The Evolution of Wings

Introduction: Despite the daily example of flight from birds and insects, humans did not unravel the mystery of flight for thousands of years and did not learn to fly until the last century. Join this exploration of wings from insects and bees to artificial wings that soar thousands of feet in the atmosphere for long periods of time. As you journey through this sampler, be thinking about how you will design a poster to show the highlights of wing evolution.

Part I. Nature's Wings

1. Plants have wings? Try the experiment and sketch the winning "spinner".
http://www.grc.nasa.gov/WWW/k-12/TRC/Aeronautics/Maple_Seed.html

2. Do bees violate the laws of aerodynamics when they fly? It doesn't look like they should be able to fly with their wing structure. Find the answer at
http://www.flyingturtle.org/askdrg/askdrgalapagos.html or
http://www.howstuffworks.com/news-item223.htm

3. What mechanisms keep insects flying and how are we using that information in the creation of robotic "bugs"?
http://www.howstuffworks.com/spy-fly1.htm

4. To analyze bird flight in the past, researchers have relied on aerodynamic theory derived from studying fixed-wing aircraft. Now new methods are being used to study bird and insect flight. What have they found out about the skeletal anatomy and the use of feathers for flight in birds?
http://www.nwf.org/nationalwildlife/flight.html

5. Studying insect flight has been a difficult task. One group of researchers has employed A tank of oil, some plexiglass and a lots of bubbles to help solve the mystery of insect flight. What have they learned?
http://www.nature.com/nsu/010823/010823-10.html

6. What do precision flight formations and migrating geese have in common? Read the article at
http://www.nasaexplores.com/lessons/01-071/9-12_index.html
Then do the bird observation activity at
http://www.nasaexplores.com/lessons/01-071/9-12_1.html and complete the two items below.

1. Write a summary on how birds use a V-formation in flying.
2. Why would this formation be of interest to aircraft engineers or competitive bicycle or racecar drivers?

Part II. Early Human-made wings

7. Leonardo da Vinci is considered to be the first student of flight. Why?
http://www.imss.firenze.it/news/mostra/6/index.html

8. George Cayley was an aeronautical genius who invented a series of gliders during the Victorian period. He is also called the father of Aviation. Why?
http://www.centennialofflight.gov/essay/Prehistory/Cayley/PH2.htm

9. The German engineer Otto Lilienthal was the first man to launch himself into the air, fly, and land safely and studied birds extensively. What did he learn about how birds fly?
http://www.centennialofflight.gov/essay/Prehistory/lilienthal/PH6.htm

10. The Wright Brothers were the first to use wind tunnels to test wing designs Their experiments on different wing shapes produced data critical for the successful gliders and the powered aircraft that would follow.

1. How many different wing shapes did the Wright Brothers test?
http://www.centennialofflight.gov/essay/Wright_Bros/1901/WR3.htm

2. Find out the basics of wind tunnels. What are the five parts of a typical wind tunnel? http://observe.arc.nasa.gov/nasa/aero/tunnel/tunnel_main.html

Part III. The Future of Wings

11. How does an airplane fly? Try the paper experiment and report what happened.
http://quest.arc.nasa.gov/aero/background/

12. NASA is planning to fly one of the most revolutionary aircraft concepts of recent decades to explore its potential as a future configuration for passenger and airfreight transportation. The design is called the Blended Wing Body (BWB) and is a hybrid shape that mainly resembles a flying wing.

1. What are its main features?
2. Why might this design be desirable?
http://oea.larc.nasa.gov/PAIS/BWB.html

13. How can aeroelastic technology help airplanes control flight?
http://www.nasaexplores.com/lessons/02-019/fullarticle.html
See an image of a concept vehicle at

14. The solar flying wing is new technology that can enable scientific study at high altitudes without a human pilot. What is the size of Helios? What distance and altitude is it capable of achieving?
http://www.dfrc.nasa.gov/PAO/X-Press/stories/050802/new_helios.txt.html

Conclusion: Flying creatures have served as the inspiration for flight. Design a poster or timeline to show how our knowledge (and dreams) of flight have changed . Be prepared to share your design with an explanation of why you chose the elements of your poster.

Extension Activity: Try your hand at testing different wing designs to evaluate how the weight, balance, and ailerons affect a glider's path.
http://www.nasaexplores.com/lessons/02-019/5-8_1.html

Teacher's Notes: Grades 7-12. This is a challenging site for the curious 7th grader. Seniors in High School will rely on past science courses in physical and life science. Students are encouraged to examine and to compare content. For example, how do the wings of a bee or insect work and how can that be applied to a robot insect? Another comparison in this unit involves the flight of the wings of plants spreading seeds -with the precision flight formations of geese. Hands-on projects creating assorted wing designs are very engaging, This site is best with teacher help in scaffolding connections of concepts or for the independent learner who would know how to seek information as the need arises. It is a site full of diverse aspects of 'wings'. A great "inquiry experience" with teacher guidance makes this challenging and fun.

National Science Standards:
Content Standard A: Inquiry Process where students are self directed in seeking answers or setting up projects.
Content Standard B: Physical Science reviews the forces of flight, principles of motion and effects of friction.
Content Standard C: Life Science intertwines the physical laws of flight with a look at birds, bees and other wings.
Content Standard E: Science and Technology is touched on with design principles including the use of solar energy.