WebQuest: From Wright Flyer to Mars Airplane

YOUR AMAZING INTRODUCTION

Have you ever looked at the horizon over land or sea and wondered what was just beyond the limit of your view? Have you ever looked up to the sky on a sunny day and watched the puffy white clouds sail with the wind while your thoughts drift along with them? If so, then you are the perfect candidate to be an explorer and a scientific investigator. How would you like to exercise those skills and go on an adventurous journey right now?

You can, for this journey will take you back to an exciting time long ago when people dreamed of being able to reach the clouds and see beyond the horizon. You and your research team members will experience the thrill along with those first people who dared to fly above the ground, then proceed into their future as better ideas led to the production of more capable craft, and finally get to put yourself in their shoes and formulate your own unique ideas in developing a special type of aircraft for our future. Would you like to go on such a journey of exploration and adventure? All you will need are your hands, a little curiosity and imagination, a computer linked to the World Wide Web, and your instructor to guide you along the way.

What were the thoughts, feelings, and intuitive actions of Orville and Wilbur Wright as the process unfolded in designing and constructing the first airplane with sustainable flight? What are the fundamental and technical differences between that first airplane and more modern aircraft? What would these differences need to be for an airplane to function properly under an entirely new set of conditions? These are some of the questions that can and will be addressed as you move from a study of the Wright Flyer all the way to the Mars Airplane incrementally with regards to technological advancements and innovation.

AN INTERESTING TASK

Let's attack this journey like a true explorer! Got your hiking shoes on and your backpack filled? We'll need a map, a compass, and a guide to help us along the way. We may also need an altimeter, some clearance, a holding pattern, a locator, some marker beacons, and a transponder as well. What's that, you say? Oh, it's just some aviation jargon you'll be running across from time to time. Don't worry; every journey we go on requires us to learn some "language of the land."

Your Map

Maps give us direction, distance, and connecting paths to reach our destination. The only problem is that some places we want to get to either don't exist or are very difficult to reach. For much of our journey, we will need a time machine to travel back into the past. A computer, like a time machine, can send signals that approach the speed of light, and can illustrate a previous time period through images, sound clips, videos, and true stories. It can also propel us into the future using animations and virtual reality tours. The Internet will serve well as our map, helping us as we travel wherever we want to go.

Your Compass

A compass points us in the direction we need to go as we travel. A good set of directions can act as our compass, keeping us on track and helping us adjust our course at any point along the path of our journey.

DIRECTIONS:

As in any journey, a clear set of plans can help you stay on course. Here's one plan to try: There are four tasks to be completed through three phases going from Wright flyer to Mars airplane. Groups of four explorers will form Research Teams as the social historian, research investigator, scientific inventor, and political analyst. The research will involve three phases in which you will actively investigate the Wright Brothers, prototypes leading to Modern Aircraft, and the design and construction of an airplane that can effectively fly on the planet Mars. Your teams can be assembled from different classes, such as Social Studies, Humanities, History, Science, Mathematics, American Government, Vocational in woods or metals, etc. Within your research report using multimedia and demonstration of a Mars Airplane, you will address the questions below:

			PHASE		
			Wright Flyer	Modern Aircraft	Mars Airplane
	ROLE	DUTIES	History of the Wright Brothers and the first attempts to fly	Technological developments as aircraft became more sophisticated	Using the principles and laws of nature to design and create a new aircraft
T	Social Historian	A look into society from a philosophical, technological, and scientific perspective	What was the Wright Brothers' motivation and impact on society?	How did technology affect the aviation industry in regard to transportation and war?	How does society perceive a manned mission to Mars and how will this airplane benefit humans?
A	Research Investigator	Explains the scientific principles behind the flight and operation of the aircraft	What was the science background of the Wright Brothers and what principles did they use?	What scientific breakthroughs led to the development of larger and faster aircraft?	Which scientific principles will be needed to investigate how an airplane will fly above the surface of Mars?
S	Scientific Inventor	Entrepreneur/engineer applying science to an aircraft's function and design	How did the Wright Brothers come up with an airplane design and what were the setbacks?	Who invented the various types of aircraft and how were they different or improved?	What innovative changes to airplane design will be necessary to enable one to fly efficiently in Mars' sky?
K	Political Analyst	Conveys the significance of a project for the purpose of acquiring grants and public approval	Where did the funding for the Wright Flyer come from and what was their influence?	When was major funding approved for evolving aviation design and for what purpose?	Why should the government and various agencies be supportive of the Mars Airplane?

Your Guide

Your instructor will act as your guide throughout the process of completing WebQuest.

THE FUN PROCESS

The journey begins here – Observation and Data Recording

Assignment 1a: Go out to your backyard - or any place with a clear, unobstructed view of the sky - and observe the sky for any flying objects or organisms for 20 minutes. Record your observations.

Everyone will most likely come in the next day with a variety of recording methods, so it might be prudent to take a ten-minute class discussion on the variety of ways the recorded observations were made and end with a list of which methods and senses were used to make the observations on the blackboard.

Assignment 1b: Switch assignment 1a with a classmate and evaluate using a method, known as a rubric, you can develop with your instructor together on the blackboard. You should include a comment that illustrates the main points in your evaluation.

Assignment 1c: Reflect on your first observation and write down some ways to improve your observation technique and recording method.

Assignment 2: Go to the same investigation site and make another 20-minute observation. Record your observations. Increasing the score you received on the original observation using the conclusions you formed in Assignment 1c should be your primary goal.

Some questions to consider during this activity include:

- How did you position yourself while making the sky observation?
- Were there limiting factors to the number of flying objects or organisms visible? Describe each limitation.
- How did you record what you observed? Be specific.
- Did other classmates observe a different number of flying objects or organisms? Why or why not?
- Where would be the most logical areas to observe the largest number of flying objects or organisms?
- What would this assignment have been like in the days before the first aircraft flew?
- What are some of the reasons why people wanted to be able to fly in the first place?

After you have researched all the neat things you must know and understand from the Internet:

1. The past – an historical and cultural account of the Wright Brothers, along with the science, technology, and innovation behind the construction of the Wright Flyer
2. The present – all of the revolutionary ideas in aircraft design since the time of the Wright Flyer that leads up to our current aviation technology
3. The future – taking our knowledge of aircraft design one step further: design and build an airplane that would successfully fly in the atmosphere of Mars

You will put all that great information together as a presentation and proposal to win the approval from Congress and a NASA Panel of Experienced Professionals (PEP) to use your airplane design on a manned mission to Mars. You can feel free to utilize any creative form of media you have access to, such as an interactive timeline (a good example of one for the universe can be found at http://www.pbs.org/deepspace/timeline/index.html), a PowerPoint or HyperStudio slide show, charts, graphs, tangible props, experts from the community, etc. Be as imaginative as you like!

EXCELLENT RESOURCES

Here is a list of links to educational resources that may be used during the performance of this WebQuest:

HELPFUL WEBSITES

- Some aviation interview questions for American Airlines can be viewed at http://www.hiccups.com/interviewquestions.html.
- For a list of questions on getting a pilot license, see http://www.national-aviation.com/faq.shtml.
- For questions on controlling an aircraft in flight, check out http://ldaps.arc.nasa.gov/Curriculum/Curriculum/Aircraft-control.html.
- The basics of space flight are covered at http://www.jpl.nasa.gov/basics/.
- A timeline on the history of science and technology exists at http://www-spof.gsfc.nasa.gov/stargaze/Stimelin.htm.
- Wright Brothers History http://www.centennialofflight.gov/1903.htm
- Mars Odyssey 2001 http://mars.jpl.nasa.gov/odyssey/index.html
- To explore the surface and atmosphere of mars, look to http://imagine.gsfc.nasa.gov/docs/ask_astro/answers/970604b.html
- Planetary Flight Home Page http://quest.arc.nasa.gov/aero/planetary/index.html
- A general discussion of Mars exploration missions and history can be found at http://mars.jpl.nasa.gov/
- NASA Drawings and Models of Mars Airplane Concepts http://quest.arc.nasa.gov/aero/planetary/images.html
- Planetary Flight Contests: Grades 5-8 http://quest.arc.nasa.gov/aero/planetary/contest.html
- Welcome to Planetary Flight! http://quest.arc.nasa.gov/aero/planetary/welcome.html
- Moving to Mars – A Learning Center http://quest.arc.nasa.gov/aero/planetary/teachers/Moving_to_Mars.pdf
- Live Interactive Events http://quest.arc.nasa.gov/aero/planetary/welcome.html#events

COLLABORATION

All of the students' work could be posted on a Web site, or interaction with schools around the world, with feedback from multiple other Teams, could be realized through venues such as the Global Schoolhouse Internet Projects Registry at http://www.globalschoolhouse.org/pr/. Also, the WorldCom MarcoPolo program offers standards-based Internet content, lesson plans, training, and partnerships through its Web site at http://marcopolo.worldcom.com/.

DISCUSSION

INVESTIGATIVE QUESTIONS

What were the thoughts, feelings, and intuitive actions of Orville and Wilbur Wright as the process unfolded in designing and constructing the first airplane with sustainable flight?

What are the fundamental and technical differences between that first airplane and more modern aircraft?

What would these differences need to be for an airplane to function properly under an entirely new set of conditions?

The term "astronaut" derives from the Greek words meaning, "space sailor." Determine when this term was first used and who was the first official astronaut.

List each and every living thing that flies; then identify characteristics of each organism.

A massive 747 jumbo jet weighs about 350 tons. It's amazing that it can take off, even to a scientist. How is flight for such a craft possible and how can one calculate the amount of atmospheric pressure needed to make it lift off the ground?

Which famous scientist's idea led to a modern understanding of the aerodynamic force?

Besides how airplanes fly, what are some other consequences of air pressure in the Earth's atmosphere?

A jumbo hard-boiled egg (with shell removed) is placed on the rim of an old milk bottle. The egg is considerably larger in diameter than the rim of the bottle. How can the egg be forced into the bottle without touching it or causing it damage?

EVALUATION

Teachers could evaluate using rubrics and work together discussing a consensus grade for each Team. In addition, peer review input can be used with the following template:

TEAM EVALUATION

Directions: Rate each team according to the following criteria on a scale of 1-5 (1=poor, 2=fair, 3=average, 4=good, 5=excellent) by circling the appropriate #.

Preparation	1	2	3	4	5
Effective communication	1	2	3	4	5
Believability	1	2	3	4	5
Creativity	1	2	3	4	5
Artistic ability	1	2	3	4	5
Use of media	1	2	3	4	5
Overall presentation	1	2	3	4	5

Total points: _____

CONCLUSION

In the quest to promote a general understanding and appreciation of science, technology, history, and culture, it is important for us to integrate the real-life connections of how the scientific discovery and its associated facts were made along with an approach that includes human reasoning and the fun and adventure of exploration. Incorporating a perspective involving specialists from a variety of fields can help in understanding how new ideas can lead to advanced developments in science and technology. Students will be more inclined to take ownership of scientific ideas when they are applied in familiar contexts that offer engaging insights and activities.

The primary goal of this WebQuest will be accomplished if each student develops a clear conceptual understanding of the process of science and its role to benefit the human condition and the world we live in. The realization that the body of scientific knowledge has accumulated through efforts of observation, experimentation, and the logical sequence of thoughts and creative ideas, in which they can take part, opens up a whole new perspective on scientific inquiry. Hence, the journey has just begun.

NOTES TO THE EDUCATOR/PARENT

This WebQuest activity highlights the physical and technological advancements made in the transition from flight in the Earth's atmosphere to flying a uniquely designed aircraft that is able to traverse an atmosphere of different composition and density, as found on another planet of dissimilar gravity, the planet Mars. Students in grades 7-12 from classes in

Biology, Chemistry, Physics, Earth Science, Mathematics, History, English, and American Government will be immersed into issues surrounding bioethical responsibility, properties of gases, fluid dynamics, materials science, comparative planetology, angle of attack, the Wright Flyer, stories about the Wright Brothers and the planet Mars, and the legislative process. The project culminates in the design and production of a Mars Airplane.

The general purpose of this WebQuest is to help foster higher order thinking skills that lead to the authentic utilization of knowledge obtained through inquiry. Introductory lessons and activities are used to scaffold learning so students develop a broader view of how the particulars fit into the larger conceptual framework. Principally, a deeper understanding and appreciation of aviation is enhanced when actual materials and events are analyzed comparatively while studying the how and why, then extend the learning process through new applications of such knowledge. The goal is for all the various and overlapping levels of behavior important to learning be achieved in the cognitive, affective, and psychomotor domains while being utilized through the interaction of media.

The Observation and Data Recording assignment above can help students learn to make high-quality observations and improve their note taking skills. It also helps them to be self- reflective, practice collaboration, and establish new goals.

The desired outcome of participating in this WebQuest is that educators will help students:

- Believe themselves as able to do science and develop science habits of mind
- Understand knowledge as constructed through the collaborative efforts of many scientists and through the collective input from diverse disciplines
- Identify investigative questions for which a sense of ownership is fostered and apply science process skills to answer them
- Interpret and make inferences about complex phenomena
- Appreciate the developmental aspect of applied science in the field of aviation

EDUCATIONAL GOALS

Content	*Concepts*	*Skills*
History of Flight	Fact vs. fiction	Critical thinking
	Aviation in literature	Intellectual capacity
	Storytelling	Creative writing
	Can a human fly?	Integrated perspective
	A flying craft design	Scientific reasoning
	Construction of an airplane	Measurement, physics
	Successive modification	Technical engineering

Aviation Development	Pilot and passenger safety	Structural design
	Workable components	Materials science
	Thrust, drag, gravity, and lift	Thermodynamics
	Efficiency in flight	Fluid dynamics
	Angle of attack	Performance
Mars Airplane	Comparative planetology	Analysis
	Innovative design	Synthesis
	Model building	Art, fine motor
	Test flight evaluation	Experimentation

To find out more about WebQuests and how to use them, see http://education.nasa.gov/gstw2002/webquestpurpose.html. Educator/Parent Activities can be found at http://education.nasa.gov/gstw2002/educator_parent.html. Scroll down and check out the NASA CONNECT program on The Future of Flight. The Teacher's Edition of a problem based learning activity can be found at http://quest.arc.nasa.gov/aero/planetary/teachers/teachersedition.html#3

Teachers from each class mentioned above can introduce students to the issue most closely related to their field and then rotate classes until all involved students have been presented each issue. Once completed, the students from all classes will form Research Teams to do a research project and presentation comparing the Wright Flyer to the Mars Airplane, culminating in the design of a Mars airplane using illustrations, pictures, or tangible materials in constructing one. This activity would be supported through student interaction with the NASA Quest site on Planetary Flight at http://quest.arc.nasa.gov/aero/planetary/index.html.

Each Research Team will be made up of Research Specialists in fields aligned with the issues covered above. Those include social historian, research investigator, scientific inventor, and political analyst. Each Research Specialist will present their findings to a different Research Team, who will act as a NASA Panel of Experienced Professionals (PEP). For example, the Specialist for legislative approval to fund the Mars Airplane would justify a proposal created to do so. Another option would be to have a Research Team present findings to another Team acting as a Panel, and switching roles. This could be done in the school auditorium with all of the students present.

As the student Research Teams investigate the capability of their Mars Airplane to fly effectively, you may want to encourage their use of interactive virtual wind tunnels for the correct formulae, as well as using a physical wind tunnel for the constructed plane. If your school does not have such a machine, you might consider borrowing one from a local university or industry, or build one using a Wet/dry shop vac with assistance from the students.

ALIGNMENT WITH STANDARDS AND BENCHMARKS

Significant statements about what foundational knowledge students should possess and what kinds of learning experiences they should have came with the publication of National Science Education Standards by the National Research Council (NRC) and Benchmarks for Science Literacy by the American Association for the Advancement of Science's Project 2061 (AAAS).

In order to obtain a thorough understanding of science, students working with this WebQuest shall be engaged in the use of computer technology, scientific instruments, and the role of technology in general, as well as working together as communities of practice while developing the attitudes and social values of scientific inquiry (AAAS Benchmark 3A, NRC Content Standard E).

The contributions of various cultures and time periods to scientific inventions and advancement, the traditional peer review and publication process, and the influence of research funding all play a role in developing professional ethics in matters of public concern (AAAS Benchmark 1C).

As students work together and critically evaluate each other's efforts, they become increasingly aware of the potential to formulate bias in experimental data (AAAS Benchmarks 12A and 12E).

Students working on this WebQuest will be engaged in gathering, using, and analyzing data as well as representing mathematical and statistical relationships through symbols, tables, and graphs (AAAS Benchmarks 9B and 9D). In doing so, they will use logic and models to solve problems, understand the process of comparing predictions used by models to real-world observations, design scientific investigations, and make arguments to support their design (AAAS Benchmarks 9E and 11B). Finally, students learn to value an historical perspective on modern views of Newtonian mechanics as applied to other places within the universe (AAAS Benchmark 10B, NRC Standard G).