

Aerospace Concepts at the Elementary Level

The following material has been compiled and assembled to assist elementary teachers in the planning of teaching units in aerospace education. The subjects, concepts, and questions are typical of those incorporated in aerospace units at the elementary level. The arrangement of the material should by no means indicate that the concepts should be taught in that order.

Some of the general objectives of aerospace education are presented below as an introduction to this area of study and to further acquaint the elementary teachers with the rationale of incorporating aerospace concepts into the elementary curriculum.

General Objectives

Following are some important general objectives of aerospace education applicable at the elementary level.

1. To develop an awareness of the needs and implications of aerospace education and its impact on our society.
2. To seek to integrate aerospace education with all classroom activities.
3. To motivate and stimulate pupils' interest in and understanding of the scientific and social advancements being made by mankind as a result of aerospace research and development.
4. To develop the abilities to speak and write about aerospace education in a meaningful manner.
5. To motivate the child's interest in aerospace education through all subject matter areas.
6. To create an interest and appreciation on the part of the child for aerospace literature and related materials, and to assist him in the interpretation of these.
7. To prepare all students so that they may participate in a society strongly influenced by the growth of aviation and space exploration.
8. To furnish all students opportunities for career exploration in aerospace.
9. To establish a collection of aerospace materials available to both school and community.

Specific Objectives

I. Subject: History of Flight

Statement of the Problem: Children should gain a knowledge of the advancement of flight and space through the ages and the effects it will have on developing good democratic citizens by understanding the different facets involved and applying this knowledge to the activities occurring daily in our lives.

Concepts:

1. To realize that man's learning to fly was an adaptation of phenomena already existing in nature.
2. To develop an appreciation of the work of the pioneers of flight.
3. To realize that flight, as with any other scientific achievement, was not the product of one man's work.
4. To understand that the body of scientific knowledge enabling man to fly was accumulated gradually.
5. To realize that accomplishments in flight were delayed, and still are, by the need for developing new materials.
6. To understand the place of lighter-than-air craft in aviation.

7. To realize that space probes and rocket vehicles are a development from earlier forms of flight.
8. To understand the uses of aviation and spaceflights and the changes they have produced in modern life.

II. Subject: Air and Its Properties

Statement of the Problem: The earth is located at the bottom of an ocean of air called the atmosphere. Although we depend on the life-sustaining properties of air, children are only vaguely aware that it is a real substance.

Concepts:

1. Air has weight.
 - a. Can you see air? How does it feel?
 - b. Can you feel air? Does it ever feel different? When?
 - c. Is air real?
 - d. Can you prove that air has weight?
2. Air takes up every available space.
 - a. Does matter occupy space?
 - b. Do gases move freely?
3. Air pressure is all around you even though you may not notice it.
 - a. Does air exert force in all directions?
 - b. What would happen if there were no air around you?
 - c. Can you squeeze air? How does air fill a balloon? A bicycle tire?
4. Changes in temperature affect the properties of air.
 - a. Does warm air weigh more or less than cold air?
 - b. What takes place when air is heated and cooled?
 - c. In which direction does warm air move?

III. Subject: Weather and Flying

Statement of the Problem: Weather and its forecasting affect air and space travel.

Concepts:

1. Pilots need to know how weather affects flying.
 - a. What are ideal flying conditions?
 - b. Weather changes rapidly and unexpectedly. How do these changes affect flying?
 - c. Why must pilots be concerned about weather at their destination and points between?
2. Clouds help indicate weather conditions.
 - a. What is a cloud?
 - b. What are the four basic types of clouds?
 - c. What kind of weather does each type of cloud suggest?
3. Pilots depend upon information and forecasts obtained from the United States Weather Bureau.
 - a. How does a pilot check the weather before flying?
 - b. What is a low ceiling?
 - c. What is a poor visibility?
 - d. What is turbulence?
 - e. How do these conditions restrict flying?
 - f. What are the symbols used on weather maps for rain, snow and wind direction?
4. Certain clouds are the forerunners of particular weather conditions.
 - a. Which are the fair weather clouds? Storm clouds?
 - b. What is an updraft? How does it affect flight?
 - c. Why are some hailstones very large?
 - d. How does the temperature of the air over large bodies of land or water affect air movement in winter and summer?
5. Weather can be forecast and therefore flights can be scheduled.
 - a. How does a pilot check the weather before a flight?
 - b. What effect does weather have upon launching a space ship? An airship?
 - c. What are isobars and what do they tell us?
 - d. How are balloons used to collect weather information?
 - e. How are satellites used by the U.S. Weather Bureau?
 - f. How can a pilot protect himself against the dangers of turbulent weather?

Aerospace Concepts At The Elementary Level

- b. Where can they fly?
- c. How do they get into space?
- 4. Spacecraft usually travel in orbits.
 - a. What is an orbit?
 - b. How does gravity influence an orbit?
- 5. Different types of spacecraft have been designed to serve different functions.
 - a. What are the two basic kinds of spacecraft?
 - b. What is the main design difference between these types of craft?

IX. Subject: The Solar System

Statement of the Problem: Man studies the nature of the universe.

Concepts:

1. The sun is at the center of the solar system.
 - a. How do planets revolve about the sun?
 - b. How are the nine planets of our solar system varied?
 - c. What is now known of the earth's satellite, our moon?
2. As Man's methods and tools of observation improved, his estimate of the size of the universe increased.
 - a. How far is it to the moon? to the sun?
 - b. How do the moon and earth compare in size?
 - c. How do the sun and earth compare in size?
 - d. What is a light year? an astronomical unit?
3. Our universe is constantly changing.
 - a. Why can we see the Big Dipper all year and the other stars only in some seasons?
 - b. Why does the moon have different shapes?
 - c. What tools or instruments are used by the astronomers to observe the universe?
 - d. What changes does a star go through as it develops from a very young to a very old star?

X. Subject: Man and Space

Statement of the Problem: Man is learning to live in a space environment.

Concepts:

1. Space has very little or no atmosphere.
 - a. What do astronauts breathe?
 - b. How does the lack of air affect the astronaut's performance in space?
 - c. How does an air-tight suit protect the astronaut from the extreme temperatures?
2. Decreasing gravity produces a less measurable weight.
 - a. What happens under weightless conditions?
 - b. Why is the astronaut strapped in position?
 - c. How does he eat, drink, exercise and sleep?
3. The children of today may be tomorrow's astronauts.
 - a. What training is necessary?
 - b. Why is good health important?
 - c. Could you be an astronaut?

XI. Subject: Problems of Space Travel

Statement of the Problem: Many of the problems of space travel occur because of man's inherent needs.

Concepts:

1. Some provision must be made to handle emergency or temporary medical and dental needs on spacecraft.
 - a. How much training would be necessary for the astronauts to handle their own emergency medical and dental needs?
 - b. What medical supplies would need to be aboard?
 - c. Can man use ordinary remedies like aspirin in space? What effect does the weightless state have on man's use of medicines?
2. Man must devise ways of supplying food and water for long periods of time in a limited space.
 - a. Why is it difficult for man to use the same forms of food in space that he eats on earth?
 - b. How much food and water would be required for a journey of two weeks? two months? one year?
 - c. What are some ways that this food and water might be supplied?
 - d. How might forms of algae be used to supply food?
 - e. What are the advantages of freeze-drying food?
3. Man must learn to take care of his sanitary needs such as defecation, urination, and the control of odors in the small spacecraft.
 - a. Why are odors a serious problem in space?
 - b. What provision is made for the waste of the body?

4. Many psychological problems face man as he explores space.
 - a. How does isolation from other human beings in a small space affect man's emotional well-being?
 - b. Does man become more tired as he works in a weightless condition? Of what importance is fatigue as a factor in hindering or benefiting work in space?
 - c. How are astronauts trained to overcome these psychological problems?
5. The clothing that man wears in space is important to his well-being.
 - a. What are the best materials to use for space clothing?
 - b. What are the purposes that clothing must serve in space besides the obvious one of covering the body?
6. Radiation affects man's travel in space.
 - a. Why is a careful study of the sun's radiation important to space travel?
 - b. Which types of radiation could be harmful to man? How? Which could be beneficial? How?
 - c. What methods could be used to protect man against radiation in space?
 - d. What effect has radiation on the growing of food?
7. Man must re-orient himself and his environment to problems of weightlessness.
 - a. What is g-force?
 - b. What are the effects of weightlessness on the body? How has the acquired knowledge of g-forces helped in coping with the problems of weightlessness?
 - c. How will man be able to use weightlessness to his advantage in space?
 - d. What adaptations must be made of man's normal environment to exist and work in a weightless state, as in space stations?
8. An object in space experiences constant changes in temperature.
 - a. What effect does the variance of temperatures in space have on man and his experiences in space?
 - b. What effect does water vapor have on man's tolerance of heat in space?
9. Re-entry into the atmosphere is one of the most critical phases of man's return to Earth.
 - a. What equipment and methods are used to slow the craft down for re-entry?
 - b. How wide, for example, was the safe re-entry corridor for Apollo?
 - c. What has been done to protect the crew from re-entry temperature?
 - d. What will happen if a spacecraft fails to enter the re-entry corridor?
 - e. What is man doing to solve the problem of radio blackout which occurs as a vehicle enters the atmosphere after a spaceflight?

XII. Subject: Living in Space

Statement of the Problem: Man is studying the possibility of extraterrestrial life.

Concepts:

1. Factors that determine life as we know it are atmosphere, gravity, temperature, and geology.
 - a. What is life?
 - b. What are the conditions necessary for life?
 - c. How does our atmosphere protect life on earth?
 - d. What is gravity?
 - e. What effect does gravity have on our atmosphere?
 - f. How does gravity affect you?
 - g. How are we learning more about our earth and atmosphere?
2. Much knowledge is being learned about our earth and other heavenly bodies from satellites, probes, and man's journeys into space.
 - a. How have satellites helped in the study of weather?
 - b. What information have the satellites relayed to us about the earth's shape?
 - c. How are the satellites helping map makers?
 - d. What have we found out about the moon from our satellites?
3. The possibility of life on other planets is being studied.
 - a. Is there life anywhere else in the universe?
 - b. How have we learned about other planets?
 - c. What have our satellite probes told us about Venus and Mars?
 - d. How do distances from stars affect the chances that life exists on the planets?
4. Man must develop space stations, space ferries, and space ships in order to further his exploration of the universe.
 - a. What is the purpose of a space station?
 - b. How can a space station be designed and constructed?
 - c. What equipment must a space station contain?
 - d. How can people and supplies get up to the space station?
 - e. What provisions can be made for maintaining man's environment inside a space station?