will land on water, the Orion team got splashed more than once this year. Here in Houston, the parachute team worked with the recovery team and the Navy to test parachute recovery procedures in the Neutral Buoyancy Laboratory in August. At the same time, in Langley Research Center's Hydro Impact Basin Test Facility, an 18,000-pound boiler plate test article was dropped into the water at different angles and speeds to simulate various landing conditions and gather data on how crews would be affected by each. The final series of water-impact tests wrapped up in September.

All of those tests dealt with Orion's re-entry and landing, which represents only a fraction of the mission the spacecraft will perform. In preparation for the rest of the mission, the avionics team conducted end-to-end tests with



A C-17 plane drops a test version of Orion from an altitude of 25,000 feet above the U.S. Army Yuma Proving Ground in southwestern Arizona. This test was the second to use an Orion craft that mimics the full size and shape of the spacecraft, and its main objective was to determine how the entire system would respond if one of the three main parachutes inflated too quickly.

NASA PHOTO

the Mission Control Center (MCC), sending encrypted commands to Orion, transmitting onboard telemetry through a simulated radio frequency link and downlinking test video. In addition, 28 voice loops between the MCC, Operations and Checkout Facility, Lockheed Martin's Integrated Test Lab in Denver, Space Operations Center at Cape Canaveral and Morell Operations Center's mission control were all verified in August. In July, onboard telemetry was transmitted through a radio frequency link emulating the Tracking and Data Relay Satellite network and White Sands Test Facility ground station.

Behind each of these accomplishments are untold hours of modeling, iterating and dreaming that go on before any piece of metal is cut or any mock-up put onto an airplane or into a test chamber. Building a spacecraft to transport humans to new destinations is a daunting task with an extraordinary amount of responsibility, but the Orion team is rising to the challenge to build and test a spacecraft worthy of the unprecedented missions it will perform in the near future.



PHOTO CREDIT: LOCKHEED MARTIN

NASA Deputy Administrator Lori Garver, second from left, and Lockheed Martin team members evaluate the large composite structure of the Orion heat shield in a factory near Littleton, Colo. This is where the heat shield, both the composite structure and the skeleton framework, are being built.

The Aircraft Operations Division celebrates its 50-year legacy

IN OCTOBER OF 1962, while Ellington Field was still considered an Air Force base, Johnson Space Center's Aircraft Operations Directorate (AOD) began flying planes in support of NASA's missions. As time has progressed and programs and projects have come and gone, one thing still remains the same: AOD provides a huge part of the training regimen that gets the astronauts air and space bound.



NASA PHOTO S61-01250

Photo of the Mercury astronauts standing beside a Convair 106-B aircraft. They are, left to right: M. Scott Carpenter; L. Gordon Cooper Jr.; John H. Glenn Jr.; Virgil I. Grissom; Walter M. Schirra Jr.; Alan B. Shepard Jr.; and Donald K. Slayton.

Test pilot culture

"The genesis of AOD was that it's supporting the astronauts, and that is still our primary mission," said Gregory C.

Johnson, astronaut and deputy division chief of AOD. "We have a number of pilots on our staff, many of which are former test pilots."

Test pilots, who famously became part of NASA's first Astronaut Corps, are a distinctive

part of AOD's culture. Past and present, the training involved in getting humans into space tested the mettle of the astronauts and trainers alike.

"We had helicopters to train the astronauts to understand how to land on the moon, because most jet pilots aren't also helicopter pilots," Johnson said. "AOD, in the Apollo era, trained the astronauts on the lunar landing training vehicle, and this is the vehicle that one of our astronauts ejected out of."

The daring test pilot who ejected safely after an engine failure was none other than Neil Armstrong.

Astronauts have perfected the art of commanding jets in high-stress environments for 50 years at Ellington Field. AOD continues that tradition today, and does it with an impressive aviation and ground safety record.

"This is a priority for us," said Dick Clark, division chief, AOD. "On the ground, 'Nobody gets hurt' is the slogan, and the Ellington site has earned the prestigious Voluntary Protection Program Star-certification level in the nationwide Occupational Safety and Health Administration program. In the air, AOD has not had a major mishap since the 1980s and, in fact, has safely flown over 355,000 hours in that timeframe."

Services rendered

Instructor training in the T-38 ensures that new astronaut classes have the "right stuff" as they embark on their journey to become world-class explorers.

Johnson has been on both sides of the coin—giving training to astronauts in the early 1990s, and receiving training as an astronaut when selected in 1998.

"I've seen both (sides of the) classes and, in fact, recall giving a check ride to (NASA Administrator) Charlie Bolden a long time ago," Johnson said.

But AOD has more than the T-38 ... and more facets. The Gulfstream 3,

a business jet, shuttles high-profile NASA members to and from Kazakhstan for Soyuz landing support. When not doing that, the craft works with the Jet Propulsion Laboratory (JPL) to conduct airborne science missions sampling soil moisture.

And of course, most can readily identify the "aquatic-appearing" plane in AOD's repertoire: the Super Guppy. This behemoth cargo carrier, going forward, will ferry enormous Orion capsule parts and pieces in support of the next stage of space exploration.

AOD is also still supporting microgravity missions, though not with the C-9 as before.

"We are supporting around 10 to 12 flight weeks a year for Education and research," Johnson said. "That's bringing in high school and university students ... and they're flying experiments of their own design on the Zero-G Corporation's 727."

The next 50

Being in a transition phase has meant a reduction in overall flight hours for AOD.

"The size of the Astronaut Corps has shrunk significantly, so we have less T-38s," Johnson said. "But eventually, we hope to grow back into a more robust flying organization."

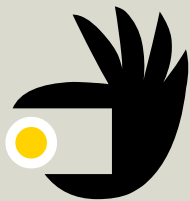
As NASA moves forward with Orion's Exploration Flight Test-1 in 2014 and furthers space station research and science, AOD will continue to play a pivotal role.

"I am most proud of our people who are willing to work so hard, spend time away from family members and take the necessary risks associated with such an incredible human adventure," said Janet Kavandi, director, Flight Crew Operations. "In 50 years, I would hope that we are still training astronauts in high-performance aircraft and conducting science and other activities in support of our agency and our country."

See more pictures of AOD and Ellington Field through the years: <http://www.nasa.gov/centers/johnson/multimedia/aod/index.html>

AOD AIRCRAFT ROSTER

- **T-38** - The main bread and butter for AOD. Essential training tool for astronauts and pilots.
- **Super Guppy** - Aircraft with super-hauling capability. Initially built to carry stages of the Saturn II, but now will transport Orion and its components.
- **Gulfstream 3** - Business jet used to ferry astronauts and management personnel to and from Kazakhstan for Soyuz landings and other major events. Also shares time with JPL in support of a science mission that samples soil moisture in North and South America.
- **WB-57** - Program provides unique, high-altitude airborne platforms to U.S. government agencies, academic institutions and commercial customers to support scientific research and advanced technology development and testing at locations around the world.
- **C-9** - Supports cold stowage returns from SpaceX, as well as the occasional need for testing in microgravity.



Spotlight: Mike Coats

former Johnson Space Center Director

Q: We hear you're leaving us for the greener pastures of retirement. What things are you looking forward to doing with all that free time?

A: Family really does come first. My wife has taken good care of me for more than 43 years and deserves my full attention now. And, I may have mentioned my adorable identical twin granddaughters, Abby and Anna. If not, how much time do you have?

Q: What have you enjoyed most while being the director of JSC?

A: The people. We have a dedicated team of overachievers who make the nearly impossible look almost routine. To paraphrase President Kennedy, we do space exploration because it's hard, not because it's easy, and I've been able to see and appreciate a talented team come up with some pretty elegant solutions to very hard problems.

Q: What will you miss the most about JSC?

A: The people. They represent the best our nation has to offer. But "miss" is not really the most appropriate word, since our JSC family includes our retirees. I intend to continue to be part of our JSC family as a NASA retiree.

Q: What big dreams did you have growing up?

A: I dreamed of having a big family and landing planes on aircraft carriers. I know how lucky I am that my dreams came true.

Q: What would people be surprised to know about you?

A: Have I ever mentioned my adorable identical twin granddaughters?

Q: If you could trade places with any other person for a week, famous or not famous, living or dead, real or fictional, who would it be?

A: Abraham Lincoln (when he was alive, not now). I recently read "Team of Rivals," and it reminded me of his people skills, political talents and strength of character. He was the right man for the most difficult period in our nation's history.

Q: What is your favorite indulgence?

A: My family. I take full credit for marrying so well, and I enjoy my family time with Diane, our son Paul, our daughter Laura and her husband Patrick. And I may not have mentioned my granddaughters, Abby and Anna. Laura says I spoil them, but I'm really indulging them and spoiling myself.

Q: What would we find in your refrigerator right now?

A: You wouldn't have to look very long to find Blue Bell ice cream ... in there with the salad and fruit bowls, of course.

Q: When you need a good laugh, who or what do you turn to?

A: Ellen DeGeneres makes me smile. The old Harvey Korman/Tim Conway skits on "The Carol Burnett Show" made me laugh until I cried.

Q: Describe yourself in three words.

A: Fortunate family man.

Q: When did you first become interested in space and why?

A: I was on my way to Vietnam when Neil and Buzz walked on the moon. They were taking a bigger risk than I was, but I envied them, of course. I never dreamed I would have the opportunity to fly in space myself, but I followed all the Apollo missions after that.



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Q: What is the best piece of advice you have ever received?

A: Treat each individual as unique, and special. If you can take the best advantage of individual strengths and differences, you win. And I love to win.

Q: JSC turned 51 in September. Where do you hope to see NASA 50 years from now?

A: I believe NASA will still be leading an international partnership as humanity explores the solar system. Our permanent moon and Mars settlements will be the first stepping stones to the universe. I envy those who will see many astounding discoveries, some of which we can't even imagine now.

Q: Parting words for JSC team members?

A: It's been a privilege to have been part of the best team in the world. I know the JSC team will continue to provide the leadership needed to make "Spaceship Earth" a better place to live for our children and grandchildren.

WANTED!

Do you know a JSC colleague or team that does something extraordinary on or off the job? Whether it's a unique skill, interesting work, special professional accomplishment, remarkable second career, hobby or volunteerism, your nominee(s) may deserve the spotlight!

The Roundup shines the light on one special person or team each edition, chosen from a cross section of the JSC workforce. To suggest "Spotlight" candidates, send your nomination to the JSC Roundup Office mailbox at jsc-roundup@mail.nasa.gov. Please include contact information and a brief description of why your nominee(s) should be considered.

(ISS Science Corner continued from page 3)

nonprofit organization in charge of promoting and managing research aboard the space station's U.S. National Laboratory segment, announced several requests for solicitations. Their current focus is on advancing protein crystallization, materials science and Earth observational science.

As one of the commercial resupply service providers now in service, SpaceX has added the capability to return science samples, and other items, to Earth in a timely manner. The return of these samples expedites research results and frees up stowage space on station.

The research carried out aboard the space station continues to provide new insights for scientists.

"We see a dramatic increase in scientific publications and their quality," Robinson said.

The next 10 years should prove very exciting in the way of new discoveries that will advance human space travel and benefit us on Earth.

"Extraordinary benefits from this research are developing," Robinson said. "The ISS is helping to save lives and make our economy stronger."

You can read more about these investigations, and others, at: http://www.nasa.gov/mission_pages/station/research/news.html



NASA/PHOTO ISS032E022628

Expedition 32 Flight Engineer Sunita Williams works at the Microgravity Science Glovebox in station's Destiny laboratory.

(Programs and projects continued from page 5)

YouTube, BioServe and Space Adventures, where high school students around the world designed microgravity experiments. In 2012, Teaching From Space represented NASA throughout various challenge phases and worked with the International Space Station Program Office and Astronaut Office to facilitate on-orbit taping of the winning experiments by station astronauts. The challenge culminated in a live chat between astronaut Sunita Williams and the student designers who won. More than 8,500 students from 80 countries participated in the challenge.

On Nov. 15, students involved in the Student Spaceflight Experiments Program (SSEP) spoke live with astronauts Kevin Ford and Williams aboard station. SSEP is an on-orbit educational research opportunity that allows students to design and send experiments to the space station through a partnership with NanoRacks, LLC. The downlink took place during International Education Week (IEW). IEW is a joint initiative between the U.S. Department of State and the U.S. Department of Education that celebrates the benefits of international education and exchange worldwide.

Education offered an out-of-this world opportunity for Purdue University and North Carolina A&T State University undergraduates to develop hardware for station through the STEM-Educational Fluids Experiment project. Students were selected to design, build and test hardware for the capillary fluid dynamics experiment for station's National Lab. The project exposed the next generation of space explorers to microgravity science, technology and design operations.

Strategic Opportunities and Partnership Development

The Strategic Opportunities and Partnership Development (SOPD) Office established the 2012 JSC Strategic Implementation Plan that outlines how JSC will help lead NASA's global enterprise in a way that is sustainable, affordable and benefits all humankind. The past year has seen great strides in sharing knowledge, expertise, capabilities and services.

- **Power of partnerships:** In 2012, SOPD reduced the average processing time for Space Act Agreements while supporting a 74 percent increase in volume. The average processing time was reduced by 30 days and will continue to drop as the team makes continued progress.
- **Cultivate relationships:** Through a nurtured relationship with the Houston Technology Center (HTC), SOPD maximized technology transfer to commercial applications. HTC will identify and support entrepreneurs willing to invest time and money to nurture new technologies.
- **Win-win initiatives:** A \$3.6 million Small Business Innovation Research phase 3 grant was awarded for bone densitometer that will fly as space station hardware.
- **Knowledge share:** The Robo-Glove received the Notable Technology Development Award by the Federal Laboratory Consortium (FLC) Mid-Continent Region. The FLC is a nationwide network of federal laboratories that helps link laboratory mission technologies and expertise with the marketplace.
- **Concrete outcomes:** JSC has a new technology license with Medcare, an investment company in medical services, for further development of improved cardiovascular monitoring of astronauts that could lead to affordable patient monitoring and use with implantable cardiac devices here on Earth.
- **Network to work together:** SOPD participated in the "Pumps and Pipes" program to engage with the medical and energy communities to explore solutions to common problems.

Read more about it here:

<http://www.nasa.gov/centers/johnson/home/pumpsandpipes.html>

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OR CURRENT RESIDENT

NASA Johnson Space Center Economic Impact in Texas | Fiscal Year 2012 (FY12)

Local and State Level Economic Benefits

- JSC had nearly \$4.4 billion, or 27 percent, of the agency's total obligations.
- Of that, just over \$2 billion were obligated to contractors having a primary place of performance in Texas.
- About \$60.5 million was awarded to more than 110 small businesses working in Texas.
- JSC obligated over \$29 million on grants, contracts and agreements with Texas universities and educational institutions.
- JSC obligated more than \$71 million to women-owned businesses in Texas.
- Nearly \$23 million was obligated to contracts performed by veteran-owned businesses in Texas.
- Nearly \$61 million was obligated on grants, contracts and agreements with non-profit organizations in Texas.

PROGRAM	OBLIGATIONS (\$B)	OBLIGATIONS %
Space Shuttle	0.52	10%
International Space Station	2.48	49%
Exploration	1.37	27%
Cross-Agency Supt. (Inc. Institution)	0.47	9%
Other	0.25	5%
Total	5.09	100%

COMMUNITIES	CIVIL SERVANT HEADCOUNT	SALARY (\$M)
CLEAR LAKE AREA TOTAL	2,375	283.3
Bacliff/Kemah/San Leon	38	4.2
Clear Lake	882	108.4
Dickinson	59	6.5
Friendswood	352	44.6
LaPorte/Shoreacres	20	2.0
League City	694	79.7
Seabrook/El Lago/Taylor Lake	250	30.2
Webster	80	7.7
HOUSTON REGION TOTAL (Outside Clear Lake Area)	773	82.0
Houston (except Clear Lake)	344	35.6
Alvin	44	4.7
Deer Park	15	1.4
Pasadena	28	2.5
Pearland	172	20.0
Brazoria County	31	3.2
Fort Bend County	41	4.8
Other Harris County Areas	42	3.8
Other Houston Region Areas	56	6.0
Houston Region Total (including Clear Lake Area)	3,148	365.3
Other Areas of Texas Total	71	4.0
Outside of Texas Total	246	14.3
GRAND TOTAL	3,465	383.6