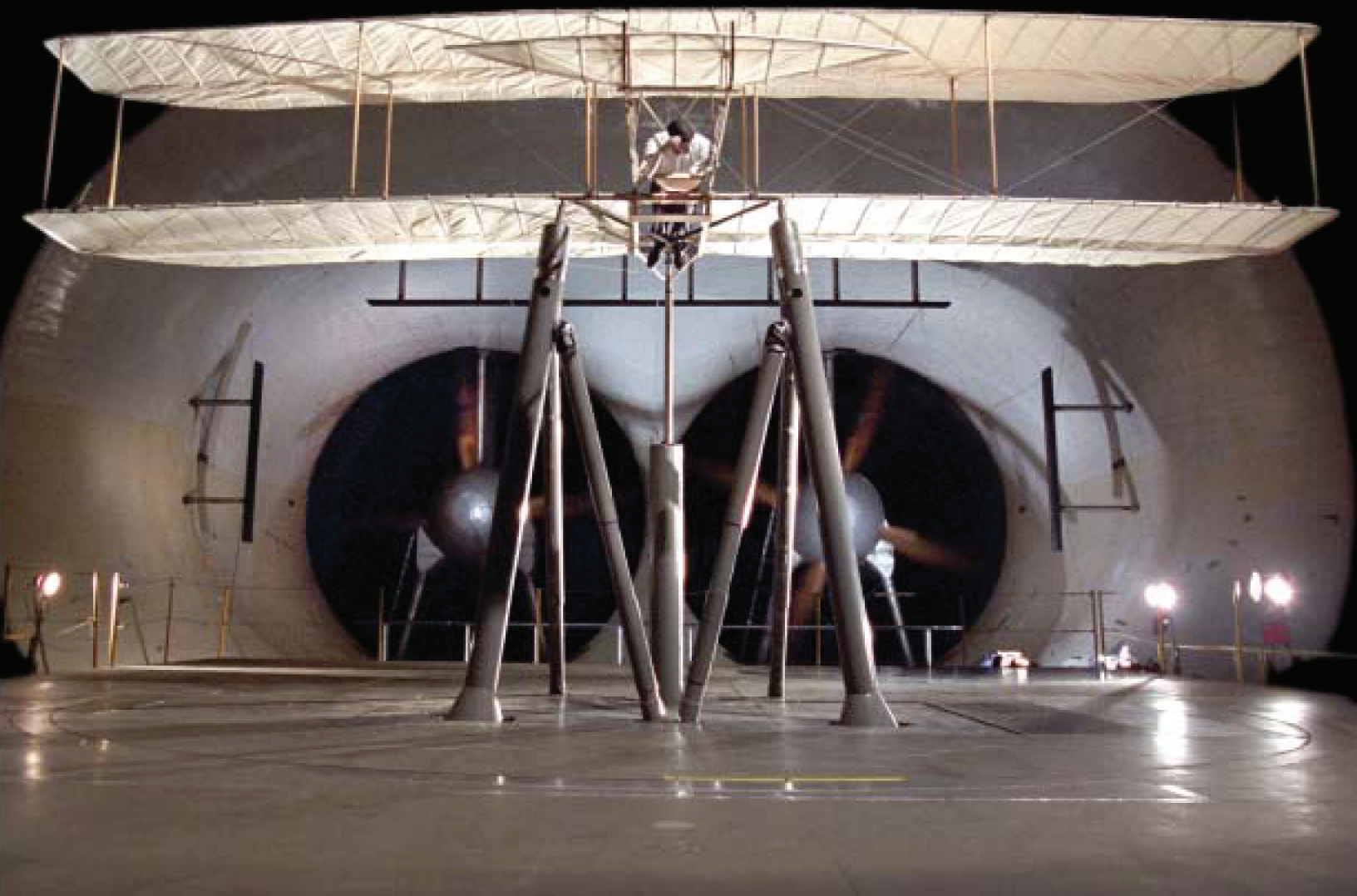



STAKEHOLDERS REPORT

A Report to the American People



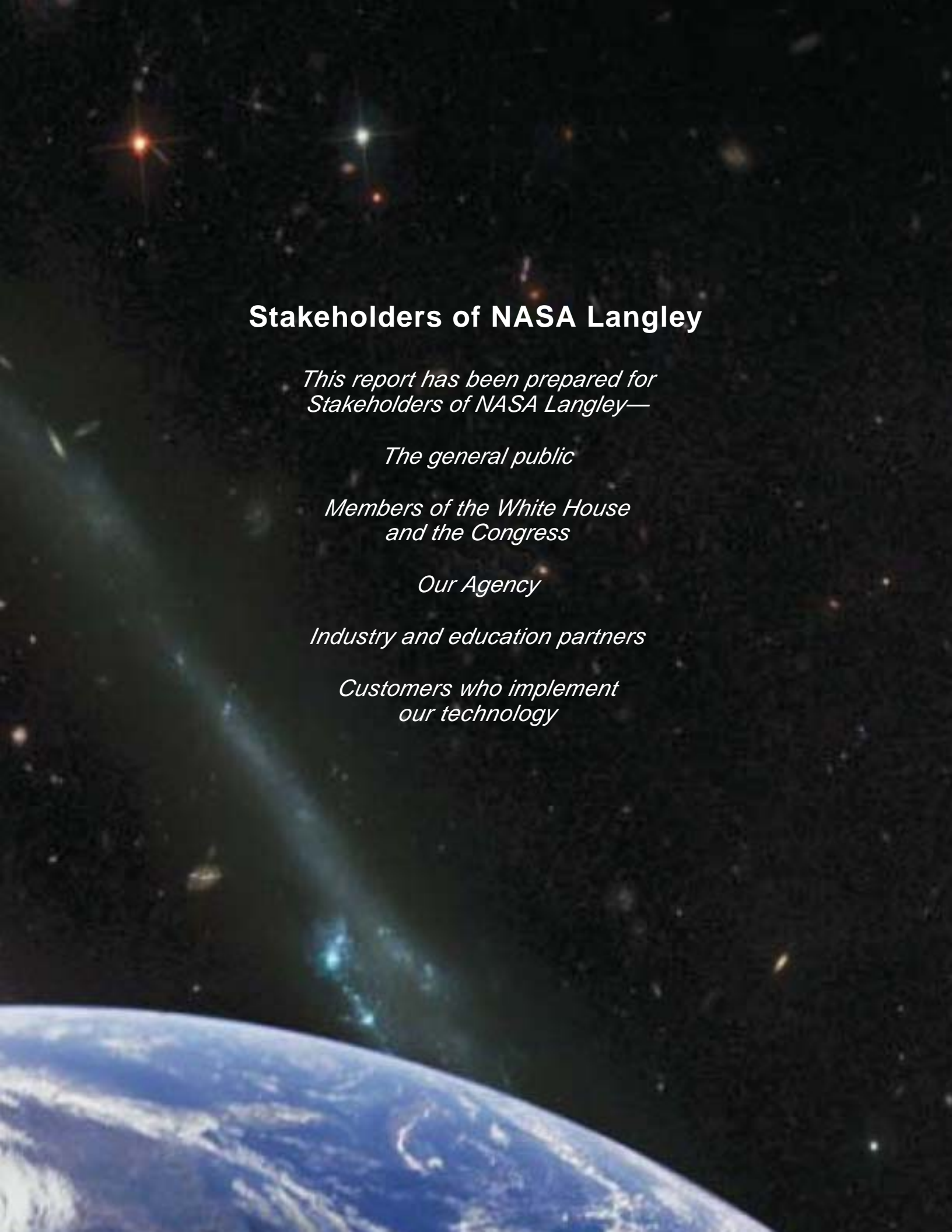


The NASA Vision

To improve life here,
To extend life to there,
To find life beyond.

The NASA Mission

To understand and protect our home planet,
To explore the universe and search for life,
To inspire the next generation of explorers,
. . . as only NASA can.



Stakeholders of NASA Langley

*This report has been prepared for
Stakeholders of NASA Langley—*

The general public

*Members of the White House
and the Congress*

Our Agency

Industry and education partners

*Customers who implement
our technology*



Message from the Director

It is with great pleasure that I present to you, our stakeholders, this report of NASA Langley Research Center and some of the exciting accomplishments of the men and women of our Center.

As the centennial of Wilbur and Orville Wright's historic flight is celebrated, we at NASA are proud of the many contributions that we have made in the advancement of human flight. Established in 1917 as the Nation's first civil aeronautical laboratory, our Center continues to contribute to the technological advances that are vital to our Nation as evidenced by our most recent accomplishments. In partnership with industry, the academic community, and other government agencies, NASA is building on an extraordinary record of accomplishment.

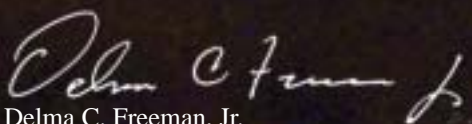
NASA is focused on providing solutions to the many challenges we face in aviation, space, and understanding our home planet. With renewed dedication, we are working to enhance the security and safety of our national air transportation system. Langley research is enabling quieter, more efficient, and more environmentally friendly aircraft. We are striving for a strengthened, more competitive aerospace industry by undertaking research beyond the risk limit or capability of the business sector. To inspire the next generation



of American achievers, Langley is reaching out to students, parents, and teachers of all grade levels across the United States to make science and mathematics education exciting and meaningful.

With the results of our research, Langley improves the quality of life for the citizens of the United States. Langley accomplishments include research in turbulence detection, which will help make airlines operate more cost effectively; new methods to reduce aircraft noise; high-altitude engine technology; technology to detect the health of an aircraft or spacecraft; research in understanding our global climate; and support for exploring Mars.

I invite you, our stakeholders, to review this report. For additional information on Langley programs and future research endeavors, I also invite you to visit us on the World Wide Web at <http://www.larc.nasa.gov/>.



Delma C. Freeman, Jr.
Center Director



History

NASA Langley in Hampton, Virginia, was recognized as a Historic Aerospace Site by the American Institute of Aeronautics and Astronautics (AIAA) in April 2002. This award recognizes worldwide sites of significant aerospace accomplishment. We are honored by this recognition of our Center as a place where enthusiastic and talented people come together to find practical solutions to the problems of flight.

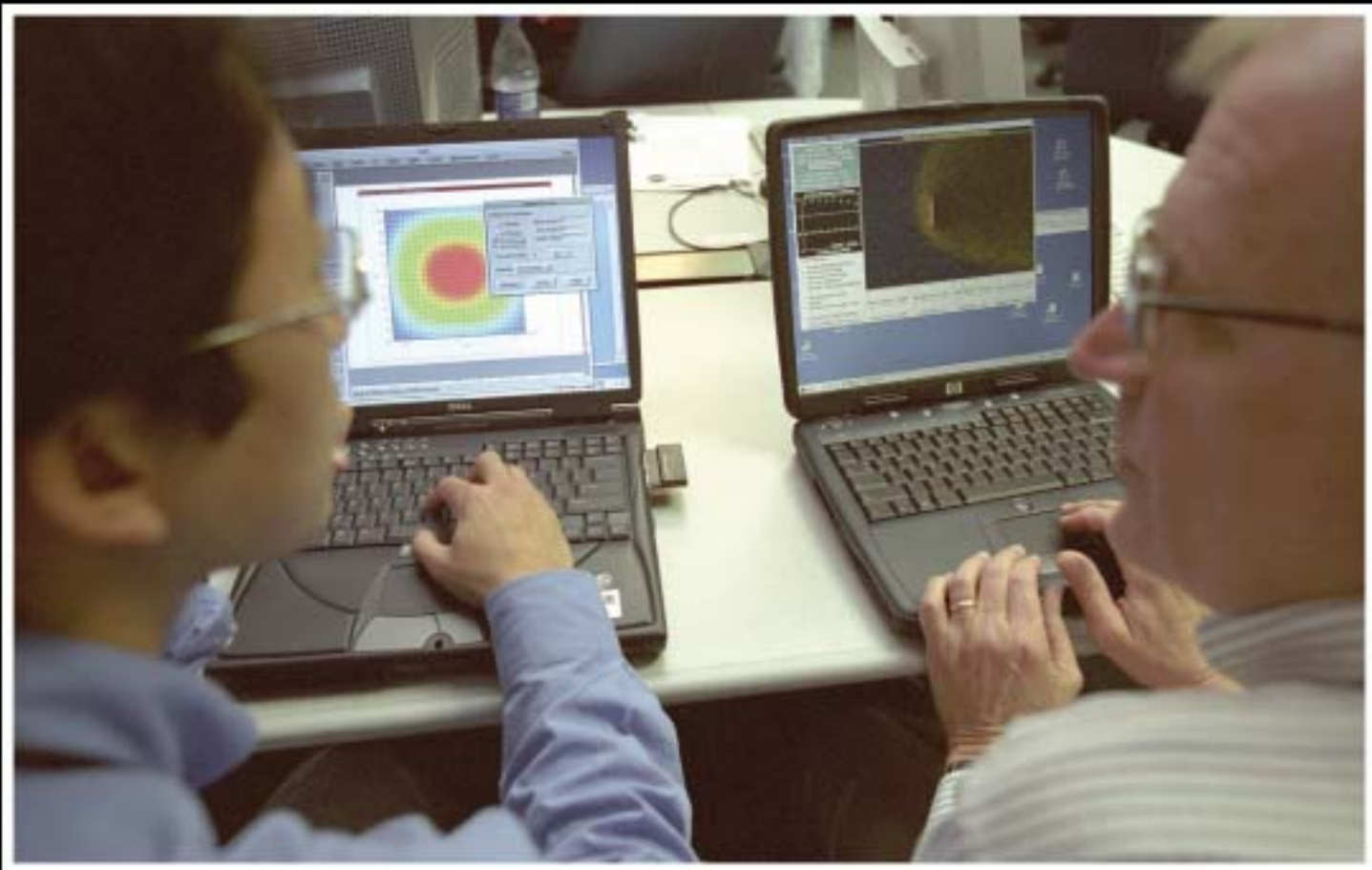
Since Langley's beginning in 1917 as a National Advisory Committee on Aeronautics (NACA) laboratory, only 14 years after the Wright brothers' historic first flight, we have examined the challenges of flight and put forth solutions that have made aircraft and spacecraft more responsive to the needs of our Nation.

Although the United States had the early lead in aviation with the flight of the Wright brothers, it was apparent by World War I that this lead had been lost to Germany, Great Britain, and France. During the early years, the Langley staff concentrated their efforts on improving American aviation. Award-winning advances found their way from Langley wind tunnels and laboratories to American aircraft. Cowlings that reduced drag on radial air cooled engines, airfoil classification and characteristic identification that became industry design standards, pioneering aircraft icing research, supersonic flight research, design of a slotted-throat wind tunnel for effective transonic research, formulation of the area rule for design of transonic aircraft, as well as many other achievements helped to make the United States an aviation industry world leader.

At the dawn of the Space Age, the United States was again at a technological disadvantage. As a result of the space flight achievements of the former Soviet Union, the NACA was reorganized and became the National Aeronautics and Space Administration (NASA). The newly renamed NASA Langley Research Center increased examination of the challenges of spaceflight. The uniquely qualified Langley staff helped to make the United States a spaceflight world leader through crucial contributions to the Mercury, Gemini, Lunar Orbiter, Apollo, Viking, and Space Shuttle programs. NASA Langley also continued to make important aeronautical contributions. Comprehensive aircraft improvements, such as energy efficient engine technology, improved aircraft aerodynamics, and advanced composite materials, helped to strengthen the aviation industry as it faced the global energy crisis of the 1970s. More recently, Langley researchers focused their knowledge, experience, and talent on problems facing the general aviation industry. The resulting partnership of NASA, the FAA, industry, universities, and airport authorities revitalized the general aviation industry and will offer options in air transportation for the benefit of American citizens.

Today, our Nation faces new challenges. The people of Langley Research Center are providing solutions for these challenges. With computer-enhanced wind tunnels and laboratories, a variety of research aircraft, and state-of-the-art flight simulators, the Langley staff contributes to the technological advances of our Nation. Langley works not only to make the national air transportation system safer, more secure, and more efficient, but also to make aircraft and spacecraft safer, more environmentally friendly, and quieter. The staff contributes to the exploration of our universe and to improved understanding of our home planet. Perhaps more importantly, the people of Langley partner with parents and educators to inspire the next generation of Americans to respond to future challenges.

Samuel P. Langley (shown on left) aviation pioneer and third secretary of the Smithsonian Institution.



Langley Research Center—A National Resource

NASA Langley is an important resource for our Nation. The knowledgeable and talented Langley staff provides answers to aerospace challenges through research conducted in partnership with other government agencies, industry, and educational institutions.

Civil Service Skill Mix

Skill	Number of employees
Scientific/Engineering	1,243
Administrative	384
Technical/Craft/Production	527
Clerical	149

Civil Service Educational Mix

Education level	Number of employees
Doctoral	335
Master	586
Bachelor	624
Associate	356
Some college	252
High school diploma	149
Less than high school diploma	1

Contractor Workforce

Employees	1,420
Contract Types	Research and Development Support Data Processing and Instrumentation Installation Operation and Maintenance Facility Operation and Maintenance Models and Fabrication

Recent Langley Staff Honors and Awards

The (Virginia) Peninsula Engineers Council 2002 Peninsula Engineer of Year was awarded to Dr. Bruce J. Holmes.

The (Virginia) Peninsula Engineers Council 2002 Doug Ensor Young Engineer of the Year Award was awarded to Ms. Anna-Maria McGowan.

The American Institute of Aeronautics and Astronautics (AIAA) Daniel Guggenheim Medal was awarded to Richard T. Whitcomb, retiree.

The AIAA 2002 Aerodynamics Award was awarded to Richard Campbell.

The AIAA selected Mr. Charles Miller as a Fellow.

The Hampton Roads Section of the AIAA, 2002 Laurence Bement Young Professionals Paper Competition

- First place awarded to Lynda J. Kramer, for her paper titled “Comparison of Pilots' Situational Awareness While Monitoring Autoland Approaches Using Conventional and Advanced Flight Display Formats” (NASA TP-2000-210284).
- Second Place awarded to Paul M. Danehy, for his paper titled “Flow-tagging velocimetry for hypersonic flows using fluorescence of nitric oxide” (AIAA Journal).
- Third Place awarded to David J. Piatak, for his paper titled “A Parametric Investigation of Whirl-Flutter Stability on the WRATS Tiltrotor Model.” (Journal of the American Helicopter Society).

The Virginia Polytechnic Institute and State University, Academy of Engineering Excellence inducted former Center Director Paul Holloway.

The International Conference on Computational Engineering and Sciences awarded the 2002 T.H.H. Pian Medal to Ivatury S. Raju.

The American Helicopter Society Howard Hughes Award was awarded to the Langley Tiltrotor Aeroacoustics Code (TRAC) System Development Team.

The Presidential Early Career Award for Scientists and Engineers was awarded to James Crawford.

The Acoustic Emission Working Group selected William H. Prosser as a Fellow.

Society for the Advancement of Material and Process Engineering (SAMPE), first place, outstanding paper by SAMPE member at 2002 SAMPE Symposium in Long Beach, California, awarded to Brian W. Grimsley of Langley Research Center, Pascal Hubert of Old Dominion University in Virginia, Roberto J. Cano of Langley Research Center, Xiaolan Song of Virginia Polytechnic Institute and State University, R. Byron Pipes of the College of William and Mary in Virginia, and Alfred C. Loos of Virginia Polytechnic Institute and State University.

Recent Center Awards

Recognition as a Historic Aerospace Site by the AIAA.

Pollution Prevention Award from the Hampton Roads Sanitation District.

Gold Pretreatment Award from the Hampton Roads Sanitation District.

Recognition by the Hampton Roads Chapter of the American Red Cross for largest corporate blood donor.

NASA Agency recognition for meeting or exceeding goals for 2001 negotiated business goals at the Minority Business and Advocates Awards.



AIAA

American Institute of Aeronautics and Astronautics
Historic Aerospace Site

Langley Memorial Aeronautical Laboratory

The Langley Memorial Aeronautical Laboratory, now the core of the Langley Research Center, was a unique facility that served as the source of aerodynamic research to the U.S. Navy from its beginning in 1917 to its transformation into NASA's Langley Research Center in 1958. It fulfilled world renown for its testing of specialized research tools and its staff's emphasis on practical solutions to the problems of flight.

2002

Facilities

A wide array of wind tunnels, laboratories, computational facilities, flight simulators, and research aircraft are used for research at Langley. The Center occupies more than 200 buildings on nearly 800 acres. If NASA Langley were replaced today, it would cost over \$4 billion.

Wind Tunnels

Wind tunnels at Langley helped the United States become the global leader in military and civilian aviation. Researchers use wind tunnels in conjunction with flight simulators, computer simulations, and research aircraft. Many of these tunnels are unique to the United States. Scale models are tested in wind tunnels to safely and cost effectively gather information about the aerodynamic and acoustic performance of future aircraft and spacecraft.

Laboratories

NASA Langley staff performs extensive research in laboratories with computers. The Center also relies on a variety of shops where wind tunnel models and other research hardware are fabricated. Research in Langley laboratories examines challenges in developing new materials, refining aircraft structures and instruments, unraveling the complexities of space travel, and learning more about our home planet.

Simulators

Computers and improved software have increased the use of piloted simulation for research and training. The highly configurable simulators can replicate vehicles from fighter aircraft to commercial airliners, supersonic aircraft to general aviation aircraft, and Earth-to-orbit spacecraft. With common software, hardware, and processes for both the simulators and the Langley Boeing 757 research aircraft, a simulation-to-flight capability provides government and industry with a unique and efficient way to develop and test new technology that enhances the capacity, security, and safety of the national air transportation system.

Research Aircraft

Langley's largest current flying laboratory is a transformed Boeing 757. Called ARIES, or Airborne Research Integrated Experiments System, the aircraft is used to conduct research to increase aircraft safety, operating efficiency, and compatibility with future air traffic control systems. Langley's array of research aircraft also includes smaller aircraft such as the OV-10A, Cessna 206, Lancair Columbia 300, and Cirrus SR22.





Aeronautics

From its inception, NASA Langley has tackled the challenges of aeronautics. In fiscal year 2002, approximately 69 percent of Langley's research effort was devoted to aerospace technology. From small general aviation aircraft to large commercial aircraft, from subsonic to hypersonic flight, Langley researchers are improving the national air transportation system through safer, more secure, more efficient, more affordable, and quieter aircraft for the benefit of the American public.

American-made aviation products remain the largest positive industrial contributors to the U.S. balance of trade. However, other countries are actively challenging this position. The technology being developed by Langley and its partners in industry, educational institutions, and other government agencies helps the United States remain competitive in the global marketplace.

Turbulence Detection

Researchers with the NASA Aviation Safety Program (AvSP)—a partnership with the Federal Aviation Administration (FAA), aircraft manufacturers, airlines, and the Department of Defense—tested a new way to predict turbulence associated with thunderstorms by measuring the motions of moisture in the air. Atmospheric turbulence is hazardous and costs the airlines money and time because of rerouting and late arrivals. Turbulence is the leading cause of in-flight injuries to airline passengers and flight crews. Currently, pilots predict turbulence ahead by experience and intuition, getting information from other aircraft that have encountered turbulence close by, and extrapolating the existing weather radar system. An alert of impending air turbulence could make aircraft safer and the national air transportation system more efficient.

Synthetic Vision System Tested in Colorado Mountains

Commercial and business aircraft of the future may be fitted with an advanced computer display system that has the potential to make flying safer in bad weather and darkness. This system is known as a synthetic vision system. It shows the outside terrain and obstacles as if it were a sunny day regardless of visibility conditions. NASA researchers and pilots from an aircraft manufacturer, the FAA, and three major airlines tested the NASA and industry synthetic vision system concepts at Eagle County Colorado Regional Airport, which is surrounded by rugged mountains. The pilots flew over 100 airport approaches. During the flights, pilots compared conventional displays with the new synthetic vision display. Early results indicate that the pilots were more aware of the outside terrain with the new synthetic vision than with the conventional displays. The new synthetic vision instruments can be fitted into existing aircraft, as well as future aircraft.

Health Management System for Aircraft

Aircraft accidents caused by equipment failure may some day be prevented with the Aircraft Condition Analysis and Management System (ACAMS). NASA is developing this technology collaboratively with an industry partner. The future system would read data from sensors throughout an aircraft. Detection of a malfunction or degrading performance would trigger an alert to the aircrew or maintenance team for appropriate action. During a flight simulation, the ACAMS technology prototype successfully identified landing gear brake faults that were intentionally set into the flight simulation program. In addition, it predicted how a small crack in an airframe structure would grow if no corrective action were taken. The prediction of the crack growth allows sufficient time for corrective action to be taken to avoid a potential accident. Further development of this technology is planned to include monitoring the health of landing gear, airframe systems, and propulsion systems.

Smart Wing

Aircraft wings are designed to be most efficient at a single flight condition, such as high-speed flight. Adaptive material actuator systems, or “smart technologies,” are being investigated for subtle wing shape control without hinged surfaces. The Smart Wing Program is an effort by industry, other government agencies, and NASA to develop and demonstrate these technologies. Tests of a smart wing were performed in the Langley Transonic Dynamics Tunnel. Actuator arms driven by motors were integrated into a control surface on a wind-tunnel model. The actuator arms could be rotated, which allows the control surface to deflect and twist into smoothly contoured shapes. These changes in shape could potentially allow the wing to respond to changing aerodynamic conditions and allow the vehicle to fly more efficiently by reducing drag and fuel consumption.

Nozzle on Aircraft Noise

The Quiet Aircraft Technology (QAT) team led by NASA Langley is addressing the difficult problem of reducing noise from flying aircraft. Noise generated from wing slats and flaps and landing gear—airframe noise—as well as engine noise is being examined. To quiet engine noise, “scarfed” engine inlets, noise-absorbing treatments in the inlet, and “chevron” engine nozzle exit concepts were successfully flight-tested. Researchers are examining ways that aircraft fly around airports to determine flight paths that have the least noise impact on surrounding communities.

Better Flight Service for More People

The Small Aircraft Transportation System (SATS) is a vision for the expansion and integration of general aviation aircraft into the national air transportation system. This expansion will increase access to smaller communities and improve the transportation of people, services, and goods by effective use of over 5,000 smaller public airports. The SATS comprises a broad consortium of state aviation and transportation authorities, private companies, nonprofit organizations, and universities. The consortium is developing technologies such as digital flight controls, highway-in-the-sky navigation, synthetic vision maps, and digital data links with a computer-based glass cockpit. The digital data links could provide departure and arrival airport conditions, weather along the route, and positions of nearby aircraft, all updated during flight.





Space Sciences

From Project Mercury to a concept for an airplane designed to fly in the atmosphere of Mars, Langley Research Center plays a critical role in space transportation technology development. The goal of NASA programs is to foster safer, more affordable access to space by advancing technologies. Langley—in conjunction with other NASA centers, industry, and universities—supports the Nation’s space program with research in advanced spacecraft, remote sensing applications, and space flight projects.

Flying Faster than Five Times the Speed of Sound

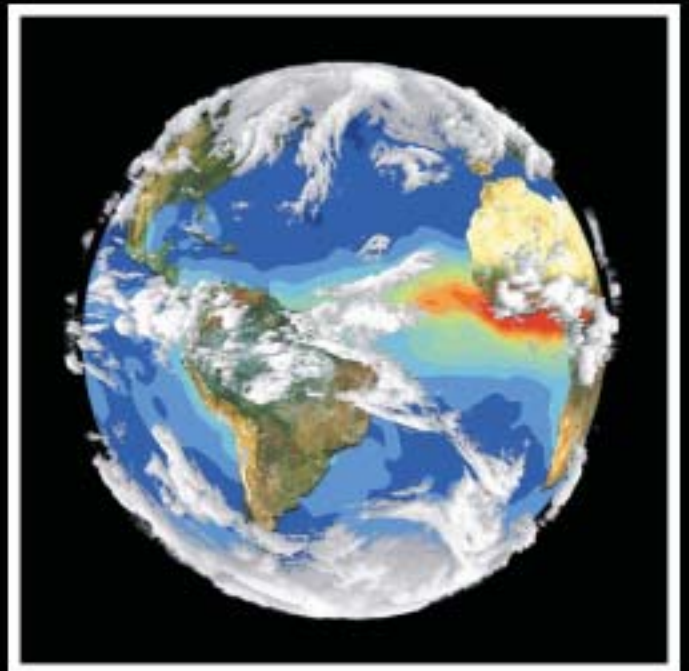
To demonstrate air-breathing engine technologies that could increase payload capacity or reduce vehicle size for the same payload for future hypersonic or reusable space launch vehicles, NASA is conducting a multiyear ground and flight test program. Hypersonic speeds are speeds above Mach 5 or five times the speed of sound. NASA Langley and NASA Dryden are participating in the program. Langley tested a spare flight engine on an X-43 wind tunnel model that accurately represents the size and shape of the full-scale vehicle. The model was tested in the Langley 8-Foot High Temperature Tunnel to verify the propulsion system performance at Mach 7 flight conditions. The X-43 hypersonic research vehicle, known also as Hyper X, will be launched with a modified Pegasus booster rocket from a B-52 for flight tests.

2001 Mars Odyssey

The NASA 2001 Mars Odyssey is orbiting Mars for three years to determine the composition of the planet’s surface, to detect water and shallow buried ice, and to study the radiation environment. The Odyssey reached Mars in October of 2001. Managed by NASA’s Jet Propulsion Laboratory (JPL), Langley supported the mission by performing aerobraking flight simulations to define a safe rate for the vehicle to go from the initial elliptical orbit to the 2-hour circular observing orbit. The simulations also served to predict the atmospheric density on Mars for each orbit, monitor the aerodynamics of the spacecraft as it passed through the thin Martian atmosphere, and predict how hot the spacecraft became as it dipped into the atmosphere.

Airplanes for Mars

Langley researchers worked with a team from industry, universities, and other government laboratories to adapt Earth aircraft technology for a concept for flight in the atmosphere of Mars. Researchers hope to use the aircraft to measure the relationships between water in the atmosphere, at the surface, and within the crust of Mars. The Mars airplane would have a unique vantage point that is close to the surface and still able to cover a large distance. The aircraft successfully completed a flight test in Mars-like conditions. With its wings and tail folded in the same position as during a trip to Mars, the aircraft was attached to a high-altitude balloon. At nearly 19 miles above the Earth, the aircraft separated from the balloon, unfolded its wings and tail, and completed a preprogrammed flight path.



Atmospheric Sciences

NASA Langley is an international leader in atmospheric studies. Using aircraft, satellites, and other research platforms, Langley scientists conduct an aggressive program of research focused on understanding the life-giving atmosphere surrounding our home planet. We use this knowledge to improve the quality of life on Earth and to make aircraft safer and more efficient.

Preserving the Charters of Freedom

At the request of the National Archives, a team of Langley scientists examined the atmosphere of encasements that held the Declaration of Independence, the U.S. Constitution, and the Bill of Rights. These historical documents, called the Charters of Freedom, were sealed in cases filled with humidified helium to preserve them. Archivists had noticed white flakes forming on the encasement glass. It was feared the documents were deteriorating. Langley scientists determined that the backing paper was the cause of the potentially damaging carbon dioxide and humidity. The National Archives plans to replace the existing backing paper with a special paper that will preserve the documents for future generations.

Looking at Clouds

Scientists from Langley, six other NASA Centers, and several government agencies and universities traveled to Florida to study tropical cirrus clouds. During CRYSTAL-FACE (Cirrus Regional Study of Tropical Anvils and Cirrus Layers—Florida Area Cirrus Experiment), scientists operated six research aircraft and three ground stations to measure cirrus cloud properties. The energy exchanged in the tropics among cirrus clouds, the sun, atmosphere, and Earth is an important, but not well understood, part of the heat exchange that creates our weather. Data collected during the study will be used to improve weather-prediction computer models.

Oceans and Climate

Langley scientists and researchers from Old Dominion University teamed to study phytoplankton off the Virginia coast during the CERES Ocean Validation Experiment (COVE). The CERES (Clouds and the Earth's Radiant Energy System) study is taking several global measurements of the Earth's energy. The COVE is examining the effect of phytoplankton on Earth radiant energy, an important factor to understand as two-thirds of the planet's surface is covered by water. The Earth's radiant budget—the balance between the planet's incoming and outgoing energy—drives weather and climate.

2002 Program Year Budget

Aerospace has continued its long trend of being the single largest net exporter of any industry sector of the U.S., with a net trade balance in 2002 of \$30 billion. The aviation and aerospace industry employs approximately 2 million workers. However, U.S. dominance in aeronautics and space is being aggressively challenged by foreign competitors. To meet this challenge, Langley strives to maintain an effective program budget.

Program Year 2002 Budget ¹	\$771M
Research and Development	\$498.3M (65%)
Research and Program Management	\$225.8M (29%)
Research Operations Support	\$26.3M (3%)
Construction of Facilities	\$20.6M (3%)

¹Program year 2002 budget includes funds from fiscal years 2002 and 2003.

Economic Impact

The Center's influence extends beyond its technology contributions. Langley Research Center in Hampton, Virginia, plays a central role in the economy of the southeastern area of Virginia known as Hampton Roads. The Center has both financial and institutional impact on local and national companies, universities and colleges, regional small businesses, and many non-profit organizations. Langley also contributes to the national economy through competitive awarding of contracts for goods and services vital to the successful performance of its mission.

Fiscal Obligations by Economic Sector

National Economy ¹	\$463.4M
Businesses	\$352.2M
Nonprofit Institutions	\$41.4M
Educational Institutions	\$69.8M
Virginia Economy ²	\$235.9M
Businesses	\$195.7M
Nonprofit Institutions	\$25.2M
Educational Institutions	\$15.0M
Hampton Roads Economy	\$201.8M
Businesses	\$167.9M
Nonprofit Institutions	\$23.9M
Educational Institutions	\$10.0M

¹Intragovernmental or outside U.S. obligations not included.
²Intragovernmental obligations not included.

Distribution of Obligations



Dissemination of Research Information

The President, Congress, and the NASA Administrator emphasize to the Nation the value of research conducted by NASA. The National Aeronautics and Space Act of 1958 stipulates that NASA should “provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.” Langley actively provides research information and expertise through several channels. With the appropriate dissemination of research information, NASA helps to increase industrial competitiveness, which provides jobs, contributes to a positive balance of trade, and improves the quality of life.

Invention Disclosures	158
Patent Applications	21
Patents Granted	13
Licenses Executed	9
Small Business Innovation Research	39
Space Act Agreements	21
Annex Work Tasks	
Space Act Agreements	4
Interagency Agreements	6
Publications	920



Virginia Air & Space Center

Official Visitor Center of Langley Research Center

The Virginia Air & Space Center (VASC) is a spectacular place for exploring NASA Langley Research Center's achievements in aeronautics and space. A collection of full-sized aircraft suspended from the 90-foot ceiling, the Apollo 12 command module, a Moon rock, and over 100 hands-on exhibits are on display at the VASC. Traveling exhibits, IMAX films, a distinguished scientist lecture series, and an array of educational programs provide an ever-changing visitor experience. Almost one-half million people visit annually.

The VASC provides quality science education, designed to assist with Virginia Standards of Learning guidelines, through school field trips, classroom programs, camps, interactive demonstrations, and tours. The VASC has contracts for science education services with Hampton City Schools, Newport News Public Schools, Norfolk Public Schools, and Portsmouth Public Schools. Approximately 200,000 students attended the science education programs in 2002.

Through the NASA Educator Resource Center, located within the museum, over 5,700 educators have access to a wealth of curriculum enhancing science materials for the classroom. The Educator Resource Center also provides equipment for duplication of educational videos and Internet stations for access to additional educational material.

“Wild, Wild Weather,” an exhibit created in partnership with Langley, interactively presents the amazing world of weather with a focus on the extremes, their phenomena and causes, and how weather impacts flight safety. Featured in the exhibit are aircraft safety research efforts such as weather in the cockpit, which gives pilots access to current weather and enables them to see through storms. The exhibit also includes Langley’s atmospheric science research with the GIFTS (geosynchronous imaging fourier transform spectrometer) instrument. This instrument is designed to orbit on a satellite and could revolutionize weather analysis and forecasting.

The VASC is embarking on the most exciting expansion in the museum’s history. In celebration of the centennial of flight and the VASC’s tenth anniversary, a new 15,000 square-foot Adventures in Flight Gallery will be developed. The new gallery will highlight regional accomplishments in commercial, civil, and military aviation while exploring the origins of flight. Many exhibits will focus on Langley’s extensive contributions to aviation, including aviation safety and the future of flight. The first phase gallery has a Wright brothers exhibit that will be permanently displayed.



WEST

NASA

Systems Log

Systems Log

NASA

NASA Langley Research Center Educational Programs

The NASA Langley Center for Distance Learning

The Langley Center for Distance Learning is the home of five exciting, innovative, and inspirational educational programs. Created cooperatively in 1996 by Christopher Newport University and the NASA Langley Office of Education, the Center for Distance Learning offers programs that combine the power and strength of several educational technologies to reach millions of educators, students, faculty, and adult (life-long) learners. These Emmy® award-winning programs are research and inquiry-based; support the national mathematics, science, technology, and educational technology standards; use NASA knowledge to increase scientific literacy; and stimulate student interest in mathematics, science, and technology. The programs support the standards for the preparation of web-based educational materials and the information literacy standards. The television programs are close-captioned. Plans are underway to add descriptive and open captioning. To help ensure that “no child is left behind,” efforts are underway to offer these programs in Spanish. During 2002, two programs received three regional Emmy® awards and two were finalists for the prestigious Japan prize. NASA Langley's Center for Distance Learning was a finalist for the Grace Hopper award for the innovative use of information technology. Visit the NASA Langley Center for Distance Learning web site at <http://edu.larc.nasa.gov/dl.html>.

NASA's Kids Science News Network

NASA's Kids Science News Network (KSNN) are 1-minute programs that feature kids teaching mathematics, science, technology, and facts about NASA to other kids in an entertaining format. KSNN explores topics such as what makes popcorn pop, how long is a meter, and why is the sky blue. The programs are available to teachers, families, care givers, English as second language learners, and home schoolers on the Internet along with supporting content, hands-on activities, related resources, and links to educational web sites. Available in both English and Spanish, KSNN can be streamed from the web site or viewed on Public Broadcasting System (PBS) stations. Thus far, the English-language KSNN programs air on 14 PBS stations and have a potential audience of 8.4 million viewers while the Spanish-language KSNN programs air on 8 PBS stations and have a potential audience of 3.5 million viewers. More information about KSNN is available from the web site <http://ksnn.larc.nasa.gov>.

NASA Science (NASA SCI) Files (Formerly The NASA “Why?” Files)

The NASA Science or NASA SCI Files series of science-based, instructional programs introduces students in grades 3-5 to NASA and integrates mathematics, science, and technology through problem-based learning (PBL), scientific inquiry, and the scientific method. Emphasizing standards-based instruction, each program has three components: a 60-minute television broadcast (divided into four 15-minute segments), an educator guide, and an interactive web site featuring a PBL activity that enables students to further explore topics presented in the broadcast. The web site also contains a wealth of instructional resources. The series seeks to motivate students to become critical thinkers and active problem solvers. Follow the exploits of the tree-house detectives as they solve “real world” problems by using mathematics, science, and technology, and by getting help from NASA researchers, community experts, print and electronic resources, and members of the NASA SCI Files Kids Club. Educators who register for the NASA Science Files can be matched with a classroom mentor from the Society of Women Engineers (SWE). The NASA Science Files air nationwide on PBS. Program partners include the American Institute of Aeronautics and Astronautics (AIAA) Foundation, Christopher Newport University, Hampton City Public Schools, Busch Gardens (Williamsburg, VA), and Sea World (Tampa, FL). Currently, about 167,000 educators, representing 3.7 million students, view the program nationwide. The production of the NASA SCI Files series is made possible by the generous support provided by NASA Langley's Aerospace Vehicle Systems Technology Office. For more information, visit the web site at <http://whyfiles.larc.nasa.gov>.

NASA CONNECT

NASA CONNECT is a series of 30-minute, instructional mathematics programs for grades 6-8. Emphasizing standards-based instruction, this series seeks to establish a connection between the mathematics, science, and technology concepts taught in the classroom to those same concepts used by NASA researchers. Each program has three components: a 30-minute television broadcast, which can be viewed live or taped for later use; a lesson guide which includes a hands-on activity that reinforces and extends the objectives presented in the program and establishes a connection between the math, science, and technology taught in the classroom; and an interactive web activity that provides educators with the opportunity to integrate technology in the classroom. Educators who register for the NASA CONNECT can be matched with a mentor from the American Institute of Aeronautics and Astronautics (AIAA) who will assist them with the hands-on and web-based activities. Program partners include the AIAA Foundation, Christopher Newport University, and Riverdeep Interactive Learning. NASA CONNECT currently airs nationwide on 85 PBS-member stations, with approximately 228,079 educators, representing around 10 million students, using the program. More information about NASA CONNECT is available from <http://connect.larc.nasa.gov>.

NASA LIVE

NASA LIVE (Learning Through Interactive Videoconferencing Experiences) is a series of videoconferencing programs designed to extend and strengthen NASA's commitment to educational excellence at the precollege and university levels and with adult (lifelong) learners. NASA LIVE provides opportunities for learning, instructional enrichment, the communication of NASA knowledge, and professional development for students, teachers, and faculty by engaging them in an interactive, virtual environment with NASA researchers. Since its beginning in the fall of 2001, 12 NASA LIVE videoconferences have been conducted reaching a total 200 precollege students, 15 precollege teachers, 63 university students, 7 university faculty, and 23 adult (lifelong) learners. More information about NASA LIVE is available from <http://live.larc.nasa.gov>.

NASA's Destination Tomorrow

NASA's Destination Tomorrow are 30-minute educational television programs that focus on NASA research and are designed for educators, parents, and adult (lifelong) learners. Each program has segments ranging from 3–8 minutes. Programs in the series are designed to

- Create and heighten adult interest in mathematics, science, technology, and NASA.
- Increase scientific and information technology literacy of adults.
- Improve literacy of adults who do not use English as their primary language.
- Serve as a mechanism for parents and caregivers to become involved in the education of children and young adults.

A web site provides summaries of stories and links to related program material. Destination Tomorrow airs on 560 cable, instructional, and public television stations nationwide with a potential audience of about 136 million and is available in English and Spanish. More information about NASA's Destination Tomorrow is available from <http://destination.larc.nasa.gov>.



The NASA Langley Aerospace Education Services Program

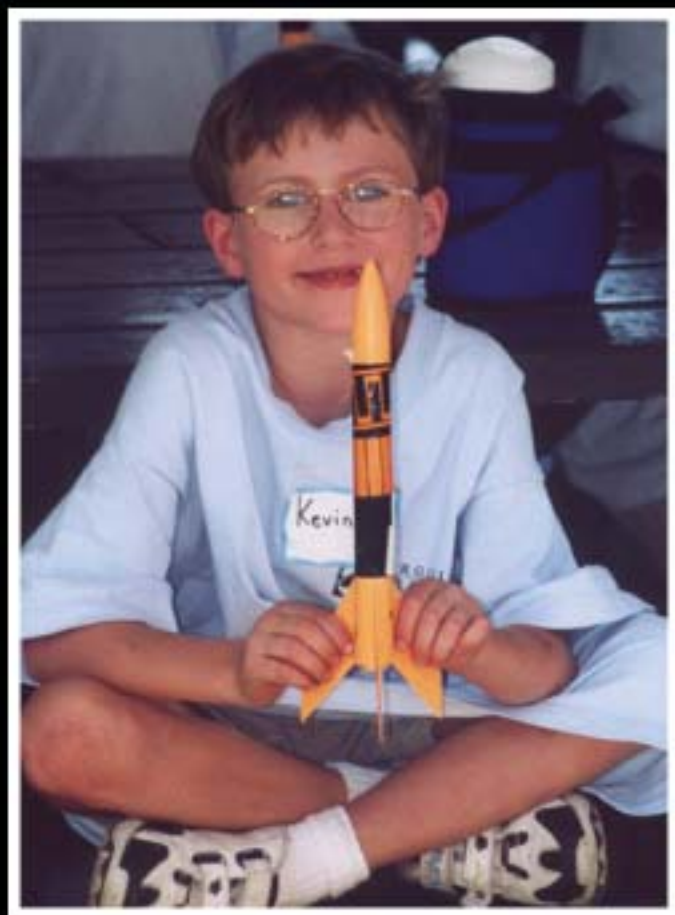
The Langley Aerospace Education Services Program (AESP) serves Langley's five-state service region of Kentucky, North Carolina, South Carolina, Virginia, and West Virginia. The AESP specialists enhance awareness and understanding of scientific and technological advances resulting from NASA's missions of research, discovery, and exploration. They provide assistance and support to educators in updating science, mathematics, and technology curricula and in using new instructional technology and teaching strategies. AESP specialists assisted 1,582 educators and 19,430 kindergarten through grade 12 students in the 5-state precollege area. There were 431 additional contacts with higher education, administrators, and parent groups. A total of 56,962 stakeholders, including public outreach at conferences, conventions, and museums, were served.

NASA Educational Workshop

Langley Research Center hosted three NASA Educational Workshops (NEW). Twenty-five teachers attended the first two-week workshop, NEW K-6. NEW Rural was another two-week workshop and attended by 24 K-12 educators and 2 teachers from France. The educators were from Langley's precollege area of Kentucky, North Carolina, South Carolina, Virginia, and West Virginia. The educators attended as teams of an administrator lead and 3 teachers. The participants attending the third workshop, West Virginia NEW Systemic, were from all 8 regions of the state. NEW Systemic was one week. The teams consisted of people from business, policy, and education.

Preservice Teacher Program

The Preservice Teacher Program (PSTP), originated at Langley Research Center, enhances the ability of preservice educators to teach math and science at elementary and middle school levels. It comprises a network of over 70 historically black colleges and universities, Hispanic serving institutions, tribal colleges and universities, and some majority institutions with outstanding accredited teacher education programs. The PSTP consists of an annual conference attracting over 500 preservice teachers and faculty educators and 2-week summer residential institutes held at Langley, NASA Stennis Space Center, and NASA Marshall Space Flight Center. The Honorable Rod Paige, Secretary of Education, attended the annual conference held near Washington, DC, in February 2002. In 2003 the institutes will expand to include NASA Ames Research Center, NASA Kennedy Space Center, and NASA Johnson Space Center.

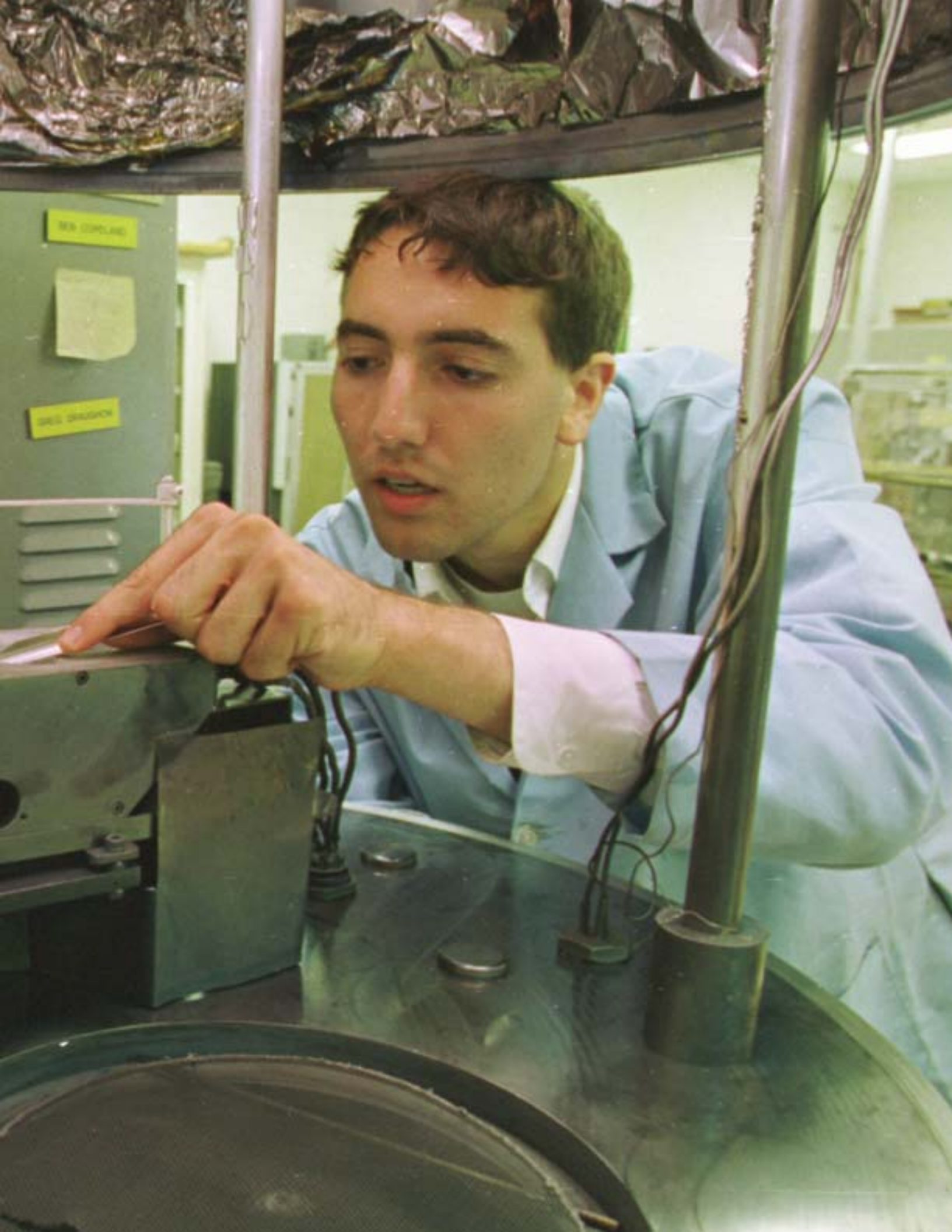


Langley Aerospace Research Summer Scholars (LARSS) Program

The LARSS Program benefits rising undergraduate juniors and seniors and first-year graduate students who are pursuing degrees in engineering, science, mathematics, computer science, and selected aerospace-related disciplines of interest to NASA Langley Research Center (LaRC). Approximately 125 students are selected each year and sponsored for a 10-week period of research under the supervision of a NASA technical mentor. Over 1,500 students have participated in the LARSS Program since 1989. In the past 5 years, 634 students have participated in the LARSS Program, including 42 percent females, 35 percent underrepresented minority members, and 3 percent persons with disabilities. Longitudinal surveys indicate 65 percent of past participants are pursuing or have completed graduate degrees.

State-Based Systemic Professional Development

NASA Langley conducted two unique Systemic Professional Development Workshops designed in collaboration with the key educational leaders from each of two states—Kentucky and South Carolina. The South Carolina workshop focused on the state's systemic initiatives by identifying NASA programs from a systemic perspective, aligning NASA's programs and resources with state-level standards-based reform initiatives, and reinforcing NASA's position as a partner in state-based systemic improvement. Although some of the objectives for the Kentucky Leadership Academy (KLA) were similar to the South Carolina workshop, the KLA focused on the role of leadership. Each presentation, tour of a facility, or activity featured NASA researchers and technicians in a leadership role. The KLA participants, as educational explorers, pioneers, and innovators, were challenged to relate these experiences to benefit the quality of life in their classrooms and schools. The KLA participants also developed an action plan to implement in their school environments.





Community Service

Langley Research Center employees are committed to activities that benefit the community. In addition to the many individual volunteer hours, the following are a few of the Center activities that employees support.

Combined Federal Campaign

NASA Langley Research Center has a high participation rate in the Peninsula Combined Federal Campaign. In all, 1339 employees contributed approximately \$389,471 in 2002.

Blood Drives

Several times a year, Langley Research Center sponsors blood drives. During 6 blood drives in fiscal year 2002, Center employees donated 1,166 pints of blood to the Hampton Roads Chapter of the American Red Cross, which serves the mid-Atlantic region.

Speakers Bureau

The Speakers Bureau at Langley provides a link with our most important stakeholder, the American taxpayer. Center employees and retirees responded to 131 requests from various civic, professional, educational, and other nonprofit organizations. Presentations about NASA and Langley Research Center were made to 14,695 stakeholders in fiscal year 2002.



Community Day of Caring

For the past 12 years, Center employees volunteer one day in a concentrated effort to lend their skills to organizations throughout the Hampton Roads area. Volunteers pitch in to paint, repair, landscape, clean, file, sort, and help in many other ways. In 2002, over 200 volunteers donated time at 30 agencies.

Study Buddies

Forty-nine employees volunteered one day a week throughout the school year during their lunch breaks to tutor first, third, and fifth grade students at Machen Elementary School, which is near the Center. Volunteers work with one or two students to improve students' knowledge in mathematics and language skills.

Adventures in Technology = Options in Math and Science

This exciting program inspires eighth graders to consider careers in math and science. In partnership with Thomas Nelson Community College, employees in the Fabrication Technology Area conduct workplace tours and visit schools.

National Engineers Week

NASA Langley Research Center celebrated National Engineers Week through Career Day programs that were attended by 373 students and 27 teachers.



The Future

Congress formed NASA to advance our Nation into the Space Age. The American people have since looked to NASA for the future of aerospace technology. Building on a legacy of awe-inspiring accomplishments and in partnership with industry, academia, and other government agencies, we continue our Nation's journey to the future.

Aviation is an integral part of American life. It is an essential part of business for the timely transportation of people, products, and raw materials. Aerospace is vital to our national defense. Personal travel on commercial aircraft is growing steadily. Through space, we have advanced scientific knowledge and come to a better understanding of our home planet. However, there are many challenges to providing the best aerospace transportation system. We are developing technologies to

- Understand Earth's system and apply science to improve the prediction of climate, weather, and natural hazards.
- Enable a safer, more secure, efficient, and environmentally friendly air transportation system.
- Create a more secure world and improve the quality of life by collaborating with other agencies, industry, and academia.
- Explore the solar system and the universe beyond, understand the origin and evolution of life, and search for evidence of life elsewhere.
- Inspire and motivate students to pursue careers in science, technology, engineering, and mathematics.
- Engage the public in shaping and sharing the experience of exploration and discovery.
- Ensure the provision of space access and improve it by increasing safety, reliability, and affordability.
- Enable revolutionary capabilities.

Perhaps the most important challenge our Nation faces for the future is to provide a quality education for America's students. NASA works closely with educators and home schooling parents to ensure that students from kindergarten through graduate school have a strong mathematics and science education and are prepared to face their generation's challenges.

NASA is an investment in America's future and we continue to prepare the way for humanity's greatest adventures. The Nation faces extraordinary challenges; the Agency has tremendous opportunities. To ensure the best return on that investment, the Agency will continue to examine and reshape priorities to remain focused on solving our Nation's challenges.



Additional Information

World Wide Web Sites

For additional information on items included in this report, visit NASA Langley Research Center on the World Wide Web.

NASA Langley Research Center

<http://www.larc.nasa.gov/>

NASA Langley Economic Impact Summary

Impact of Langley Research Center on the economy by fiscal year.

<http://oea.larc.nasa.gov/org/impact/>

NASA Langley Technology Commercialization Program Office

Information about business opportunities with Langley Research Center.

<http://tech-transfer.larc.nasa.gov/>

NASA Langley Office of Education

Exciting programs, web sites, and activities for educators, parents, and students from kindergarten through university graduates.

<http://www.larc.nasa.gov/education/education.htm>

NASA Langley Technical Report Server

Publicly available reports on research performed at NASA Langley.

<http://www.larc.nasa.gov/reports/reports.htm>

Virginia Air & Space Center

Official visitor center of Langley Research Center.

<http://www.vasc.org/>

On the Cover

This historically authentic replica of the Wright brothers' 1902 glider was tested in the NASA Langley Full-Scale Tunnel, which is operated by Old Dominion University (ODU) to further aerospace engineering education. ODU faculty, graduate and undergraduate students, and research support staff conduct full-scale and large-scale aerodynamic, airflow management, and acoustic testing and research. The Wright brothers' project is a cooperative effort with the National Park Service, the Experimental Aircraft Association, and the Wright Experience to recreate the historic first flight of the Wright brothers at Kitty Hawk, North Carolina, on December 17, 2003.



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