Time: 25 minutes

Aviation in Kansas

Test out experimental aircraft.

OBJECTIVES

Students will:

- know that aviation has been, and still is, part of Kansas history
- recognize the importance of experimentation in aviation
- monitor flights of an experimental "aircraft" to observe the effects of structural alterations

MATERIALS FROM TRUNK

Graphics

#14 - Hunt's Rotary Aeroplane
#15 - Biplane
#16 - Cessna Citation X

Worksheet

#9 - Glider

OTHER MATERIALS

- Paper clips
- One pair of scissors
- One sheet of paper (8 ½" x 11")
- Chalkboard to write observations on

TEACHER PREPARATION

- Make a glider from worksheet #9 to use for demonstration purposes. DO NOT CUT THE FLAPS. Experiment with this portion of the lesson before doing it with the class in order to know what to expect.
- Be prepared to write down observations. For students unable to read, use signs such as arrows or "tornado-type" swirling lines to indicate length and direction of flight.

HISTORICAL BACKGROUND

Aviation in Kansas History

Kansas's role in aviation history is an active and important one. Kansas provided America with some of its greatest aviation pioneers in the early twentieth century including Clyde Cessna, A.K.

Longren, Lloyd Stearman, and Walter and Olive Beech. Many innovators in the field of aviation, both successful and less successful, called Kansas their home. They helped make Wichita the "Air Capital of the World" and provided a base that led to flight in space. Through its impact in aviation Kansas played a part in changing life on earth forever.

The years immediately following the first flight by the Wright brothers in 1903 are marked by experimentation in small towns throughout the United States including many Kansas towns. The Aerial Navigation Company in Girard became one of the first to build airplanes west of the Mississippi. In 1910 a blacksmith in Jetmore, A.E. Hunt, built a "rotary aeroplane" - - a helicopter of sorts. Two inventors from Goodland unsuccessfully built a two-story machine that was supposed to rise, descend, and have the ability to remain stationary, be propelled, and guided.

The first successful aircraft manufactured in Kansas is credited to A.K. Longren. "While growing up on a farm near Leonardville, Kansas in the 1890s, Alvin K. Longren enjoyed watching turkey vultures soar effortlessly through the sky and dreamed of some day flying himself. He did not realize his dream until 1911. On September second of that year he flew a pusher-type biplane (plane with the propeller behind the pilot) from a meadow outside Topeka. This plane, dubbed the Topeka I, is one he had constructed himself." For a variety of reasons his vision to build airplanes on a large scale never became a reality, and Longren became a consultant for other aircraft manufacturers.

The mechanical talent displayed by Clyde Cessna on his father's farm near Rago, Kansas, led to the development of one of the largest and most successful manufacturers of small aircraft in the world. While working as a car salesman in Enid, Oklahoma, Cessna attended an "air circus" where he discovered the world of airplanes. In 1910 he left Oklahoma to work for an airplane company in New York, but he soon left to build airplanes in Oklahoma. Without a job or steady income, Cessna decided to return to the farm near Rago while he perfected his craft. By 1917 he had opened his aircraft factory in Wichita. He eventually went into business with Walter Beech and Lloyd Stearman. Cessna's desire to build a monoplane (a single wing plane) led to the disintegration of the partnership, and Cessna went on to begin a company that is still one of the largest manufacturers of small aircraft.

Expansion of the Cessna, Beech, and Stearman plants, and the introduction of the Boeing Airplane Company in Kansas during World War II allowed for the production of the B-29 Superfortress and many other aircraft used in the war effort. The relationship of Kansas to the air industry continued.

Basic Instruction on How Planes Stay in the Air/How They Fly

Planes can't fly without wings, and the wings need to be a special shape. The top surface of the wing is more curved than the bottom surface. It takes the air longer to flow over the curved upper

surface than the flatter bottom. This creates **lift,** the force that lifts the plane off the ground. The plane's weight pulls it down, and this force must be overcome by the lift from the wings. The engines, either a jet engine or one spinning a propeller, propel the plane forward and force air across the wings. This is called **thrust**. As it moves through the air a force called **drag** tries to slow the plane down.

VOCABULARY

Airplane	A machine with wings that uses a motor to get off the ground and fly.
Aviation	The science of making it possible for aircraft to fly.
Biplane	A plane with two sets of wings, one above the other.
Capital	Most important or influential.
Glider	An aircraft with wings but no motor. They use other means (such as being towed by an airplane) to attain the altitude they want. Once there they use rising air currents to stay in the air.
Helicopter	An aircraft without wings that uses rotating blades above the craft to lift and keep it in the air.
Monoplane	A plane with one set of wings.

ACTIVITY

1) Show the class graphics #14, Hunt's Rotary Aeroplane; #15, Biplane; and #16, Cessna Citation X one at a time.

   Ask them what is shown in each photograph. How are the three planes different? Which plane would the students rather ride in? Why? Which do they think would be easier to fly? Why?

   After the class has identified or been told that these are all machines people built to fly, explain that airplanes did not always look like the photo of the modern airplane. When people first started building airplanes they didn't really know what would fly and what wouldn't. They built many different types of airplanes searching for the ones that worked best.

   Explain that not all the ideas people had worked. Graphic #14, Hunt's Rotary Plane is an example of this. It was just too heavy to get off the ground. Some people in Kansas were very good at

building airplanes that worked well. This is one reason airplanes are still built in Kansas today and Wichita is called the "Air Capital of the World."

2) Have the class sit in two lines facing each other. Stand between the lines at one end. Show the class the glider that was prepared in advance. Explain the difference between an airplane, helicopter, and glider.

- ® ***An airplane is a machine with wings that uses a motor (engine) to get off the ground and fly.***
- ® ***A helicopter uses rotating blades to lift and keep it in the air.***
- ® ***Gliders have wings but no motor. They use other means to attain the altitude they need to rise into the air. Once there they use rising air currents to stay in the air.***

3) Explain that the class is going to see an experiment. The objective is to see how changes made to the glider affect how it flies.
The class is responsible for observing the "test flights" of this glider and determining which design changes work and which do not. **Note that you may need to do several "test flights" at each stage of experimentation to note accurately how the glider is responding to the changes.**

First - Throw the glider between the two rows of students so that they can all see it perform. Ask for observations and write these down on the board. (The "V" fold going down the center of the plane will create a "V" shape to the front of the glider.)

- ® ***It probably won't fly too far and it may tend to dive to one side as it descends.***

Second - Attach a paper clip to the nose of the glider (holding the "V" fold together). Fly it again and get the students' reactions. Does the paper clip make an improvement in its performance? Try changing the number of paper clips and see how this alters the flight.

- ® ***The glider should fly farther and straighter. It may take more than one paper clip to achieve the best results. At some point the addition of more paper clips will cause the glider to nosedive as its nose becomes too heavy.***

Third - Cut the flaps on the rear edge of the glider and fold them down.

- ® ***It should make a short flight and nosedive.***

Fold one flap up and one flap down. Observe the flight and then change which flap points up and which one points down. Does the direction that the flaps are folded make any difference?

- ® ***The glider should make a somewhat short flight and then spin or flip towards the flap that is folded down before nosediving abruptly to the ground.***

Fold both flaps up.

® ***The glider should fly fairly far and straight. It should also look like it is lighter as it remains high in the air for a longer period of time than the other flights.***

Show the class the photos once more and remind them of the many types of airplanes built through the years. Some aircraft designs never went past the experimental phase while others developed into the types of airplanes we know today.

EXTENDED ACTIVITIES

1) Let students build their own aircraft and experiment with the effects of a variety of structural changes.

2) See the "Jobs in Aviation" lesson in this manual.

3) View the video included in this trunk, *There Goes an Airplane*.

4) Invite a pilot to class to discuss how planes fly.

5) Contact an aviation museum about programs or information they have available. Some museums in Kansas include: The Kansas Aviation Museum in Wichita, The Combat Air Museum in Topeka, the Mid-America Air Museum in Liberal, and the Cosmosphere in Hutchinson.

6) Experiment with other types of paper airplanes. See what types fly the best and which fly the worst. Which goes farther than the other?

   Experiment with other types of building materials such as styrofoam meat trays and heavier weight paper.