activity eleven

Field Experiences - Visiting an Aerospace Museum

"AEROSPACE TECHNOLOGY PAST AND PRESENT"

OBJECTIVE

Technology may be defined as putting science to work for mankind. The objective of this activity is to visit an aerospace museum with an eye on aerospace technology of the past and how it evolved into the great advances we know today.

NATIONAL SCIENCE STANDARDS

Content Standard B: Physical Science

- Motions and Forces

Content Standard E: Science and Technology

- Abilities of technological design
- Understandings about science and technology

Content Standard G: History and Nature of Science

- Science as a human endeavor
- Historical perspectives

BACKGROUND

The ultimate "museum experience" would be a visit to the National Air & Space Museum in Washington, D.C. For this activity, the author visited the Wings Museum in Denver and set the theme, "Aerospace Technology, Past and Present."

DISCLAIMER

The author realizes that not every senior member is going to have access to an aerospace museum in his/her hometown. However, many travel during vacation periods and the author recommends that CAP volunteer

members use the Internet to see if there is aerospace-related museum in the area where vacation plans have been made. The author is fortunate to have the Wings Over The Rockies Air & Space Museum "right in his back yard" and recommends this beautiful museum be visited if vacation plans include Colorado. For more information and features of the "Wings" Museum, look on the Internet at http://www.wingsmuseum.org. The author also recommends, while visiting Colorado, CAP volunteers also tour the United States Air Force Academy in Colorado Springs. Both the Wings Museum and the Academy will be a once-in-a-lifetime experience for a Civil Air Patrol Senior Member.

To get a listing of air and space museums, go to **http://www.aero-web.org/museums/museums.htm.**

Rather than just walking slowly around an aerospace museum casually looking at all of the various displays, try this approach: Pick on area of technology and then mentally go from display to display studying the evolution of that theme. Examples of this idea are given below. Because of the enormous scope of museum displays, it is impossible to cover every facet; however, if you narrow it down to just one or two technologies, in one museum, you will find that you can go back again and again and learn something fascinating every time.

Here is an example: In our first "technology study," take a look at the evolution of the shape of airfoils.

This kite is a replica of the Langley Aerodrome. It was built by a Denver physician, Jeff Cain M.D. It also happens that Dr. Cain is a pilot and an airplane builder.

Study the airfoil from the standpoint of strength and how the early pioneers achieved strength through bracing, wires and guideposts. It is also interesting to see how current-day ultralights have strength technology similar to the very early aircraft. The Langley Aerodrome and several other "close-to-scale" kites were built and contributed to the Wings Museum by Dr. Jeff Cain, a family physician in Denver, Colorado. The Museum also displays other Cain replicas of Otto Lilienthal's glider and Octave Chanute's box-kite-like aircraft.

This early Alexander Eagle Rock clearly shows how biplanes used a strut bracing that was very similar to that used in a box kite. Essentially, one wing braces another.

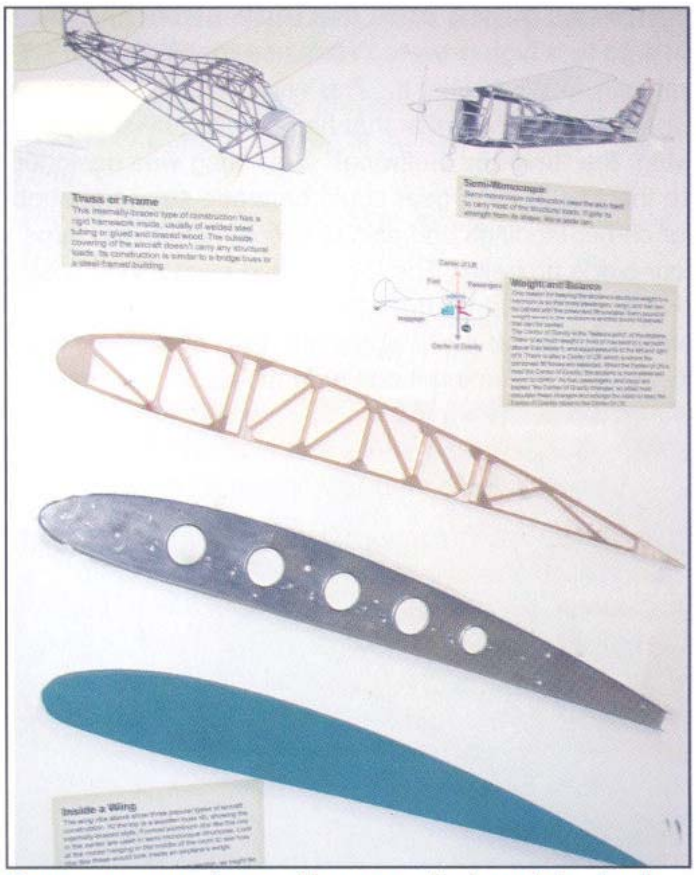
This set up allows double the wing area and gives the aircraft enormous lifting capabilities.

The Alexander Aircraft Corporation built 100 of these magnificent airplanes before the factory burned down. They established a new plant in Colorado Springs between 1926 and 1931 and became one of the largest aircraft manufacturers in the world.

The airplane is powered by a 90 horsepower Curtiss OX-5 engine seen sitting just forward of the leading edge of the right wing. Following WWI, many of these engines were available as military surplus and could be purchased new in the crate for as little as $20. The engine was an 8 cylinder, water-cooled vee that cranked out 90 horsepower at 1,400 r.p.m. It weighed 390 pounds and had a displacement of 503 cubic inches. Fuel consumption was around 8 gallons per hour and the engine would propel the Eagle Rock along at a steady 70 mph cruise.

The Alexander Aircraft Corporation didn't make it through the Depression and was liquidated. The assets were acquired by Aircraft Mechanics, Inc., and is now known as AMI. This company became part of the BF Goodrich Corporation and was eventually involved in the manufacture of aircraft ejection seats.

The senior member is now urged to examine an aircraft from a later era. The Piper J3 Cub is a classic and has a classic wing design for the 30s, 40s, and beyond. As a study in technology, look at the wing bracing compared to the Alexander Eagle Rock.



Many museums have side rooms that explain simple aerodynamic principles to the public. This one gives an excellent explanation of the various types of wing ribs that were light in weight, but provided great strength to the airfoil.

This beautifully restored Piper Cub shows how the wing was braced with two struts attached at the trailing edge of the landing gear. Notice the struts that brace the inner main struts about midway between attachment points.

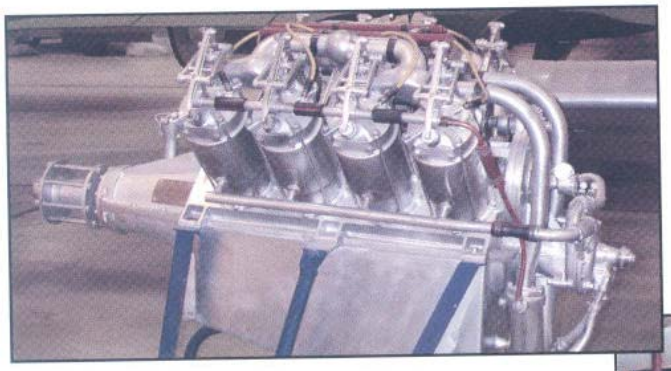
From the training plane that evolved from the 30s, let's go to a high-powered warplane that fought so valiantly in World War II. The Wings Museum has a Chance Vought Corsair that has an unusual shaped wing, the "Inverted Gullwing!" This wing was designed so that the landing gear could be made strong enough for carrier landings and also to accommodate the large four-blade propeller. The Corsair had such a long nose and cowling that carrier pilots had to approach an aircraft carrier at a slip angle and then straighten it out just before slamming it down on the deck. You can imagine how strong the landing gear had to be to absorb the enormous shock of this airplane hitting the deck. The Navy calls this a "controlled crash!"

Once the observer gets past the "low & slow" airplane construction of the past, it is a great idea to start looking at the evolution of airfoils that came along in the 30s and during World War II. One of the most interesting is this "inverted gull wing" of the Chance Vought Corsair, a Navy fighter of WWII.

However, when it comes to highly aerobatic, airshow type maneuverability, "what goes around comes around!" A biplane, like this Christen Eagle, uses two wings and struts to brace it for high strength... just like a box kite. Thank you Octave Chanute!

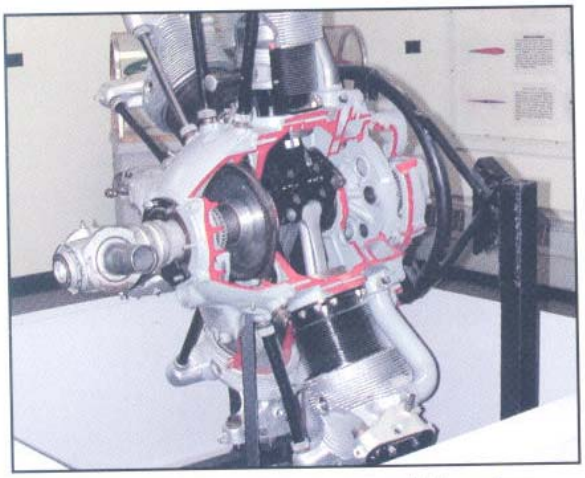
When the sound barrier was finally broken in 1947, a whole new generation of airfoils evolved to operate in the trans and supersonic ranges. Notice the thickness of the camber and think of how an airfoil doesn't need a large camber or chord to achieve lift. With great speed, the airfoil is "slimmed down" to achieve high velocities with a minimum of aerodynamic drag.

IF THE MUSEUM HAS SEVERAL ENGINES ON DISPLAY, TAKE THE OPPORTUNITY AND COMPARE THE EVOLUTION OF AIRCRAFT ENGINE TECHNOLOGY.



This is the powerplant that propelled the Eagle Rock and thousands of Curtiss Jennies at 70 miles per hour. Can you find:

1. *The rocker arms?*
2. *The fuel lines?*
3. *The propeller hub?*
4. *Ignition wires?*
5. *How much did this engine weigh?*
6. *How many cubic inches of displacement did it have?*
7. *How many horsepower?*



If you get a chance to see a radial engine cutaway, study how all of the pistons turned a common propeller shaft. Then try to figure out the four-cycle timing mechanism that fired each of the plugs in each cylinder. This was a marvel in technology. Think back to a time when Charles A. Lindbergh put his life on the line for the technology of a Wright Whirlwind radial engine. When he started it on that cold morning, May 20, 1927, it kept on running for 33.5 hours and took the Spirit of St. Louis across the Atlantic Ocean.

Today, we have the incredibly reliable jet engine that is so efficient and so powerful that it can provide thrust to lift thousands of pounds of aircraft to great heights and at great speeds. This engine is truly a modern day marvel. And it doesn't even have a propeller!

AND... You can help in a small way by buying something at the gift shop. Normally, museums rely on contributions and donations from individuals and support groups. Volunteers often give their time to work with the public, but you would be surprised how much a well-stocked gift shop can do to help keep doors open to a wonderful aerospace museum.