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| **AE Lesson 1.1 Evolution of Flight** |

**Preface**

Flight is rooted deep within cultures around the world from the time of ancient myth to the development of the international space station. The evolution of flight parallels the evolution of science, engineering, and industry. Exposing students to the engineering problems faced during the development of flight, will lay a foundation of appreciation of the challenges that engineers face when developing flying machines.

In this lesson, students will be introduced to the evolution of flight through the cause and effect relationship of flight advances.

**Concepts**

1.     Understanding the evolution of flight instills an appreciation of past engineering accomplishments.

2.     Knowledge of aerospace history provides insight to future challenges involving travel through the atmosphere and space.

3.     Aerospace engineers typically work in teams to design smaller components of a larger system. The success of the entire system relies on each component to function correctly and to interact correctly with each other.

4.     Success often comes from learning from failures which is demonstrated throughout the history of aerospace development.

**Standards and Benchmarks Addressed**

***Standards for Technological Literacy***

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| **Standard 1:  Students will develop an understanding of the characteristics and scope of technology.** | |
| **BM J:** | The nature and development of technological knowledge and processes are functions of the setting. |
| **BM K:** | The rate of technological development and diffusion is increasing rapidly. |
| **BM L:** | Inventions and innovations are the results of specific, goal-directed research. |
| **BM M:** | Most development of technologies these days is driven by the profit motive and the market. |
| **Standard 2:  Students will develop an understanding of the core concepts of technology.** | |
| **BM W:** | Systems’ thinking applies logic and creativity with appropriate compromises in complex real-life problems. |
| **BM X:** | Systems, which are the building blocks of technology, are embedded within larger technological, social, and environmental systems. |
| **BM Y:** | The stability of a technological system is influenced by all of the components in the system especially those in the feedback loop. |
| **BM Z:** | Selecting resources involves trade-offs between competing values, such as availability, cost, desirability, and waste. |
| **BM AA:** | Requirements involve the identification of the criteria and constraints of a product or system and the determination of how they affect the final design and development. |
| **BM BB:** | Optimization is an on going process or methodology of designing or making a product and is dependent on criteria and constraints. |
| **BM CC:** | New technologies create new processes. |
| **Standard 3:  Students will develop an understanding of the relationships**  **among technologies and the connections between technology and other fields of study.** | |
| **BM G:** | Technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function |
| **BM H:** | Technological innovation often results when ideas, knowledge, or skills are shared within a technology, among technologies, or across other fields. |
| **BM I:** | Technological ideas are sometimes protected through the process of patenting. The protection of a creative idea is central to the sharing of technological knowledge. |
| **BM J:** | Technological progress promotes the advancement of science and mathematics. Likewise, progress in science and mathematics leads to advances in technology. |
| **Standard 4:  Students will develop an understanding of the cultural, social, economic, and political effects of technology.** | |
| **BM H:** | Changes caused by the use of technology can range from gradual to rapid and from subtle to obvious. |
| **BM I:** | Making decisions about the use of technology involves weighing the trade-offs between the positive and negative effects. |
| **BM J:** | Ethical considerations are important in the development, selection, and use of technologies. |
| **BM K:** | The transfer of a technology from one society to another can cause cultural, social, economic, and political changes affecting both societies to varying degrees. |
| **Standard 6:  Students will develop an understanding of the role of society in the development and use of technology.** | |
| **BM H:** | Different cultures develop their own technologies to satisfy their individual and shared needs, wants, and values. |
| **BM I:** | The decision whether to develop a technology is influenced by societal opinions and demands, in addition to corporate cultures. |
| **BM J:** | A number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads contribute to shaping the design of and demand for various technologies. |
| **Standard 7:  Students will develop an understanding of the influence of**  **technology on history.** | |
| **BM G:** | Most technological development has been evolutionary, the result of a series of refinements to a basic invention. |
| **BM H:** | The evolution of civilization has been directly affected by, and has in turn affected, the development and use of tools and materials. |
| **BM I:** | Throughout history, technology has been a powerful force in reshaping the social, cultural, political, and economic landscape. |
| **BM M:** | The Renaissance, a time of rebirth of the arts and humanities, was also an important development in the history of technology. |
| **BM N:** | The Industrial Revolution saw the development of continuous manufacturing, sophisticated transportation and communication systems, advanced construction practices, and improved education and leisure time. |
| **BM O:** | The Information Age places emphasis on the processing and exchange of information. |

***National Science Education Standards***

**Unifying Concepts and Processes:**  As a result of activities in grades K-12, all students should develop understanding and abilities aligned with the following concepts and processes.

        **Systems, order, and organization**

        **Evidence, models, and explanation**

        **Change, constancy, and measurement**

        **Evolution and equilibrium**

        **Form and function**

**Science As Inquiry Standard A:** As a result of activities in grades 9-12, all students should develop

        **Understanding about scientific inquiry**

**Science and Technology Standard E:** As a result of activities in grades 9-12, all students should develop

        **Abilities of technological design**

        **Understandings about science and technology**

**History and Nature of Science Standard G:** As a result of activities in grades 9-12, all students should develop understanding of

        **Science as a human endeavor**

        **Nature of scientific knowledge**

        **Historical perspectives**

***Principles and Standards for School Mathematics***

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| **Connections** | Instructional programs from pre-kindergarten through grade 12 should enable all students to recognize and use connections among mathematical ideas; understand how mathematical ideas interconnect and build on one another to produce a coherent whole; recognize and apply mathematics in contexts outside of mathematics. |

***Standards for English Language Arts***

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| **Standard 1** | Students read a wide range of print and non-print texts to build an understanding of texts of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classical and contemporary works. |
| **Standard 4** | Students adjust their use of spoken, written, and visual language (e.g. conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes. |
| **Standard 5** | Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences and for a variety of purposes. |
| **Standard 6** | Students apply knowledge of language structure, language conventions (e.g. spelling and punctuation), media techniques, figurative language, and genre to create, critique, and discuss print and non-print texts. |
| **Standard 7** | Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g. print and non-print texts, artifacts, and people) to communicate their discoveries in ways that suit their purpose and audience. |
| **Standard 8** | Students use a variety of technological and informational resources (e.g. libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge. |

**Performance Objectives**

*It is expected that students will:*

       Create a historical perspective on Aerospace industry and Aerospace technology to provide context for subsequent curriculum lessons.

       Summarize historical precedence in problem solving.

       Explain cause and effect relationships in design.

       Explain that aerospace terminology and expanded history are integral parts of design.

**Assessment**

*Explanation*

       Students will explore the evolution of flight from the prospective of technology advancement.

*Interpretation*

       Students will interpret the impact society has had on the evolution of flight.

       Students will interpret the impact the evolution of flight has had on society.

*Application*

       Students will apply evolution of flight research findings to determine the cause and effect relationship of the aerospace industry

*Empathy*

Students will reflect on the evolution of flight from the perspectives each time period affected by its evolution.

*Self-knowledge*

       Students will apply knowledge of the evolution of flight to the discovery of current and future flight advancements.

**Essential Questions**

1.     What role has technology played in the evolution of flight?

2.     What role has society played in the evolution of flight?

3.     What role has the evolution of flight played in the culture of the world?

4.     How does knowledge of aerospace history provide insight to future challenges involving travel through the atmosphere and space?

**Key Terms**

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| **Term** | Definition |
| **Aerospace Engineer** | Develops new technologies for use in aviation, defense systems, and space exploration, often specializing in areas such as structural design, guidance, navigation and control, instrumentation and communication, and production methods. |
| **Aircraft** | A device that is used or intended to be used for flight in the air. |
| **ATC** | Air Traffic Control, A system is to prevent a collision between aircraft operating in the system and to organize and expedite the flow of traffic, and to provide support for National Security and Homeland Defense. |
| **FAA** | Federal Aviation Administration. The U.S. Federal Aviation Administration is an operating mode of the Department of Transportation responsible for the safety of civil aviation. |
| **NASA** | National Aeronautics and Space Administration. The United States government agency that is responsible for science and technology related to air and space. |
| **NACA** | National Advisory Committee for Aeronautics. From March 3, 1915 until October 1, 1958, the National Advisory Committee for Aeronautics (NACA) provided advice and carried out much of the cutting-edge research in aeronautics in the United States. |

**Day-by-Day Plans**

*Time:  4 days*

**Day 1:**

       The teacher will distribute course and school specific materials relating to Aerospace Engineering course expectations and procedures.

       The teacher will distribute an engineering notebook to each student.

       The teacher will present [**Engineering Notebook.ppt**](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\Aerospace\AE_2011_Teacher.chm::/Lessons/Unit_1/L1_1_EngineeringNotebook.pptx) while students take notes in their journal.

       The teacher will present [**Evolution of Flight.ppt**](mk:@MSITStore:C:\Documents%20and%20Settings\DAVID_ROEMER\Desktop\Aerospace\AE_2011_Teacher.chm::/Lessons/Unit_1/L1_1_EvolutionOfFlight.pptx) while students take notes in their journal.

**Day 2-3:**

o   The teacher will distribute and explain **Project 1.1.1 Aerospace Evolution Documentary**

       Students will take notes in their journal.

       The teacher will direct students through **Project 1.1.1 Aerospace Evolution Documentary** steps 1 through 3.

       Teacher will assign **Project 1.1.1 Aerospace Evolution Documentary** steps 1 through 3 for homework if students do not finish during class.

**Day 4:**

       The teacher will direct students through Project 1.1.1 Aerospace Evolution Documentary.

       Students will present Project 1.1.1 Aerospace Evolution Documentary.