Lesson 1 – Evolution of Flight

Preface

The study of aerospace engineering would not be complete without a basic understanding of the history of aerospace. Many students think that the Space Shuttle can go to the Moon and some even think people have been to Mars. These misconceptions are often the result of watching science fiction movies or television programs that look real to students.

In this lesson, students will be introduced to the history of flight through hands-on activities, research, and a presentation in the form of a commercial. By having the entire class experience the flight characteristics of various vehicles and explore the difference of aircraft and rockets, research their respective histories, and view each other’s commercial productions, each student will gain a greater understanding of the evolution of flight.

Concepts

1. The history of aerospace studies has influenced how people meet the challenges of traveling through the atmosphere or in space.
2. Engineering designs in aerospace exploration evolve as they are developed.
3. Different types of vehicles result in different types of flight.

Standards and Benchmarks Addressed

Standards for Technological Literacy

Standard 7: Students will develop an understanding of the influence of technology on history.

BM D: The specialization of function has been at the heart of many technological improvements.

BM G: Most technological development has been evolutionary, the result of a series of refinements to a basic invention.

Standard 8: Students will develop an understanding of the attributes of design.

BM F: There is no perfect design.

Standard 11: Students will develop abilities to apply the design process.

BM K: Test and evaluate the design in relation to pre-established requirements, such as criteria and constraints, and refine as needed.

BM L: Make a product or system and document the solution.

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
• Constancy, change, and measurement
• Form and function

Science as Inquiry Standard A: As a result of activities in grades 5-8, all students should develop
• Abilities necessary to do scientific inquiry.

Science and Technology Standard E: As a result of activities in grades 5-8, all students should develop
• Abilities of technological design.
  o Identify appropriate problems for technological design.
  o Design a solution or product.
  o Implement a proposed design.
  o Evaluate completed technological designs or products.
  o Communicate the process of technological design.

Principles and Standards for School Mathematics

Problem Solving: Instructional programs from pre-kindergarten through grade 12 should enable all students to apply and adapt a variety of appropriate strategies to solve problems.

Connections: Instructional programs from pre-kindergarten through grade 12 should enable all students to recognize and apply mathematics in contexts outside of mathematics.

Standards for the English Language Arts

Standard 5: Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.

Standard 8: Students use a variety of technological and informational resources (e.g., libraries, database, computer networks, video) to gather and synthesize information and to create and communicate knowledge.

Standard 12: Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

Performance Objectives

It is expected that students will:
• Apply their knowledge of research techniques to investigate the history of an aerospace vehicle.
• Utilize language arts skills to write a script for a commercial promotion of an aerospace vehicle.
• Experience the flight characteristics of kites, whirly gigs, model airplanes, hot air balloons, and model rockets.

Assessment

Each of the three activities to be completed in this lesson will be evaluated by the instructor upon completion. The Evolution of Flight Rubric evaluation will be used to assess the entire lesson.

Application
1. Students will apply what they learned about the history of aerospace to learn how to work with flight characteristics.
2. Students will design and develop a commercial that explains their understanding of the impact their flight vehicle had on the evolution of aerospace history.

Documentation
1. Students will keep records of their teamwork in an engineering notebook.
2. (Optional) Using the following questions as a guide, students will write in a journal their reflections on their experiences while creating the video based on their research of the history of aerospace:
   - If given more time for developing the video, what would your team do differently?
   - If given a chance to redo your video, what would your team want to change or do differently?
   - Complete the following prompt: What surprised me the most concerning what I learned about the history of aerospace is…

Essential Questions
1. What are the various types of flight vehicles?
2. What were the first technological advancements that continue to lead to the advancement of flight?
3. What engineering challenges did the Wright brothers face?
4. Who were the pioneers of rocketry?
5. What are some similar problems associated with both airplanes and rockets today and possibly in the future?

Key Terms

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<thead>
<tr>
<th>Airfoil</th>
<th>Dialogue</th>
<th>Drag</th>
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<tbody>
<tr>
<td>Jingle</td>
<td>Lift</td>
<td>Pitch</td>
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<tr>
<td>Rehearsal</td>
<td>Roll</td>
<td>Slogan</td>
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<tr>
<td>Thrust</td>
<td>Video Editing</td>
<td>Weight</td>
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<td>Yaw</td>
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Day-by-Day Activities

Total Time: 14 days

Prior to teaching the lesson, the teacher may want to review the Teacher Notes located in the Teacher Guidelines section at the end of this lesson.

Day 1 – 4:
- The teacher will present the Essential Questions and provide students with a lesson overview.
- The teacher will provide an overview of the lesson explaining the expectations, criteria, and constraints.
- The teacher will present Activity 1.1 Researching Aerospace Vehicle History.
- Students will begin the research component of the activity. Each student in each group should perform an Internet search or visit the school library. The teams should decide what specific area of research each individual student would gather.
- Students will record their research notes in their student engineering notebooks.

Days 5 - 9:
- The teacher will explain the requirements for completing Project 1.2 Flying Aerospace Vehicles.
- Students will sign-up for one of the following activities:
- Kite
- Hot air balloon
- Helicopter and Whirly gig
- Glider (Rubber band-powered model airplane optional)
- Model Rocket

**Note:** The teacher should determine the appropriate number of students on each team to provide an even distribution of vehicle investigations.

- Students should make notes in their engineering notebooks and make a sketch of the component details of the aerospace vehicle they have selected.

**Days 9 - 11:**

*Note:* This part of the lesson may be extended if students are building the vehicles from kits or materials listed in Instructional Resources. In addition, an Optional Project 1.2 Flight Vehicle Instructions with Student Worksheets is provided to guide students in the construction of their vehicles.

- Students will prepare their selected aerospace vehicle for a test flight.
- The teacher will inspect each vehicle before flight-testing.
- The teacher will instruct the entire class regarding the specific safety rules related to flying each vehicle. Refer to Project 1.2 Flying Aerospace Vehicles.
- Students will observe the appropriate safety rules associated with flying their vehicles.
- Students will make modifications necessary to perfect the flying characteristics of their vehicle.
- The teacher (or selected students) will record video clips that can be used in Project 1.3 Aerospace Commercial: Designing the Future.
- The teacher will remind students that their research will be used to produce the commercial in the next activity.
- Students should be directed to find interesting facts that would distinguish their aerospace vehicle from others. (Note: Video editing software can be used to assemble clips with the commercial produced in the Project 1.3 Aerospace Commercial. If video editing equipment is not available, individual tapes should be used to record the test-flights. This will provide additional tape space for the commercial message to be added later.)

**Days 11 - 13:**

- The teacher will provide an overview of Project 1.3 Aerospace Commercial: Designing the Future explaining the expectations, criteria, and constraints.
- Students will continue working on the same team to write a script for a commercial video or PowerPoint presentation with embedded video that will promote their selected aerospace vehicle.
- Students may use word processing software to craft their scripts.
- The teacher and students will discuss the requirements for the commercial that will be designed. Requirements include:
  - Sales slogan
  - Jingle
  - Dialogue (Script narrative)
  - Time limit
- The teacher will remind students that their commercial should be based on facts that represent a possible future aerospace vehicle or a unique science fiction idea.
- Students will rehearse and time their commercial. Modifications to scripts should be made and rehearsed to make the commercial last exactly 60 seconds or a predetermined time selected by the teacher.
- The teacher and students should record the completed commercial on an appropriate videotape or digital camera. For example, the students should use the appropriate clip of their test-flight or edit together as equipment permits.

**Day 14:**

- Students will present their commercials to the class.
- The entire class will view and critique all of the completed commercials.
- Students will use the Evolution of Flight Rubric to evaluate their work and the work of their classmates.
- The teacher will present the video commercials in their chronological order so students can understand the development of aerospace vehicles from a historical perspective.
- (Optional) A simple timeline of important dates in Aerospace History or an appropriate video may be presented.
Instructional Resources

Word Documents

Activity 1.1 Researching Aerospace Vehicle History
Project 1.2 Flying Aerospace Vehicles
Project 1.3 Aerospace Commercial: Designing the Future

Answer Keys or Rubrics

Activity 1.1 Researching Aerospace Vehicle History Answer Key
Lesson 1 Evolution of Flight Rubric

Teacher Guidelines

Lesson 1: Teacher Notes
Optional Project 1.2 Flight Vehicle Instruction and Student Worksheets

Reference Sources


Websites


