Hiller Aviation Museum Exhibit Safari

# General Tour

Explorations in Aviation

## ANSWER KEY

1. Both the 1903 Wright Flyer and the 1869 Marriott Avitor had 1 engine and 2 propellers.

   *An airplane driven by a single propeller is more difficult to control because of turning forces from the propeller. The Wrights and Marriott recognized this and devised mechanisms to turn two propellers with a single engine. The propellers turned in opposite directions, negating the turning tendency. Later light airplanes had stronger control surfaces and could fly safely with a single propeller.*

2. Name three aircraft in the Museum that have pusher propellers.

   *The 1903 Wright Flyer, the Vin Fiz, Black Diamond, Curtiss Pusher, Little Looper, Buhl autogiro, Stearman-Hammond Y, Republic Seabee and Rutan Defiant. Pusher propellers were popular in early aviation but in a rough landing the engine could come loose and crash forward into the pilot. By 1915 most propeller-driven aircraft had changed to tractor propellers that pull the airplane through the air.*

3. Was the Avitor considered to be an airplane, or an airship?

   *An airplane. Although its structure included a hydrogen-filled envelope that partially offset its weight, the Avitor still weighed about 15 pounds when ready for flight. Additional lift had to be generated by the wings for the Avitor to fly.*

4. What powered the Avitor?

*A steam engine. Marriott, like other aviation pioneers of his time, was hobbled by lack of a lightweight, powerful engine. It was not until gasoline powered internal combustion engines came into use at the turn of the 20th century that sustained, powered flight with people aboard became a possibility.*

5. The Black Diamond Airplane, Eugene Ely's airplane and Lincoln Beachey's Little Looper are all examples of what kind of airplane?

*All are variants on the Curtiss Pusher. Glenn Curtiss' design was popular in the early history of aviation. Unlike Wright aircraft such as the 1903 Flyer or the Vin Fiz, Curtiss Pushers had a single propeller and used ailerons for roll control instead of wing warping. Nearly all aircraft today continue to use ailerons for roll control.*

6. What is the biggest difference between the Curtiss biplanes flown by Lincoln Beachey and Eugene Ely?

*Beachey's Little Looper has no forward stabilizer. At the time, most aircraft had stabilizers in front of and behind the wings. At an early flying meet Beachey had a rough landing and damaged the Little Looper's forward stabilizer. The impatient Beachey simply removed the stabilizer and returned to the air. The rear stabilizer proved to be sufficient for his aircraft, and the reduction in weight and drag boosted performance. Within a short time the single stabilizer design had been adopted for most aircraft.*

7. What was the Stanford Wind Tunnel built to investigate?

*Propeller efficiency. Wilbur and Orville Wright were the first to discern that propellers were essentially rotating wings, and part of their early success was due to superior propeller design. The Stanford facility built on their idea and brought propeller design to new levels of efficiency while providing valuable data for improving aircraft performance.*

8. What is unusual about the rotor systems for the XH-44 and UH-4 helicopters compared to most helicopters today?

*Both of these early helicopters had twin counter-rotating main rotors and no tail rotor. The turning motion of the single large rotor on a helicopter gives it a turning tendency. Stanley Hiller believed the solution to this problem was to use a single engine to turn two rotors in opposite directions. This worked, but helicopters with one large rotor and a smaller tail rotor able to compensate for the turning effects ultimately proved more efficient. Note that only a model of the XH-44 is on display, as the original is currently at the Smithsonian.*

9. The Boeing SST would have had 4 engines.

*Boeing's proposed supersonic transport would have flown faster and farther than the rival Concorde then under development in Europe. Although technologically advanced, both the Boeing SST and the Concorde used enormous amounts of fuel to reach their high cruising speeds. A dramatic increase in fuel prices contributed greatly to the*

*cancellation of the Boeing SST before its first flight, and to the end of the Concorde program after only 20 aircraft had been built.*

10. How many passengers did the Boeing Condor carry?

*None. The Condor was an early Unmanned Aerial Vehicle (UAV), designed to fly at extreme altitudes for extended periods of time. UAVs are ideal for reconnaissance missions in which flights lasting twenty-four hours or more are common. Computers on the ground and in the aircraft guided the flight. The Condor is similar in design to the Northrop Grumman Global Hawk, a UAV currently in service with the United States Air Force.*