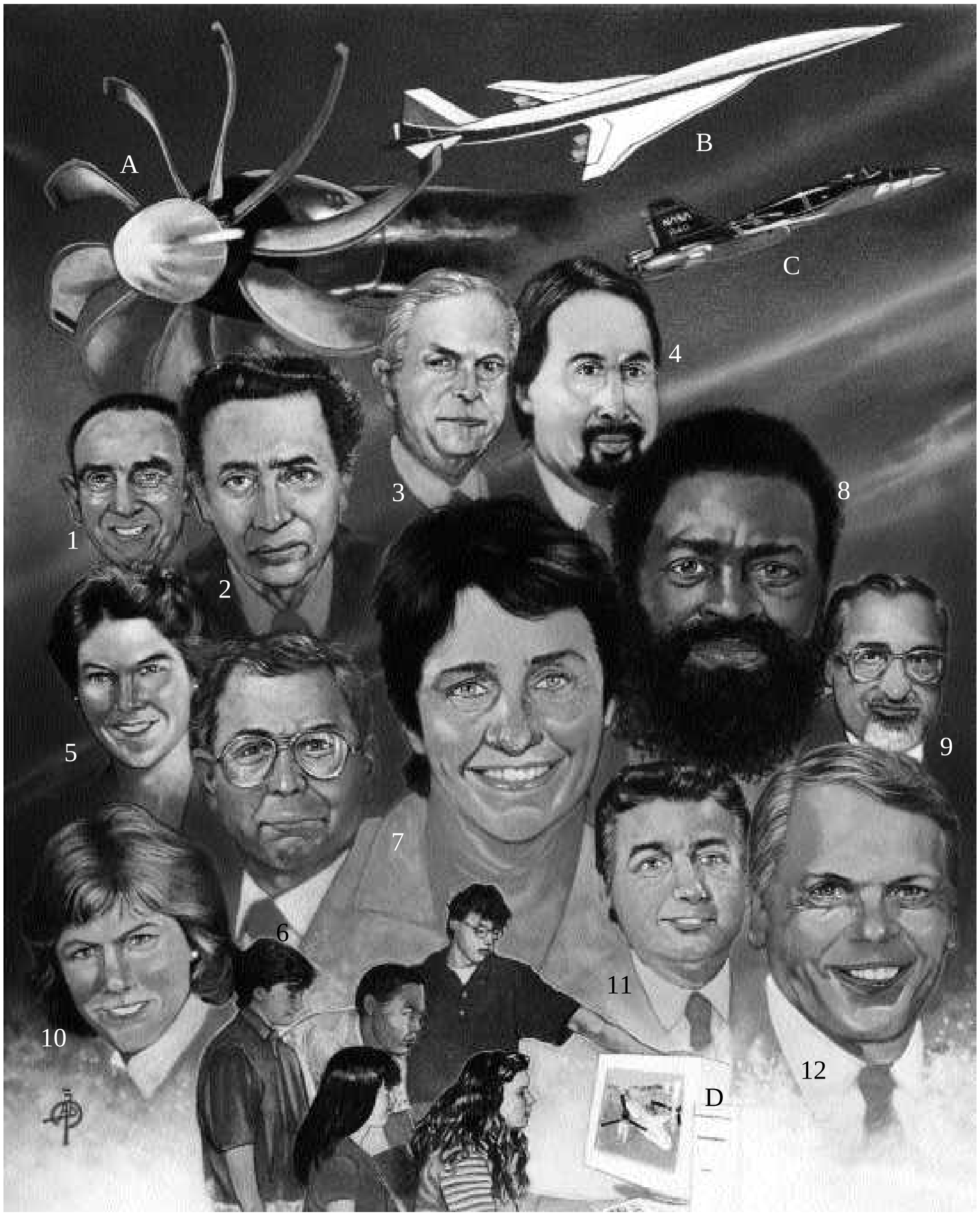
YOUR ATTITUDE DETERMINES YOUR ALTITUDE

SUPERSTARS OF MODERN AERONAUTICS

National Aeronautics and Space Administration

Your Attitude Determines Your Altitude

Superstars of Modern Aeronautics



Superstars of Modern Aeronautics

1. Mr. Edwin J. Saltzman (DFRC)
2. Dr. Robert T. Jones (ARC)
3. Dr. Richard Whitcomb (LaRC)
4. Dr. Jolen Flores (ARC)
5. Dr. Karen L. Gundy-Burlet (ARC)
6. Dr. John J. Adamczyk (LeRC)
7. Ms. Marta Bohn-Meyer (DFRC)
8. Mr. Albert L. Johns (LeRC)
9. Dr. Simon Ostrach (LeRC)
10. Dr. Kathy H. Abott (LaRC)
11. Dr. James C. Newman, Jr. (LaRC)
12. Dr. Kenneth W. Iliff (DFRC)

Research Center—Photo Representation

A) LeRC—Advanced Turboprop
B) LaRC—High Speed Research
C) DFRC—High Alpha Research Vehicle
D) ARC—Tilt-Rotor Computational Fluid Dynamics

About the Artist

Alexander Bostic, an African-American artist, received a bachelor's degree in fine arts and illustration from Pratt Institute in Brooklyn, New York. He has been a professional illustrator for 18 years. Currently, he is an assistant professor at the Virginia Commonwealth University School of the Arts in Richmond, Virginia.

Your Attitude Determines Your Altitude

Poster Highlights

This poster was created to highlight NASA's Aeronautics program and recognize a few of the many talented individuals who have contributed to the excellence of our Nation's civil and military aircraft and our air transportation system. Aeronautical research is a team effort, and success requires both the creativity and leadership of key people and the dedicated, competent, and often brilliant efforts of numerous scientists, engineers, technicians, and administrative personnel. Education is the key to success in every field and at every level. We hope that you will seek out and take advantage of educational opportunities, try your best, and be your best. With that combination, we know you will go far!

General Spence (Sam) Armstrong
Associate Administrator for Aeronautics and Space Transportation Technology

On the front of this poster are twelve "Superstars" of modern aeronautics, selected for their significant contributions to NASA's aeronautics programs over the past 50 years. These scientists and engineers are all former or current NASA employees representing the four aeronautics centers: Ames Research Center, Mountain View, CA; Dryden Flight Research Center, Edwards, CA; Langley Research Center, Hampton, VA; and Lewis Research Center, Cleveland, OH. Each center was given the difficult task of selecting only three people.

This is the third in a series of posters designed to be used by teachers to encourage their students to consider the increased opportunities that education provides as they prepare for their future careers. Aeronautics offers many exciting and diverse fields that students may wish to consider as they pursue their dreams.

The first "A" in NASA: The National Advisory Committee on Aeronautics, or NACA, was the origin of NASA's Aeronautics program. The importance of aviation was realized by a small group of people at the start of World War I. This group, with the help of the National Academy of Sciences and the Smithsonian Institution, convinced Congress of the need for an aeronautical advisory committee and aeronautical research laboratory. Congress created NACA in 1915. Under the National Aeronautics and Space Act of 1958, Congress changed NACA to NASA, the National Aeronautics and Space Administration. Although NASA's major focus then turned toward space exploration, research in aeronautics continued and regained its momentum in the late 1960's. Over the 80-year history of NACA/NASA aeronautics, the people of NACA and NASA have contributed fundamental knowledge, critical technologies, and key innovations to the world of flight.

Today, aviation plays a significant role in the economic and national security of the United States. The aeronautics industry generates almost $100 billion in annual revenues, accounts for almost 10 percent of U.S. manufactured exports, and creates hundreds of thousands of jobs for skilled professional and trade people. Air travel has become an enormous and critical element of our national economy, providing the backbone for long distance and global transportation. The aeronautics industry is also key to our national defense, the most sophisticated in the world. Future competitiveness and security demand continued advancements in technology.

NASA, in a national partnership with the aeronautics industry, the academic community, and other government agencies, is working to keep the United States a world leader in the research and application of aeronautical science and technology. NASA's role in aeronautics is to pursue the development of long-term, high-risk, high-payoff technologies and to achieve advances in aircraft safety, efficiency, affordability, and environmental compatibility—key requirements for the 21st century.

Visit our website: *http://www.hq.nasa.gov/office/aero/*

About the Classroom Scene

This classroom scene depicts students studying a computer-generated model of the tiltrotor aircraft, an experimental vehicle that combines the efficient vertical operation of a helicopter (rotors up) with the high-speed capability of a propeller-driven fixed-wing aircraft (rotors horizontal). The computer model was created to predict the air pressure distributions in the wake of the aircraft's rotors, shown by colored lines, as it flies. Computers are critical tools in many fields of work, including aeronautical research and development, so learning computer skills is very important for the future. Portrayed in this scene are students from the Douglas S. Freeman High School in Richmond, Virginia: (A) Peter Coughter, (B) Feng Yuan, (C) Robert Hamilton, (D) Will Alley, and (E) Megan Keck.

Your Attitude Determines Your Altitude

Centers of Excellence and Mission Areas

Besides its people, one of NASA's most important contributions to the Nation is its technical facilities, which are available for research use by other government agencies, industry, and universities. Four of NASA's ten field centers focus on aeronautics research, developing new concepts that could advance aeronautical technology, and developing a better fundamental understanding of selected physical phenomena important to the field of aeronautics. Each aeronautics center has unique facilities and excellent capabilities in the expertise of the scientists, engineers, technicians, and other support personnel that work there.

Ames Research Center (ARC), Mountain View, CA, is NASA's Center of Excellence in Information Systems. Ames is home of the Numerical Aerodynamic Simulation (NAS) facility that gives the Nation an unparalleled capability for supercomputer-based research and its application in aeronautics, space, and earth sciences.

Shown in the poster is a computer generated model of a tiltrotor aircraft (see "About the Classroom"). Ames' mission in Aviation Operation Systems leads NASA's research in air traffic management (ATM) and human factors technologies, both closely involving the Federal Aviation Administration. ATM research is developing automation tools to more effectively manage large volumes of air traffic in and around airports. Human factors research includes aircrew fatigue and human interactions with automation to develop the most effective forms of instrument displays and communications.

Dryden Flight Research Center (DFRC), Edwards, CA, is NASA's Center of Excellence in Atmospheric Flight Operations. Dryden's mission in Flight Research includes using high-performance aircraft like the X-31, F/A 18, F-16XL, F-15, and the Mach 3+ SR-71 "Blackbird." Shown in the poster is the F/A-18 HARV (High-Alpha Research Vehicle).

Alpha, or angle of attack, is an aeronautical term to describe the angle of an aircraft's body and wings relative to its actual flight path. In high-performance aircraft, pilots often perform maneuvers at extreme (high) angles of attack, with the nose pitched up while the aircraft continues in its original direction. The lift provided by the wings is reduced and often insufficient to maintain altitude or control of the aircraft. Data from this research gives engineers and aircraft designers a better understanding of aerodynamics, effectiveness of flight controls, and air-flow phenomena at high angles of attack, enabling them to design better and safer high performance aircraft.

Langley Research Center (LaRC), Hampton, VA, is NASA's Center of Excellence in Structures and Materials. Langley's mission is Airframe Systems research and development. Langley leads two major research activities, the High-Speed Research (HSR) program and the Advanced Subsonic Transportation (AST) program because of its expertise in airborne systems, structures and materials, aerodynamics, and mission and systems analysis. These programs include research efforts to create safer, more affordable, and environmentally compatible air transportation for the future, as well as technology research that would revolutionize future aircraft.

Shown in the poster is a supersonic airliner concept that may be made feasible through NASA research. The goals for this aircraft are to travel at Mach 2.4, carrying 300 passengers over 600 nautical miles, making a trip from San Francisco to Tokyo possible in about 4 hours.

Lewis Research Center (LeRC), Cleveland, OH, is NASA's Center of Excellence in Turbomachinery. Lewis' mission is Aeropropulsion research and development. The Center's expertise on advanced engines, turbomachinery, mechanical engine components,propulsion materials and structures, and propulsion support technology, contributes to major programs such as HSR. Lewis also does much of NASA's research on aircraft icing and ice protection systems.

Shown in the poster is the Advanced Turboprop concept, developed in response to the "energy crisis" of the 1970s. Promising a potential 30 percent fuel savings, the Advanced Turboprop Project (ATP) was led by Lewis, and involved all of the aeronautics centers. It was an extremely successful program, and as a result, Lewis and the entire NASA/industry ATP team was awarded the 1987 Collier Trophy, the most prized aeronautical honor in America.

Your Attitude Determines Your Altitude
Biographies

Dr. Kathy H. Abbott was born in Pittsburgh, Pennsylvania. She decided to pursue a career in aeronautics as a result of her initial interest in computers, which she applied to aircraft. She developed a very strong interest in airplanes as a result. She received a B.S. in mathematics and information sciences from Christopher Newport College in 1978, an M.S. in computer science from George Washington University in 1981, and a Ph.D. the in computer science from Rutgers University in 1990. Dr. Abbott joined the Langley Research Center in 1980, where the focus of her research has been to develop computer-based tools and systems for cockpit automation and to improve human-computer interactions. Her research activities have the specific objective of improving aviation safety and operational efficiency, such as her work in pilot/vehicle interface and interaction, flight deck design, human performance assessment, and cognitive/decision aiding. Dr. Abbott's leadership on a number of research and study teams has improved knowledge and advanced the state of the art in a critical field of aeronautics. In 1991, Dr. Abbott was the principal researcher for the diagnostic portion of "Faultfinder," a concept for aiding flight crews in managing aircraft system faults. This project received *R&D* magazine's "R&D 100 Award" as one of 1991's top 100 technical innovations. Currently, Dr. Abbott is on an extended assignment with the Federal Aviation Administration (FAA) as the National Resource Specialist for Cockpit Human Factors. She serves as the chief scientific and technical advisor to the FAA on several human factors issues. She also serves as an FAA liaison to industry and other government and international agencies dealing with cockpit human factors. She is a certificated private pilot and has completed familiarization ground courses on the B747-400, MD-11, and A-320. Dr. Abbott's hobbies and interests include reading, birdwatching, and flying. She has three thoughts she wanted to share with students, because it is advice she has followed for herself. First, choose a career that you can "be passionate" about. Second, never underestimate how much you can contribute if you try. And finally, "You can get even more done working with other people, especially people with different perspectives—that type of synergy can be powerful."

Dr. John J. Adamczyk was born in Stamford, Connecticut. He received a B.S. and M.S. in mechanical engineering in 1965 and 1966 and a Ph.D. in applied mechanics in 1971,all from the University of Connecticut. Dr. Adamczyk was drawn to engineering because engineers get a chance to design and build devices that benefit people. He has worked at the Lewis Research Center since 1975, where he has held several senior positions. He has been actively involved in the analysis of turbomachinery flow since 1966. This includes numerical and analytical modeling of steady and unsteady flows, grid generation,and algorithm development. One of his significant accomplishments has been the development of a unified flow modeling approach for multistage turbomachinery. This modeling approach has resulted in a computer simulation model that is being adopted by the aero-engine industry as the basis of a next-generation turbomachinery aerodesign system. He has authored more than 35 technical papers. Currently, Dr. Adamczyk is a Fellow of the Lewis Research Academy. He is a highly sought-after lecturer at national and international symposiums, as well as at numerous colleges and universities. Dr. Adamczyk enjoys golf, golf club making, and jogging. His advice to students interested in a career in aeronautics is to get involved in aeronautics propulsion. The challenge to future aeropropulsion engineers—and the key to successful aircraft development programs—is the continued development of efficient, reliable, and environmentally friendly propulsion systems. It is an exciting field, and the challenges in propulsion will exist well into the 21st century. One additional thought by Dr. Adamczyk is that the modern jet engine is truly a miracle of engineering. "It has made the world a lot smaller and has allowed people to travel to places that were only a dream a generation ago. It has resulted in people of different cultures getting to know one another."

Born in Amityville, New York, **Ms. Marta Bohn-Meyer** graduated in 1979 from Rensselaer Polytechnic Institute with a B.S. in aeronautical engineering. From 1976 to 1979, she was a student in a cooperative education program involving the Institute and NASA's Langley Research Center. She participated in rotorcraft research and wind tunnel and flight safety projects associated with small civil aircraft. "I knew from the time I was 15 that I'd likely be an aeronautical engineer/flight test engineer," says Ms. Bohn-Meyer. "Most likely because: (1) I started learning to fly when I was 14 and loved it, and (2) my father worked for an aerospace 'giant' and airplanes were always spoken in my home." She adds, "Where I am today in my career is more a result of a series of lucky opportunities taken once I acquired the basic set of right qualifications." She is currently the Deputy Director of the Dryden Flight Research Center's Aerospace Projects Directorate. She is also one of two flight engineers assigned to fly in the SR-71 highspeed flight research program at Dryden. She is the first female crew member of NASA or the Air Force—and the second woman—to fly in one of the triple-sonic aircraft. She joined Dryden in 1979 as an operations engineer and has worked on a variety of research projects, specializing in flight test operations,developing test techniques,and conducting laminar flow research. Prior to her current position, Ms. Bohn-Meyer managed the F-16XL laminar flow project,designed to improve the understanding of laminar air flow on aircraft flying at sustained supersonic speeds. The F-16XL data will be useful to the development of future high-speed commercial aircraft. She is a certified flight instructor. Her hobbies include competitive aerobatics, aircraft building, classic car restoration, running, cycling, swimming, and reading about American history. Ms. Bohn-Meyer advises students to "spend some of your time and energy preparing yourself to be the one with the 'right'qualifications and enthusiasm for your chosen career. Then take advantage of being in the right place at the right time."

Your Attitude Determines Your Altitude

Biographies

Dr. Karen L. Gundy-Burlet was born in San Jose, California. She decided on a career in aeronautical engineering because of wonderful family stories about her great uncle, a barnstormer who performed aerobatic stunts with his wing-walker for audiences all along the west coast. Dr. Gundy-Burlet began her career at the Ames Research Center as a high school junior in the Student Space Biology Program. She started by developing computer graphics postprocessing routines for an airfoil aerodynamics code (TAIR). She worked at Ames throughout college. NASA's educational programs enabled her to earn a B.S. in mechanical engineering from the University of California at Berkeley in 1983 and an M.S. and Ph.D. in aeronautical engineering from Stanford in 1987 and 1991. Her contributions to computational fluid dynamics include developing highly efficient codes for computing unsteady multistage turbomachinery flows, such as those found in jet engines. Her research has impacted such programs as the F-119 aircraft and the NASA Space Shuttle. Currently, Dr. Gundy-Burlet is working on a full three-dimensional code for flow fields in an axial turbomachine. She is interested in programs aimed at helping students develop an interest in science and engineering. She has sponsored several students in the Student Space Biology Program, training them in computer science and aeronautics. She is very active in science fairs, and she gives lectures on her perspective and experiences as a female in engineering. She is featured in the AIAA/NASA inspirational video for students, "Fast Forward to the Future," to promote interest in science and mathematics. Her advice for students is to be well-rounded individuals with good communication and technical skills. "This will help you to adapt to career choices in the 21st century which are not even imaginable today!" In addition to her career, Dr. Gundy-Burlet faces the personal challenge of living with insulin-dependent diabetes mellitus. Instead of a multiple injection regimen, she uses an insulin pump because it gives her freedom to handle her chaotic lifestyle. She has ample motivation to keep her diabetes under good control. She has a loving husband and two young daughters. Her hobbies include horseback riding and gardening, and she is an avid reader.

Dr. Jolen Flores, born in San Francisco, received all of his degrees—a B.S. and M.S. in applied mathematics in 1974 and 1976 and a Ph.D. in engineering science/mechanical engineering in 1980 from the University of California at Berkeley. He pursued a career in engineering because of his interest in mathematics. In college, Dr. Flores became interested in numerical analysis (solving math equations using computers), and while working on his doctorate, his interests expanded to fluid dynamics. It was natural for him to apply numerical analysis to problems in fluid dynamics, a field known as computational fluid dynamics (CFD). At the Ames Research Center, Dr. Flores pioneered the development of several areas in CFD. In the area of Navier-Stokes capabilities, he developed the Transonic Navier-Stokes (TNS) multizone code capable of simulating three-dimensional flow fields about realistic aircraft. This ultimately led to the computation of transonic flow over a complete F-16 fighter plane, the first time this type of computation had ever been done. His development of the Compressible Navier-Stokes (CNS) code directly supported NASA's program in hypersonics. Currently, Dr. Flores is Branch Chief of the Advanced Aircraft and Powered Lift Branch. He is responsible for managing the development and demonstration of advanced aeronautical concepts and technologies for the next generation of military aircraft. Through work, Dr. Flores supports equal employment opportunity functions, including college recruitment for Ames, career fairs, science and technology fairs, and involvement in Ames' Hispanic Advisory Group. He also enjoys coaching baseball and soccer with his children, skiing, scuba diving, biking, racquetball,tennis, and basketball. Dr. Flores'advice to students who are interested in pursuing an aeronautics career is to get a strong mathematics and science background and to visit aeronautics museums to understand the history of aviation. He also advises students to take tours of aerospace companies and talk to different engineers to see the types of problems they work on, to find out about summer jobs, and to participate in cooperative programs. These are great ways to get first-hand experience and mentoring. "But most importantly," Dr. Flores advises, "as future airplane designers of the 21st century, don't ever limit your imagination."

Dr. Kenneth W. Iliff was born in West Union,Iowa. He graduated from high school soon after the first Sputnik launch. It was the dawn of the Space Age, and he was inspired to be an active player in it. He received B.S. degrees in aeronautical engineering and mathematics from Iowa State in 1962, an M.S. in mechanical engineering from the University of Southern California in 1967, and a Ph.D. in electrical engineering from UCLA in 1973. Dr. Iliff has been at the Dryden Flight Research Center since 1962. He is the world's leading expert in aircraft parameter identification, which is one of the most significant analytical advances in flight research and flight testing. He continues to be the pioneering influence in advancing the science and technology of this field. Dr. Iliff explains the field of parameter identification simply as: "Given the answer, what is the question?" Given that we know what an aircraft has done (its flight data), what made it perform in that way? Dr. Iliff's work is the field of determining the mathematical equations that describe an aircraft's characteristics from the flight data gathered. The information extracted by his methods is used in the design of virtually all new aircraft. Dr. Iliff has worked on all of the advanced research aircraft flown by NASA in the past 36 years. His work is the basis for the successful aircraft parameter identification computer codes used by flight test organizations worldwide. He has also extended the use of his methods to nonaeronautical systems, such as economic, medical, and chemical systems. For this work, he was awarded the NASA Exceptional Scientific Achievement Medal in 1976. Dr. Iliff is an AIAA Fellow and an inductee into the National Hall of Fame for Persons with Disabilities, Inc. Currently, Dr. Iliff is the Chief Scientist at Dryden and an adjunct professor in electrical engineering at UCLA. In addition to his interest in high-tech toys and finance, Dr. Iliff shares a passion for travel with his wife, and they have visited more than 70 countries. He said, "I wanted to explore Mars and couldn't; therefore, I decided to explore the planet I was already on." Dr. Iliff does not let the fact that he has been in a wheelchair, since contracting polio at the age of nine, limit him in any way. His advice to students is: "Learn all you can in math and science, starting at an early age. Besides courses, there are many other sources to take advantage of, such as libraries, the Internet,books, and CD's to help you learn."

Your Attitude Determines Your Altitude

Biographies

Mr. Albert L. Johns was born in Pahokee, Florida. He received a B.S. in aerospace engineering from the Indiana Institute of Technology in 1967, and did graduate work at Toledo University in 1972. He continues to be involved in learning through the Lewis Research Center's in-house training programs. Mr. Johns decided to pursue a career in aerospace engineering because of his love for airplanes and rockets during his high school years. He wanted to be a pilot and make a lasting contribution to aeronautics, but he later chose aeronautics research because he became fascinated with laboratories and experiments. During the past 12 years at Lewis, Mr. Johns has provided national leadership in developing unique wind tunnel test techniques and making technological advancements in hot gas ingestion (HGI) characteristics for advanced supersonic short takeoff and vertical landing aircraft. Additionally, he has developed several new test techniques, including the use of sheet laser systems for visualizing the complicated flows resulting from the interaction of multiple exhaust systems. Because of his HGI expertise, Mr. Johns has received national and international recognition, as a leader in aeropropulsion research. Mr. Johns is very active in the Lewis African Heritage Advisory Committee and in numerous outreach activities in his community. Through his personal skill and diligence, he has enhanced the image of NASA, as well as America. His interests include working with young people and helping them develop an interest and understanding of science and engineering through hands-on problem-solving activities. He is an avid enthusiast of early era blues and jazz. His hobbies include automotive mechanics, computers, walking, bowling, fishing, and gardening, especially growing roses. Mr. Johns' career advice is to be diverse in both educational background and people skills. "Being able to communicate and work effectively with people of diverse backgrounds will be as important as your educational achievements. Also, because we are living in a highly technological world, be computer literate. Give life 200 percent! Have a great life!"

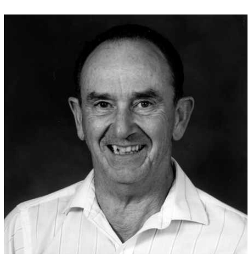
Dr. Robert T. (R.T.) Jones was born in Macon, Missouri. He developed an interest in aviation in high school in the mid-1920's, and wanted to pursue it as a career. He left the University of Missouri after 1 year because of the lack of aeronautics courses and began his aviation career with a flying circus ground crew. He later spent 3 years attending evening courses at Catholic University, under Dr. Max Munk, but never received a bachelor's degree. In 1971, he received an honorary doctorate of science from the University of Colorado. Dr. Jones' temporary appointment to NACA at the Langley Aeronautical Laboratory in the mid-1930's led to a permanent position. By the end of World War II, Dr. Jones had become one of the premier supersonic aerodynamicists in the world. His proposal in 1945, that wings should be swept back in supersonic flight to keep the Mach number subsonic at the wing's leading edge, was met with much skepticism. His theory was vindicated when a test conducted at Langley showed that at Mach 1, the wings with a 45-degree sweep had less than one-tenth the drag of the straight wings tested. This was a defining moment in the history of aviation, but acceptance was not immediate. After the straight-winged X-1 aircraft barely achieved supersonic flight, all subsequent supersonic research aircraft had swept wings. With the design of the B-47, B-707, and the DC-8, a new age in military and commercial aviation was launched. Dr. Jones transferred to the Ames Research Center in 1946. His work there is highlighted by his refinement of linear supersonic wing theory and his proposal for oblique-winged aircraft. Although proven in analysis and by experiment, practical development of the oblique wing remains to be achieved. Dr. Jones' major contributions to aviation have resulted in direct benefits to military and commercial aircraft, and his design concepts are commonplace today. Literally all programs concerned with supersonic flight or flight at high subsonic Mach numbers have been affected by his work. Currently, Dr. Jones is retired from NASA and from teaching at Stanford University, and he spends his time pursuing his many interests. He makes telescopes, which have won many prizes at amateur star-gazing events, and violins. He has recently developed an electromechanical device that reproduces the acoustic spectrum of stringed instruments. Dr. Jones' advice to students is: "Follow your dreams, even if they are unpopular with others."

Dr. James C. Newman, Jr., was born in Memphis, Tennessee. He received a B.S. in civil engineering from the University of Mississippi in 1964 and an M.S. and Ph.D. in engineering mechanics from Virginia Tech in 1969 and 1974. On his career choice, Dr. Newman states: "Very early in high school, I realized my strong capabilities in mathematics and science and my father greatly influenced my decision to become a civil engineer. As a senior in college, I conducted research on a National Science Foundation student grant and found that I enjoyed the field of research, especially the search for new scientific knowledge. When I was offered a job from NASA Langley, my dream had come true." Dr. Newman has been involved in many different and challenging projects addressing stress analyses of materials and structural components used in aircraft and the Space Shuttle system. These projects have contributed greatly to the safety and performance of the Space Transportation System. He has made significant contributions to the field of fatigue and fracture of metallic materials. Many of the crack solutions used in American Society for Testing Materials Standards for fatigue and fracture testing were developed by Dr. Newman and his colleagues at the Langley Research Center. He also worked with colleagues at the Johnson Space Center developing two major life-prediction codes for metallic materials: FASTRAN and NASA FLAGRO. These codes are rapidly becoming the durability and damage-tolerance codes used by many aerospace and nonaerospace companies worldwide. Dr. Newman enjoyed 32 years of research in the field of fracture mechanics—a field that was born in the late 1950's. Currently, he is a Senior Scientist at Langley, conducting research on experimental and computational aspects of fatigue and fracture mechanics of metallic materials. His interests are centered around his sons and grandchildren. His career advice to high school students is: "Work hard at whatever career you choose because, if you do, you will achieve your goals. While in school,look for teachers who will give you challenging course work because this is how you will build a good knowledge base for your future."

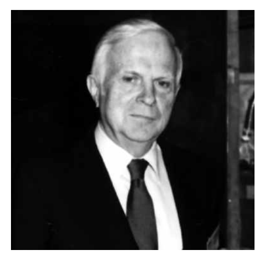
Your Attitude Determines Your Altitude

Biographies

Dr. Simon Ostrach was born in Providence, Rhode Island. He received a B.S. in mechanical engineering and a master of engineering from the University of Rhode Island in 1944 and 1949. He received his Sc.M. and Ph.D. degrees in applied mathematics from Brown University in 1945 and 1950, as well as three honorary doctorates from other distinguished universities. Dr. Ostrach's many contributions to aeronautics include helping design and develop single-cylinder test cells to study various problems in aircraft engines; pioneering studies of buoyancy-driven flows; furthering unsteady boundary-layer theory; and performing analyses of various turbojet and turboprop engine systems to help determine optimum jet propulsion performance. Although Dr. Ostrach has enjoyed a long and rewarding career in aerospace engineering, he did not originally choose it as a career. As a son of illiterate immigrants, he lived in a neighborhood where the only professionals were teachers and physicians. His parents hoped that he would be a physician. He worked at a summer camp with his high school guidance counselor, who convinced him to change to an engineering program. During Dr. Ostrach's first year at college, World War II broke out. Before graduation, he was recruited by NACA as one of the two top engineering students to work at the Lewis Research Center. Dr. Ostrach worked with a senior engineer to help find quick fixes to combustion chamber cooling problems for the Pratt & Whitney R-2800 and Wright 3350 aircraft piston engines. He went on to become a pioneer in the field of turbine engine cooling. Dr. Ostrach worked at Lewis during the 1940's and 1950's. Currently, he is a full professor at Case Western Reserve University. He is also Home Secretary of the National Academy of Engineering, which involves him in many national engineering policy issues, and he is active in many professional committees and advisory boards. High on Dr. Ostrach's list of interests is his family. Other hobbies and interests include sailing, sailboat racing, classical music, jazz, and big band music. His advice to students is: "Do not be too concerned about the career aspects of life upon entering college. Concentrate on getting the best and broadest educational background, at the highest level possible, in your area of interest." He would caution students about specialization because, "In this new world of technology, one must be versatile and flexible. Work in one field may also make important contributions to other unrelated fields. Whatever the field, though, the possible contributions to society from science and engineering are endless."



Mr. Edwin J. Saltzman has had a long-standing interest in "mechanical things," and for this reason, he studied physics and mathematics in college on the GI Bill after World War II. Born in rural Henry County, Iowa, Mr. Saltzman graduated in 1950 from Iowa Wesleyan College with a B.A. in physics. He began his career at NACA in 1951 as a performance aerodynamics researcher. Mr. Saltzman devised and demonstrated how to measure boundary-layer and skin friction in-flight to Mach 5. He also pioneered the concept of evaluating aircraft performance component by component. His method was used to evaluate the X-1, X-15, X-29, and lifting bodies, and the concepts of Area Rule, the supercritical wing, and the winglet. His research has influenced the basic design of transonic, supersonic, and hypersonic flight vehicles. In response to the energy crisis in the early 1970's,Mr. Saltzman applied his aeronautics experience and creativity to the aerodynamics of ground vehicles (buses,trucks, and motor homes) to save energy. His research results demonstrated the potential to save 26 million barrels of fuel per year in the United States. In 1980, he received the President's Council Award for Energy Efficiency for this work. Applying his knowledge to yet another field, Mr. Saltzman designed a livestock hauling vehicle that provides a more healthy, humane environment for livestock through an innovative ventilation design. His contributions to the field of lift and drag research have resulted in more efficient airliners and supersonic aircraft. On the ground, his work has helped motorists save fuel and cut the costs of transporting consumer goods. During the past four decades, numerous Dryden Flight Research Center researchers have benefited from Mr. Saltzman's mentorship. Although he is retired from NASA, he is still working as an engineer. He enjoys the "big outdoors," keeping physically active by hiking and bicycling. He is also an amateur carpenter and pursues related activities that satisfy his mechanical interests. His advice to students is: "Accumulate the technical tools that will ensure your usefulness in aeronautics. . . . Once you are employed in aeronautics, be very determined that you will not be easily fooled. By this I mean, employ healthy skepticism, asking the decisive question that will reveal the truth."



Dr. Richard T. Whitcomb was born in Evanston, Illinois. He pursued a career in aeronautics because the dynamics of flight fascinated him. He received his B.S. in mechanical engineering in 1943 and an honorary doctorate of engineering in 1956, both from Worcester Polytechnic Institute. In 1985, Old Dominion University awarded him an honorary doctorate of science. At the Langley Research Center, Dr. Whitcomb is best known for his pioneering contributions to aeronautics, including the conception, development, and validation of the Area Rule, the supercritical airfoil, and winglets. These concepts have substantially increased performance for a wide range of subsonic and supersonic aircraft. In the early 1950s, he had the basic idea for a concept to minimize aircraft drag at transonic speeds, known as the Area Rule. This concept greatly improved efficiency of fighter and bomber aircraft intended to fly through Mach 1. In 1964, Dr. Whitcomb conceived of an idea, known as the supercritical airfoil, that was a radical departure from conventional high-speed airfoil designs. This aerodynamic concept reduced the upper surface shock losses through the careful contouring of the airfoil surface. He next worked on the development of wing tip devices, known as winglets, to reduce the induced drag of high-speed wings. The supercritical airfoil and winglets provided aircraft designers with two new, powerful, and versatile concepts to design far more efficient wings. Industry analyses have shown that these technologies can provide substantial fuel savings. The most fuel-efficient aircraft ever designed use Dr. Whitcomb's concepts. He received the Collier Trophy in 1954, the most prized aeronautical honor in America, for the discovery and verification of the Area Rule. He has also received numerous other prestigious honors and awards for his contributions to aeronautics. His interests are centered around reading, which he has always enjoyed. His advice to students is to "understand the basis of anything you work on."

Your Attitude Determines Your Altitude

Career Paths

The world of the 21st century will be exciting. There will be more changes and advances in our society and in technology than we can imagine. The following thoughts on careers are focused towards students interested in pursuing a scientific or a technical career, such as engineering, but at the same time, they are much broader. Students interested in other fields will also need to think about many of these same things.

Discuss your goals and ambitions with people who can help guide you. To help you prepare for college and beyond, seek out people who work in the careers or fields that interest you. The list below describes some of the skills and attributes that will contribute to your success.

Skills and Attributes

To start towards your dream now, you must be prepared for the technical curriculum in college. Equally important is the need to learn good communication skills, how to work in teams,and how to think. Engineers do a lot of problem solving!

The following list, "Attributes of an Attractive Engineering Graduate," will help you see the kinds of qualities that NASA and many other companies find valuable. As you can see, the list includes more than just technical knowledge.

- Good grasp of engineering science fundamentals
- Good understanding of the design and manufacturing process
- Basic understanding of the social/economic/political context in which engineering is practiced
- Good communication skills
- Ability to think both critically and creatively, independently and cooperatively
- Ability and the self-confidence to adapt to rapid/major change—flexibility
- Curiosity and a life-long desire to learn
- Understanding of the importance of team work

Starting Out

When thinking about your future career, take some time to think about what you like to do and what your favorite courses are in school. Try to imagine what types of jobs could combine these choices. Explore ideas with your school counselors,teachers, role models, and others. Seek out career information resources. The more information you can collect on the types of work you would like to do, the better you can prepare yourself during high school and college. In fulfilling a dream, preparation is the key.

High School

Chose your high school classes carefully to make sure you are prepared both for your future career and the college or university you would like to attend. Even if your dreams are not directly related to science or mathematics, do not neglect these subjects because a foundation in science and math will be an asset in most careers. Current labor trends suggest that the average person will change careers about six times during their work life. This places even more importance on the educational foundation you are building. During high school is the time to start exploring your career ideas seriously.

College

College is the time to focus on developing your skills and working on the attributes mentioned above, along with your curriculum studies. College is an exciting and challenging time with much to do and learn. Do not be shy in finding what you need to make this time meaningful and productive. Seek out and team up with other students in your classes to help study difficult subjects.

If you plan to work during your college years, finding jobs or other opportunities that relate to your interests can help you improve needed skills and evaluate potential career choices. Take advantage of the many resources and services that your school offers. As you finish your college years, be sure to consider if additional education is needed for advancement in your career field. Many companies offer educational opportunities, so explore your education needs and options to plan what is best for you.

The Evolving Workplace

It is important that you be flexible and use your imagination in order to be successful in the dynamic environment of the future. The career(s) that you choose may not exist today. Who knew what an Internet engineer was ten years ago! The field of engineering has already been permanently affected by the pace of technological innovation. Information technology has played a major role in transforming how people communicate and with whom they communicate.

The 21st century will see a truly global economy, international competition, a diverse workforce, finite resources, environmental concern, and ever increasing change. A successful student will be one who knows to expect the unexpected, and is prepared for it. You will be putting into practice your skills, attributes, and knowledge.

Your Attitude Determines Your Altitude

NASA Resources for Educators

NASA's Central Operation of Resources for Educators (CORE) was established for the national and international distribution of NASA-produced educational materials in audiovisual format. Educators can obtain a catalogue and an order form by one of the following methods:

- NASA CORE
  Lorain County Joint Vocational School
  15181 Route 58 South
  Oberlin, OH 44074
- Phone (440) 774-1051, Ext. 249 or 293
- Fax (440) 774-2144
- E-mail nasaco@leeca.esu.k12.oh.us
- Home Page: *http://spacelink.nasa.gov/CORE*

Educator Resource Center Network

To make additional information available to the education community, the NASA Education Division has created the NASA Educator Resource Center (ERC) network. ERCs contain a wealth of information for educators: publications, reference books, slide sets, audio cassettes, videotapes, telelecture programs, computer programs, lesson plans, and teacher guides with activities. Educators may preview, copy, or receive NASA materials at these sites. Because each NASA Field Center has its own areas of expertise, no two ERCs are exactly alike. Phone calls are welcome if you are unable to visit the ERC that serves your geographic area. A list of the centers and the regions they serve includes:

AK, AZ, CA, HI, ID, MT, NV, OR, UT, WA, WY
NASA Educator Resource Center
Mail Stop 253-2
NASA Ames Research Center
Moffett Field, CA 94035-1000
Phone: (650) 604-3574

CT, DE, DC, ME, MD, MA, NH, NJ, NY, PA, RI, VT
NASA Educator Resource Laboratory
Mail Code 130.3
NASA Goddard Space Flight Center
Greenbelt, MD 20771-0001
Phone: (301) 286-8570

CO, KS, NE, NM, ND, OK, SD, TX
JSC Educator Resource Center
Space Center Houston
NASA Johnson Space Center
1601 NASA Road One
Houston, TX 77058-3696
Phone: (281) 483-8696

FL, GA, PR, VI
NASA Educator Resource Laboratory
Mail Code ERL
NASA Kennedy Space Center
Kennedy Space Center, FL 32899-0001
Phone: (407) 867-4090

KY, NC, SC, VA, WV
Virginia Air and Space Museum
NASA Educator Resource Center for
NASA Langley Research Center
600 Settler's Landing Road
Hampton, VA 23669-4033
Phone: (757) 727-0900 x 757

IL, IN, MI, MN, OH, WI
NASA Educator Resource Center
Mail Stop 8-1
NASA Lewis Research Center
21000 Brookpark Road
Cleveland, OH 44135-3191
Phone: (216) 433-2017

AL, AR, IA, LA, MO,TN
U.S. Space and Rocket Center
NASA Educator Resource Center for
NASA Marshall Space Flight Center
P.O. Box 070015
Huntsville, AL 35807-7015
Phone: (256) 544-5812

MS
NASA Educator Resource Center
Building 1200
NASA John C. Stennis Space Center
Stennis Space Center, MS 39529-6000
Phone: (228) 688-3338

NASA Educator Resource Center
JPL Educational Outreach
Mail Stop 601-107
NASA Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099
Phone: (818) 354-6916

CA, cities near the center
NASA Educator Resource Center for
NASA Dryden Flight Research Center
45108 N. 3rd Street East
Lancaster, CA 93535
Phone: (805) 948-7347

VA and MD's Eastern Shores
NASA Educator Resource Lab
Education Complex—Visitor Center
Building J-1
NASA Wallops Flight Facility
Wallops Island, VA 23337-5099
Phone: (757) 824-2297/2298

Regional Educator Resource Centers (RERCs) offer more educators access to NASA educational materials. NASA has formed partnerships with universities, museums,and other educational institutions to serve as RERCs in many states. A complete list of RERCs is available through CORE, or electronically via NASA Spacelink at *http://spacelink.nasa.gov*.

NASA On-line Resources for Educators provide current educational information and instructional resource materials to teachers, faculty, and students. A wide range of information is available, including science, mathematics, engineering, and technology education lesson plans; historical information related to the aeronautics and space program; current status reports on NASA projects; news releases; information on NASA educational programs; and useful software and graphics files. Educators and students can also use NASA resources as learning tools to explore the Internet, accessing information about educational grants, interacting with other schools that are already on-line, participating in on-line interactive projects, and communicating with NASA scientists, engineers, and other team members to experience the excitement of real NASA projects.

Access these resources through the NASA Education Home Page: *http://www.hq.nasa.gov/education*.

NASA Television (NTV) is the Agency's distribution system for live and taped programs. It offers the public a front-row seat for launches and missions, as well as informational and educational programming, historical documentaries, and updates on the latest developments in aeronautics and space science. NTV is transmitted on the GE-2 satellite, Transponder 9C at 85 degrees West longitude, vertical polarization, with a frequency of 3880 megahertz, and audio of 6.8 megahertz.

Apart from live mission coverage, regular NASA Television programming includes a Video File from noon to 1:00 pm, a NASA Gallery File from 1:00 to 2:00 pm, and an Education File from 2:00 to 3:00 pm (all times Eastern). This sequence is repeated at 3:00 pm, 6:00 pm, and 9:00 pm, Monday through Friday. The NTV Education File features programming for teachers and students on science, mathematics, and technology. NASA Television programming may be videotaped for later use.

For more information on NASA Television, contact:
NASA Headquarters, Code P-2, NASA TV, Washington, DC 20546-0001 Phone: (202) 358-3572
NTV Home Page: *http://www.hq.nasa.gov/ntv.html*

How to Access NASA's Education Materials and Services, EP-1998-03-345-HQ This brochure serves as a guide to accessing a variety of NASA materials and services for educators. Copies are available through the ERC network, or electronically via NASA Spacelink. NASA Spacelink can be accessed at the following address: *http://spacelink.nasa.gov*.

Please take a moment to evaluate this product at ***http://ehb2.gsfc.nasa.gov/edcats/educational_wallsheet****.*
Your evaluation and suggestions are vital to continually improving NASA educational materials. Thank you.

EW-1998-07-126-HQ