



Meets Georgia Performance Standards:

Second Grade

S2P2 Students will identify sources of energy and how the energy is used.

S2P3 Students will demonstrate changes in speed and direction using pushes and pulls

Fourth Grade

S4P3 Students will demonstrate the relationship between the application of a force and the resulting change in position and motion on an object.

Meets South Carolina Academic Standards:

Third Grade:

Standard 3-5 The student will demonstrate an understanding of how motion and sound are affected by a push or pull on an object and the vibration on an object.

Fifth Grade:

Standard 5-5 The student will demonstrate an understanding of the nature of force and motion.

EDUCATORS' GUIDE TO SCIENCE OF FLIGHT WORKSHOP

In a classroom setting, learn about Newton's Laws of Physics while discovering how an aircraft's weight, thrust, lift and drag all influence its ultimate design. A functioning wind tunnel is used to analyze lift and drag in aircraft design and a model turbojet engine helps demonstrate thrust. A tethered radio-controlled model plane flying into a wind stream demonstrates how the rudder, elevators and ailerons control flight.

Program Personnel

- ➔ Heather Thies, Director of Education, The Mighty Eighth Air Force Museum
- ➔ Mr. Pat Conner, Aircraft Performance Engineer, Gulfstream Aerospace Corporation
- ➔ Mr. Bill Murdock, Retired Project Engineer Manager for Pratt & Whitney

RECOMMENED ACTIVITIES BEFORE YOUR MUSEUM VISIT

Help your students discover how humans dreamed of powered flight for centuries before it became a reality in the early twentieth century.

1. Greek Myth of Daedalus and Icarus
2. Leonardo da Vinci
 - a. Articulated Wing (Codex Atlanticus, f. 846 v) and full size model of his articulated wing housed in the Leonardo Museum in Vinci, Italy

3. Wilbur and Orville Wright
 - a. First successful flight of a heavier-than-air craft (the Wright 1903 Flyer or Kitty Hawk Flyer) on December 17, 1903

RECOMMENDED ACTIVITIES AFTER YOUR MUSEUM VISIT

1. Review the forces on an airplane: lift, drag, thrust, weight (gravity).
2. Review the principle control surfaces of an airplane (elevators, rudder, ailerons).
3. Review Bernoulli's Principle: "The faster fluid flows-in this case air-, the less pressure it has."
4. Review the Law of Conservation of Matter as applied to a moving fluid: "in a moving stream of fluid (including air), the density times the cross sectional area of the flow times the velocity must always be constant."
5. Review Newton's Third Law of Motion: "For every action there is an equal and opposite reaction." How does this apply to jet engines?
6. Review the main components of the turbo jet engine (compressor which compresses air to high pressure; turbine which extracts enough energy to drive compressor; burner which burns fuel to provide energy).

RESOURCES

Books

Nahum, Andrew. *Flying Machine*. New York: Alfred A. Knopf.

The Eyewitness Book, *Flying Machine* includes information about the Greek myth and Leonardo da Vinci's interest in flight (pages 6-7).

Freedman, Russell. *The Wright Brothers: How They Invented the Airplane*. Scholastic. Filled with illustrations, it is an excellent introduction to the achievements of Orville and Wilbur Wright.

Anderson, John D., Jr. *A History of Aerodynamics*. Cambridge: Cambridge University Press, 1998.

Smith, Hubert. *The Illustrated Guide to Aerodynamic*. Blue Ridge Summit, PA: Tab Books, Inc. 1985.

Internet

The Leonardo Museum in Vinci includes Leonardo da Vinci's articulated wing.

<http://www.leonet.it/comuni/vinimus/invinmus>

The collections in the Smithsonian's National Air and Space Museum include the Wright 1903 Flyer. <http://www.nasm.si.edu/>