EDUCATORS' AND ACTIVITIES GUIDE

LET YOUR MIND SOAR!

3D ENTERTAINMENT DISTRIBUTION

Published by 3D Entertainment Distribution
Curriculum Developed by Young Minds Inspired

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A WORD FROM THE FILMMAKERS

Fasten your seat belts for an exhilarating ride with ***Air Racers***, a documentary film that will take you and your students from the aerial battles in the skies above Europe during World War II to the thrilling National Championship Air Races in the "Valley of Speed" in the desert near Reno, Nevada—flying the same military planes! The Reno Air Races feature some of the greatest combat aircraft ever built, now lovingly restored to continue a tradition of fleet, heart-stopping action in the sky.

Air Racers is a fast-paced, dramatic film that will engage your students' imaginations as they watch young Steve Hinton prepare to fly his restored P-51 Mustang in the annual Unlimited Gold Championship finals in Reno, Nevada. The vintage planes compete for the fastest round, flying at speeds over 500 mph (804 km/h) while only 50 feet (15 meters) above the ground—and Steve competes to become the youngest-ever pilot to take the title.

To capture your students' excitement about this amazing sport—and the history and science of aviation—we have developed separate sets of activity sheets for students in grades 2-5 (ages 7-10) and in grades 6-9 (ages 11-14). We invite you to take your students to see ***Air Racers***, either before or after completing these activities, in order to enrich their educational experience.

We encourage you to share your opinions about our program online on Facebook at **www.facebook.com/AirRacers** or at **www.AirRacers-theFilm.com**. Your comments are important to us as we continue to develop exciting film documentaries that will encourage young people to get excited about science and its application to the real world. Restoring and racing vintage military aircraft takes practice, hard work, and dedication—the same qualities it takes to be a great student.

We hope this documentary film helps your students take flight!

Sincerely,

Christian Fry and Jean-Jacques Mantello
Co-Directors

TABLE OF CONTENTS

PROGRAM OBJECTIVES

- To introduce students to the history and science of flight through the heart-stopping action of World War II vintage aircraft at the Reno National Championship Air Races portrayed in ***Air Racers***.
- To motivate student interest in aerodynamics and the history of flight.
- To develop students' skills in science, social studies, geography, language arts, and history.

TARGET AUDIENCE

Students in grades 2-9, ages 7-14.

HOW TO USE THIS GUIDE

- Review the materials and schedule them into your lesson plans. Screen the film at your local theater to use it with students.
- Photocopy the reproducible activity sheets appropriate for your grade level for every student in your class, and share a copy with other teachers in your school.
- Use the resources on the back cover of this guide to facilitate research. Challenge students to work in teams—as aircraft restorers and racers do—to share research and learn from each other.

FILM SYNOPSIS

Fly into Nevada's "Valley of Speed" for a breathtaking exploration of the fastest race in the world combined with spectacular air show entertainment: the legendary Reno National Championship Air Races. Join today's piloting elite as they fight for position, wingtip-to-wingtip, and skim 50 feet (15 meters) above the ground around an oval course at twice the speed of a NASCAR® race. Discover this ultra-competitive world through the eyes of rookie pilot Steve Hinton as he attempts to fly his P-51 Mustang fighter plane to victory in the most highly anticipated and unpredictable race class. Learn about the history and science behind the sport, whose concept dates back to the dawn of aviation, and see top-notch aerobatic performers, including the Canadian Forces Snowbirds. With spectacular aerial photography and unprecedented access granted to the course, ***Air Racers***, narrated by Paul Walker, puts you in the cockpit to experience the intensity and high-speed thrills of a sports event like no other.

GLENN CURTISS: PIONEER OF FLIGHT

In 1907, Alexander Graham Bell, the inventor of the telephone, invited Glenn H. Curtiss to join the Aerial Experiment Association group as "director of experiments." On May 22, 1908, Curtiss successfully flew his "White Wing" 1,017 feet (310 meters). He went on to win three Scientific American Trophies—for longest distance (1908), circular flight (1909), and cross-country flight (1910). In August 1909, in Reims, France, he took first place for speed at the first major international air race, zooming along at 46 mph (74 km/h).

ALIGNMENT WITH NATIONAL EDUCATION SCIENCE STANDARDS	Grade Level		Activity			
	2-5	6-9	1	2	3	4
History and Nature of Science						
• Science as a human endeavor	•	•	•			
• History of science		•	•			
• Historical perspectives		•	•			
Science as Inquiry						
• Abilities necessary to do scientific inquiry	•	•		•		
Physical Science						
• Properties of objects and materials	•				•	
• Properties and changes of properties in matter		•			•	
• Position and motion of objects	•			•	•	
• Motions and forces		•		•	•	
• Transfers of energy		•			•	•
Science and Technology						
• Abilities of technological design	•	•				•

ACTIVITIES FOR GRADES 2-5 (AGES 7-10)

ACTIVITY 1: THE HERITAGE OF FLIGHT

Objectives:

- To introduce students to highlights in aviation history.
- To recognize basic components of design that enable aircraft to fly.

Draw a simple one-year timeline on the board. Ask students to brainstorm things that happen during the course of a year—birthdays, holidays, school vacations—and place them on the timeline. Then distribute the activity sheets and point out the aviation timeline in **Part 1**. Ask students to work in groups to match the year with the plane by drawing a line between the two. **Answers:** a-1981, b-1947, c-1927, d-1903, e-1969. In **Part 2**, prompt students to identify the features that the Wright Brothers' Flyer and the P-51 Mustang flown in ***Air Racers*** have in common (wings, propellers, rudder, and elevators). Use the illustrations to discuss the concepts of thrust and lift, and discuss which components of airplane design enable these to happen. **Answers to Part 3:** 1-f, 2-e, 3-g, 4-d, 5-h, 6-c, 7-i, 8-b, 9-j, 10-a.

ACTIVITY 2: THE VALLEY OF SPEED

Objectives:

- To introduce students to the world's fastest competition, the Reno National Championship Air Races, and their relationship to relative speeds found elsewhere.
- To understand more about aerodynamics by designing a paper airplane.

Divide the class into groups to brainstorm different types of races that students can think of, ranking them from slowest to fastest. **Answers to Part 1:** 1-d, 2-g, 3-a, 4-e, 5-f, 6-h, 7-b, 8-c. Ask students to organize these speedsters from slowest to fastest. In **Part 2**, have students use the website and sheets of paper to help them build two different styles of plane, encouraging them to experiment with their own designs as well and decorating their models with insignia to make them their own.

ACTIVITY 3: THE HUMAN COMPONENT

Objectives:

- To understand the role human intelligence, judgment, and physical stamina play in flying, including withstanding the G-forces exerted by gravity.
- To gain a sense of the passion for history that motivates vintage plane experts.

Give students time to read the background of Steve Hinton in **Part 1**, and then introduce the concept of G-forces by distributing the materials listed and reviewing the directions with them. Be sure they have plenty of space in which to twirl their coin. Explain that G-force is the combination of gravity and motion, and that the acceleration in a plane increases the force of gravity that affects a human body, making it feel heavier. In **Part 2**, encourage students to use their creativity to decorate the outline of the Strega shown on the sheet with their own colors and symbols, and to write a sentence explaining why they chose that color scheme and design.

ACTIVITY 4: BUILT FOR SPEED

Objectives:

- To increase student understanding of flight mechanics.
- To apply aeronautic principles in order to predict victory.

The rules at the Reno National Championship Air Races are simple—fly low, go fast, and turn left. In order to do that, however, the role of the plane's wing is critical. First explain how the foil shape of the wing—like a teardrop on its side—is always designed to create lift. Then review with students the information on the sheet that describes airflow over and under the wing and how this enables the plane to take off. Regardless of whether students are planning to see ***Air Racers***, have them compare the horsepower of the two planes shown and then write down their predictions on a folded paper. How many students predicted correctly that Strega would win?

ACTIVITIES FOR GRADES 6-9 (AGES 11-14)

ACTIVITY 1: THE HERITAGE OF FLIGHT

Objectives:

- To introduce students to a timeline of aviation history.
- To recognize design components that enable aircraft to fly.
- To identify the traits and skills of successful pilots.

In **Part 1**, ask students to work in groups to research one of the aircraft listed on the timeline and make simple sketches from which they should identify features that show how aircraft design has changed over time. In **Part 2**, discuss how the force of lift—which results from differences in air pressure—overcomes the force of gravity, allowing a plane to rise into the air. In **Part 3**, ask students to write a job description for an airline pilot, accessing the sources listed.

ACTIVITY 2: THE VALLEY OF SPEED

Objectives:

- To introduce students to the world's fastest competition, the Reno National Championship Air Races, and their relationship to relative speeds found elsewhere.
- To understand more about aerodynamics by designing a paper airplane.

Part 1 of this activity is designed to help students understand the very high speeds involved in air racing by researching and comparing other sources of speed. In **Part 2**, have students use the website and sheets of paper to build two different styles of plane, encouraging them to experiment with their own designs to help them answer the questions on the sheet. Then have students race their planes against each other in their own version of the Reno National Championship Air Races.

ACTIVITY 3: THE HUMAN COMPONENT

Objectives:

- To understand the role human intelligence, judgment, and physical stamina play in flying, including withstanding the G-forces exerted by gravity.
- To gain a sense of the discipline and dedication it takes to be an air racer.

In **Part 1**, have students review the background on the sheet about Steve Hinton and his family. Then discuss the concept of G-force and the physical effects students will or did observe during the aerobatics section of ***Air Racers*** as the stunt pilot, the late Greg Poe, experiences the effect of 10G's. Then have students estimate how much they would weigh if they were able to fly to various planets. **Answers:** 1-d, 2-e, 3-d, 4-f, 5-c, 6-b, 7-c, 8-a. In **Part 2**, ask students to create a recruitment brochure or short video designed to attract young pilots to their team, highlighting the special qualities needed for an air racer.

ACTIVITY 4: BUILT FOR SPEED

Objectives:

- To increase student understanding of flight mechanics.
- To apply aeronautic principles in order to predict victory.

In **Part 1**, use the aircraft seen at Planes of Fame Air Museum in Chino, California, to reintroduce the airflow concepts that govern Bernoulli's Principle as students review the differences between the planes shown there. In **Part 2**, have students compare the specs belonging to Steve Hinton's Strega P-51 Mustang and the Rare Bear Grumman Bearcat to write a "pre-race" blog predicting which plane they think will win the competition at the Reno championships. Then, regardless of whether or not students have seen ***Air Racers***, have them suggest modifications that might help prepare the planes for victory in a rematch.

ACTIVITY I

THE HERITAGE OF FLIGHT

PART I

Do certain dates make your year special, like birthdays, school vacations, and holidays? When you write those dates on a calendar, you are making a timeline that shapes your year. The timeline below begins more than 100 years ago, when Orville and Wilbur Wright achieved the first aircraft flight in history. Their plane, the Wright Flyer, only stayed aloft for 12 seconds during that first flight, but it was a milestone in aviation history! Only six years later, in 1909, American airplane designer Glenn H. Curtiss won the first-ever major international air race, flying at a blistering 46 mph (74 km/h) in the skies over Reims, France.

MILESTONES OF FLIGHT

1903	1909	1918	1927	1932	1933	1947	1969	1981	2006
Orville and Wilbur Wright's first successful self-propelled airplane flight.	Glenn H. Curtiss wins first major international air race, in Reims, France.	U.S. Army pilots begin the Post Office's first regular airmail route between Washington, D.C., and New York.	Charles A. Lindbergh completes the first solo, nonstop trans-Atlantic flight from the United States to Europe.	Amelia Earhart becomes the first woman to fly alone across the Atlantic from the United States to Europe.	A modern commercial airliner flies for the first time, with 10 passengers and 400 pounds of luggage onboard.	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.	The first flight of the prototype of the Supersonic-transport (SST) aircraft Concorde, at faster than the speed of sound.	The first flight of the Stealth military aircraft, the Lockheed F-117A, which is invisible on radar.	Pilot Steve Fossett makes the longest flight around the globe without refueling, traveling some 26,000 miles.


a.


b.


c.

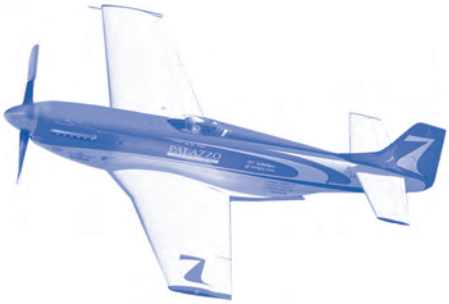

d.


e.

Match the events on this timeline with the images of these airplanes by drawing a line from each plane to the date when it flew. You will notice that airplanes have changed a lot in the last century!

PART 2

The new film, ***Air Racers***, shows the excitement of vintage World War II planes that compete at the Reno National Championship Air Races. Look at the picture of the Wright Brothers' Flyer above and the P-51 Mustang that Steve Hinton flies in ***Air Racers*** below. What do they have in common?



Label these parts of each plane:

Wings (These provide **lift** to get the plane off the ground.)
Propellers (These provide **thrust** to power the airplane forward.)
Rudder (This part swings back and forth to steer the plane left and right.)
Elevators (These parts tip up and down to make the plane climb and descend.)

PART 3

Would you like to talk the way pilots do when they're chatting back and forth on their radios? Roger that! Match each definition below to the pilot "lingo," or slang, it describes.

Definition	"Lingo"
1. ____ okay	a. light the fire
2. ____ ceiling and visibility unlimited (the best flying weather)	b. gizmo
3. ____ aircraft	c. bandit
4. ____ go as fast as you can	d. buster
5. ____ pilot	e. cavu
6. ____ enemy aircraft	f. roger
7. ____ take it easy	g. birds
8. ____ any technical gear in the plane	h. driver
9. ____ heavy rain or fog	i. throttle back
10. ____ start the engine	j. great day for ducks

THE VALLEY OF SPEED

PART 1

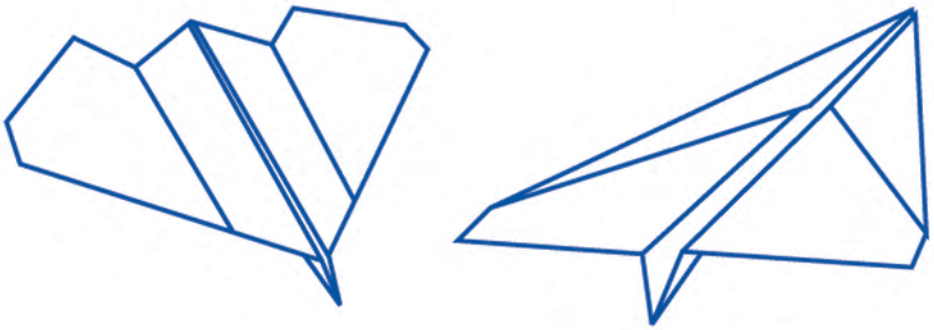
The annual National Championship Air Races in Reno, Nevada, that are featured in the exciting new documentary film ***Air Racers***, are the fastest competitions in the world, with planes clocking speeds at over 500 mph. With your group, brainstorm a list of all the different types of races you can think of. Then, with your class, rank them from slowest (turtle races) to fastest (airplane races).

Now try matching these well-known speedsters to their speeds:

1. ____ Fastest land animal, cheetah.	**a.** 267 mph
2. ____ Fastest human, Usain Bolt, Olympic sprinter.	**b.** 200 mph (diving)
3. ____ Fastest car, the Bugatti Veyron Super Sport.	**c.** 361 mph
4. ____ Fastest NASCAR.	**d.** 70 mph
5. ____ Fastest sea animal, Atlantic sailfish.	**e.** 212.8 mph
6. ____ Fastest airplane, the X-43A jet.	**f.** 68 mph
7. ____ Fastest bird, Peregrine falcon.	**g.** 23 mph
8. ____ Fastest train, the MagLev.	**h.** Mach 9.6 (nearly 7,000 mph)

PART 2

Now stage your own air race, like the pilots in ***Air Racers***. First build a simple, straight-wing paper airplane. Then try a different style. You can find instructions for several styles at **www.10paperairplanes.com**.



Experiment with your own design, too. The sky's the limit! Decorate your airplanes with insignia and then stage an air show. Invite another class to attend your show.

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 won 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).

Want to create your own G-force? You will need the following:

- A piece of string about three feet long
- Scotch tape
- A quarter (return it to the teacher when finished)

Next:

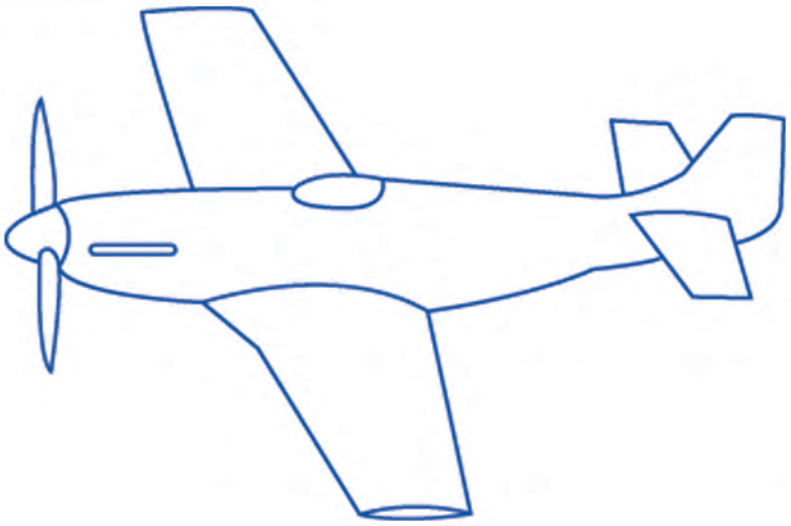
- Tie one end of the string around the coin as if you're wrapping a package.
- Wrap tape around the coin and string so the coin won't slip out.
- Hold the other end of the string and feel the weight of the coin. (That's the quarter under one G of force.)
- Make sure you have plenty of space around you. Hold the end of the string above your head and start swinging—very carefully!
- Does the coin feel different when you swing it slowly instead of fast?

What's going on? The faster you swing the coin, the heavier it feels. That's because the coin is under a G force greater than ordinary gravity. If it's spun fast enough, it can feel 5, 10, or even 50 times heavier than when it is at rest. (If the coin were a pilot, it would really be feeling those G's!)

G-force is the combination of gravity and motion. Accelerating, as a pilot does in a plane, increases the force of gravity affecting a body, making it feel heavier. When you're standing still, you're feeling one G. When you're in an airplane taking off, you feel much more G-force. Imagine how Steve Hinton feels as he makes the fast, tight turns in the Unlimited race!

PART 2

Part of the fun of participating in a competition like the Reno National Championship Air Races is being part of a team. Team colors and airplane decoration play an important role in the race. For one thing, the colors help spectators identify the planes as they zoom by. Steve Hinton's P-51 Mustang fighter plane, "Strega," is painted red and white, with a stylized 7 on the tail. Now it's your turn. Decorate this outline of "Strega" with your own colors and symbols, and write a sentence explaining why you chose them.

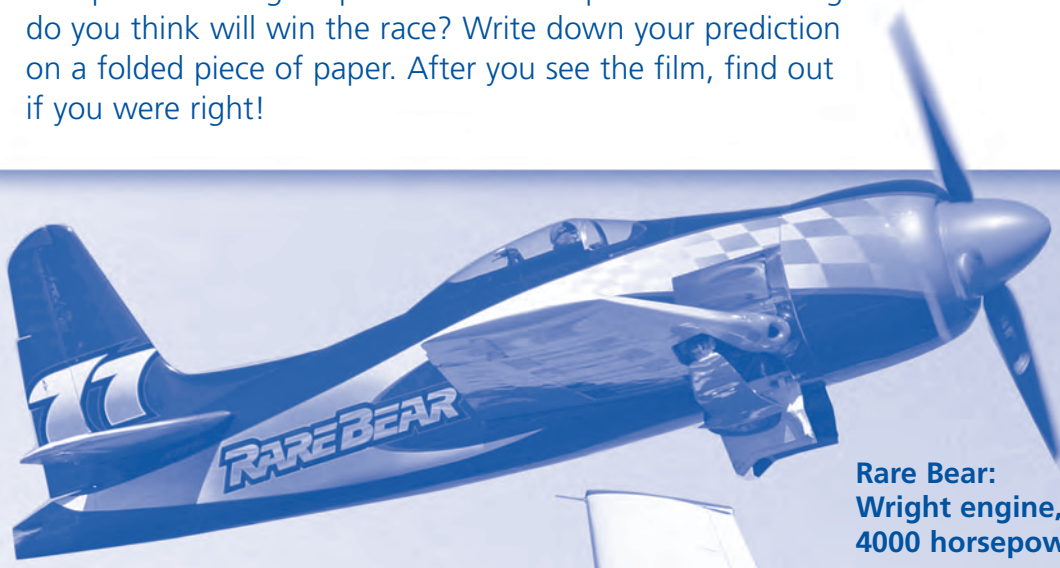


BUILT FOR SPEED

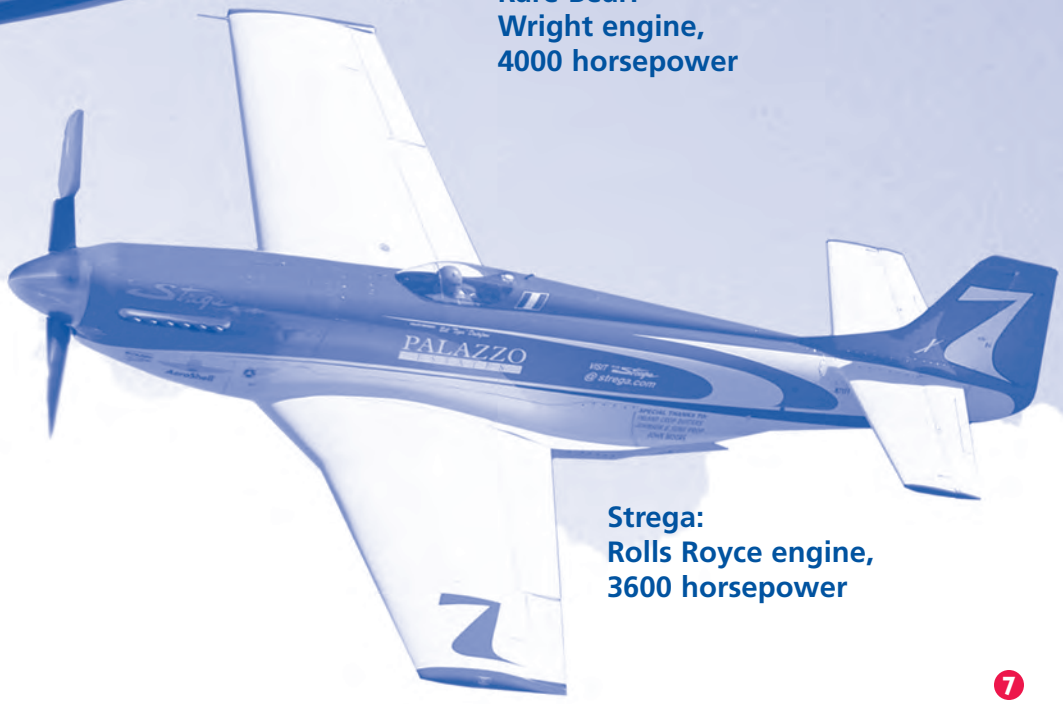
The rules at the Reno National Championship Air Races featured in ***Air Racers*** are simple—fly low, go fast, and turn left. The planes built for World War II aerial combat that are used in the races were, in fact, breakthroughs in airplane design at the time. These planes were built to be nimbler and more powerful than ever before. Before you view ***Air Racers***, review the basics of what makes a plane take off and stay in the air once it is aloft.

Look closely at the pictures of the vintage fighter planes on this page that are two of the planes featured in the film. 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, causes air to flow faster over the top of the wing than it does underneath the wing. The airflow on top of the wing has to cover a longer distance than the airflow under the wing, so it has to move faster. And this faster airflow creates lower air pressure on top of the wing, which pulls the plane up into the air. The difference between the lower air pressure on top of the wing and the higher air pressure underneath creates lift—an effect called Bernoulli's Principle.

Compare the wing shapes and the horsepower—the strength—of these two planes. Which one do you think will win the race? Write down your prediction on a folded piece of paper. After you see the film, find out if you were right!



Rare Bear:
Wright engine,
4000 horsepower



Strega:
Rolls Royce engine,
3600 horsepower

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?

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!

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!

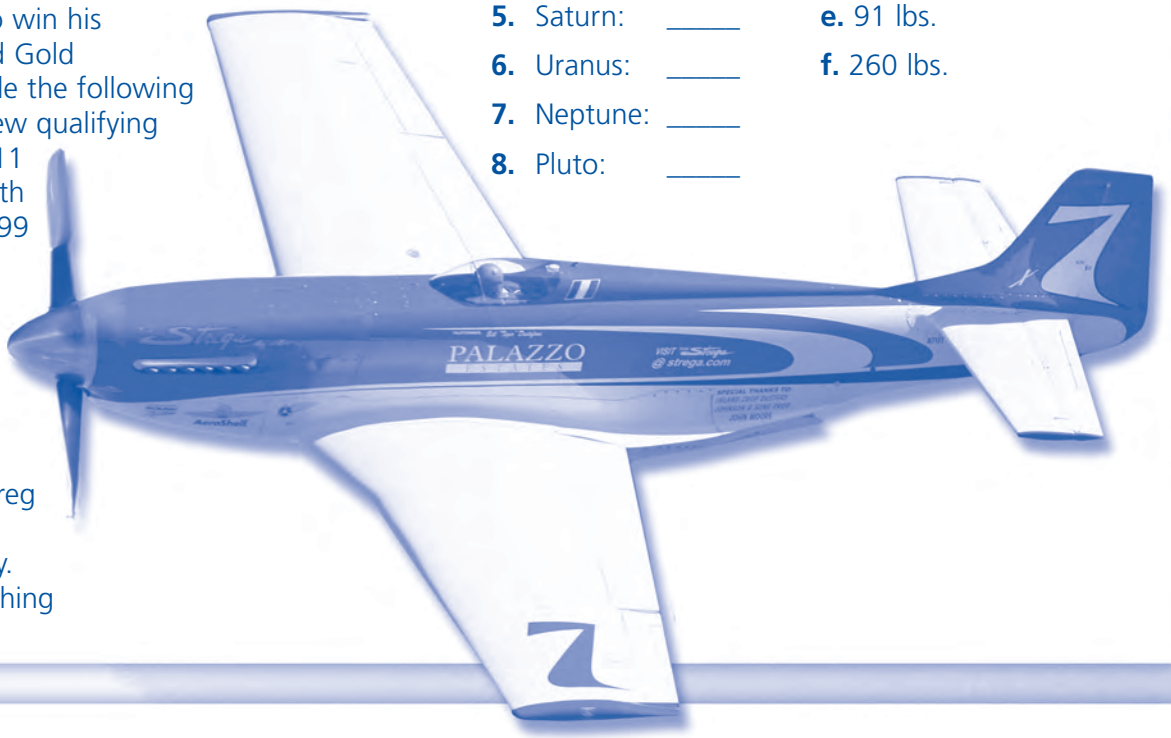
Steve went on to win his second Unlimited Gold championship title the following year and set a new qualifying record at the 2011 event in Reno with a top speed of 499 mph (803 km/h).

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?

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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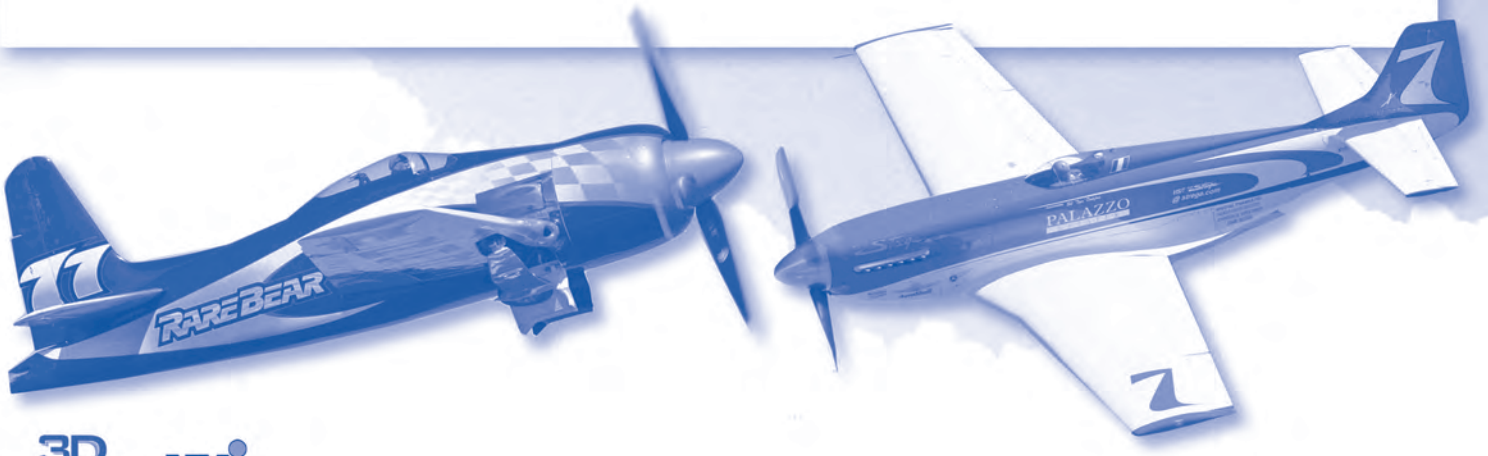

AIR RACERS

AirRacers-theFilm.com | Facebook.com/AirRacers

RESOURCES FOR TEACHERS

The Heritage of Flight
goo.gl/QYlnb (aviation timeline)
www.rouch.com/aviation_history.html
www.icepilots.com/pilot_slang.php
goo.gl/rQBgy (Wright brothers)

The Valley of Speed
www.airrace.org/at_the_races/racing.php
goo.gl/GQqbu (X-43A jet)

The Human Component
www.planesoffame.org
goo.gl/rntgZ (G-force experiments)
www.glennhcurtissmuseum.org
www.aef.org

Built for Speed
www.airrace.org
goo.gl/lCmM5 (Strega)
www.lewisairlegends.com/aircraft/rare-bear

BOOKS

Airplane Racing: A History, 1909-2008, by Don Berliner. Jefferson, NC: McFarland, 2009.

A Dream of Wings: Americans and the Airplane, 1875-1905, by Tom D. Crouch, New York: Norton & Co., 2002.

Treasures of the National Air and Space Museum, by Martin O. Harwit. New York: Abbeville Press, 1999.

Understanding Flight, by David Anderson. New York: McGraw-Hill, 2009 (second edition).

Wings: A History of Aviation from Kites to the Space Age, by Tom D. Crouch. New York: W.W. Norton, 2003.

RESOURCES FOR STUDENTS

The Heritage of Flight
www.aviation-for-kids.com/time-line.html
www.airandspace.si.edu
goo.gl/wXsgn (Wright brothers)

The Valley of Speed
www.airrace.org/at_the_races/racing.php
goo.gl/uYALP (Bernoulli's Principle experiments)
www.exploratorium.edu/exploring/paper/airplanes.html

The Human Component
www.planesoffame.org
goo.gl/rntgZ (G-force experiments)

Built for Speed
www.airrace.org
goo.gl/lCmM5 (Strega)
www.lewisairlegends.com/aircraft/rare-bear

BOOKS

First to Fly: How Wilbur and Orville Wright Invented the Airplane, by Peter Busby. New York: Crown, 2003.

Flying: Just Plane Fun, by Julie Grist. Los Angeles: Spoonbender Books, 2006.

Into the Air, by Ryan Ann Hunter. Washington: National Geographic Children's Books, 2003.

Sky Pioneer: Amelia Earhart, by Corinne Szabo. Washington: National Geographic Children's Books, 1997.

The Story of Flight: Early Flying Machines, Balloons, Blimps, Gliders, Warplanes, and Jets, Dan Hagedorn, ed. New York: Scholastic Inc., 1995.

The World Record Paper Airplane Book, by Jeff Lammers. New York: Workman, 2006.

Curriculum developed by Young Minds Inspired

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For additional resources and online activities, please connect to AirRacers-theFilm.com

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