We Can Fly, You and I

Making Time Fly -------------------------------80
Where is North? The Compass Can Tell Us -------87
Let's Build a Table Top Airport -------------------91
Plan to Fly There----------------------------------97
Interdisciplinary Learning Activities --------------107
Objectives

The students will:
Identify and research aviation events.
Create a time line of aviation events.
Analyze the information to interpret changes in aviation.
Develop a presentation based on historical events in aviation.

Standards and Skills

Science
Science in Personal and Social Perspectives
History and Nature of Science

Science Process Skills
Communicating
Investigating
Collecting Data

Mathematics
Problem Solving
Communication

Background

Each event in a time line can be thought of as a link to the past or future of something. Building an aviation time line based on drawings or models helps students visualize the numerous changes that have occurred in the history of aviation.

The changes in aviation offer important clues to help students not only understand the concept of advancement and improvement, but also the reasons behind the changes.

In 1783 the balloon became the first human-made device capable of lifting humans into the air. It allowed humans to fly, but balloons drift with the wind, and the speed and destination of each flight depended largely upon the weather. The limitations of ballooning inspired people to develop new technologies to expand the realm of flight. Change was inevitable. Propulsion was added...
to the balloon to help control its flight path, increase its speed, and make it move against the wind.

When powered, controlled flight became possible with the Wright Flyer airplane in 1903, changes in aviation happened at a quick rate. Many of the changes were driven by aviators' desire to fly higher, faster, and farther. Some changes occurred to satisfy specific, practical requirements: the flying boat permitted flight operations from bodies of water, and the helicopter could takeoff and land practically anywhere. Navigation instrumentation allowed for flights in adverse weather and darkness.

Other changes occurred to satisfy the human spirit. Advanced gliders allowed people to soar with the birds, and acrobatic airplanes allowed pilots to dance in the sky.

Creating a time line requires students to find out all they can about an event. Research information for a time line can be obtained from many sources. Books, magazines, newspapers, and people are a few examples. A vast amount of information is also available on the Internet.

More information about some of the events listed in this activity are contained in the "Aeronautics Background for Educators" section of this guide (pp. 10-12).

**Management**

The amount of time required for this lesson will be primarily determined by how much time the students are assigned for research. Students may work individually, in pairs, or small groups.

**Activity**

1. Show students a picture of a modern airliner that can be found in a magazine or book. Ask them if this is the type of plane in which people have always flown.

2. Review what a time line is and why it is an important way of displaying information.

3. Hand out the Student Pages (Time Line Events, and illustrated Time Line). Briefly discuss events on the sheet and how they depict a time line.
4. Explain to the students that they are going to research aviation events and create a time line that shows important people and changes in aviation. Each student or pair of students should find out all they can about an event and be able to draw a picture of it.

5. Once students have completed their research, they can decide how the event will be displayed in the time line. Students can design cards for the time line or build a paper model. Other ways to display the event include magazine cutouts, pictures, and models made from recycled or "throw away" items found around their home.

6. Bring all items together to form a class time line. The time line can be hung from the ceiling, attached to a wall or put on a shelf or table. Ask each student to present and position his or her event on the time line.

Discussion

1. How important was the event you researched to changes in aviation?

2. If a particular time line event had never occurred, how do you think this might have changed aviation history?

3. How did the time line that the class created help you to learn about aviation history?

Assessment

Students will successfully meet the objectives of this lesson by researching an aviation event and creating their part of the time line.

Extensions

1. Have students predict what future events and designs in aviation might look like. Draw pictures and write about it.

2. Using the information gathered in the students' research, have them write a report or story about their event.

3. Have students pretend they are one of the aviation characters that they researched. Groups of students can role-play the characters in skits or plays.
Use these events to begin your time line

Key words are in the events below.

400 B.C. The first kites were invented by the Chinese.

1485 Leonardo da Vinci designed the ornithopter (a wing flapping aircraft).

1783 Joseph and Etienne Montgolfier launched the first passengers—a duck, a sheep, and a rooster—in a hot air balloon.

1849 Sir George Cayley, “The Father of Aerial Navigation,” designed the first three-wing glider that lifted a person off the ground.

1891 Otto Lilienthal built the first practical glider for long flights.

1903 The Wright Brothers developed the first motor-powered airplane that a pilot could control.

1907 Paul Cornu built the first free flying helicopter.

1919 Lieutenant-Commander A.C. Reed and his crew were the first to fly across the Atlantic Ocean, making several stops, in the Curtiss Flying Boat.

1927 Charles Lindbergh was the first person to fly across the Atlantic Ocean nonstop.

1935 Amelia Earhart was the first person to fly solo across the Pacific Ocean from Hawaii to California.

1947 Chuck Yeager became the first pilot to break the sound barrier.

1979 The Gossamer Albatross was the first craft powered by a human (Bryan Allen) to fly across the English Channel.

1986 Dick Rutan and Jeana Yeager flew Voyager around the world nonstop without refueling.

1997 The NASA/AeroVironment Pathfinder became the first solar-powered aircraft to fly above the troposphere.
**Time Line**

### 400-350 BC
- The Chinese invent kites
- 400 BC

### 1450-1499
- da Vinci ornithopter
- 1485

### 1750-1799
- First hot air balloon
- Montgolfier brothers
- 1783

### 1800-1850
- 3-wing glider
- Sir George Cayley
- 1849

### 1850-1899
- Lilienthal glider
- 1891

### 1900-1949
- First motor-powered airplane flight
- Wright brothers
- 1903
1900-1949

- First helicopter
  Paul Cornu
  1907

- First trans-Atlantic flight
  A. C. Reed
  1919

- First non-stop flight across Atlantic
  Charles Lindbergh
  1927

- First solo flight Hawaii-California
  Amelia Earhart
  1935

- First human flight faster than sound
  Chuck Yeager
  1947

1950-2000

- First human-powered flight across English Channel
  Bryan Allen
  1979
Time Line

Add to the time line by researching other aeronautical events, or design events of the future.

1950-2000

First non-refueled flight around the world
Jeana Yeager & Dick Rutan
1986

First solar-powered aircraft to fly above the troposphere
NASA/AeroVironment
1997

1900-1949

1950-2000

2000-2050

1950-2000

1950-2000

1950-2000

1950-2000

### Objectives

The students will:
- Build a compass.
- Determine the direction of north, south, east, and west.

### Standards and Skills

**Science**
- Science as Inquiry
- Physical Science
- Earth and Space Science
- Science and Technology

**Science Process Skills**
- Observing
- Inferring
- Making Models

**Mathematics**
- Connections
- Verifying and Interpreting Results
- Prediction

### Background

The compass has been used for centuries as a tool for navigation. It is an instrument that aligns a free pivoting bar magnet (called the needle) in Earth’s magnetic field.

Since the invisible lines of the magnetic field are oriented in a north/south direction, the needle will orient itself in a north/south direction. The other cardinal points of the compass (east, west, and south) are defined in relation to north.

Pilots use a compass to determine direction when flying airplanes. Boaters, hikers, and hunters are examples of other people who rely on compasses.

---

**WHERE IS NORTH? THE COMPASS CAN TELL US...**

![Diagram of a compass and Earth showing north and south poles]
Materials

- Paper clips
- Fourpenny (4p) finishing nail
- Shallow dish or pan 15-30 cm diameter
- Liquid soap
- Magic markers
- Styrofoam cup, .25 L capacity
- Scissors
- Magnet

Management

Students can participate in this activity in a variety of ways:

1. Students can build a single class compass.
2. Teams of 3-5 students can build team compasses.
3. Students can build individual compasses.

Activity

1. Fill a shallow dish with water.
2. Cut the bottom out of the cup and float it on the water.
3. Place one drop of liquid soap in the water. This will reduce the surface tension friction and will keep the Styrofoam disk from attaching itself to the container wall.
4. Magnetize the compass "needle" by rubbing it in one direction on a small magnet.
5. Place the magnetized compass needle on the floating Styrofoam disk. To minimize compass errors, place the compass away from metals, magnets, or electrical wiring.

6. Ask students to observe the compass needle as it aligns parallel with the invisible magnetic field.

7. Discuss ways to verify which end of the needle is pointing north and which end is pointing south. (Sunrise, sunset, shadows, commercial compass).

8. Place a piece of metal near the compass and observe changes in the needle orientation.

9. Write or cut the letter N and position to indicate the north direction. Follow this by placing the letters S, E, and W around the edges of the compass.

**Assessment**

Identify an object in the classroom and ask students to state what direction the object is from the compass.

**Extensions**

1. Hide "prizes" at different locations in the classroom. Have students locate the prizes using a compass while following teacher's directions (north, south, southeast, etc.).

2. Name different areas of the school, and have students determine the area's cardinal direction (north, south, etc.).
Where is North?
Let's build
A table top airport

Objectives
The students will:
- Design and build a model airport.
- Learn the components of an airport.
- Use the model to demonstrate airport operations.

Standards and Skills

Science
- Science and Technology
- Science in Personal and Social Perspectives

Science Process Skills
- Measuring
- Making Models
- Investigating
- Communicating

Mathematics
- Communication
- Reasoning

Background

A model airport can provide students with an accurate representation of a real airport. Real airports provide a place for airplanes to takeoff and land. Many communities have small airports to serve small or general aviation airplanes.

Some cities have large airports with long runways to accommodate commercial airline service. All airports have certain things in common such as one or more runways, hangars, a wind sock, and a taxiway. Larger airports have parking lots and passenger terminals.
Buildings at airports serve many different purposes and needs. Buildings where airplanes are stored and maintained are called hangars. The terminal is a building where passengers can get flight information and buy tickets. Other types of businesses found at an airport may include flight instruction, the sale of fuel, aircraft parts, and pilot supplies.

The construction of a model airport will help students identify and understand problems that face architects and planners of real airports. Models allow planners to identify potential problems with airport location, layout, and design before expensive construction begins.

### Materials
- Table approximately 2 m by 1 m or larger
- Small miscellaneous boxes (shoe box size)
- Thin cardboard
- Markers
- Masking tape
- Bulletin board paper
- Model airplanes, cars, and trucks

### Preparation
Provide a table to simulate a site in the community where students can start construction of a model airport. Multiple airport models can be constructed by teams.

Explain that an airport location requires flat terrain unobstructed by buildings, trees, and towers. Also mention that airports need to be located away from residential areas because of noise factors.

### Activity
1. Cut and place a long, narrow rectangular piece of bulletin board paper on the table to represent the location of a runway. Label this component of an airport.

2. Place several model airplanes at the airport site. The model airplanes can be brought from home, made in class from paper, or cut out of magazines. Discuss with the students the potential hazard to airport operations if airplanes are parked on a runway. Ask students to suggest a safe and accessible place to park airplanes.
3. Cut and place bulletin board paper on the table to represent airplane parking ramps. Label the parking ramp. Place the model airplanes on the ramp.

4. Provide a place on the airport grounds to park the cars and trucks that bring people to the airport. Place model cars and trucks in the parking lot.

5. Small boxes can be used as buildings for the model airport. Label each type of building (terminal building, hangar) or write a business name on the building. Construct and place the hangers that will be used for airplane service, maintenance, and storage. Label the hangar.

6. Provide a facility at the airport to fuel airplanes.

7. Name the airport.
Assessment

1. Invite other students, teachers, or school officials to view and identify the model.

2. Ask a student to role-play the manager of the new model airport, providing a tour of the facility to a group of citizens. The student should use correct terminology to describe the airport.

3. Have a student simulate the first or inaugural takeoff and landing from the new airport using a model airplane. Ask the student to describe the event from a pilot’s perspective.

Extensions

1. Using modeling clay, pencil, Styrofoam cup, and paper clip, build a model wind sock for the airport (see illustration).

2. Use a compass to draw a "compass rose" at the airport site.

3. Ask five (5) or more students to take off from the airport with their model airplanes. Have them "fly" to a destination in the classroom and return to the airport for landing. Ask student observers to describe what method the pilots used to avoid hitting each other. Discuss reasons why real airports designate flight patterns for pilots to use. Why is it important that pilots communicate with each other during a flight?

4. Busy airports (controlled airports) employ air traffic controllers to direct flight operations. Pilots are required to have radio contact with the control towers to receive takeoff and landing instructions. This method helps to ensure safe operations. Have a student air traffic controller direct flight operations at the model airport.

5. Runway numbers are based on magnetic direction. For example, if an airport runway is numbered 27, it is aligned in a direction of 270 degrees (it points west). Number the runways on the model airport.

6. Airplanes always try to takeoff and land into the wind. Place a small electric fan on the table to test the wind sock. Use the information from the wind sock to decide which runway to use.

7. Visit a local airport with the students to see how it is arranged.
Table Top Airport
Table Top Airport
**Plan to Fly There**

**Objectives**

The students will:
- Create a simple flight plan.
- Role-play the communication process pilots use.
- Identify the components of a flight plan.
- Determine a quantity by using a map scale.

**Standards and Skills**

**Science**

Physical Science

**Science Process Skills**

Communicating
Measuring

**Mathematics**

Problem Solving
Communication
Connections

**Background**

It would be very difficult to build a house without a plan. A builder depends on the plan to provide information about the design and size of a house under construction. Plans can also be used to describe an action or sequence of events such as planning for a celebration.

The pilot of an airplane depends on a *flight plan* to provide information to help ensure a successful flight to a destination. The plan may contain the following information:

1. Aircraft number (identification)
2. When the flight will leave (departure time)
3. Where the plane will takeoff from (departure point)
4. How it will get there (route of flight)
5. Where it will land (destination)
Abbreviations and codes are used on flight plans to save space and reduce the number of words. For example, the code for San Francisco International Airport in California would appear on the flight plan as SFO.

The pilot plans the route of flight by connecting a series of points on an aeronautical chart. These points are abbreviated, and are listed on the flight plan to describe the route of flight.

Pilots use a radio or telephone to communicate or "file" flight plan information with a Flight Service Station.

Once the airplane is airborne, Air Traffic Control (ATC) controllers use the information on flight plans to help track airplanes, and to maintain a safe distance between airplanes.

Talking on a radio or telephone can sometimes change the sound of words and letters. For example the letter B sounds like the letter P and the letter C sounds like the letter D. Most of the information on the flight plan is abbreviated or coded using letters and numbers. To help eliminate mistakes caused by a change in the sound of a letter, pilots use the International Phonetic Alphabet.

The International Phonetic Alphabet assigns word sounds to every letter in the alphabet. Instead of saying the letter A, pilots say the word Alpha. The code SFO would be stated Sierra Foxtrot Oscar.

**Materials**

- Barrier (a screen, portable chalkboard, bookcase, etc.)
- Paper and pencil
- Noise source (radio static simulated by crumpling cellophane)
- Copies of student Flight Plans
- Copies of student Aero-Charts
- Radios or walkie-talkies (optional)
Preparation

Make copies of the Student Pages for each student. Student Pages can be used to prepare students for this activity.

The Aero-Chart Student Page is used as a worksheet by the students to determine such factors as departure airport, destination airport, route of flight, and flying time in hours. Students complete the Flight Plan Student Pages by answering questions on the form.

Different airplanes travel at different speeds. Pilots determine the time en route based upon the cruising speed of their airplane. Students determine how long it will take to fly a route by using the icon at the bottom of the chart to scale the time. The length of one icon equals 1 hour flying time in the airplane. Example: If the course is 5 icons in length, it will take 5 hours to fly the distance. The students decide the departure time and add the flying time to determine arrival time at the destination airport.

The students can role-play the communication of flight plans between pilot and air traffic controller. Set up listening stations with chairs on either side of the barrier and have the students talk to each other in a normal voice level. If walkie-talkies are available, students could be in different rooms.

Introducing background noise near the stations can simulate real world problems pilots have when communicating with radios. Radio transmissions are sometimes unclear because of static or interference, which can change phonetic sounds.

Activity

1. Hand out a copy of the Aero-Chart and of a flight plan to each student. (Students can work in pairs or small groups for this activity.)

2. Ask the students to choose any departure and destination airport shown on the chart.

3. Ask the students to mark a route between the two airports by connecting the lettered dots. Write the route on the flight plan. Note: Routes do not have to be “direct” to an airport. Consider what might influence the choice of a particular route; examples include mountain avoidance, restricted areas, flight time limits because of fuel tank capacity, and sightseeing en route.
4. Using the time icon (located at the bottom left corner of the Aero Chart Student Page), have the students determine the amount of time the flight will take. Enter this in the flight plan.

5. Ask the students to decide on a departure time and add the flight time to determine the arrival time. Add this information to the flight plan.

6. Have the students complete the flight plan by adding an aircraft identification and pilot's name.

7. To simulate talking on a telephone or radio, divide the students into pairs with a barrier between them. Ask one student in each pair to "transmit" the flight plan information to the other student and have them write down the information as they receive it.

8. The students can exchange flight plans to see if the information matches.

Discussion

1. What would you do if you had to communicate with Air Traffic Controllers in Italy? The international language for air traffic control is English. Controllers in Italy and most countries communicate using the English language.

2. Do pilots have to use a flight plan? Pilots are required to use flight plans certain types of flights. For example, pilots flying commercial airliners are required to use flight plans. Many other pilots use flight plans voluntarily for safety reasons; if a flight plan is not cancelled on time, government agencies are notified so search and rescue operations may begin to locate the pilot and airplane filed on the flight plan.

3. Can pilots change a flight plan? Yes, flight plans can be changed by talking to a Flight Service Station.

Extensions

1. Have students plan a flight route using a chart they create.

2. Invite a pilot to the classroom to talk about flight plans.

3. Have students draw a picture of what they would see on an airplane flight over a city or farm.

4. Have the student spell his or her name using the phonetic alphabet.
5. Prominent landmarks such as radio towers, race tracks, and mountains are depicted on aeronautical charts to help pilots navigate. Pilots also use landmarks to specify their location when communicating on the radio to flight controllers and air traffic. Have students review the route of their flight and describe how they used landmarks to navigate.

6. Have students identify local landmarks that pilots could use for navigation.

Assessment

1. Have the students complete a flight plan using the International Phonetic Alphabet.

2. Ask the students to create a chart scale for distance.

3. Create a walk/bike plan to describe how a student could get to a friend's house.

4. Create a travel plan for getting to school.
### International Phonetic Alphabet

<table>
<thead>
<tr>
<th>Letter</th>
<th>Code</th>
<th>Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ALPHA</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>BRAVO</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>CHARLIE</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>DELTA</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>ECHO</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>FOX</td>
<td>TROT</td>
</tr>
<tr>
<td>G</td>
<td>GOLF</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>HOTEL</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>INDIA</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>JULIET</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>KILO</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>LIMA</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>MIKE</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>NOVEMBER</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>OSCAR</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>PAPA</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>QUEBEC</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>ROMEO</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>SIERRA</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>TANGO</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>UNIFORM</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>VICTOR</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>WHISKEY</td>
<td></td>
</tr>
<tr>
<td>X</td>
<td>X-RAY</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>YANKEE</td>
<td></td>
</tr>
<tr>
<td>Z</td>
<td>ZULU</td>
<td></td>
</tr>
</tbody>
</table>
Two Wings tower, November Two Zero Charlie Bravo over Guppy Lake at six thousand five hundred feet.

Roger, November Two Zero Charlie Bravo. Advise when over Mystery Marsh.
# Plan to Fly There

**Directions**
1. Look at the Aero-Chart Student Page and use it as a worksheet to help plan your trip.
2. Use the Aero-Chart to answer some of the questions on the flight plan below.
3. Fill in the blank spaces on the form to create a flight plan.

## Aircraft Identification
1. What is my airplane's number?

## Departure Time
2. What time will we leave?

## Departure Airport
3. From what airport will we leave?

## Route of Flight
4. How will we get there?

## Destination of Trip
5. Where will we land?

## Estimated Time En Route
6. How many hours will it take to get there?

## Arrival Time
7. What time will we land?

## Aircraft Color
8. What color is my airplane?

## Name of Pilot
9. What is my name?
Pilot's Flight Plan

Aircraft Number________________ Departure Time____________
Departure Point______________

Route of Flight________________________________________
Destination______________________________

Estimated Time En Route_____________ Arrival Time__________
Color of Aircraft____________

Name and Address of Pilot
____________________________________________________
**WE CAN FLY, YOU AND I**  
**INTERDISCIPLINARY LEARNING ACTIVITIES**

**Science**
- Create a classroom model of an airport terminal.
- Collect and interpret weather maps from the local newspapers.
- Discuss what kinds of science would be important for pilots to study and understand. Why?
- Discuss why weather is an important factor for aircraft to fly safely.
- List and discuss environmental concerns when constructing a new airport in any community.

**Mathematics**
- Discuss what the numbers on a runway mean.
- If traveling to different time zones, determine what the local time will be when reaching the destination.
- Make a graph comparing the distances flown by the rotor motor, bag balloon, and delta wing glider.
- Determine how many years elapsed between different time line events.

**Technology Education**
- Discuss technology that contributes to airport safety.
- Discuss the importance of computers on aircraft and in airports.

**Fine Arts**
- Make a mobile using aviation as a theme.
- Design or draw the layout of an airport.
- Design art that depicts what airports will look like in the future.
Social Studies

- Undertake a field trip to the local airport.
- Create an advertisement to market your privately owned airline.
- Debate possible locations for a new airport in your community.
- Research the history of your local airport.
- Invite airport employees, or pilots, to speak to students about their careers in aviation/aerospace.
- Discuss careers available in the aviation field.
- Interview airport employees.
- Research the development of airports. How have airports changed?

Language Arts

- Write an imaginary conversation between the control tower and pilot.
- Fill out a logbook as if you were a pilot for an airline.
- Role-play as a newspaper reporter at a major historical aviation event.
- Write a story about an aviation-related job.
- Imagine you are a pilot or navigator; you just completed an adventurous flight, and you are describing the flight for a television news program.

Health/Physical Education

- Discuss the feelings experienced when flying in an airplane.
- Determine how long it will take to walk or run the distance of a typical airport runway (.6 - 3.0 km).
- Determine how many students standing shoulder-to-shoulder it takes to equal the wingspan of these aircraft: 747 airliner (60.3 m wingspan), F-15 Eagle (13.2 m wingspan), and X-15 rocket airplane (6.8 m wingspan).