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Introduction:

Our aerospace demo gives students a closer look at how interesting the field of aeronautical sciences can be. Throughout this lesson, the wizards will take you on a journey through science in which you have never been before. You will experience working with a wind Tunnel, WART Water Channel, Bernoulli principal Experiments –Bazookas, Hair dryers and Vertical Fans , RC Blimp with wireless video camera, New High Tech Wind Tunnel, Laptop with Flight Simulator, Hot Air Balloons, and more. This lesson is not only fun and exciting but it is a learning experience of a lifetime.

Our experienced wizards from WPAFB are on call to go out to local schools and share their expertise with you to enhance your knowledge in the field of aerospace.

Module Overview

Aerospace K-6 Module Overview

The basic concept is to enhance the student's knowledge in the area of aerospace engineering. Some of the duties that an Aeronautical engineers tends to work on are projects like performing wind tunnel tests on an aircraft model, designing and analyzing the structure of an airplane wing, taking data from a flight test to study how a new component works or how it can be improved. They also building and testing engines or rocket motors for new airplanes or missile, using computers to predict the aerodynamic behavior of a new aircraft design, designing flight control systems to make airplanes easier and safer to fly, and predict the performance characteristics (such as maximum range and maneuverability) of aircraft and missiles. Finally, they create flight simulators for training pilots or modeling the flight characteristics of various aircraft.

Typical projects an astronautical engineer might be involved with include designing systems to provide power to a satellite over its 20-year lifetime. Analyzing spacecraft structures to insure they are strong enough to survive their journeys, developing communications systems to provide contact with distant space probes, designing new rockets and reusable space vehicles to carry people and equipment into space, are some of the duties that an astronautical performs on a daily basis.

An Aerospace engineer is planning, designing, construction, or management of machinery on roads, bridges, buildings, etc. Our goal is to give the student a different prospective on the life of an engineer and help the student to make an alternative career decision.

Teacher interested in having this demonstration in their classrooms will contact the Wright - Patterson Air Force Base Educational outreach office. The Program director will be happy to assist you in scheduling a wizard to visit your classroom for a one-hour presentation. The teacher receives a Pre-activity one week prior to the actual presentation to formularize the students with lesson preceding the visit. The per-activity consists of vocabulary, a lesson overview, description of an engineer and the materials used in the demo.

Once the demonstration is scheduled, the wizard visits the site that the demo is held and the students will partake in hands on experiences that will help with future decision for a stable career.

Therefore, to get a good picture of what aerospace, aeronautical, and astronautical engineering are like, you really need to read about or talk to people working in some of these diverse areas. A few good websites give some basic information about the field.

- [Bureau of Labor Statistics: Aerospace Engineer](#) -- general overview and job outlook
- [Purdue University: Aerospace Careers](#) -- general overview
- [KiwiCareers: Aeronautical Engineer](#) -- though intended for residents of New Zealand, this series of pages gives a pretty good general overview of the field
- [Careers in Aerospace FAQ](#) -- although a little old, this site gives a good overview of the types of work done by aerospace engineers

Other good sites feature interviews or biographies of individual engineers. These sites are useful because they describe the kinds of backgrounds needed to do different types of work in the aerospace field.

- [NASA Langley: Interview an Aerospace Engineer](#) -- this one is especially good because it is based on the experiences of a specific engineer and answers many relevant questions
- [NASA: Women of NASA](#) -- although intended mainly to interest young girls in math and science, these biographies of female NASA engineers include many descriptions of the kinds of work they do in a wide variety of fields
- [Real Science](#) -- provides biographies of people with many different kinds of careers in science and engineering, including aeronautical and aerospace engineering

Additional information about a variety of careers available in the aerospace industry can be found in the [biographical profiles](#) of our very own Aerospaceweb.org staff members.

- answer by [Jeff Scott](#), 18 March 2001



Aerospace:

Focus: Aeronautical Engineering

Grades: suggested for grades 4-12

Background:

The aerospace demo design gives students a closer look at how interesting the field of aeronautical sciences can be. Throughout this lesson, the wizards will take you on a journey through science on which you have never been before. The variety of experiences available to you include small low-tech and high-tech wind tunnels, water channel, Bernoulli bazookas and other Bernoulli principle experiments. Other hands-on demonstrations involve a radio-controlled blimp with wireless video camera, laptop with Flight Simulator, hot air balloons, and more. Lessons are not only fun and exciting but are learning experiences that you will never forget. Our experienced wizards from WPAFB are on call to go out to local schools and share their expertise with you to enhance your knowledge in the field of aerospace.

Objectives:

- ✓ Students will construct a recognizable simple model of a real object using familiar materials.
- ✓ Children will explore similarities and differences observed in a wide diversity objects and organisms.
- ✓ Students will be able to interview and interact with community members to discuss past events and development in science and technology.
- ✓ Students will explain and discuss various influences affecting observations and interpretations.

Students will utilize caution and demonstrate care and concern for ones self, classmates, equipment, specimens and the environment when making observations, conducting experiments and participating in group interactions

Academic Content Standards:

These K-8 science grade level indicators for Physical science & Science and Technology are parallel the Ohio Achievement test.

- Kindergarten:** No indicators present in this grade level for any of the standards.
- Grade One:** No indicators present in this grade level for any of the standards.
- Grade Two:** No indicators present in this grade level for any of the standards.
- Grade Three:**
1. Describe and objects position by locating it relative to another object or the background (Physical Science)
 2. Describe an objects motion by tracking and measuring its position over time. (Physical Science)
 3. Identify contact/ noncontact forces that affect motion of an object (e.g., gravity, magnetism and collision). (Physical Science)
 4. Predict the changes when an object experiences a force e.g., a push or a pull, weight and friction) (Physical Science)
- Grade four:**
3. Develop, design and conduct safe, simple investigations or experiments to answer questions (Scientific inquiry)
 4. Formulate instructions and communicate data in a manner that allows others to understand and repeat an investigation or experiment. (Scientific inquiry)
- Grade Five:**
1. Select and safely use the appropriate tools to collect data when conducting investigations and communicating finding to others (e.g., thermometers, timers, balances, spring scales, magnifiers, microscopes and other appropriate tools). (Scientific inquiry)
 4. Identify one or two variables in a simple experiment. (Scientific inquiry)

6. Explain why the results of an experiment are sometimes different (e.g., because of unexpected differences in what is being investigated, unrealized differences in the methods used or in the circumstances in which the investigation was carried out, and because of errors in observations). (Scientific inquiry)

Grade Six: 3. Distinguish between observation and inference

Grade Seven: 3. Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific investigation. (Scientific inquiry)

5. Analyze alternative scientific explorations and predictions and recognize that there may be more than one good way to interpret a given set of data. (Scientific inquiry)

7. Use graphs, tables, and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density). (Scientific inquiry)

Grade Eight: 1. Read, construct and interpret data in various forms produced by self and others in both written and oral form (e.g., tables, charts, maps, graphs, diagrams and symbols) (Scientific inquiry)

Activities

Bernoulli principal

Flow tank

Hovercraft

Wind Tunnel

Blimp

Bazookas hairdryers & ping pong

Paper airplanes

Straw rockets

Vertical Fans

Laptop with Flight Simulator

ACTIVITY: WIND TUNNELS

- Discussion of how a wind tunnel works and why we use them
- Discussion of the forces acting on an airplane (Lift, Weight, Thrust, Drag)
- Demonstration of the forces of Lift and Drag
- Hands-on investigation of effects various shapes have on Lift and Drag
- Hands-on investigation of effect increased/decreased Thrust has on Lift and Drag

Experiments:

Part I - Hands-on investigation of effects various shapes have on Lift and Drag

Set the speed of the wind tunnel by using the variable speed controller.

Install a shape (disk, sphere, or teardrop) into the wind tunnel

Turn on the wind tunnel

Record the Lift and Drag as shown on the measurement instrumentation

Turn off the wind tunnel

Install second shape into the wind tunnel; repeat steps 3-5

Install third shape into the wind tunnel; repeat steps 3-5

Discuss the effects various shapes have on Lift and Drag

Determine which shape provides the most Lift while having the least Drag

A good way to do this is by plotting your measurements on a Lift/Drag curve

**Part II - Hands-on investigation of effect increased/decreased Thrust
has on Lift and Drag**

Install the teardrop shape into the wind tunnel

Set the speed on the variable controller to Level I

Turn on the wind tunnel

Record the Lift and Drag as shown on the measurement instrumentation

Turn off the wind tunnel

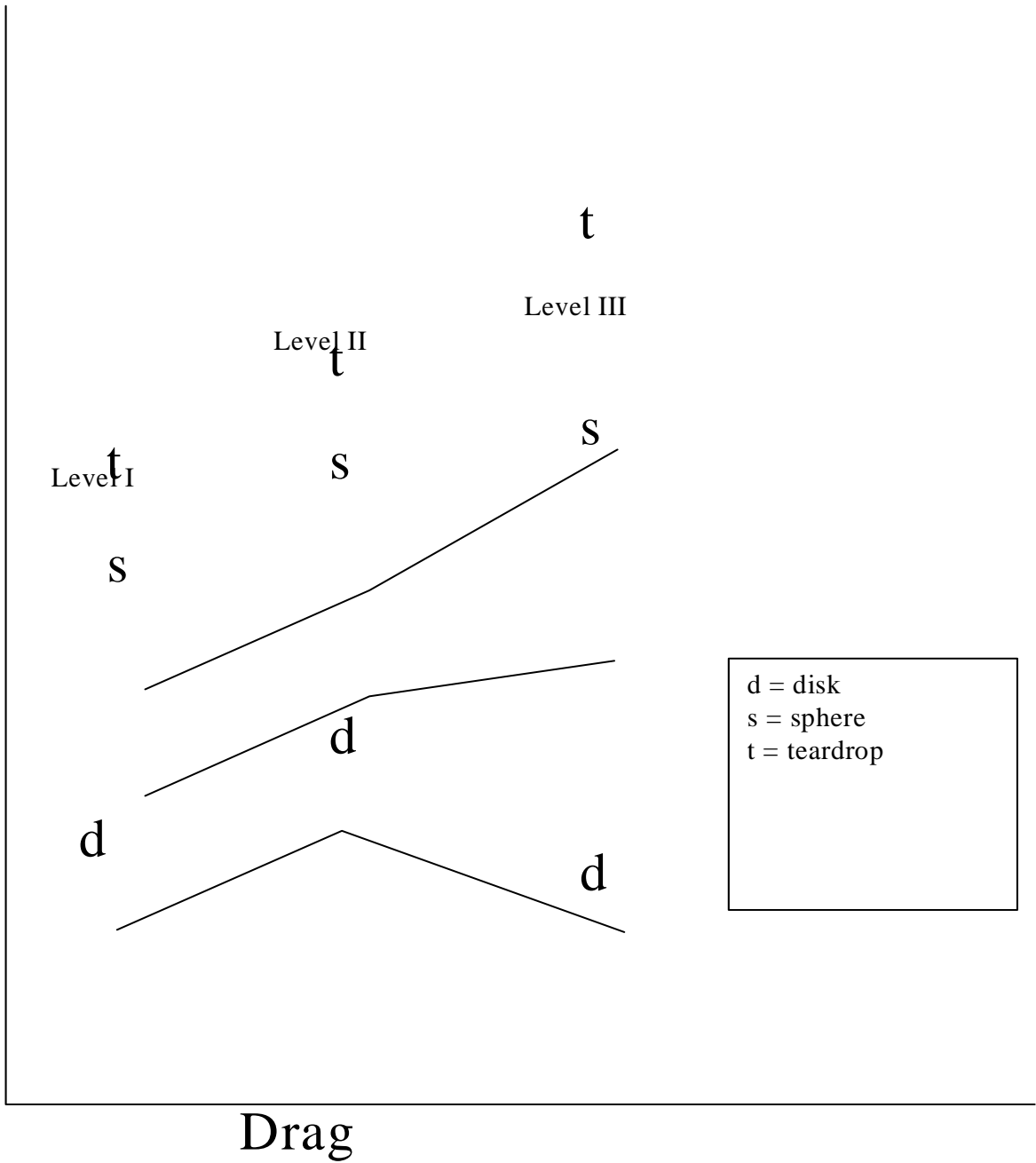
Set the speed on the variable controller to Level II; repeat steps 3-5

Set the speed on the variable controller to Level III; repeat steps 3-5

Plot your data on Lift/Thrust and Drag/Thrust curves

What is the effect of increased speed (Thrust)?

Lift



Drag

d = disk
s = sphere
t = teardrop