National Aeronautics and Space Administration

aerospace design

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ABOUT AEROSPACE DESIGN

The images on the front of this poster are artifacts from an exhibition called "Aerospace Design: The Art of Engineering from NASA's Aeronautical Research." The exhibition was organized by the Aeronautics Research Mission Directorate at NASA to commemorate the centennial of the Wright brothers' first powered flight in December 1903. Artifacts include architectural and engineering designs for wind tunnels, wind tunnel models, and designs for conceptual airplanes, past and present.

For detailed descriptions of each artifact, exhibit photographs, and information about how to schedule the exhibit, visit:

http://aeronautics.nasa.gov/exhibits/aerospace/

ABOUT AERONAUTICS RESEARCH AT NASA

NASA research helps make aircraft quieter, safer, more efficient, and more reliable. For decades, our researchers have created revolutionary vehicle improvements that are used today on nearly every aircraft—from winglets that maximize air flow and improve fuel efficiency, to wing deicing systems that save time on the ground and improve safety in the air.

NASA's Aeronautics Research Mission Directorate continues to focus on improving aircraft, but we also focus on improving the airspace in which those aircraft fly. Dramatic changes are needed to turn our current airspace system into one that can soon handle three times as many aircraft safely and efficiently. Together with the FAA and other partners, we are developing the tools and technologies needed for the next generation air transportation system.

We also use our unique expertise to help discover how to send vehicles safely through the atmospheres of Earth and other planets—a critical component of NASA's Vision for Space Exploration.

NASA is committed to the pursuit of technical truth that benefits the entire aeronautics community and beyond.

http://aeronautics.nasa.gov

ABOUT CAREERS IN AEROSPACE DESIGN

Designing an aircraft's components and how they come together is primarily the job of the aerospace engineer.

Aerospace (aeronautics) engineers work on the design and performance of everything from transport and military aircraft to helicopters and spacecraft. To do this, they have knowledge of aerodynamics (how an aircraft lifts and flies), aircraft structures and materials (how to build the aircraft), propulsion (how to build engines to propel vehicles into the atmosphere), flight dynamics and control (how to control the aircraft), and several other disciplines such as computer science.

Engineers often use their most creative skills when it comes to design. They determine the size, shape, structure, arrangement, and function of components of aircraft to meet the specifications set by the customer, and by safety or cost constraints.

Aerospace engineers are often aviation enthusiasts, curious about those "famous flying machines" and the science behind them.

Characteristics of a good aerospace engineer include:

- 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.

Samples of types of aerospace engineering degrees include:

- Aerodynamics
- Flight Dynamics and Control
- Aerospace Propulsion
- Aerospace Structures
- Aerospace Design

Visit the Education pages at the ARMD Web site:

http://aeronautics.nasa.gov/education.htm

NASA AERONAUTICS SCHOLARSHIP PROGRAM

NASA is committed to supporting a future workforce that helps us continue to reach our goals in science and exploration. In 2008, ARMD started the Aeronautics Scholarship Program for graduate and undergraduate students. The program expects to annually award 20, two-year scholarships plus summer internships to undergraduate students; and five, two- to three-year scholarships plus summer internships to graduate students.

Apply online at: http://www.asee.org/fellowships/nasaasp/

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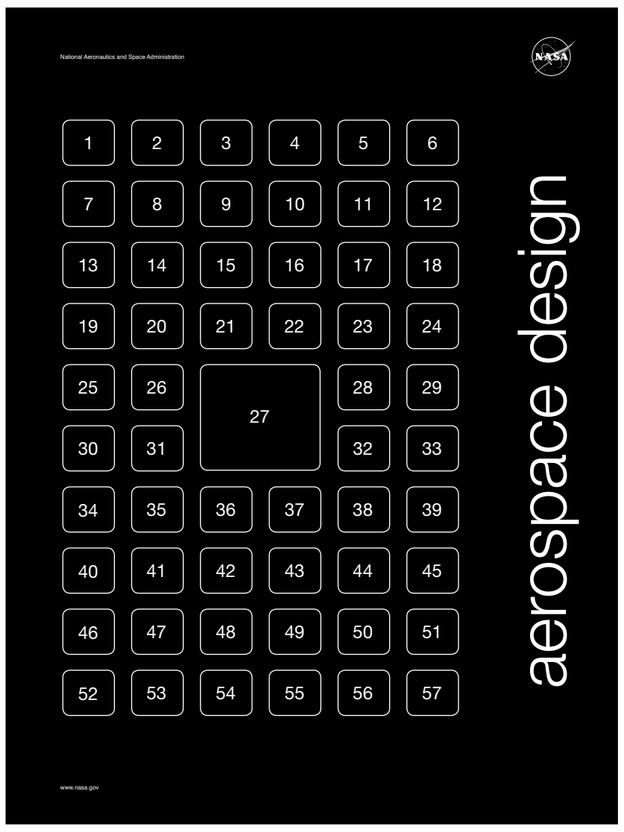

ABOUT BOOKS ON AEROSPACE DESIGN

Aerospace Design: Aircraft, Spacecraft, and the Art of Modern Flight, Anthony M. Springer (ed.), (companion book to the NASA exhibition), London, UK (Merrell Publishers), 2003

Aircraft Design: A Conceptual Approach, Daniel P. Raymer, Reston,VA (American Institute of Aeronautics and Astronautics) 1989,Second Edition 2002

Aircraft Performance and Design, John Anderson (McGraw-Hill International Editions) 1999

Airplane Design (8 Volume Series), Dr. Jan Roskam (Design Analysis and Research) 1989-2002

At the Edge of Space: The X-15 Flight Program, Milton O. Thompson, Washington, DC (Smithsonian Institution Press) 1992

Building for Air Travel: Architecture and Design for Commercial Aviation, John Zukoskwy (ed.), Munich (Prestel) 1996

Building for Space Travel, John Zukowsky (ed.), New York, NY (Harry N. Abrams) 2001

Concept to Reality: Contributions of the Langley Research Center to U.S. Civil Aircraft of the 1990s, Joseph R. Chambers, NASA History Series (NASA SP-2003-4529) 2002

Flying without Wings: NASA Lifting Bodies and the Birth of the Space Shuttle, Sutton O. Thompson and Curtis Peebles, Washington, DC (Smithsonian Institution Press) 1999

A History of Aerodynamics and Its Impact on Flying Machines, John D. Anderson, Jr., Cambridge, UK (Cambridge University Press) 1997

Innovation in Flight: Research of the NASA Langley Research Center on Revolutionary Advanced Concepts for Aeronautics, Joseph R. Chambers, NASA History Series (NASA SP-2005-4539) 2005

Quest for Performance: The Evolution of Modern Aircraft, Laurence K. Loftin, Jr., Washington, DC (Government Printing Office) 1985

The X-Planes: X-1 to X-45, Jay Miller, North Branch, MN (Specialty Press) 2001

Space Shuttle: The History of the National Space Transportation System The First 100 Missions, 3rd Edition, Dennis R. Jenkins (Dennis R. Jenkins) 2001

NASA CENTERS TO CONTACT ABOUT AERONAUTICS RESEARCH

NASA Ames Research Center
http://www.nasa.gov/centers/ames

NASA Dryden Flight Research Center
http://www.nasa.gov/centers/dryden

NASA Glenn Research Center
http://www.nasa.gov/centers/glenn

NASA Langley Research Center
http://www.nasa.gov/centers/langley

ARTIFACT TITLES

1. Boeing F4B-2 Model, ca 1931–33
2. Stearman 85, Spin Tunnel Model, ca 1937
3. Douglas XBTD-1 Destroyer Spin Tunnel Model, ca 1944
4. Northrop P-61 Black Widow Wind Tunnel Model, 1943
5. Wind Tunnel Fan Blade
6. Modified Bell X-1 Spin Tunnel Model, ca 1950
7. Bell X-2 Wind Tunnel Model, ca 1954
8. Early X-15 Concept Model, ca 1953
9. North American X-15 Spin Tunnel Model, 1950s/60s
10. Advanced X-15 Configuration, ca 1966
11. North American XB-70 Valkyrie, Pressure Sensitive Paint Model, ca. 1960
12. North American XB-70 Valkyrie, Force Model, ca 1960–65
13. North American XB-70 Valkyrie, Spin Model, ca 1966
14. Oil Flow Patterns on Wedge Shapes, ca 1980
15. Northrop (HL-10) Lifting Body Model, ca 1965
16. Waveride Model, ca 1980–85
17. Hypersonic Skip-Guide Model, 1960s
18. Boeing X-20 Dyna-Soar Wind Tunnel Model, 1960-63
19. A Series of Delta Wing Wind Tunnel Models, 1980s
20. Proposed Shapes for the Mercury Capsule, 1957–60
21. Pitot Probe, 1970s
22. Douglas BTD-1 Spin Tunnel Model, 1940
23. Early Hypersonic Wind Tunnel Model, ca 1980
24. Supersonic Commercial Air Transport Wind Tunnel Model, Late 1950s
25. High Speed Civil Transport, HSCT Model, ca 1990
26. Oblique Wing Model, ca 1960
27. Evolution of the Space Shuttle Configuration in Wind Tunnel Models, 1969–72
28. Early Hypersonic Wind Tunnel Models, ca 1995
29. Span Loader II Wind Tunnel Model, ca 1972
30. Wooden Wedge Proof Model, ca 1970–75
31. Martin X-24C Lifting Body, Wind Tunnel Model, ca 1974
32. Generic Research Flying Wing Spin Tunnel Model, ca 1990
33. Space Shuttle Orbiter Wind Tunnel Model, ca 1970–78
34. HL-20 Lifting Body, Water Tunnel Model, ca 1983
35. Engine Exhaust Nozzle Model, 1980s
36. Generic Transport Aircraft, ca 1984
37. Rogallo Wing, Designed for Spacecraft Recovery, ca 1961
38. F-6F Grumman Hellcat Spin Tunnel Model, 1942
39. Chevron Nozzle, ca 1998–2001
40. Advanced Wing Shapes, ca 2001
41. Wavy Blade Helicopter Rotor Model, ca 1999
42. Blended Wing Body Model, ca 2000
43. Hyper-Elliptic Cambered Span (HECS) Wing Model, ca 2001
44. Scalloped Wing Wind Tunnel Model, ca 2001
45. Crew Transfer Vehicle Models, ca 1999
46. Microcosm SR-1, Wind Tunnel Model, ca 1998
47. Lockheed SR-71 Blackbird, Wind Tunnel Model, 1963–70
48. Grumman X-29 Model (1/16 Scale), ca 1980–85
49. 1/10 Scale Mercury Space Capsule, Spin Tunnel Model, ca 1959
50. Vought F-8 Crusader Super Critical Wing Research Model, ca 1968
51. Twelve-Chute Plug Nozzle, 1980s
52. Early Hypersonic Wind Tunnel Model, ca 1980
53. Model of a Mars Airplane Concept, ca 2002
54. HL-10 Lifting Body Wind Tunnel Model, ca 1960
55. Douglas F4 D-1 Sky Ray Spin Tunnel Model, 1955
56. Northrup P-61 Black Widow Wind Tunnel Model, 1943
57. North American X-15 Spin Tunnel Model, 1950s/60s

* All artifact models are property of NASA.