THE HERITAGE OF FLIGHT

PART 1

The exciting new film ***Air Racers*** takes us back in time to the beginnings of flight. You'll see some experimental flying machines that never even got off the ground, and the original Wright Flyer, the first airplane to actually take off—even though it went only 20 feet up, flew for only 12 seconds, and traveled only 120 feet!

The timeline at right shows important steps in the development of flight and some of the aircraft that have made history. Working in groups, conduct research online or in the library to find photographs or illustrations of one of the planes featured. Draw a simple sketch of your plane on the other side of this sheet. What do you observe about how airplane design evolved over time? How did the evolution of airplane design make planes function better?

- **1903:** Orville and Wilbur Wright's first successful self-propelled airplane flight.
- **1909:** Glenn H. Curtiss wins the first major international air race, in Reims, France, flying at 46 mph (74 km/h).
- **1918:** U.S. Army pilots begin the post office's first regular airmail route between Washington, D.C., and New York.
- **1927:** Charles A. Lindbergh completes the first solo, nonstop trans-Atlantic flight from the United States to Europe.
- **1930:** Frank Whittle, British inventor, invents the jet engine.
- **1932:** Amelia Earhart becomes the first woman to fly alone across the Atlantic from the United States to Europe.
- **1933:** A modern airliner, a Boeing 247, flies for the first time with 10 passengers and 400 pounds of luggage on board.
- **1939:** Germany's Heinkel 178 becomes the first fully jet-propelled aircraft.
- **1947:** Charles E. Yeager breaks the sound barrier in the Bell X-1, the first aircraft to exceed the speed of sound, flying at 670 miles per hour.
- **1952:** The De Havilland Comet becomes the first jet-powered aircraft to offer regular passenger service.
- **1969:** The first flight of the prototype of the Supersonic-transport (SST) aircraft Concorde, flying faster than the speed of sound.
- **1981:** The first flight of the Stealth aircraft, the Lockheed F-117A, which is invisible on radar.
- **2006:** Pilot Steve Fossett makes the longest flight around the globe without refueling, traveling some 26,000 miles.

PART 2

Compare the structural components of these three aircraft. What differences do you notice? Which parts of the planes create lift and thrust? Which create drag?

The Wright Brothers' Flyer managed to get aloft because its design provided thrust from the propellers and its wings provided lift. Airplane wings are shaped to make air move faster over the top of the wing. When air moves faster, the pressure of the air decreases so the pressure on the top of the wing is less than the pressure on the bottom of the wing. This difference in pressure creates a force on the wing that lifts the plane up into the air.

PART 3

Pilots must understand their craft to do their job well. Write a job description for a pilot that includes technical abilities, training, skills, and personal qualities needed. Explore websites such as the Aircraft Owners and Pilots Association at **www.aopa.org** and **www.baseops.net/militarypilot/** to find out about how pilots are trained. Do you think you have "the right stuff" to become a pilot?

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THE VALLEY OF SPEED

PART 1 The annual National Championship Air Races in Reno, Nevada, that are featured in the exciting new film ***Air Racers***, are the fastest competitions in the world, with planes clocking speeds at over 500 mph (804 km/h). First research the speeds of the following and then create a bar graph at right, ranking them from slowest to fastest:

- Reno National Championship Air Races "Unlimited" airplane speed (500 mph; 804 km/h)
- Fastest car—Bugatti Veyron Super Sport
- The X-43A jet
- Fastest land animal—cheetah
- Fastest sea animal—Atlantic sailfish
- Fastest bird—Peregrine falcon
- Fastest human—Usain Bolt, Olympic sprinter
- Fastest train—the MagLev
- Fastest NASCAR

Research several additional speedsters to add to the bar graph in addition to those listed above, such as "fastest female runner," "fastest bicyclist," etc.

PART 2 Now stage your own air race. Build a simple, straight-wing paper airplane and one with a more complex shaped-wing style, using one of the styles found at **www.10paperairplanes.com**. Fly your planes, and then discuss the aerodynamic qualities that led to success or failure, considering the following questions:

- How would you adjust the wings to make the plane fly faster?
- How would you adjust the wings to make the plane glide farther?
- What happens if you make the plane out of cardboard? Aluminum foil?
- What happens when you put paper clips on different parts of the plane?

Now redesign and rebuild your paper planes for a second race. As at the Reno National Championship Air Races, choose a group of finalists to compete for your class championship!

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THE HUMAN COMPONENT

PART 1

In ***Air Racers***, you meet Steve Hinton, who inherited his passion for World War II military aircraft from his father. The Hinton family's business, the Planes of Fame Air Museum in Chino, California, is dedicated to preserving the legacy of the remarkable "warbirds"—planes built for combat during World War II. The museum is home to 150 aircraft, more than 50 of which are flyable. Like his father, Steve is a pilot of these vintage craft, and earned his license at age 17.

Air Racers shows how Steve prepares to break his father's record and become the youngest-ever pilot to win the "Unlimited" race at the Reno National Championship Air Races in 2009, flying a P-51 Mustang—the "Cadillac of the Skies." He's not only up against his dad's record—he also has to contend with G-force as he speeds through the air at up to 500 mph!

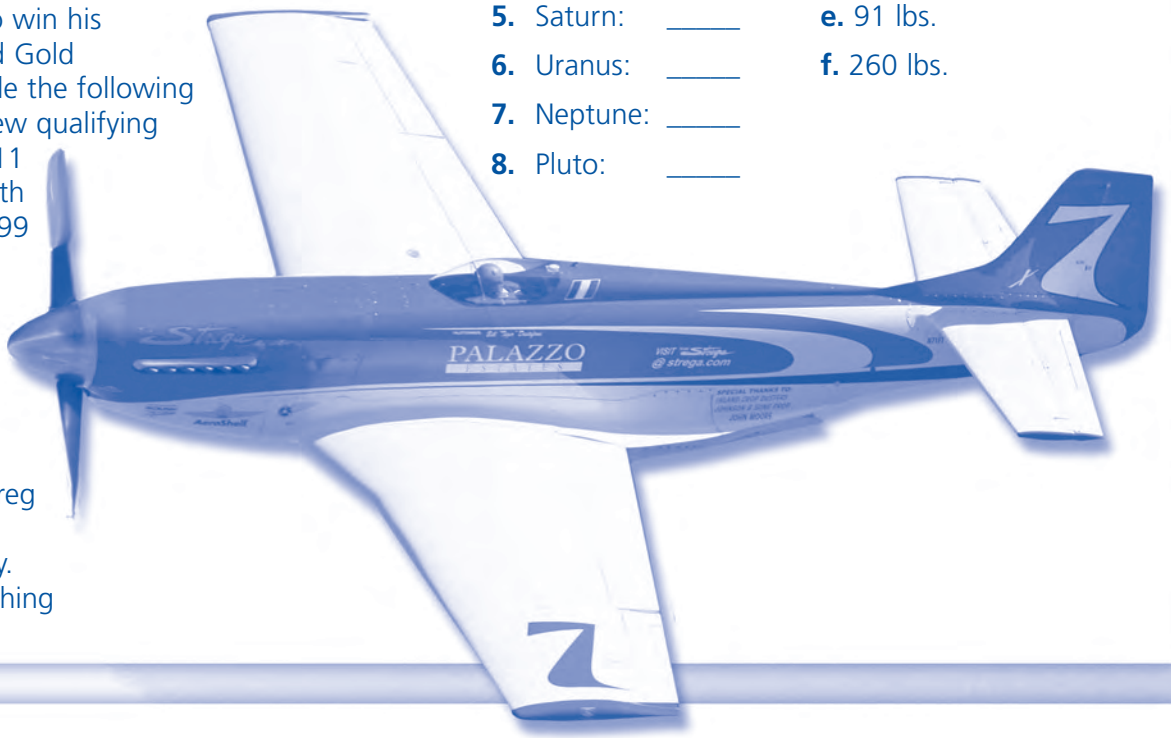
Steve went on to win his second Unlimited Gold championship title the following year and set a new qualifying record at the 2011 event in Reno with a top speed of 499 mph (803 km/h).

In the film, G-force is graphically on display in the distorted face of the stunt pilot Greg Poe during his aerobatics display. That's 10 G's pushing his skin! Have you ever experienced G-forces during an airplane takeoff or a roller-coaster ride?

Imagine that you can travel by spacecraft to another planet. When you get there, your weight will be quite different, because different planets exert different amounts of gravity—or G-force. The bigger the planet, the greater the G-force. Let's say someone weighs 100 pounds on Earth. How much would that person weigh on these planets? Match the weights to the correct planets. Remember: Mercury and Mars are about the same size, as are Saturn and Neptune.

1. Mercury: _____
2. Venus: _____
3. Mars: _____
4. Jupiter: _____
5. Saturn: _____
6. Uranus: _____
7. Neptune: _____
8. Pluto: _____

a. 7 lbs.
b. 89 lbs.
c. 110 lbs.
d. 38 lbs.
e. 91 lbs.
f. 260 lbs.



PART 2

Becoming a member of an air racing team takes discipline and dedication. Work with a classmate or as a team with others to create a recruitment brochure or short video designed to attract young pilots to your team. If you have seen ***Air Racers***, think about the short World War II recruitment clip that opened the film. What kind of person do you hope to recruit? What skills does he or she need? And what can you say—or show—to attract the attention of young aviators who have "the right stuff" to learn the challenging, dangerous, and precise art of air racing?

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BUILT FOR SPEED

PART 1

When you see the exciting new film ***Air Racers***, you'll see that airplane wings come in different shapes and sizes, but a wing's shape is always designed to create lift. The top surface is slightly curved, while the bottom is flat. This shape, called an airfoil, allows air to flow faster over the wing than it does underneath the wing. That's what carries the plane into the air. The airflow on top of the wing has to travel faster to cover a longer distance. The airflow speed underneath the wing is slower. The faster airflow creates lower air pressure on top of the wing. The slower airflow under the wing creates higher pressure. The higher pressure helps the plane take off. The difference between the high and low pressure creates lift—an effect called Bernoulli's Principle.

You'll find many of the planes featured in ***Air Racers*** across the U.S. at air and space museums, including the Smithsonian's National Air & Space Museum in Washington, D.C., and the Udvar-Hazy Center in Chantilly, Virginia, as well as at Planes of Fame Air Museum in Chino, California.

Visit the museums at **www.airandspace.si.edu** or **www.planesoffame.org** and look closely at the design of the various aircraft in the collection. Then team up with a classmate and brainstorm a list of the ways in which these vintage planes resemble contemporary aircraft, and the ways in which they are different. Write your thoughts below about how these differences might affect air speed and maneuverability:

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PART 2

Before you watch ***Air Racers***, visit **www.strega.com** and **www.lewisairlegends.com/aircraft/rare-bear** to examine the specs of the planes "Strega" and "Rare Bear." Then write a short "pre-race" blog on the other side of this sheet, predicting which plane will win the race. Include an explanation of the characteristics that you feel will make it the winner. Read your blog aloud in class and vote as a group on which plane will win. Were you correct?

What do you think could be modified in order to change the result in a future rematch?

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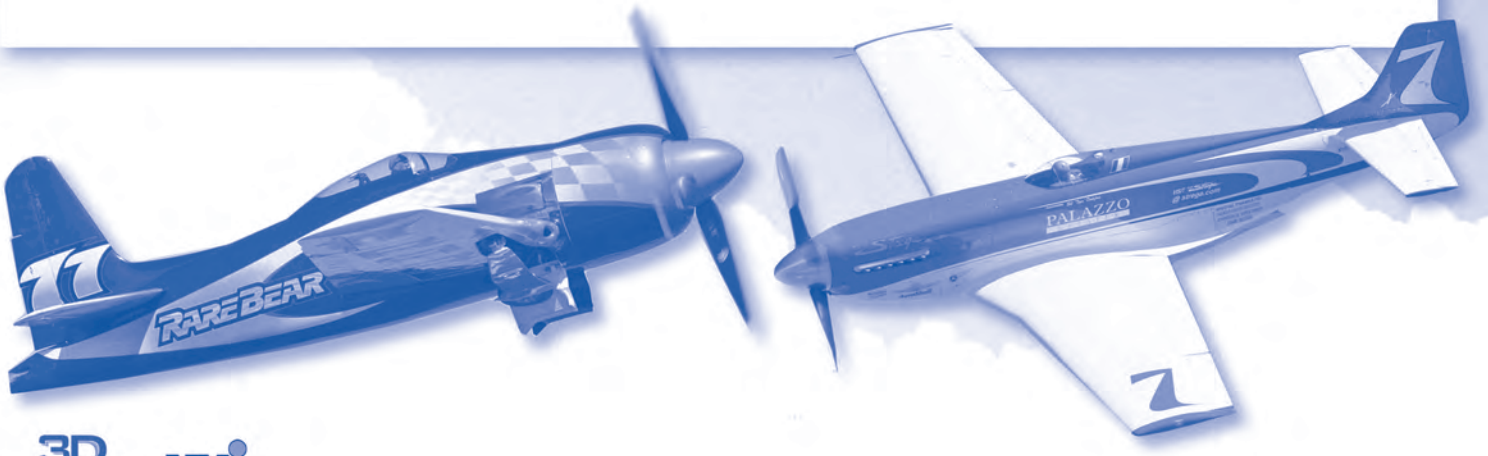

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