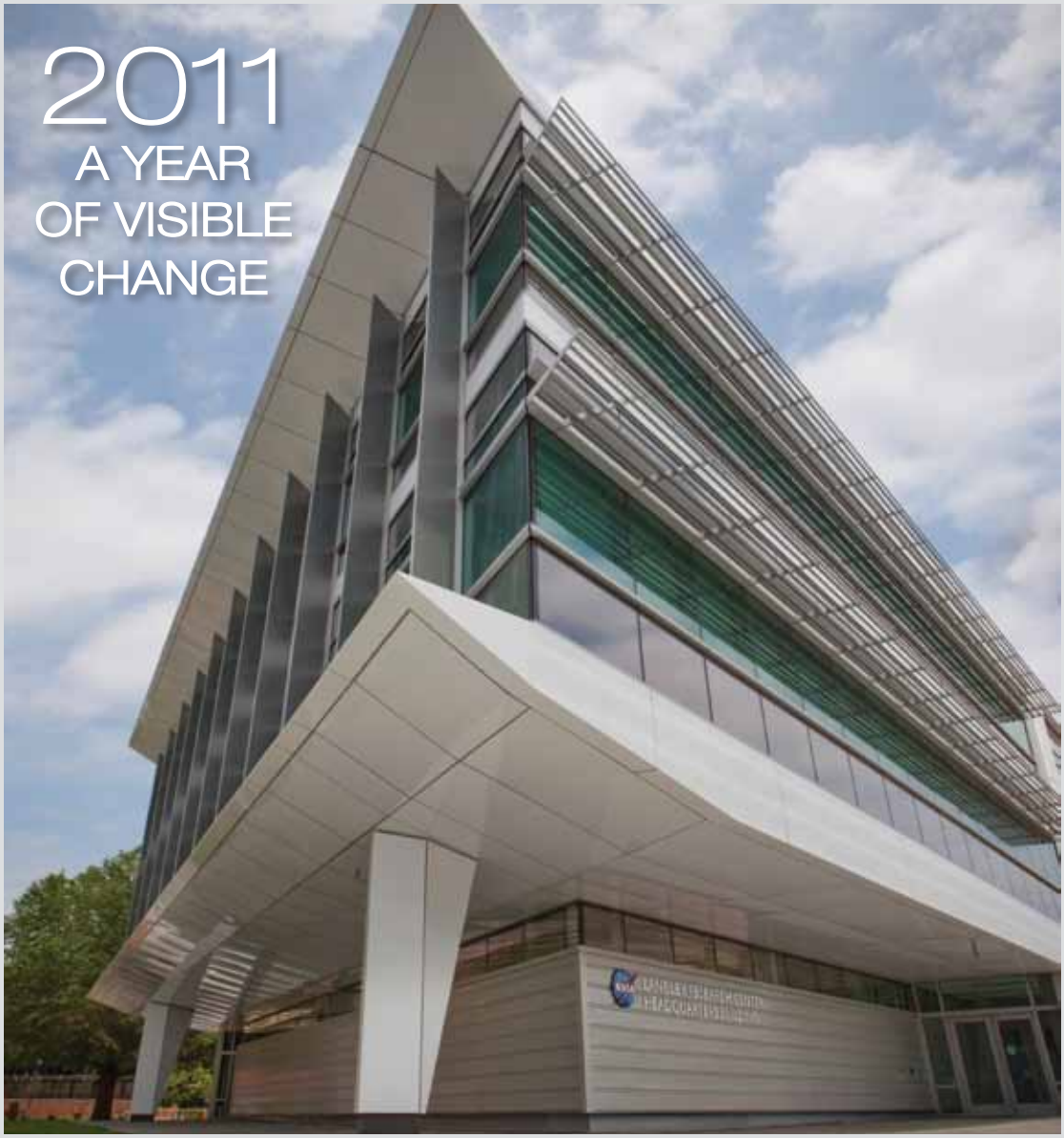
National Aeronautics and Space Administration

2011
A YEAR OF VISIBLE CHANGE



LANGLEY RESEARCH CENTER

www.nasa.gov

contents

“NASA is on a reinvigorated path of exploration, innovation and technological development leading to an array of challenging destinations and missions.”

— Charles Bolden
NASA Administrator

(Inside cover) Splashdown of a crew capsule mockup in Langley’s new Hydro Impact Basin during a drop test.

A conference room in Langley’s new headquarters building uses sections of fan blade from a wind tunnel to highlight the ceiling and honor our legacy.

Photos: NASA/Sean Smith

director's message

Clockwise from right: Langley's new headquarters building; artist's concept of a supersonic aircraft; a handful of biochar, a soil supplement; a Langley materials experiment on the space station; testing a futuristic concept in the 30x60-Foot Tunnel; deconstruction of the 30x60.

The Langley Research Center landscape has seen some significant changes this year – both literally and figuratively. Staff and visitors are immediately drawn to the newly constructed headquarters building just past the main gate. The ribbon cutting in June for this first building in our New Town initiative was a grand ceremony and it punctuated the beginning of a renewed Langley, a center focused on what we do best: innovation, collaboration and continual revitalization.

New Town is a multiyear project that will ultimately result in six new buildings and the phased removal of deteriorated and underused buildings and facilities. As a tribute to our past, we incorporated fan blades from the 16-Foot Tunnel into the ceiling system in the new Langley headquarters and a complete fan hub assembly from the Full-Scale Tunnel will be on permanent display at the Smithsonian's National Air and Space Museum in the "Milestones of Flight" exhibit.

We are making significant changes not only to address reduced budgets, but to also ensure that our center's technical capabilities, facilities and infrastructure are poised to meet the grand challenges that will enable NASA to fulfill its mission. One of the most obvious additions to our technical resources is the Hydro Impact Basin opened in July. After facility checkout, testing of the Orion crew capsule began in October. This is a critical step to ensure safe water landings for astronauts who will venture into space aboard Orion.

We are investing in capabilities and technologies that will fuel the innovation of our talented employees. It's been an extremely busy year in Science

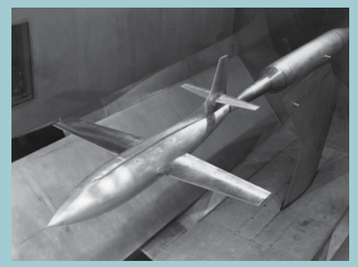
Clockwise from left: the next building in the New Town project; a test model in the 16-Foot Transonic Tunnel; deconstruction of the 16-Foot; artist's concept of an Earth-observing satellite; drop test of an astronaut crew capsule test article; drawing of an inflatable heat shield.

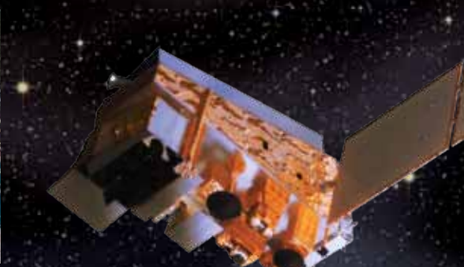
culminating with the launch of our CERES instrument and preparing our SAGE III instrument for the International Space Station. In Aeronautics, we are investing in the next-generation air transportation system and increasing performance by reducing fuel consumption, emissions, and airport noise. In Exploration, we are leading the development of the Launch Abort System and supporting the Space Launch System and Orion in the critical areas of navigation, guidance, control and landing systems.

However, we don't do this alone. Langley collaborates with our diverse network of partners ranging from small startup firms and academia to large corporations and other government agencies. Together we are driving advances in science, aeronautics and exploration. Accelerating these collaborations is an important part of our center strategy to ensure we have the right capabilities for the opportunities of the future.

I believe Langley's best days are ahead of us. Our core competencies are critical to the vitality of our nation. A continually revitalized Langley will ensure we maintain our tradition of technical excellence, develop innovative technologies and solve some of the world's toughest problems. We are reaching for new heights and revealing knowledge that will benefit all humanity.

Lesa B. Roe
Director





Developing a New Launch and Crew Vehicle

The Orion crew capsule mockup lands in the Hydro Impact Basin during a drop test at Langley.

Nineteenth century American pioneers trekking west to new homes in covered wagons likely didn't anticipate the details of 21st century solar system exploration. They were focused on getting from here to there, and they needed transportation.

So, too, will NASA's deep-space astronauts. Propelling them on their journeys will be NASA's Heavy Lift Space Launch System (SLS) and the Orion crew capsule, enabling trips to near-Earth objects like asteroids, to the moon, perhaps even one day to Mars.

Drawing upon a unique expertise in computational analysis and an extensive complex of wind tunnels, Langley, in collaboration with Marshall Space Flight Center, is overseeing SLS aerodynamics. The center's critical design-process contributions include collecting, analyzing, and documenting aerodynamic data to support rocket development.

Langley continues to play a central role in the Orion crew capsule, including managing development of Orion's Launch Abort System that will fly crews to safety in the event of rocket malfunction or other emergency. The center also leads testing of Orion crew capsule landing systems, both on land and in water.

Orion Drop Testing

In July 2011, engineers began drop testing the 22,000-pound Orion crew capsule mockup into Langley's new Hydro Impact Basin, which is located at the west end of Langley's historic Landing and Impact Research Facility, where Apollo astronauts trained for landing on the moon.

The crew capsule test item is similar in size and shape to the Orion capsule, but is more rigid so it can withstand multiple drops. Each test has a different drop velocity to represent possible crew capsule entry conditions during water landings.

In addition, discipline-specific expertise from Langley is used to assess crew capsule aerodynamic and aerothermodynamic performance, guidance, navigation and control, flight software design and testing, and for structural analyses. The center continues to conduct studies to understand how the use of advanced technologies, such as lightweight metallics and advanced composite materials, will improve launch vehicle performance.

Artist's concept of an inflatable heat shield.

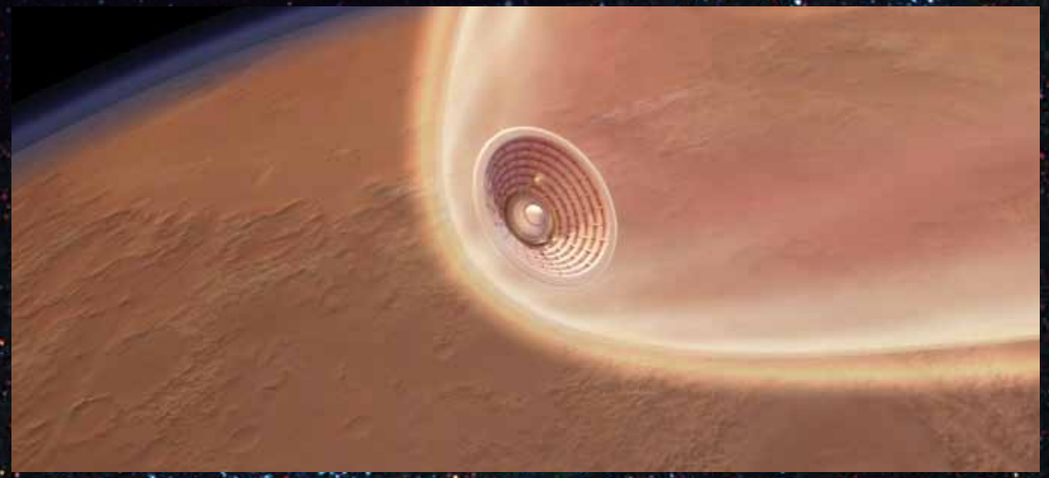
Living and Working Beyond Earth

Langley continues to develop game-changing, innovative technologies to efficiently access space and to enable people to live and work beyond Earth's orbit, including:

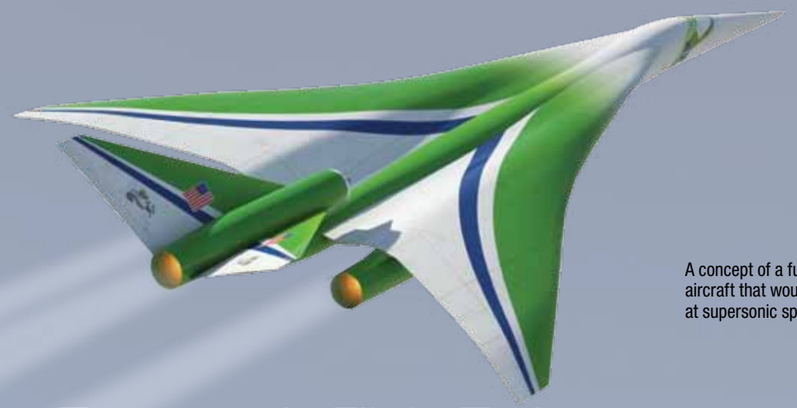
- Lightweight structures, such as deployable solar arrays and inflatable structures
- Nanotechnology advances to achieve significant reductions in mass
- Advanced sensors and controls for safe landings
- Systems and tools for predicting radiation hazards and protecting crews and spacecraft from them
- Entry, descent, and landing advances including hypersonic inflatable aerodynamic decelerators, known as HIADs
- HYTHIRM or Hypersonic Thermodynamic Infrared Measurements, which imaged shuttle reentries to learn more about heating effects on the spacecraft and for use in hypersonics research.
- STORRM or Sensor Test for Orion RelNav Risk Mitigation, which uses sensor technologies that would make it easier for space vehicles to dock to the International Space Station.

Supporting Commercial Spaceflight

As the Space Shuttle Program drew to a close in 2011, Langley continued to provide mission-specific insights to shuttle teams working on mission management, damage assessment and impact dynamics. Additionally, in the aftermath of cessation of shuttle flights, Langley is now supporting commercial spaceflight companies that will soon begin to ferry cargo and astronauts to the International Space Station.



Depiction of the entry into the Mars atmosphere of the Mars Science Laboratory, which was launched in November 2011.



A concept of a futuristic aircraft that would fly at supersonic speeds.

Forging Tomorrow's Flight Today

NASA Langley researchers are helping to implement America's next-generation air transportation system. Included in that effort is the development of technologies, concepts, and procedures for improved air traffic management and the energy-efficient, environmentally friendly aircraft that are the hallmark of NASA's "green aviation" aeronautics research.

In the spirit of green aviation, center specialists are evaluating technologies that would make transport aircraft able to fly routinely beyond the speed of sound without posing noise or environmental threats. Langley engineers and scientists are also studying concepts that would enable vehicles to fly hypersonically, or in the speed range of Mach 5, about 3,500 miles per hour.

Green, Clean and Quiet

Agencywide, NASA has committed to developing a host of green technologies to significantly reduce the impact of commercial aircraft noise and emissions. Langley researchers are studying methods to lessen emissions by boosting airplane efficiency so that less fuel per passenger is consumed. The center is also assisting in the formulation of cleaner-burning biofuels that would help to create a sustainable, energy-independent future for aviation.

Technologies such as damage-arresting, unitized composite structures show great promise for construction of safer, lighter airplanes. Langley engineers are assessing the promise of this approach, as well as new drag-reduction methods and noise-reduction strategies in and around airports.

Rotorcraft, Runways and Reliability

Center researchers continue to investigate the benefits of craft that take off and land vertically; such vehicles may make air travel faster. Also under consideration are next-generation rotorcraft capable of carrying as many people as a regional jet. These new concepts reduce delays, emissions, and noise in the entire airspace system, helping all travelers to more quickly reach their destinations.

Langley is also working to develop advanced flight-deck technologies to make runway landings more efficient. Center researchers have conducted simulations to evaluate the ability of upgraded flight-deck software, displays and procedures to improve arrival operations for airports with parallel runways.

Additionally under study are ways to help pilots to better understand aircraft behavior in hazardous conditions, boosting reliability and safety. Researchers are studying subscale transport aircraft to evaluate next-generation integrated aircraft guidance and control concepts to enhance aircraft controllability when emergencies occur.

Faster Than Fast

Another Langley research priority is hypersonics, a discipline that explores technology approaches to achieving atmospheric flight at many multiples of the speed of sound: as fast as Mach 12, or between 8,000 and 9,000 miles per hour, depending on altitude. Center engineers continue a commitment to the development of new hypersonic air-breathing propulsion systems.

With a combined investment of $30 million over five years, NASA and the Air Force Office of Scientific Research have jointly established the National Center for Hypersonic Combined Cycle Propulsion at the University of Virginia in Charlottesville. It is one of three national centers of excellence in hypersonics research. Generating a fundamental physical understanding and modeling capability for engine cycle mode transitions and operation past Mach 6 are the center's major objectives.

NASA Tests Biofuels for Commercial Jets

In an RV nicknamed after an urban assault vehicle, scientists from NASA Langley traveled cross-country last year for an experiment with eco-friendly jet fuel.

The team drove 2,600 miles from Hampton, Va., to meet up with other researchers at NASA's Dryden Flight Research Center in California.

Researchers tested biofuel on a NASA DC-8 to measure its performance and emissions as part of the Alternative Aviation Fuel Experiment II, or AAFEX II. The fuel is called Hydrotreated Renewable Jet Fuel.

"It's made out of chicken fat, actually," said Langley's Bruce Anderson, AAFEX II project scientist. "The Air Force bought many thousands of gallons of this to burn in some of their jets and provided about 8,000 gallons to NASA for this experiment."

Anderson and his team tested a 50-50 mix of biofuel and regular jet fuel, biofuel only, and jet fuel only. Fuel from beef tallow was also used.

The 32-foot van was dubbed "EM-50" by researchers, after the urban assault vehicle used in the 1981 comedy "Stripes" with Bill Murray, and carried heavy equipment needed for the campaign. The van, by the way, uses regular gas, not biofuel.

"AAFEX II will provide essential gaseous and particulate emissions data as well as engine and aircraft systems performance data from operation of the DC-8 on a fuel produced from a renewable resource," said Dan Bulzan, who leads clean energy and emissions research in NASA's Subsonic Fixed Wing Project.

Testing is being done at a time when the U.S. military has set a goal of eventually flying its aircraft using 50 percent biofuel. The Air Force is currently engaged in certifying its fleet to operate on a 50-percent blend of the same fuel being tested in AAFEX II. Some military cargo and fighter planes already use alternative fuels.

"The use of alternative fuels, including biofuels, in aircraft is a key element for substantially reducing the impact of aviation on the environment and for reducing the dependency on foreign petroleum," said Ruben Del Rosario, manager of NASA's Subsonic Fixed Wing Project, which is conducting the tests.

NASA/Sean Smith

Research team from left: Bruce Anderson, Eddie Winstead, Andreas Beyersdorf, Lee Thornhill, Bobby Martin, Luke Ziemba and Charles Hudgins.

NASA Dryden/Tom Tschida

NASA's DC-8 at Dryden Flight Research Center's Aircraft Operations Facility in Palmdale, Calif.

Checkout of the SAGE III-ISS instrument, which is planned for launch in 2014. SAGE stands for Stratospheric Aerosol and Gas Experiment.

With a Langley science instrument aboard, a Delta II rocket carries an Earth-observing satellite into a polar orbit.

Tracking Dynamic Change

NASA Langley scientists measure, monitor and model Earth's atmosphere, how it's changing, and how that change affects everything from air travel to air quality to global climate. We develop instruments and measurement techniques for land, air and space. In so doing, we've amassed one of the world's most comprehensive and precise collections of climate data.

We are passionate about our quest to understand what is truly changing on Earth, so that the information we collect from the research we conduct, the missions that we run and the instruments that we fly in the air and in space can collectively be put to use for the greater good: a safer planet and a better tomorrow.

Air Quality, Weather and Climate

The crux of climate change is energy. In 1984, NASA began measuring and keeping an accurate record of changes in Earth's energy with a satellite instrument known as ERBE (Earth Radiation Budget Experiment) and then its successor, CERES (Clouds and the Earth's Radiant Energy System).

Five satellites and 27 years later, not a single year has passed without a record of Earth's energy. In October 2011, the climate-monitoring torch was passed to the NPOESS Preparatory Project (NPP), a satellite carrying a copy of the CERES instrument.

The CERES team explains that long-term overlapping observations help to reveal significant changes in Earth's climate by showing what the normal pattern of incoming and outgoing energy looks like. Another copy of the CERES instrument is in development for flight in 2016.

For a satellite that's only five years old, NASA Langley's CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) mission has accomplished a lot. Data from the satellite is helping scientists understand where particles in the air called aerosols block sunlight, and under what conditions high ice clouds warm the atmosphere and lower clouds cool the planet.

In 2011, CALIPSO data contributed to a research project revealing that aerosols in the upper layer of the atmosphere have played a significant role in cooling the climate in the past decade, despite being at persistently low levels. Results from this research will help improve climate simulations to create more accurate predictions of climate change.

Stratospheric Aerosols and Radiation

The next generation of the SAGE (Stratospheric Aerosol and Gas Experiment) mission underwent a battery of tests in early 2011 after being stored for almost 10 years awaiting a ride to the International Space Station (ISS). SAGE III-ISS is scheduled to board one of NASA's first commercial Space X flights in 2014 for a ride to the ISS.

SAGE III-ISS will continue the legacy of SAGE ozone monitoring instruments that 25 years ago helped scientists realize that Earth's protective ozone layer was thinning.

The SAGE family of instruments was pivotal in making accurate measurements of the amount of ozone loss in Earth's atmosphere. SAGE also played a key role in measuring the onset of ozone recovery after internationally mandated policy changes that regulated chlorine-containing chemicals were passed in 1987.

A NASA P-3B research aircraft is prepped for flight during a mission to study air quality.

Airborne Air-Quality Campaign Created a Buzz

If you were driving in the Baltimore-Washington area last summer, you may have been buzzed by a NASA airplane.

For a month ending July 30, the agency conducted a field study to assess air quality over northeast Maryland. Two research airplanes – one flying high and the other low – completed 14 flight days sampling in coordination with ground sites monitoring air quality.

The flights sampled pollutants in the lower atmosphere over major interstates, densely populated areas, small towns, and the Chesapeake Bay.

"These flights allowed us to gather an unprecedented dataset for evaluating the factors governing air quality over the Maryland-DC area," said Jim Crawford, the mission's principal investigator, who is based at NASA Langley. "We look forward to sharing the data and results over the coming months."

One of the planes, a NASA P-3B, spiraled over six ground stations in Maryland, flying as low as 1,000 feet and gathering just over 250 soundings. The 117-foot aircraft gathered air-quality data for the mission called DISCOVER-AQ (Deriving Information on Surface conditions from Column and Vertically Resolved Observations Relevant to Air Quality).

A second aircraft, a UC-12, used a lidar (laser) to take "profiles" of particulate pollution in the atmosphere, while a second instrument took measurements of gaseous pollution beneath the aircraft flying at 26,000 feet.

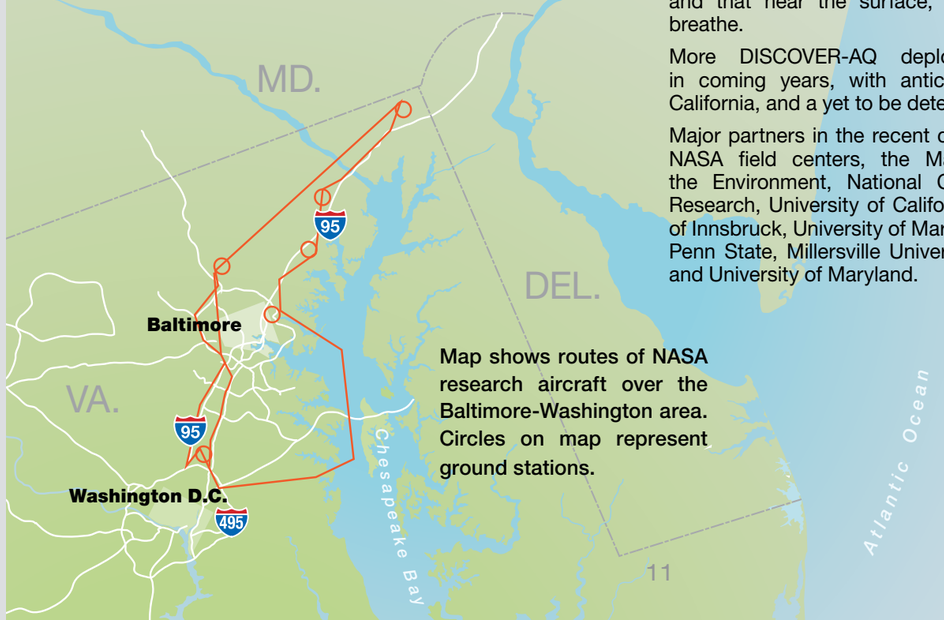
The mission measured gaseous and particulate pollution over the populous region to better understand how satellites can be used to improve air-quality forecasts.

By analyzing data from instruments on both airplanes, scientists hope to get a clearer picture of how satellites in space might be used to provide a broader geographical view of air quality near the Earth's surface beyond what can be provided by ground sites.

A challenge for satellites measuring air quality is to distinguish between pollution high in the atmosphere and that near the surface, where people live and breathe.

More DISCOVER-AQ deployments are planned in coming years, with anticipated stops in Texas, California, and a yet to be determined location.

Major partners in the recent campaign included other NASA field centers, the Maryland Department of the Environment, National Center for Atmospheric Research, University of California-Berkeley, University of Innsbruck, University of Maryland-Baltimore County, Penn State, Millersville University, Howard University, and University of Maryland.



Map shows routes of NASA research aircraft over the Baltimore-Washington area. Circles on map represent ground stations.

Making the Complex Work

As the nation continues a transition to the Next Generation Air Transportation System, or NextGen, planners must gauge the impact of a dramatic increase in air traffic. Affected areas range from air traffic operations, to aviation safety, to on-ground congestion at airport metroplexes, even aircraft design. Each area features potentially revolutionary performance gains.

Accordingly, in 2011, NextGen aeronautics research efforts were analyzed and assessed by Langley's systems analysis experts.

It was one among a number of systems analysis studies conducted in 2011 at Langley in support of NASA initiatives. Reviews ranged from NextGen assessments, to potentially environmentally neutral aircraft, to new spacecraft and remote-sensing systems.

Concept for fuel-efficient aircraft and a planetary exploration roving habitat.

Providing Unbiased Information

Langley has a heritage of pulling together resources from other NASA centers, academia, and industry to conduct aerospace systems analysis to provide unbiased information to decision makers. Evaluated areas include mission architectures, advanced system concepts, system and technology trades, life-cycle cost and risk analysis, system integration, and predecisional sensitive information to enable informed technical, programmatic and budgetary decisions.

At Langley, we focus on continuously acquiring and developing the personnel and advanced analysis and design tools required to excel, all the while considering budget constraints, as we capture the most advanced technology and costing methodology. We work to establish and actively maintain NASA center-to-center system-analyses alliances. We identify where and how Langley and partners can realize NASA's vision for aeronautics and sustainable human and robotic exploration of space.

Langley's systems analysis capabilities extend to

- Air transportation on earth
- Earth-to-orbit space access
- In-space transportation
- Exploration and science missions to other planets

21st Century Aeronautics

During 2011, Langley systems analysis studies included assessments of the emerging class of aircraft known as hybrid wing bodies, and truss-braced wing/fuselage designs and concepts. Both could one day lead to major improvements in aerodynamic efficiencies and significant reductions in harmful emissions.

Because Langley leads hypersonic systems analysis for NASA, we also examined ways NASA is applying air-breathing propulsion technology to high-speed atmospheric flight, as well as highly reliable, responsive space access.

Our engineers also evaluated ultra-high-bypass ratio engine-airframe integration concepts that would substantially reduce polluting emissions and noise while boosting engine fuel economy. Low-sonic-boom supersonic aircraft design studies were also conducted.

Reliable Architectures for Earth and Space

In 2011, the center's systems analysts played a significant role in defining reliable space exploration architectures. Our analysts evaluated the feasibility, design, development and fabrication of potential space vehicles and habitats, including the second-generation Space Exploration Vehicle mockup cabin that was designed and built at Langley and delivered to Johnson Space Center earlier in the year.

During 2011, we also analyzed development of Near Earth Objects, human exploration "buildup" scenarios, and associated architectures to maximize science return.

Langley continues to provide systems analysis support to the International Committee on Earth Observation Satellites, evaluating the Earth-observing fleet of satellites in orbit. Our ultimate goal is to develop options to ensure that requirements for performance and reliability are met, and solutions are affordable and timely.

Lockheed Martin

Crew capsule and launch abort system undergoing acoustic and vibration tests.

Astronaut Chris Ferguson and Sesame Street's Elmo at a NASA event in Manhattan.

Collaborating to Transition NASA Technologies

Successfully transitioning technologies derived from NASA research to commercial application requires collaboration with industry, academia and an array of government groups. Langley's Innovative Partnerships Office (IPO) is a leader in such efforts.

During the past year, IPO funded novel technology-development projects involving energy harvesting, virtual environments, solar sails, and amorphous robots, among others.

Partners Local and Global

In 2011, through Space Act Agreements, IPO collaborated with a variety of partners, including Gulfstream Aerospace, Northrop Grumman, Boeing, Exxon Mobil, Sierra Nevada, Old Dominion University, the National Institute for Aerospace, the Federal Aviation Administration, and other government agencies.

IPO has also been leading efforts to work with local partners such as the city of Hampton, on new ventures that include next-generation business development and "green" initiatives. IPO staff members have been helping educate master gardeners from throughout the Hampton Roads region on the advantages of "biochar," which can improve carbon capture and water quality, increase soil fertility, raise agricultural productivity and reduce pressure on old-growth forests.

Lou Gold

A handful of biochar, a soil supplement.

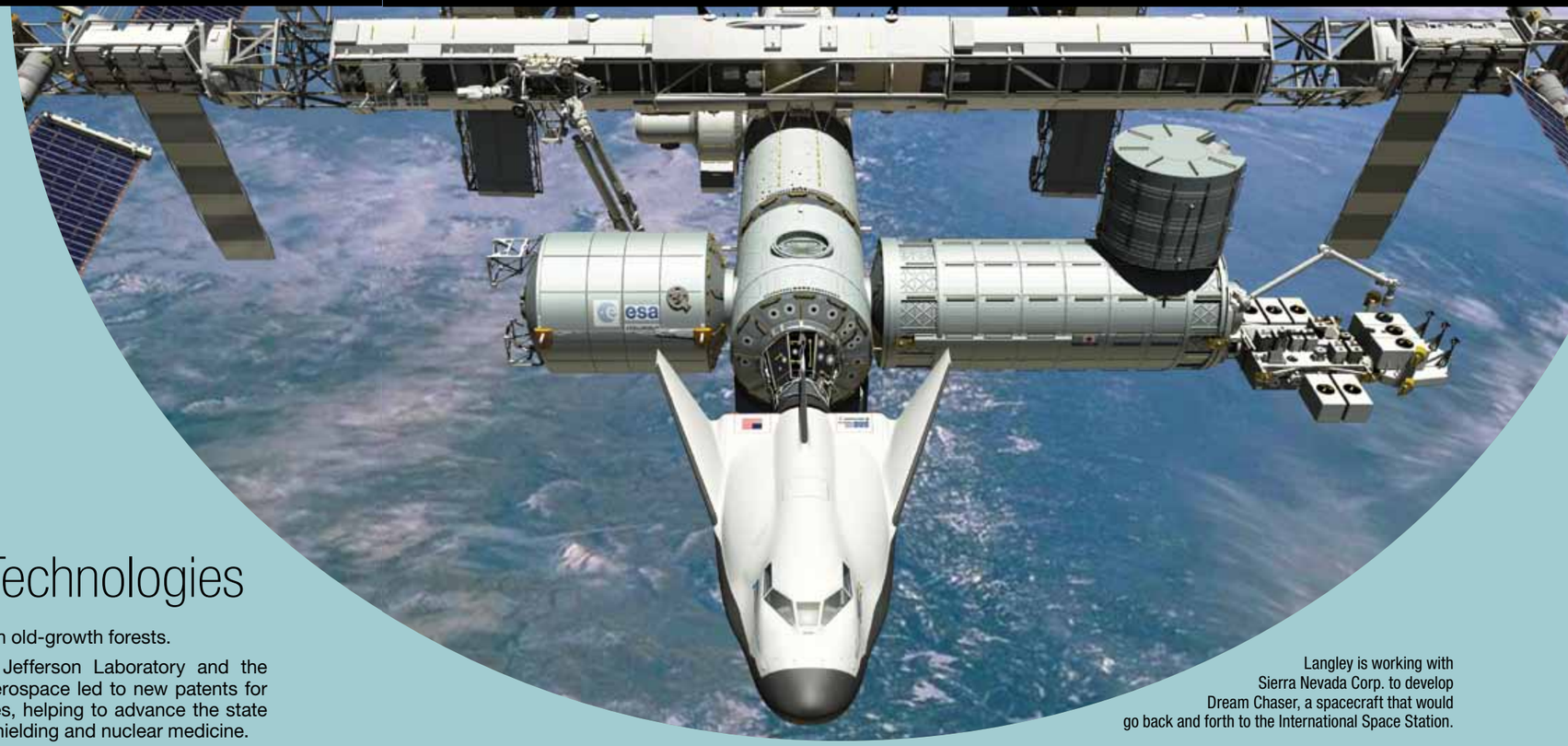
Working with nearby Jefferson Laboratory and the National Institute of Aerospace led to new patents for boron nitride nanotubes, helping to advance the state of the art in radiation shielding and nuclear medicine.

IPO is also part of Innovate! Hampton Roads, an activity that supports expansion of business growth in various industry clusters, such as aerospace, modeling and simulation, sensors, and energy.

Forums and Outreach

In May, IPO organized and presented a NASA showcase of partnership and licensing opportunities to industry and academia, including an "open innovation" panel that featured NASA representatives.

In August, Langley led a multi-disciplinary team that included NASA Headquarters and six NASA centers, three nonprofit organizations, two small businesses, and one university in partnership with a hotel in New York City on a event called "What's Your Favorite Space?" Subsequently, Langley formed an ongoing collaboration with the Manhattan-based nonprofit organization known as the Big Screen Project, which has incorporated NASA video into regular programming on its 30-foot-by-16-foot video screen on Big Screen Plaza.



Langley is working with Sierra Nevada Corp. to develop Dream Chaser, a spacecraft that would go back and forth to the International Space Station.

In September, IPO organized the Electron-Beam Free Form Fabrication Forum to discuss with potential partners this novel manufacturing process and related technologies, as well as commercialization means and methods.

Future Products

To move Langley technologies from the lab to the commercial marketplace, in 2011 IPO executed new licenses for materials and software to pave the way for market products. Such is the case for BLR Aerospace, Inc., which a number of years ago licensed a tailboom strake technology from Langley. Today, helicopters with the boom strake are used by emergency medical services, firefighters, humanitarian organizations, the off-shore oil industry, and the military.

Technology Fusion

Langley develops technologies for space exploration, advancing the understanding of Earth's climate, and improving air transportation.

These technologies have many potential near-term and down-to-earth benefits.

A helicopter equipped with a Langley-developed technology.

Through partnerships, Langley can create new technologies and relationships that are mutually valuable in reducing research and development costs, expanding capabilities, accelerating solutions to technical challenges and creating new products.

Two Launches Carried Langley Instruments into Space

Last October, an arc of light illuminated a pre-dawn sky in California, as a Delta II rocket flawlessly launched with a science payload from NASA Langley. A month later, another Delta lifted off from Cape Canaveral in Florida, sending another Langley payload into orbit.

Even as the space shuttle program was being dismantled, uncrewed launch vehicles continued to deliver a steady stream of satellites into space to study everything from the solar system and beyond to our own planet Earth.

In Langley's case, the October launch carried an instrument to study Earth's atmosphere, called CERES, or Clouds and Earth's Radiant Energy System. It is designed to get a better understanding of the role of clouds and the energy cycle in global climate change, and was one of five instruments launched Oct. 28 from Vandenberg Air Force Base.

The second launch carried the Mars Science Laboratory, a car-size rover named Curiosity, scheduled to land on Mars in August 2012. Langley's role: help design a "beat the heat" system for surviving and also recording data during entry, descent and landing on the red planet.

CERES

The CERES instrument is the latest in a series that has studied the Earth's climate for nearly 30 years. Previous CERES instruments have returned data about the solar energy reflected and absorbed by Earth, the heat the planet emits and the role of clouds in that process.

CERES is one of five instruments on NASA's first next-generation Earth-observing satellite, which is called NPP (NPOESS Preparatory Project). NPP is a critical first step in preparing for the next-generation Joint Polar Satellite System that will collect data on long-term climate change and short-term weather conditions, monitoring changes in the atmosphere, oceans, vegetation, ice and solid Earth.

Data from NPP will enable the National Oceanic and Atmospheric Administration to continue issuing accurate forecasts and provide advance warning of severe weather. NPP also will extend critical long-term data sets that advance Earth system science and applications supported by NASA, NOAA and other agencies.

Mars Heat Shield

Unlike earlier rovers, Curiosity carries equipment to gather samples of rocks and soil, process them and distribute them to onboard test chambers inside analytical instruments. It's also about twice as big as any other Mars rover.

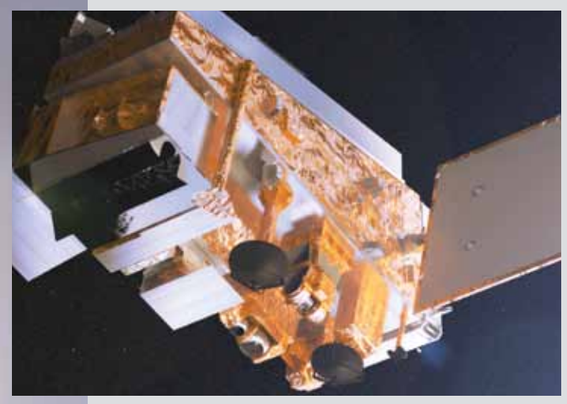
Protecting Curiosity on the way in was a heat shield carrying the Mars Science Laboratory Entry, Descent and Landing Instrumentation or MEDLI. It is made up of 14 sensors that took measurements eight times per second from about 10 minutes before the vehicle entered the top of the Martian atmosphere to until after the parachute opened – about four minutes after entry.

The measurements will be analyzed for information about atmospheric conditions and performance of the entry vehicle. Experience gained with this mission will aid planning for future missions that could be even heavier and larger, such as would be necessary for a human mission to Mars.

2011 marked the end of the space shuttle program.

Artist's concept of the Mars Science Laboratory landing.

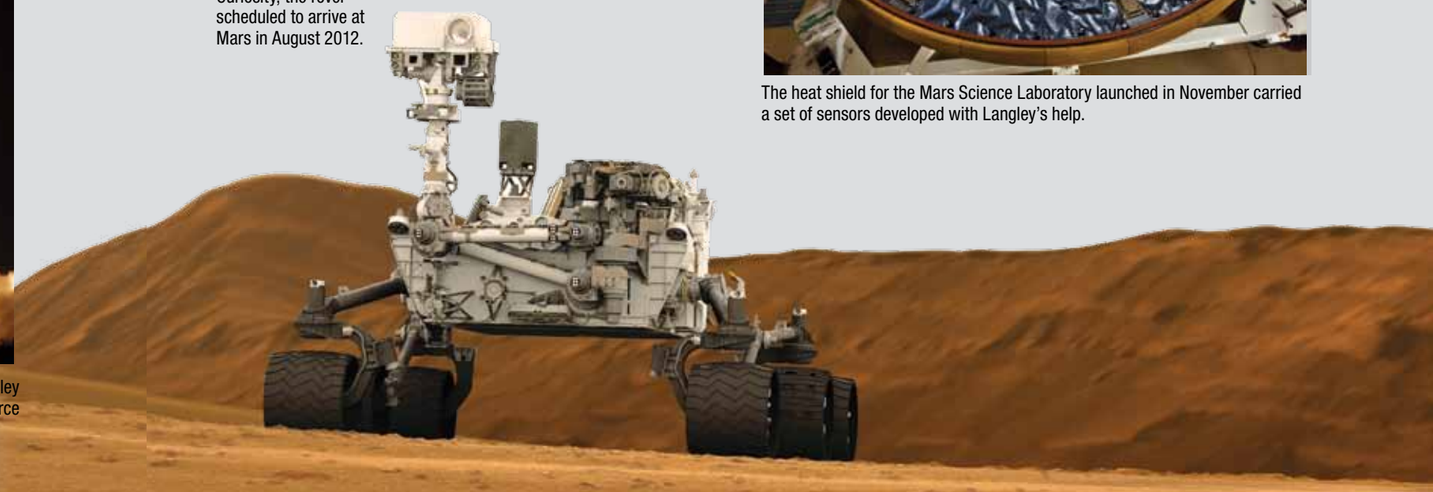
The heat shield for the Mars Science Laboratory launched in November carried a set of sensors developed with Langley's help.



Left: The Mars Science Laboratory blasts off from Cape Canaveral in Florida.

Above: An Earth-observing satellite (left) with a Langley instrument aboard takes off from Vandenberg Air Force Base in California (right).

Curiosity, the rover scheduled to arrive at Mars in August 2012.



Launch of Space Shuttle Columbia on April 12, 1981.

Space Shuttle Atlantis making its, and the shuttle programs, final touchdown on July 21, 2011.

STS-135: The Final Voyage

With a merging of technology and tears, the final chapter in the 30-year history of space shuttle flights was written.

It was a hot July day on Florida's Space Coast as nearly a million spectators gathered along the beaches, rivers and causeways to watch history in the making. The weather forecast was a daunting 70 percent "no-go" to start the day, yet the countdown proceeded smoothly.

"The space shuttle spreads its wings one final time for the start of a sentimental journey into history," said Ascent Commentator Rob Navias. As the shuttle achieved orbit, Navias added, "For the last time, the space shuttle's main engines have fallen silent as the shuttle slips into the final chapter of a storied 30-year adventure."

The crew of four veteran astronauts aboard Atlantis -- Commander Chris Ferguson, Pilot Doug Hurley, and Mission Specialists Sandy Magnus and Rex Walheim — set off on the STS-135 mission to deliver a stockpile of supplies and parts to the space station.

Weather on landing day proved more predictable than it was for launch, and Mission Control in Houston gave astronauts the "go" for a de-orbit burn that would bring them home on their 200th orbit of Earth.

At 5:57 a.m. on July 21, space shuttle Atlantis dropped out of the predawn darkness and landed at Kennedy's Shuttle Landing Facility Runway 15. Caught in the last seconds by the brilliant xenon lights, a space shuttle rolled to a stop for the final time.

Seven of the more than 500 trained astronauts and mission specialists called Langley home one time in their NASA careers.

Roy D. Bridges, Jr.
STS-51 1985 Pilot

Frederick D. Gregory
STS-51B 1985
STS-33 1989 Commander
STS-44 1991 Commander

An early shuttle design undergoing tests in the Transonic Dynamics Tunnel in 1972.

Langley engineers tested tires, brakes and surfaces for the landing strip at NASA Kennedy.

A scale model of the shuttle being tested in Langley's 16-Foot Transonic Tunnel.

Langley Contributions to the Shuttle Program

Building on its strong tradition of research into the performance of winged flying vehicles as well as pioneering work on hypersonic gliders, the X-15 rocket plane, and other types of "space planes," Langley made vital contributions to NASA's Space Shuttle program. Langley:

- Contributed to the technology base for a reusable space vehicle and developed preliminary shuttle designs
- Recommended modified delta wing for vehicle rather than conventional straight wing
- Conducted wind tunnel tests (60,000 wind tunnel hours) and analysis; over one-half of the Aerodynamic Design Data Book came from Langley wind tunnel test results
- Defined ascent aerodynamic wing loads
- Conducted structures and materials tests to determine the requirements for various areas of the vehicle
- Investigated and certified the Thermal Protection System for launch environment
- Performed independent design, analyses and simulation studies to solve problems on the Orbiter flight control and guidance systems
- Conducted landing tests on shuttle main and nose gear tires and brake systems
- Conducted runway surface texture tests and recommended Kennedy runway modifications
- Participated in the redesign of solid rocket booster components
- Examined launch abort and crew bailout capabilities

In addition to helping with development of the shuttle, Langley sent aloft numerous science payloads, primarily instruments to orbit Earth and study the planet's atmosphere. Langley also was instrumental in helping monitor and assess shuttle health from liftoff to landing.

Kenneth D. Cameron
STS-37 1991 Pilot
STS-56 1993 Commander
STS-33 1995 Commander

Roger K. Crouch
STS-83 1997
STS-94 1997 Commander

Stephen K. Robinson
STS-85 1997
STS-95 1998
STS-114 2005
STS-130 2010

Charles J. Camarda
STS-114 2005

Leland D. Melvin
STS-122 2008
STS-129 2009

NASA Fuels Virginia's Economy

NASA's two field centers in Virginia contributed nearly $3 billion in the past year to the local, state and national economies.

NASA Langley had a $2.1-billion impact nationally, while the Wallops Flight Facility on the state's Eastern Shore had a $618.7-million impact.

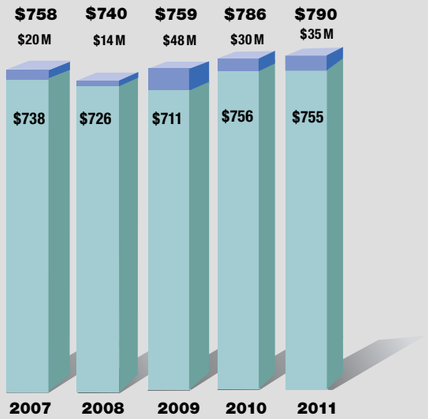
Langley had a $793.3 million budget in fiscal year 2011, a slight increase over the previous year.

Economic Impact of Langley Alone

- U.S.: $2.1 billion that supported 17,062 jobs
- Virginia: $1 million supporting 9,058 jobs
- Hampton Roads: $937.3 million supporting 8,839 jobs

Combined Impact of Langley and Wallops

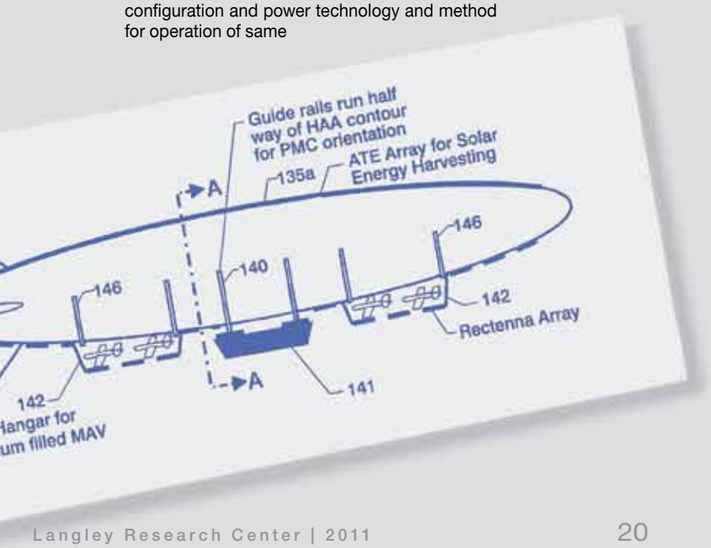
- U.S.: $2.7 billion supporting 21,839 jobs
- Virginia: $1.2 billion supporting 10,780 jobs
- Hampton Roads: $937.3 million supporting 8,389 jobs



Source: NASA and Chimura Economics & Analytics report "The Economic Impact of NASA Virginia Operations for Fiscal Year 2011"

Patents translate into technologies that contribute to everyday life - and the economy.

Patent 8,020,805 B2 for a high altitude airship configuration and power technology and method for operation of same



146

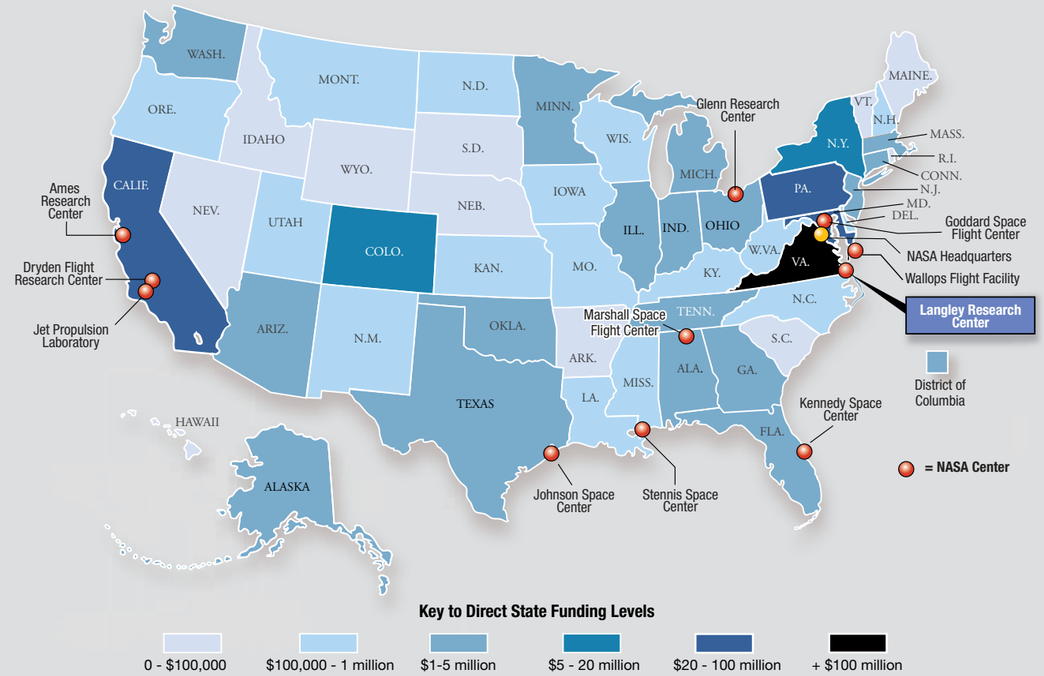
Number of invention disclosures for Langley (1,720 for Agency)

30

Number of patents issued on applications filed by NASA for Langley (106 for Agency)

30

Number of patent applications filed by NASA for Langley (106 for Agency)



Top Obligations to Business Contractors

Jacobs Technology, Inc.	$ 79,067,260
Science Systems and Applications, Inc.	46,389,706
ATK Space Systems, Inc.	44,237,051
SGT, Inc.	26,750,641
Tessada & Associates, Inc.	18,684,417
Lockheed Martin Corporation	15,881,314
The Boeing Company	11,941,230
Science Applications International	10,118,716
Earth Resources Technology, Inc.	9,910,090
Dominion Power Company	9,652,197
Analytical Mechanics Associates, Inc.	9,160,478
Unisys Corporation	7,316,069
Safety & Quality Assurance Alliance	6,453,793
Northrop Grumman Space & Mission Sys.	5,995,251
Chugach Federal Solutions, Inc.	4,718,884
CSC Applied Technologies, LLC	4,406,733
Inuteq, LLC	3,099,370
ASRC Management Services, Inc.	3,002,158
Analytical Services & Materials, Inc.	2,871,598
Modern Machine and Tool Company, Inc.	2,659,277
Science and Technology Corporation	2,436,931
Chugach Industries, Inc.	2,105,142
Northwest Research Associates, Inc.	1,493,929
Intentional Leadership, Inc.	1,475,300
Research Triangle Institute	1,448,913

Top Obligations to Nonprofit and Education Institutions

National Institute Of Aerospace	$ 22,037,309
City of Hampton	5,841,560
Pennsylvania State University	5,175,517
Georgia Tech Research Corporation	2,563,442
Cal Poly Corporation	1,334,520
Regents of The University of Michigan	1,319,584
The Aerospace Corporation	1,282,578
Leland Stanford Junior University,	1,000,000
Christopher Newport University	745,050
Wheeling Jesuit University, Inc.	700,000
University Corp. for Atmospheric Research	673,494
Virginia Tech	546,760
University of Illinois	545,647
City of Newport News	540,275
Ohio University	499,997
Congressional District Programs, Inc.	459,133
Old Dominion University Research Foundation	441,384
University of Tennessee	431,837
University of Arizona	396,534
Southern University and A&M College	315,295
Research Foundation of CUNY	306,616
Regents of the University of California	283,475
The Trustees of Columbia University	280,219
University of Maryland Baltimore Co.	257,059
North Carolina A&T State University	252,920

A Profile of Langley's People

Ever wonder what NASA Langley is as a community?

Sixty-one percent of the center's roughly 1,940 civil servant employees are what most people would call "rocket scientists" — engineers and scientists. Nineteen percent of the total number of employees hold doctorates, while 31 percent have masters degrees and 27 percent a bachelors.

Sixteen percent have associate degrees and seven percent have some college, an advanced study certificate or high school. The 7% includes those who have gone beyond high school, but not achieved an associates degree. Less than 1% haven't finished high school, while over 6.8% have high school or higher.

Twenty-two percent of the staff is classified as administrative mission support — the people who work in procurement, budget tracking, technology transfer and with educational programs.

Fourteen percent are technicians, the folks who prepare for testing and keep the wind tunnels and other facilities running. Three percent are clerical.

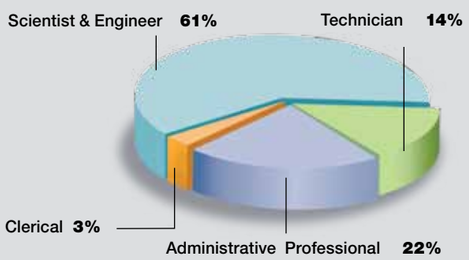
In addition, 48 students in the co-op program were classified as civil service employees.

In all, Langley employed 1,940 civil service positions and 1,750 contractors.

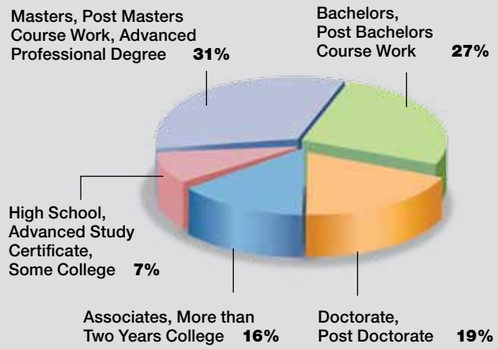
It takes a diverse group to run a complex organization like Langley, and there are many interesting people stories here … like the one on the next page.

One way Langley employees learn new skills is through programs that combine science and engineering with training. One such program is the DEVOTE (Development and Evaluation of Satellite Validation Tools by Experimenters) project, a training initiative led by a team of early career scientists and engineers who are gaining mission experience and contributing to the latest Earth science research through a field campaign.

Occupation Distribution



Education Distribution



Education and occupation distribution numbers apply to 1,940 civil servants only. Data is not collected for contractors.

From left, Tremaine Wills, Marile Colon Robles, Rob Lorkiewicz, Vicki O'Neill, Glenn Hrinda, and Tiffany Hunter.

> "Every child is different and any adopted child is going to have lingering effects from their past experiences, but you just keep moving forward to give them the best opportunities that you can to have a great life."

Langley Family Adopts 5 from Russia

In 2008, after a mission trip to Russia and eight months after their second biological child left for college, Stuart and Sally Johnson adopted three children from Russia.

"We had been hosting two girls from Bellarus every summer for the past six years, and then we went to Russia and saw the older children in the orphanages," said Sally. "We learned that most of these older children in the orphanages had slim chances of being adopted, and most would grow up and end up in crime."

Said Stuart: "We came to this gradual realization of being called to adopt. In 2008, we adopted three kids from Russia, ages 8, 10, and 10."

With an increase in the size of their family came the need for a decrease in the responsibilities in their careers. "I had to give up my branch head position prior to adopting kids, because I was also working on a team. I had to choose so I could fit it all in," Sally said.

Stuart and Sally have 30 years at NASA. Stuart does advanced aircraft research, and Sally deals with avionics and air traffic research.

This summer, their family grew when they adopted two more children, ages 7 and 9, from Russia.

"It was only supposed to be one, but then we found out she had a sibling," Stuart said.

Besides their five adopted children, the Johnsons have two older biological children. "Our biological children are much older and do not live at home, but the adopted children adore them and cherish their visits and attention," Sally said.

Stuart and Sally Johnson meet up with their five children on the playground outside of the Reid Conference Center. Deana is sitting in front. From left to right, the children in the back are Andrei (red shirt), Alexei, Svetlana and Anya.

They are adoption veterans now, which should make the addition of two children less difficult.

"Every child is different and any adopted child is going to have lingering effects from their past experiences, but you just keep moving forward to give them the best opportunities that you can to have a great life. Progress is often measured in months and years, not days," Sally said.

From left: Gary Wainwright, Upendra Singh, Nicole Hintermeister, Patricia Pahlavani, and Mark Shuart.

Photos: NASA/Sean Smith

100th anniversary of a historic glider flight.

Astronaut Roger Crouch at Langley with students in the Virginia Aerospace Science and Technology Scholars program.

Tweeps from around the country paid their own way to Langley for a daylong tour and tweetup. Awesome!

Inspiring All Generations of Explorers

NASA informs the public about its research and inspires the next generation of explorers through outreach.

Sixty-one students participated in DEVELOP, an applied Earth sciences training program. The students' projects included a partnership with Wise County Va. The program demonstrates how NASA science measurements and predictions can be used to address local management and policy issues.

Three hundred Hampton Roads students participated in TEDxYouth@NASA, one of 100 TEDx events in 44 countries.

Over 40 "tweeps" attended Langley's first tweetup, including a Wisconsin physics student, an actor, a pilot, a kindergarten teacher and a museum official. The tweetup included a daylong tour.

Langley celebrated the 100th anniversary of Orville Wright's historic glider flight in Kitty Hawk. Astronaut Susan Kilrain spoke about the "Space Shuttle: World's Most Complex Glider."

Belvedere Plantation in Fredericksburg, Va., featured an 8-acre maze of a Mercury rocket as part of Space Farm. A NASA tent showcased exhibits, an astronaut picture opportunity, and a corn rocket craft.

NASA's Associate Administrator for Education Leland Melvin and recording artist Pharrell Williams.

Center Director Lesa Roe spoke at MODSIM World 2011 in Virginia Beach. The conference explored the possibilities of computer modeling and simulation. Educators received tools and sample lesson plans for bringing modsim to students.

Cindy Jones, a Midlothian teacher wanted to excite kids about engineering. Collaboration with NASA Langley resulted in an affordable engineering kit for middle and elementary school students.

About 500 Virginia Aerospace Science and Technology Scholars (VASTS) completed online assignments and attended a one-week summer session at Langley. The high school students worked with NASA mentors to complete a mission to Mars challenge.

Virginia teachers also participated in the VASTS experience. About 25 teachers attended a summer session and took back techniques for using science, technology, engineering and math jointly in lesson plans.

In August, the Eventi Hotel, NASA, the Intrepid Museum, and others presented "What's Your Favorite Space?" at the Eventi plaza in New York City. The event featured the Atlantis crew from the final shuttle mission and a Mars rover.

The Langley Aerospace Research Summer Scholars (LARSS) program celebrated 25 years. Some of its 4,600 alumni now work in the agency's top programs.

Photos: NASA/Sean Smith

Around the country, agritourism farms celebrated NASA using space-theme designs in cornfields.

Big Brothers Big Sisters and the Virginia Air & Space Center partnered for a Summer of Innovation program. Girls, Inc. and Langley presented a similar program to children of migratory farm workers in North Carolina and Virginia's Eastern Shore.

Astronauts Rex Walheim, Sandy Magnus, Chris Ferguson and Doug Hurley hang with Sesame Street's Elmo at NASA event in Manhattan.

Langley put on another successful TEDxYouth@NASA.

Ten co-op students earned the only nationally recognized certification for aerospace technicians. The SpaceTEC certification includes a written, oral, and practical exam. The students attended Thomas Nelson Community College and rotated through 15 assignments in 23 facilities at Langley.

Recording artist Pharrell Williams and NASA Associate Administrator for Education and former astronaut Leland Melvin spoke with young people in Virginia Beach in April. NASA and Williams' foundation, From One Hand to Another partnered to inspire students about science, technology, engineering and math. Many students had participated in Langley's Summer of Innovation camps. Katherine Johnson, a NASA trailblazer, spoke about her job as a "computer" at Langley who calculated the trajectory of Alan Sheperd's 1961 space flight.

This summer the Big Brothers Big Sisters and the Virginia Air and Space Center presented a Summer of Innovation program. Girls Inc. and Langley worked with children of migrant farm workers in North Carolina and on the Eastern Shore of Virginia.

At the CIAA basketball tournament NASA talked about its education programs. At a breakfast forum in Charlotte, a group of educators, astronauts, North Carolina legislators and NASA officials discussed science, technology, engineering and math education with Administrator Charlie Bolden and Associate Administrator for Education Leland Melvin via Skype. More than 200 teachers learned how to use NASA missions and resources during workshops. Almost 2,000 middle school students from across North Carolina met with college representatives.

Students gather around a robot at the annual Central Intercollegiate Athletic Association event in Charlotte, N.C.

■ **Jack Fishman,** Chemistry and Dynamics Branch, was awarded the rank of Fellow by the American Meteorological Society.

■ **Patrick Minnis,** Climate Science Branch, was awarded the rank of Fellow by the American Meteorological Society and received the Losey Atmospheric Sciences Award from the American Institute of Aeronautics and Astronautics (AIAA).

■ **Frank Batts,** Test Technologies Branch, was installed as commander of the 29th Infantry Division of the Virginia Army National Guard and was promoted to the rank of Major General.

■ **Clinton Cragg**, NASA Engineering and Safety Center, received the National Security and International Affairs Medal from Partnership for Public Service as part of the team that assisted with the rescue of Chilean miners.

■ **Roger Wagner**, Ground Facilities Testing Directorate, received a Legion of Merit Medal from the United States Air Force.

■ **Bruce Wielicki** and **Norman Loeb**, Climate Science Branch, representing the CERES Science Team, received the William T. Pecora Award from the Department of Interior.

■ **Terry Morris**, Safety-Critical Avionics Systems Branch, received a Certificate of Public Leadership, Brookings Institution and Extraordinary Service Award for Volunteer Center of Virginia.

■ **Raymon McAdaragh**, Crew Systems & Aviation Operations Branch, certificate of excellence, UAS Research & Development Matrix Team from the Federal Aviation Administration, NextGen & Operations Planning.

■ **Michael Kaszyca**, Mission Services Contracting Branch, was one of the five finalists for the Procurement Round Table 2011 Elmer B. Staats Young Acquisition Professional Excellence Award, a government-wide award.

■ **Clayton Turner,** Office of the Director, received the Monroe Community College Alumni Hall of Fame Recognition.

■ **Charles Harris**, Director of Research, received the Distinguished Career Award at the Virginia Tech College of Engineering Academy of Engineering Excellence.

■ **Joel Levine,** Science Directorate, received the Distinguished Alumnus Award from the Brooklyn College of the City University of New York.

■ **Stephen Wilkinson,** Flow Physics & Control Branch, received the Old Dominion University Pioneer Award for his work in viscous drag reduction.

■ **Ivatury Raju**, NASA Technical Fellows Office, received a Lifetime Achievement Award at the 2011 International Conference on Computational & Experimental Engineering & Sciences.

■ **Phil Drummond,** Distinguished Research Associate in the Hypersonic Airbreathing Propulsion Branch, received the Joint Army, Navy, NASA, and Air Force Executive Committee Lifetime Achievement Award at the 58th JANNAF Propulsion Meeting.

■ **Christopher Rumsey,** Computational Aerosciences Branch, was elected a Fellow of the American Institute of Aeronautics and Astronautics (AIAA).

■ **Ray Rhew**, Aeronautics Systems Engineering Branch, was elected an Associate Fellow of the AIAA.

■ **Joseph Morrison,** Computational Aerosciences Branch, was elected Associate Fellow, AIAA.

■ **Ferdinand Grosveld**, Structural Acoustics Branch, was named director, Northeast Region (Region I), AIAA.

■ **John Micol,** Business Strategy Integration Office, was elected president of the Supersonic Tunnel Association, International.

■ **Ramon Paryz,** Subsonic/Transonic Testing Branch, was awarded member emeritus of the Supersonic Tunnel Association, International.

■ **Upendra Singh**, Engineering Directorate, was elected a Fellow of the Optical Society of America.

■ **Fereidoun Farassat,** Aeroacoustics Branch, was awarded the rank of Fellow of the American Helicopter Society.

■ **Karen Jackson,** Structural Dynamics Branch, was elected a Technical Fellow of the American Helicopter Society.

■ **Farzin Amzajerdian,** Laser Remote Sensing Branch, was elected a Fellow of the SPIE, International Society for Optics and Photonics.

■ **Jay Brandon,** Flight Dynamics Branch, received the AIAA 2011 Engineer of the Year award.

■ **Peter Parker,** Aeronautics Systems Engineering Branch, received the 2011 National Society of Professional Engineer's Federal Engineer of the Year Award.

■ **Sayata Ghose,** Advanced Materials & Processing Branch, was awarded the 2011 Society of Manufacturing Engineers (SME) Outstanding Young Manufacturing Engineer Award.

■ **Sharon Jones,** Aeronautics Systems Analysis Branch, received a Research Leadership Award at the Black Engineer of the Year Awards, Science, Technology, Engineering and Mathematics Global Competitiveness Conference.

■ **Jill Prince**, Atmospheric Flight & Entry Systems Branch, received an achievement award for her work in development of autonomous aerobraking from Women in Aerospace.

■ **Martin Mlynczak**, Climate Science Branch, received the Marcus O'Day Memorial Award.

■ **Sara Wilson,** Aeronautics Systems Engineering Branch, received an early career grant from the American Society for Quality Statistics.

■ **Jonny Callahan,** Aerospace Composite Model Development Section, earned national certification as an aerospace technician with a SpaceTEC certification.

■ **Christopher Savage,** Advanced Fabrication Processes Section, earned national certification as an aerospace technician with a SpaceTEC certification.

■ **John Lin,** Flow Physics & Control Branch, received the AIAA sustained service award.

■ **Michael Park,** Computational Aerosciences Branch, won the Laurence J. Bement Young Professional Paper Competition, Hampton Roads Section, AIAA.

■ **Eric Walker,** Configuration Aerodynamics Branch, received the Peninsula Engineering Council's 2011 Doug Ensor Award recognizing the young engineer of the year.

■ **Amanda Cutright,** Mechanical Systems Branch, received the Ed Payne Outstanding Young Engineer of the Year Award from the Society of Allied Weight Engineers.

■ **Jeremy Pinier,** Configuration Aerodynamics Branch, received an activity award and certificate of appreciation, Hampton Roads Section, AIAA.

■ **Michael Madrid,** Chief Counsel, received a Patriot Award for employer support of the National Guard.

■ **Michael Chapman,** Test Technologies Branch, received a Patriot Award for employer support of the National Guard.

■ **Eric Greenwood,** Aeroacoustics Branch, received the best paper in the Acoustics session at the 67th American Helicopter Society Annual Forum for "The Effects of Ambient Conditions on Helicopter Rotor Source Noise Modeling."

Levine

Prince

Martinez

Brandon

awards

Jones

Raju

C. Harris

Fishman

■ **Ponnampalam Balakumar** and **Michael Kegerise,** Flow Physics & Control Branch, received the 2011 Fluid Dynamics Best Paper Award for "Receptivity of Hypersonic Boundary Layers to Acoustic and Vortical Disturbances" at the 49th AIAA Aerospace Sciences Meeting.

■ **Jarvis Arthur III,** Lawrence Prinzel, Steven Williams, Randall Bailey, Kevin Shelton and Mike Norman, received best paper of session for "Enhanced/Synthetic Vision and Head-Worm Display Technologies for Terminal Maneuvering Area NextGen Operations" at the Enhanced and Synthetic Vision Conference, SPIE.

■ **Linda Kramer, Randall Bailey, Kyle Ellis, Michael Norman, Steven Williams, Jarvis Arthur III, Kevin Shelton** and **Lawrence Prinzel,** were awarded best paper of conference for "Enhanced and Synthetic Vision for Terminal Maneuvering Area NextGen Operations" at the Enhanced and Synthetic Vision Conference.

■ **Foluso Ladeinde, Ken Alabi, Tayo Ladeinde, Douglas Davis, Matthew Satchell, and Robert Baurle,** received a Best Paper Award for "CFD Enhancements for Supersonic Combustion Simulation with VULCAN at the 46th AIAA/ASME/SAE/ASEE Joint Propulsion Conference.

■ **Richard DeLoach,** Aeronautics Systems Engineering Branch and **John Micol**, Ground Facilities & Testing Directorate, received the AIAA 2011 Best Ground Testing Paper award for "Comparison of Resource Requirements for a Wind Tunnel Test Designed with Conventional vs Modern Design of Experiments Methods."

■ **Yuan Chen**, Electronic Systems Branch, presented an invited paper "Micro- and Nano-Electronic Technologies and their Qualification Methodology for Space Applications under Harsh Environments" at the SPIE Defense, Security and Sensing Conference. Co-authors are **Carissa Weber**, NASA Ames, **Mohammad Mojarradi** and **Elizabeth Kolawa**, NASA JPL.

■ **Qamar Shams** and **Allan Zuckerwar,** Aeronautics Systems Engineering Branch, were selected for a 2011 Award for Excellence in Technology Transfer by the Federal Laboratory Consortium for Technology Transfer for A Portable Infrasonic Detection System.

■ **Stanley Woodard** and **Bryant Taylor**, Electronic Systems Branch; **Kathy Dezern**, Strategic Relationships Office; and **Robin Edwards**, Office of Chief Counsel, were selected for a 2011 Award for Excellence in Technology Transfer by the Federal Laboratory Consortium for Technology Transfer for a Safe Wireless Fluid-Level Measuring System.

■ **Stanley Woodard, Doug Taylor, and Chuantong Wang** won a 2011 R&D 100 Award for SansEC Temperature Sensor.

■ **Thomasena H. Woods,** Senior Aerospace Education Specialist, Program STEM Education Advisor, was selected for the National Science Teachers Association's (NSTA) Distinguished Service to Science Education Award.

■ **Stewart Harris,** Engineering Directorate, and Patricia Taylor, Dean of Engineering, Science & Allied Health at Thomas Nelson Community College, received the 2011 Innovative Program Award in recognition of the NASA/TNCC Technician Cooperative Education Program.

■ **Joel Levine,** Science Directorate, and Arlene Levine, Strategic Relationships Office, received the National Alliance of Black School Educators' Presidential Award for the NASA/NABSE lecture series in Planetary Science.

■ **Joseph Ponthieux,** Crew Systems & Aviation Operations Branch, received a certificate of appreciation from the Virginia Governor's Schools.

■ **Thomas McQuigg**, National Institute of Aerospace Graduate Student in the Structural Mechanics & Concepts Branch, received the first place award in the Ph.D. category of the Paul E. Torgersen Research Awards for Virginia Tech College of Engineering graduate students finishing their degree work in 2011 for his research dissertation entitled "Compression after Impact Experiments and Analysis on Honeycomb Core Sandwich Panels with Thin Facesheets."

■ **Andrew Willemsen,** Graduate Student Research Program, Advanced Materials & Processing Branch, received an outstanding student paper award for "Enhanced Noise and Vibration Dissipation by Nanocomposite Polyurethane Foams Synthesized with Dispersed Carbon Nanotubes at the 2011 Noise Conference OR.

■ **Sharon Otero,** Crew Systems & Aviation Operations Branch, the President's Volunteer Service Award, Office of the President of the United States.

■ **Fran DeMarco**, Office of Chief Information Officer, received a service award for her work with the American Red Cross, York-Poquoson Chapter.

■ **Gloria Hernandez**, Chemistry & Dynamics Branch, received an Outstanding Latina Award in Science and Technology at the Latinas and Power Symposium.

■ **Debbie Martinez,** Orion/Flight Test Article Project Office, was chosen as role model of the week April 17 to 23, 2011, for Great Minds in STEM, a gateway for Hispanics in Science, Technology, Engineering and Mathematics, and was honored at the YWCA Virginia Peninsula's 2011 Women of Distinction Awards Ceremony in the Science and Technology category.

■ **Julie Williams-Byrd,** Space Mission Analysis Branch, received the Women of Color 2011 STEM Award in the field of Technology Innovation-Government.

■ **Denisse Aranda,** Mechanical Systems Branch, represented the Agency as guest speaker for Latino Magazine's AHORA Day Conference.

■ **Michelle Ferebee,** Strategic Relationships Office, was recognized at the 16th Annual Women of Color STEM Conference in Dallas, TX and was honored at the YWCA Virginia Peninsula's 2011 Women of Distinction Awards Ceremony in the Government/Politics category.

■ **Vernet Mull,** Research Systems Integration Branch, was honored at the YWCA Virginia Peninsula's 2011 Women of Distinction Awards Ceremony for her contributions to Religion.

■ **Jessica Henegar,** Research Directorate, certificate of recognition for raising over one thousand dollars for the American Cancer Society.

■ **NASA EDGE** received two Bronze Telly awards in online video: government relations category for video pod casts "NE @ Mercury Mission Control" and NE Live @ Orion Pad Abort One."

■ **NASA EDGE** received a Pegasus Award for "NE Live@Lunabotics Mining Competition" video pod cast.

■ **NASA Langley Research Center** received a 2010 Pretreatment Excellence and Pollution Prevention Award and the 2010 Diamond Award for 10 years of consecutive perfect permit compliance at the 18th Annual Hampton Roads Sanitation District Awards Ceremony.

■ **NASA Langley Research Center** earned the Tree City USA certification sponsored by the Arbor Day Foundation, U.S. Dept of Agriculture Forest Service and the National Association of State Foresters.

patents

■ **Joseph Zalameda, William Winfree, and William Yost** received patent 7,855,368 B2 for an air-coupled acoustic thermography for in-situ evaluation.

■ **Lisa Scott-Carnell, Ralph Stephens, Nancy Holloway, Caroline Rhim, Laura Niklason, Robert Clark,** and **Emilie Siochi** received patent 7,993,567 B2 for a method and system for aligning fibers during electrospinning.

■ **Jae-Woo Kim, Cheol Park, Sang Choi, Peter Lillehei** and **Joycelyn Harrison** received patent 7,998,368 B2 for aqueous solution dispersement of carbon nanotubes.

■ **Qamar Shams, Michael Logan, Robert Fox, John Ingham, Sean Laughter, Theodore Kuhn III, James Adams and Walter Babel III** received patent 7,962,252 B2 for a self-contained avionics sensing and flight control system for small unmanned aerial vehicle.

■ **Yeonjoon Park, Sang Choi, and Glen King** received patent 7,906, 358 B2 for epitaxial growth of cubic crystalline semiconductor alloys on basal plane of trigonal or hexagonal crystal.

■ **Sang Choi, Yeonjoon Park, Glen King,** and **James Elliott** received patent 8,018,815 B2 for a micro-fresnel zone plate optical devices using densely accumulated ray points.

■ **John Connell, Joseph Smith, Joycelyn Harrison, Cheol Park, Kent Watson** and **Zoubeida Ounaies** received patent 7,972,536 B2 for electrically conducive, optically transparent polymer/carbon nanotube composites.

■ **Neal Hass** and **Paul Schalhorn** received patent 7,890,311 B2 for a method of simulating flow-through area of a pressure regulator.

■ **Martha Williams, Trent Smith, James Fesmire, Erik Weiser,** and **Jared Sass** received patent 7,977,411 B2 for foam/aerogel composite materials for thermal and acoustic insulation and cryogen storage.

■ **Sang Choi, James Elliott, Jr, Glen King, Yeonjoon Park, Jae-Woo Kim,** and **Sang-Hyon Chu** received patent 8,020,805 B2 for a high altitude airship configuration and power technology and method for operation of same.

■ **Travis Turner, Roberto Cano, Richard Silcox, Ralph Buehrle, Christopher Cagle, Randolph Cabell,** and **George Hilton** received patent 7,958,733 B2 for a jet engine exhaust nozzle flow effector.

■ **Stephen Hales, Joel Alexa, Brian Jensen, Roberto Cano,** and **Erik Weiser** received patent 7,851,062 B2 a metal/fiber laminate and fabrication using a porous metal/fiber preform.

■ **Stephen Hales, Joel Alexa, Brian Jensen, Roberto Cano,** and **Erik Weiser** received patent 8,017,190 B2 a metal/fiber laminate and fabrication using a porous metal/fiber preform.

■ **Charles Camarda, Stephen Scotti, Pieter Buning, Steven Bauer, Walter Engelund,** and **David Schuster** received patent 8,002,219 B2 for a multi-functional annular fairing for coupling launch abort motor to space vehicle.

■ **Zoubeida Ounaies, Cheol Park, Joycelyn Harrison, Nancy Holloway,** and **Gregory Draughon** received patent 7,935,414 B2 for a multilayer electroactive polymer composite material.

■ **Norman Barnes, Brian Walsh** and **Donald Reichle, Jr.** received patent 7,848,381 B2 for a multiple-wavelength tunable laser.

■ **John Connell, Joseph Smith, Joycelyn Harrison, Cheol Park, Kent Watson** and **Zoubeida Ounaies** received patent 7,906,043 B2 for electrically conductive, optically transparent polymer/carbon nanotube composites and process for preparation thereof.

■ **Russell Wincheski** received patent 7,901,611 B2 for a method for predicting and optimizing system parameters for electrospinning.

■ **John Cantrell** and **Sean Cantrell** received patent 7,845,215 B2 for a resonant difference-frequency atomic force ultrasonic microscope.

■ **William Doggett, Bruce King, Timothy Collins** and **John Dorsey** received patent 7,878,348 B2 for a robotic-movement payload lifter and manipulator.

■ **Norman Barnes, Brian Walsh** and **Donald Reichle Jr.** received patent 7.912,101 B2 for controlling second harmonic efficiency of laser beam interactions.

■ **Mahyar Malekour** received patent 7,792,015 B2 for byzantine-fault tolerant self-stabilizing protocol for distributed clock synchronization systems.

■ **Jason Moore** received patent 7,813,599 B2 for a method and apparatus for shape and end position determination using an optical fiber.

■ **Jeffrey Jordan, David Schryer, Patricia Davis, Bradley Leighty, Anthony Watkins, Jacqueline Schryer, Donald Oglesby, Suresh Gulati** and **Jerry Summers** received patent 7,985,709 B2 for a methodology for the effective stabilization of tin-oxide-based oxidation/reduction catalysts.

■ **Paul Pao and Khaled Abdol-Hamid** received patent 7,991,595 B2 for adaptive refinement tools for tetrahedral unstructured grids.

■ **Noah Schiller and Randolph Cabell** received patent 7,893,602 B1 for a dual-use transducer for use with a boundary-stiffened panel and method of using the same.

■ **Russell Thomas and Kevin Kinzle** received patent 8,015,819 B2 for a wet active chevron nozzle for controllable jet noise reduction.

■ **Andrew Hahn and David Kinney** received patent 7,883,052 B2 for an aircraft wing for over-the-wing mounting of engine nacelle.

■ **Stanley Woodard and Bryant Taylor** received patent 7,902,815 B2 for a wireless system and method for collecting motion and non-motion related data of a rotating system.

■ **Luke Catella** received patent 7,871,682 for a support assembly for composite laminate materials during roll press processing.

■ **Stanley E. Woodard** received patent 7,814, 786 for a wireless sensing system for non-invasive monitoring of attributes of contents in a container.

■ **Erik Weiser, Theodorus J. Dingemans, Terry L. St. Clair** and **Jeffrey A. Hinkley** received patent 7,964,698 for wholly aromatic liquid crystalline polyetherimide (lc-pei) resins.

Lesa B. Roe
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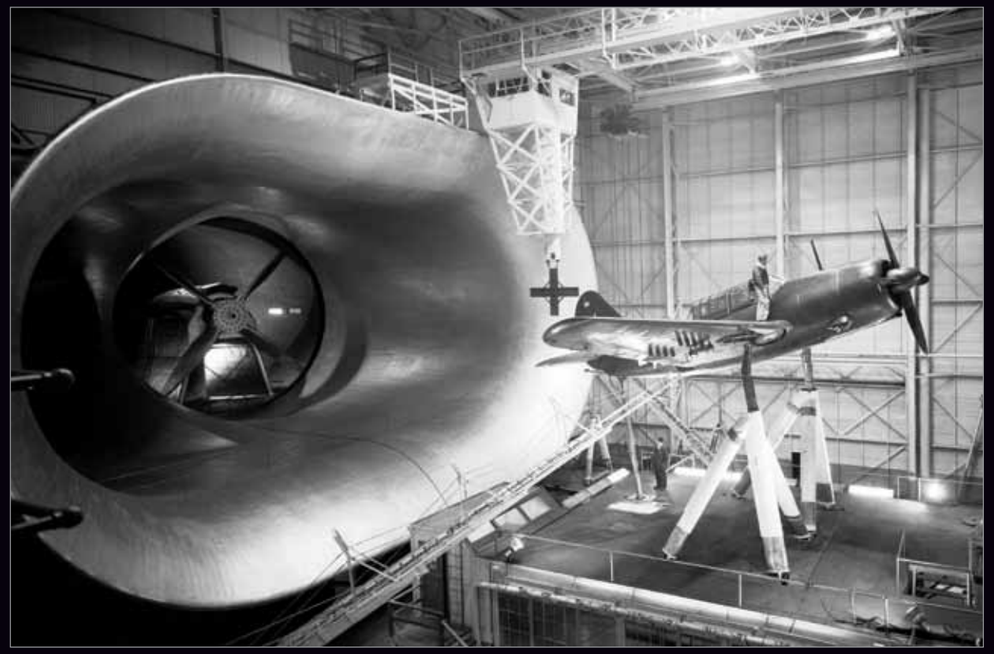
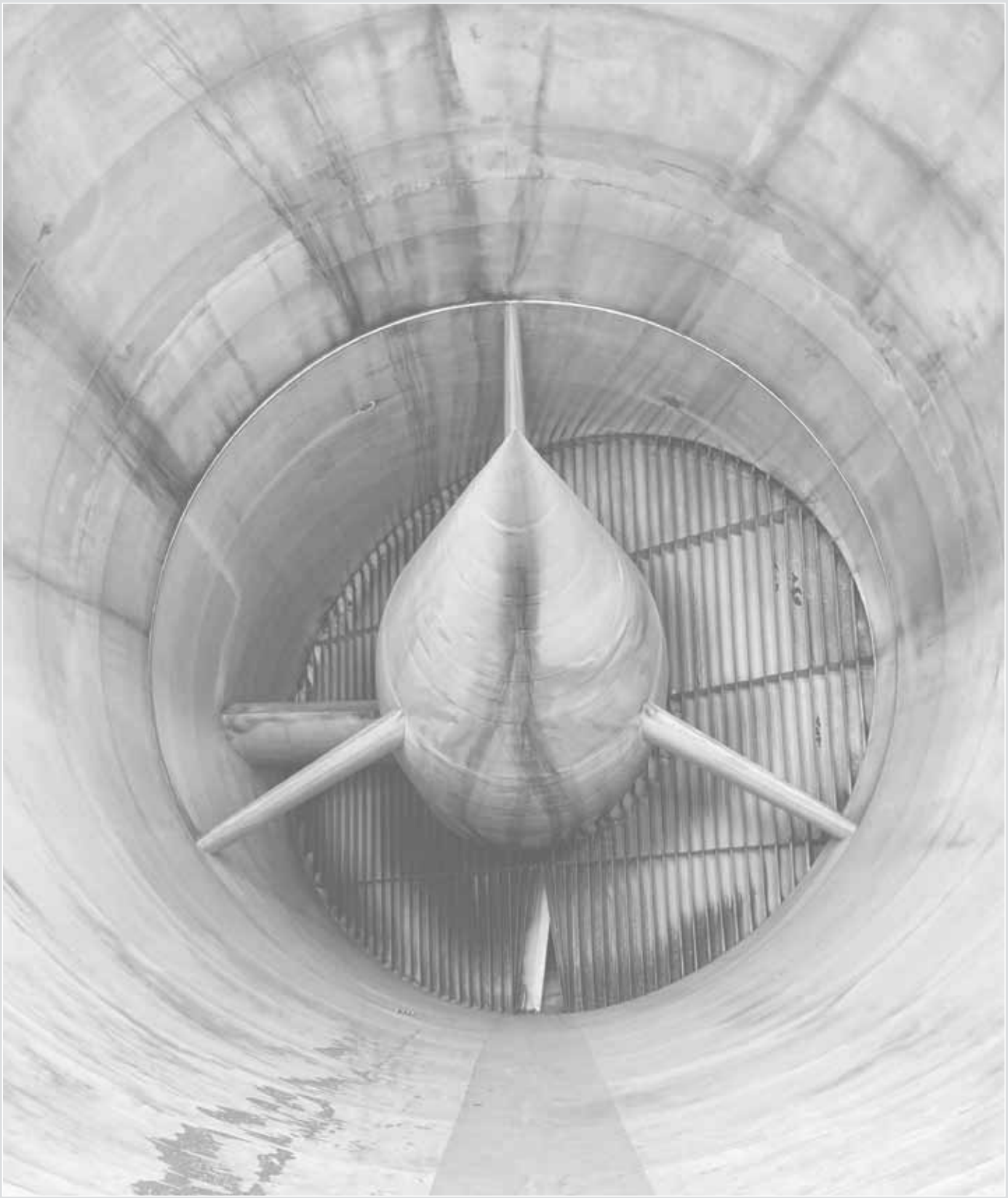
"Not enough can be said about these wind tunnels, some of the most historically significant in our nation, or to the impacts made by the people who worked in them during their combined 150 years of service."

— ***Lesa Roe**, Director*



A Curtis SB2C dive bomber is tested in the full-scale tunnel in 1939.

Bell X-1 model mounted in the slotted test section of the 16-Foot Tunnel, 1951.



A rare view of the fairing and turning vanes inside the venerable 16-Foot Transonic Tunnel. This view was exposed during deconstruction of the facility.

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NP-2011-12-354-LaRC