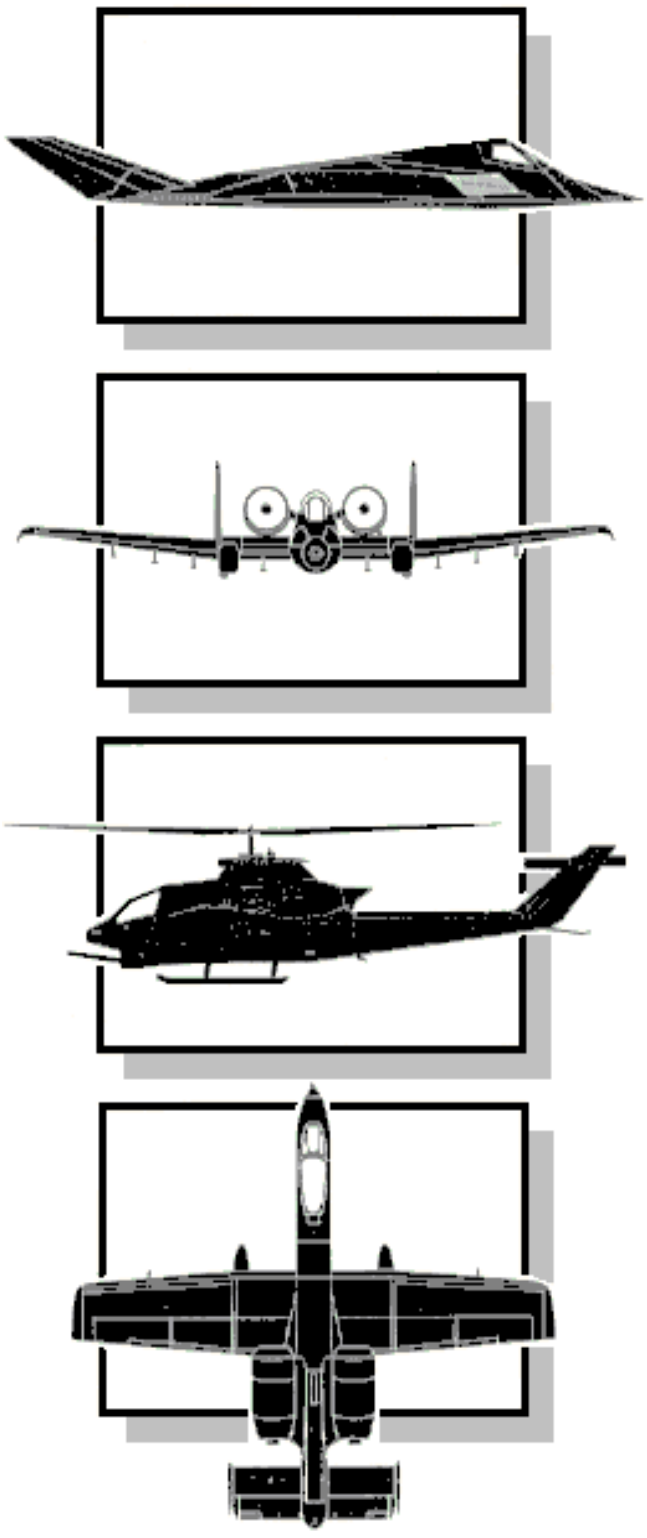

Flight And Aviation

SECONDARY SCHOOL

AN AVIATION CURRICULUM GUIDE

Edited by:
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Department of Transportation
Federal Aviation Administration
Office of Human Resources and Management
Washington, D.C. 20591

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ACKNOWLEDGEMENTS

To the Reader,

The Federal Aviation Administration is pleased to present four educational documents designed for teachers on aerospace education. They are directed to elementary and secondary schools. The documents are:

Future Aspiring Aviators: Primary K-3
Flying Ace Activities: Middle Grades 4-6
Fostering Aviation Activities: Junior High 7-8
Flight and Aviation: Secondary 9-12

We extend accolades to Northeastern Illinois University, Chicago, Illinois for the assistance and support in this project. We wish to recognize and applaud NEIU President, Dr. Gordon H. Lamb for his vision, enthusiasm and encouragement regarding the appointment of professor Margaret R. Lindman, Ed.D. to spearhead this project, at our request.

We are also pleased that the Chicago Teachers Center, a branch of NEIU's College of Education, which services teachers schools and school districts in and around the Chicago metropolitan area is now an FAA Resource Center.

Margaret R. Lindman, Ed.D., is a professor in the department of Curriculum and Instruction at Northeastern Illinois University, Chicago, Illinois. Dr. Lindman has been a teacher educator for more than 35 years. She is well known for her work in aviation and aerospace education. She conducts a Wings and Space Institute for educators at Northeastern yearly and has made presentations at many other aviation-related workshops and conferences. Formerly, Dr. Lindman was a captain in the Civil Air Patrol and also External Aerospace Education Officer for the Illinois Wing, C.A.P. Dr. Lindman was the advisory editor for the Tangley Oaks Publishing Company for many years and has written numerous articles and documents for educational publication.

Dr. Lindman's charge was to update, streamline, and modify former curriculum documents of the Aviation Education Division, FAA. The documents included Aviation Science Activities for Elementary Grades, Aviation Curriculum Guide for Middle School Level, Secondary School Level, and a Model Aerospace Curriculum, by Aimee Dye, and the August Martin High School by Mervin K. Strickler, Jr. These earlier documents continue to be available and may be accessed by computer.

Dr. Lindman retained the essence of the earlier documents in the revision. Much of the material in the current documents is based on the works of Mervin K. Strickler, Jr., Ed.D., who has been the foremost authority on aerospace education for the past 35 years.

Because these publications are aimed at teachers, Dr. Lindman felt it essential to involve teachers from the beginning development and organization of the materials through the field testing phase. Therefore, she enlisted the aid of Rosamond D. Hilton, formerly of the Chicago Public Schools, Chicago, Illinois, to act as her assistant throughout the project.

Dr. Lindman organized a project writing committee with the assistance of School District #187, North Chicago, Illinois. The former Director of Academic Affairs, Ms. Roycealee J. Wood, took the lead district-wise. She arranged for biweekly half day meetings between teachers, Dr. Lindman and Mrs. Hilton. She sat in on work groups and saw that necessary materials were distributed.

The faculty members on the committee were DeloresClark, Science Consultant, and classroom teachers Dorothy Ashby, Ethel Booker, Ronald Carlson, William Petrosky, Ann Sanders, and Lawrence Sorenson.

The committee decided that there should be a total of four documents: early childhood, middle grades, junior high, and secondary. This would act as a target for teachers. Those that have gifted classes might decide to move up a level, those dealing with less able students might decide to use the lower level. The documents emphasize science and mathematics, although some language arts and social studies and other activities are included. After dividing into grade level teams, the committee under the supervision of Dr. Lindman and Mrs. Hilton evolved their own approach to the development and presentation of the individual documents. Therefore, each document has its own unique aspects while some threads run throughout all of them.

When the documents were completed they were reviewed by a team of educators from Northeastern Illinois University, who made additions, deletions, and recommendations. The University FAA Publications Committee consisted of Harvey Barrett, Ed.D., science educator, Janet Bercik, Ed.D., Clinical Experiences Director and supervisor (elementary and secondary), Elizabeth Landerholm, Ed.D., early childhood specialist, and Jill Atthage, MLS librarian.

Finally, the documents were field tested under Dr. Lindman's supervision. Our thanks to all those North Chicago District #187 teachers who participated in the 10-week field test.

It is our hope that these documents will be beneficial to teachers throughout the country as we are propelled into the 21st century.

Sincerely,

Phillip S. Woodruff

Director, Office of Human Resource Management

INTRODUCTION

The Federal Aviation Administration (FAA) is charged with the responsibility of educating the public regarding the role of aviation as it affects our every day lives and our nation's leadership in the world. As part of that responsibility, the FAA publishes materials for use by educators and others involved in the instruction of our youth.

This curriculum guide Flight And Aviation; Secondary School, is the fourth in a series of four. The others in the series are Future Aspiring Aviators; Primary Level, Flying Ace Activities; Middle Grades, and Fostering Aerial Activities; Junior High School.

This guide is for a teacher who has had little or no training in aviation education but who has some working knowledge of science and/or mathematics or other pertinent content areas.

This guide will indicate how basic principles in various content areas can be taught in the context of the reality of aviation and flight. The guide is divided into two sections. Section A presents a sample course outline and sample unit outlines. The units can be used individually as they fit into various content areas or as a whole.

General objectives are stated, content is outlined and a list of appropriate activities is presented as well as vocabulary lists.

Section B is a description of aviation/aerospace magnet schools, focusing on the August Martin Magnet School. This could serve as a model for other such schools and indicates how aerospace education can be integrated into many phases of the curriculum. There is a bibliography, list of aerospace education secondary schools and sources of assistance.

PHOTO OF CONCORD

PHOTO OF F16 (TOP GUN PLANE)

PHOTO OF BEECHCRAFT STARSHIP 1

SELECTED AEROSPACE TOPICS IN CURRICULUM CONTEXT

Often educators who teach about aviation and space education are challenged by administrators, other teachers and parents who question the validity of such study. The following list indicates just some of the specific ways this topic interrelates with traditional studies.

How they are built is INDUSTRIAL ARTS

Where they fly is GEOGRAPHY

Who controls them is GOVERNMENT

Who made them fly is HISTORY

What they cost is ECONOMICS

How they fly is SCIENCE

Where they land is SOCIAL STUDIES

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Economic implications
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Inertial guidance
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Ground control approach
Morse Code
Phonetic alphabet
Terminology of aerospace

AVIATION/AEROSPACE EDUCATION DEFINED

As you begin to read this publication, the questions of "What is Aviation Education?" and "Why is Aviation Education necessary?" undoubtedly cross your mind. An early definition of aviation education was formulated by Dr. Mervin K. Strickler, Jr. in 1951:

> "Aviation education is that branch of general education concerned with communicating knowledge, skills, and attitudes about aviation and its impact upon society. Aviation education may be formal or informal, that is, it may be organized in school and college curriculums or it may be undertaken by agencies devoted to informal rather than to formal education--agencies such as newspapers, magazines, the radio, television. One must therefore distinguish between formal aviation and informal aviation education."

A recent issue of the FAA Administrator's Fact Book describes aviation and aerospace education as follows:

WHY? When we consider that in the United States alone a half million people board commercial airlines on a typical day; or that scheduled airlines this past year carried well over 200 million people -- the equivalent of the entire U.S. population; or that there are nearly 200,000 general aviation aircraft, 18,000 airports, and some 700,000 pilots (of that 6% are women), or that there are nearly one million people employed in the aerospace industry; or that our aerospace foreign trade balance, which was $7.8 billion last year was 70% of the total U.S. trade balance; or that the exploration and exploitation of space are benefitting mankind in so many more ways than anyone thought possible, then we begin to understand the sociological and technological importance of an aviation and space education.

Aerospace education is based on the belief that everyone -- our students and the public at large -- should:

(a) understand and appreciate the enormous impact that aviation and space have on our lives; (b) understand and be aware of the many vocational and career possibilities related to the aviation and space industry; and (c) understand and appreciate the potential of aviation and space to serve mankind and to improve our daily lives and our growing society.

WHAT IS IT? Aerospace education means many things to many people. To some, aerospace education means air age, aviation, or aeronautical education... to others, it means space or astronautical education ... some see it as futuristic education. They propose that we utilize the energy of the young men and women who wrote over 4,000,000 letters to save the Star Trek television series and help them plan for their future...

Others speak of aerospace education in terms of "specialized," "general," "basic," or "relevant" education. Some see aerospace education as specialized education, such as aerospace engineering, or aerospace technology, or aerospace management. Still others see it as flight training or courses in aviation mechanics. Others see it as very specialized education, such as astro-training. One national organizaton defined aerospace education as general education and excluded any specialized education or training efforts. In the general education programs, students visit airports and other aerospace facilities to learn more about aviation and space. They study the impact of aerospace on the social,

economic, and political aspects of our society.

Other educators see aerospace education as basic education, or as using aerospace as a motivating and meaningful medium through which to teach the basic academic subjects. They take advantage of the interests that students have in aviation and space to teach such basic subjects as geography, English, mathematics, science, physical education, music, industrial arts, business, and so forth. In a three-year research project in California, teachers and curriculum consultants developed useful aviation education materials at every grade level relating to the teaching of economics, sociology, and anthropology. Because aerospace is interlocked with so many areas of study, plans which emphasize aerospace in the curriculum at all age levels are valid.

Finally, there are educators who agree that, no matter how aerospace education is viewed, it is relevant education. Comments such as the following illustrate this viewpoint: "Student enthusiasm for the aerospace course greatly outweighs anything I have experienced in any other class. This is particularly due, I believe, to something we are hearing a great deal about today -- relevancy. Aerospace is a relevant course. Students relate to it because it is a practical application of the things they learn or are learning in their other subjects.

Still another viewpoint of aerospace education centers around spontaneous pupil interest in aircraft, rockets, and space vehicles -- special interest that can lead them into exploratory activities that will help them understand their complex age and to assume responsibility for improvement of everyday living.

Aviation and space education is a means for the school to meet its responsibility to provide career guidance and education for vocational competence. The aerospace industries, government agencies, air transport industries, and general aviation (expanding because of aviation and space development) require the services of several million trained people.

Aviation and space education also serves as an integrated curriculum, organized around a major interest employed as a frame of reference. Through the enrichment approach, standard course offerings are supplemented with pertinent aspects of aviation and space sciences, which are major factors in many general study units.

Aviation and space education have been established as proper disciplines of curriculum, meeting one or more of the seven cardinal principles of public education -- by endorsement, by accreditation, and by experience. Every state has approved courses in aviation and space education or has given full authority for their inclusion in the curriculum.

SECTION A

SAMPLE COURSE OUTLINE

The following outline is an example of a two-semester elective general aerospace education course of 36 weeks.

I. Introduction to Aerospace (3-4 weeks)

A. Preview: Introduction; The Aerospace Age

B. Aviation; Astronautics

C. The Impact of Aerospace; Progress; The Aerospace Manufacturing Industry

D. The Air Transport Industry; Industry and Aerospace Affairs

E. General Aviation; Military Aerospace Power; Aerospace Research

F. Education for the Aerospace Age; Aerospace Age Careers.

G. Summary

II. Theory of Flight (6-8) weeks

H. Preview; Introduction; Purpose

I. Wind and Wing; Newton's Laws; Bernoulli's Principle

J. Forces of Flight; Density; Wing; Angle of Attack; Lift; Drag

K. Throttle, stick, and rudder; Stability: Maneuvers; Gusts; Load Factors

L. High-Speed Flight; Shock Waves; Design; Aircraft Structure; Flight Control Members

M. Hydraulic and Electrical Systems; Aircraft Instruments

N. Station Numbering; Weight and Balance

O. Summary

III. Aircraft Powerplants (5-7 weeks)

A. Preview and introduction to AC power plants, review of physics of simple machines; energy and its use in the powerplant

B. Internal combustion engines; turbojet engines; experimental engines

C. Aircraft systems; carburetion system; fuel injection system; the supercharger

D. Powerplants and electrical systems; starter; ignition; magneto; condenser; distributor; solenoids

E. Heat energy and mechanical energy horsepower; fuel

F. Lubrication and cooling; reduction of friction; oil systems; cooling-air and liquid

G. The propeller; thrust; fixed pitch; variable pitch; hydraulic props; electrical props

H. Instruments and controls; pressure and temperature gauges; remote indicating systems; engine control systems

I. Summary

II. Airports, Airways, and Electronics (5-7 weeks)

A. Preview of unit; Airport growth and Development; Airport Marking System

B. The charting of airports and airways; Charts; Symbols and information; Airport classification

C. Electronics and aviation; Induction; Transfer of Electrical energy; Magnetism; Radio-Frequency; Waves; Transformers; Tubes; Stages of transmission; Future electronics

D. Importance of Airports; Operation, Airport administration; Airport services; Air traffic control; Supplemental airlines; Government operations

E. Air traffic control facilities; All weather flight; Radio aids and electronic devices; Traffic control; Instruments; Dependency of Aircraft on Electronics

F. Regulation of air traffic, Part I

G. Regulation of air traffic Part II; Visual Flight Rules (VFR); Instrument Flight Rules (IFR)

H. Summary

III. Navigation and Weather (5-7 weeks)

A. Introduction; Weather and flying; Types of navigation

B. Time; Distance; Direction; Longitude and Latitude; Maps - Projections, Characteristics, Use; Magnetic influences; Navigation charts and instruments; Global Positioning Satellites (GPS)

C. Pilotage

D. Dead reckoning

E. Radio flight and celestial navigation; Four-course radio range in navigation; Radio navigation instruments; Celestial navigation; Global Positioning Satellites (GPS)

F. The weather

G. Air masses, fronts, and weather hazards; Weather reports

H. Summary and critique of problems

IV. The Challenge of Aerospace Power (4-6 weeks)

A. Introduction; Nature of Aerospace Power; Elements of Aerospace strength; Factors of aerospace power

B. Military aerospace counter-force capability

C. The aerospace industry

D. Airline transportation; Civil and military relationship and control; public services; revenue

E. Airports and community needs; Advantages; Problems

F. Research and development organization; Progress problems; Future development; Space medicine

G. Education and aerospace power; Definition; Importance

The elective course is given substance and meaning through practical activities such as:

1. Field trips to aerospace industries and flying activities.

2. Orientation flights in civil aircraft and/or flight simulations

3. Communications instruction and practice.

4. Visits to military installations.

5. Visits to space centers.

6. Use of resource personnel and materials from national organizations associated with aviation, space, and the military.

7. Visits to planetariums, observatories and museums.

SAMPLE UNIT OUTLINES

The following unit outlines focus on several aspects of aviation and could be appropriately included in a variety of courses, such as social studies, science, mathematics, etc. They can be used individually or in combination. General objectives, content topics, suggested student experiences, activities, demonstrations, and vocabulary are presented.

UNIT I: HISTORY OF FLIGHT

This unit is designed to help each pupil:

1. Realize that our learning to fly was an adaptation of phenomena already existing in nature.

2. Develop an appreciation of the work of the pioneers of flight.

3. Realize that flight, as with any other scientific achievement, was not the product of one person's work.

4. Understand that the body of scientific knowledge enabling human flight to fly was accumulated gradually.

5. Realize that accomplishments in flight were delayed, and still are, by the need for developing new materials.

6. Understand the place of lighter-than-air craft in the scope and history of aviation.

7. Realize that space probes and rocket vehicles are a development from earlier forms of flight.

8. Understand the uses of aviation and spaceflight and the changes they have produced in modern life.

OUTLINE OF UNIT CONTENT

Early legends of flight

1. Daedelas and Icarus
2. Chinese Emperor Wan Ho
3. Archytas
4. Pegasus and Perseus

B. History of lighter-than-air aircraft

1. Early Developments
   a. Montgolfier Brothers
   b. Pilatre de Rozier
   c. Professor .A.Charles
   d. Charles Pierre Blanchard
   e. Henri Giffard
   f. Alberto Santos-Dumont

g. Count Ferdinand Von Zeppelin
h. The Piccard family

2. Designs and Models
a. Sir George Cayley
b. C.F. Meerwein
c. Pierre Blanchard
d. Clement F. Ader
e. Passenger carrying

3. Uses of balloons, blimps, and dirigibles
a. Novelty
b. Warfare
c. British R-34
d. Dixmude
e. Shenandoah
f. Graf Zepplin
g. Akron and Macon
h. Hindenbrug

C. History of heavier-than-air aircraft

1. Non-powered aircraft.
a. Early gliding flights
(1) Besnier
(2) Jean Marie LeBris
(3) Otto Lilienthal
(4) Percy Sinclair Pilcher
(5) John J. Montgomery

b. Modern gliders

(1) Troop and Cargo carrying
(2) Sport gliding and soaring

2. Powered aircraft

a. Early designers
(1) Sir George Cayley
(2) Octave Chanute
(3) Clement Ader
(4) The Wright Brothers
(5) Samuel Pierpont Langley
(6) The Aerial Experiment Association
(7) Louis Bleriot
(8) Others

10. Aircraft development during World War I

A. Technical advances
(1) Zeppelin air raids
(2) Synchronized machine guns
(3) Aircraft airframe and engine advances
B. The Aces
(1) Edward Rickenbacker (American)
(2) Edward Mannock (English)
(3) William Bishop (Canadian)
(4) Rene Paul Fonck (French)
(5) Baron Manfred von Richthofen (German)

11. Aviation development following World War I
A. Establishing records and first in aviation
(1) National Advisory Committee for Aeronautics formed (1915)
(2) U.S. Air Mail

Service (1918)
(3) Navy NC-3 crosses the Atlantic (1919)
(4) Alcock and Brown fly non-stop over the Atlantic (1919)
(5) First flight around the world (1924)
(6) Byrd and Bennett fly over the North Pole (1926)
(7) Lindbergh flies solo from New York to Paris (1927)
(8) Pan American opens Clipper service to the Orient (1935)
(9) Amelia Earhart lost in the Pacific (1937)

b. Barnstormers and aerial acts

c. Air races
(1) Pulitzer Trophy Races
(2) Schneider Cup Races
(3) The National Air Races
(4) Thompson Trophy Races
(5) Bendix Trophy Races

5. Development of airpower during World War II

a. Technical advance-ments
(1) High-speed fighter aircraft
(2) Long-range
(3) Aircraft production techniques
(4) Jet engines and aircraft
(5) Weapons systems
(6) Reconnaissance equipment
(7) Aviation electronics
(8) Missiles-German V-1 and V-2

6. Development since World War II

II. SUGGESSTED STUDENT EXPERIENCES AND ACTIVITIES

1. Read biographies of famous early fliers and report to the class.

2. Compile a record of famous "firsts."

3. Chart the development of aviation.

4. Obtain "genealogy" charts from such aviavion companies as Piper, Cessna, Beechcraft, Boeing, and others, and observe the development of their aircraft.

5. Prepare a bulletin board illustrating the history of aviation.

6. Prepare a bulletin board or other type of display of materials concerning the Wright Brothers.

7. Write an imaginary newspaper account of a famous first flight.

8. Construct model historical aircraft and/or spacecraft.

9. List major contributions to aviation made by various countries of the world.

10. Read the stories of such famous WWI planes as: France -- Nieuport, Spad, Breguet, Salmsen, LePere. England --Bristol Avro, Sopwith, De

Havilland, Handley Page. Italy -- Caproni. United States -- Curtiss JN-4 Jenny. Germany -- Taube, Albatros, Fokker, Rumpler, Pfalz, Halberstadt, LVG, Gotha.

11. Read and report on the stories about some of the famous aces, such as Von Richthofen, Rickenbacker, Lufbery, Fokker, and others.

12. Prepare an exhibit of materials, items, and pictures of Lindberg's flight.

13. Trace the development of the gasoline engine from the rotary engines, such as the Gnome rotaries, through such famour engines as the Salmsen, Anzani, three-cylinder Lawrence, OX-5, and the Liberty, to the Wright and Allison engines.

14. Trace the development of the jet engine to the modern-day turbofans.

15. Trace the history of rocket propulsion beginning with the Chinese to the present including Robert H. Goddard, the "father" of modern rocketry.

16. Plan a flight using only the instruments available in early days.

17. Trace the history of airmail both in the United States and in other countries.

18. Learn all about the early night flights and early instrument flights.

19. Learn about famous women fliers; Baroness de la Roche, Harriet Quimby, Ruth Oliver, Amelia Earhart, Jacqueline Cochran, Jerrie Mock, Joan Merriam Smith, and Betty Williams.

20. Make an exhibit of airmail stamps, first flight covers, and stamps commemorating famous aviation events.

21. Display pictures of early designs for flying machines such as those of da Vinci, early gliders, balloons, and all types of powered aircraft from the Wright Brothers to modern times.

22. Make models of early type gliders.

23. Make or display a time line depicting aerospace events during mankind's history.

24. Report on the latest development in rockets.

25. Investigate the history of aviation in your state.

26. Make a scrapbook of current events in aviation and space.

III. VOCABULARY

aerobatics
aerodynamics
Apollo
autogiro
balloon
biplane
blimp
centrifuge
flight simulator
gas turbine
glider
Gemini
helicopter
Mercury
monoplane
ornithopter
parasol wing
reaction engine
reciprocating engine
rocket
Rogallo wing
rotary engine
rotocraft
trimotor
triplane
turbofan
turboprop
satellite
space capsule
space probe

UNIT II: PRINCIPLES OF FLIGHT

This unit is designed to help each pupil:

1. Realize that flight is possible only within the framework of scientific principles.

2. Understand the relationship of scientific principles to the various types of aircraft design.

3. Understand the forces acting on aircraft in flight.

4. Understand the function of the controls and their relationship to aircraft performance.

5. Understand the meaning of force, energy, and power.

6. Understand how explosive energy is converted into useful work.

7. Understand the major principles involved in aircraft propulsion.

8. Develop sufficient knowledge of aircraft structure, controls, and propulsion, and to be reasonably informed on principles of light.

I. OUTLINE OF UNIT CONTENT

A. Aircraft classification by flight principles

1. Lighter-than-air craft
2. Gliders
3. Rotocraft
4. Airplanes
   - a. Prop type
   - b. Jet
     - (1) Ramjet
     - (2) Turbojet
     - (3) Turboprop
   - c. Rocket
   - d. V/STOL

B. Structure of the Aircraft

1. Wings
2. Fuselage
3. Empennage
4. Powerplant
5. Landing gear

C. Forces acting on the airplane

1. Lift
   - a. Bernoulli's principle
   - b. Venturi tube
2. Gravity (g forces)
3. Thrust
4. Drag
5. Torque (Newton's Third Law of Motion)

D. Function of the controls

1. Ailerons (roll)
2. Elevator (pitch)
3. Rudder (yaw)
4. Trim tabs
5. Flaps
6. Propeller (thrust)
   - a. Throttle
   - b. Pitch control
7. Brakes
   - a. Wheel
   - b. Air
     - (1) Flaps
     - (2) Engine (jet)
     - (3) Engine propeller
     - (4) Dive brakes

(5) Drag chute

E. Aircraft engines

1. Reciprocating

a. Operation (four-stoke cycle)
b. Controls
(1) Mixture
(2) Throttle
(3) Prop
(4) Carburetor heat
(5) Magnetos
c. Instruments
(1) Tachometer
(2) Mainfold Pressure
(3) Oil pressure
(4) Cylinder head temperature
(5) Carbueretor air temperature

2. Jet (Newton's Third Law of Motion)

a. Operation
(1) Compressor
(2) Combustion chamber
(3) Turbine
b. Instruments
c. Thrust reversors

3. Rocket (Newton's Third Lawof Motion)

a. Liquid fuel
b. Solid fuel

4. Nuclear

6.. Ion

II. Suggested Student Experiences, Activities, and Demonstrations

1. Visit a local airport and report your observations to the class.

2. Demonstrate a model plane: show thrust, pitch, yaw, and roll and the forces acting on an aircraft.

3. Construct a wind tunnel and wing sections of different shapes.

4. Demonstrate Archimedes' principle with helium-filled balloons and weights.

5. Demonstrate Bernoulli's principle by blowing through a funnel that has a ping pong ball in it.

6. Demonstrate and explain the principles involved in throwing a "curve" ball.

7. Determine several ways in which you could demonstrate Newton's Third Law of Motion.

8. Demonstrate the principle of a rocket through the use of carbon dioxide cartridges.

9. Demonstrate the effect of drag on variously shaped bodies.

10. Make a model of one type of reaction rocket.

11. Show that the reaction principle operates in a vacuum with the use of a balloon, bell jar, and vacuum pump.

12. Use an electric fan on a small wagon to demonstrate thrust.

13. Pass a model plane around the class. Have each student point out a different part of the model plane and name it.

14. Make a list of terms used in naming the parts of a plane; define the terms.

15. Identify parts of a plane according to function; describe the function.

16. Demonstrate Bernoulli's principle by blowing over a strip of paper.

17. Construct a paper glider and operate it with ailerons set at different positions. Repeat with rudder and flaps in different positions.

18. Demonstrate the effects of center of gravity on flight performance by moving the wings of a balsa glider back and forth in the slot and/or by adding paper clips at various positions.

19. Collect and exhibit plant seeds that "fly." Explain the science principles that are involved.

20. Collect and exhibit model planes and gliders.

21. Demonstrate comparative strengths of construction (i.e., truss, semimonocoque, honeycomb, etc.).

22. Demonstrate Bernoulli's principle by placing a common pin through a small piece of cardboard and inserting it into one end of the hole in a spool. Blow through the other end. Observe and explain the result.

23. Make a model of a jet and a reciprocating engine. Explain their operations to the class.

24. Make a report on different types of V/STOL aircraft.

25. Identify Lift as the force that opposes gravity. Identify Drag as the force that opposes thrust.

26. Demonstrate a dihedral construction and its relationship to rolling stability by use of cardboard gliders.

27. Display pictures of successful and unusual plane designs.

28. Demonstrate principle of auto-rotation with paper helicopter. (Slit rectangular piece of paper halfway down, fold and warp those ends and place a paper clip on unslit end.)

29. Have contest with class members using paper gliders to show how adjustments of surfaces control flight.

30. Use auto engine model to demonstrate four-stroke cycle engines.

31. Investigate nuclear propulsion possibilities of aircraft.

32. Report on methods of starting airplane engines.

33. Demonstrate a simple speedometer by rotating a small tin can floatingin a slightly larger tin can which is floating. Relate principles involved to tachometer.

34. Construct different propeller pitches. Explain advantages of each.

35. Relate tachometer reading to air-speed indicator reading in level flight, a dive, a climb, and a stall.

36. Report on principles involved in variations of propeller pitch.

37. Demonstrate with a rubberband-powered airplane model how vertical stabilizer must be offset to counteract the effect of propeller torque.

38. Report on types of deicers and the principles they employ.

39. List safety features incorporated into the design and structure of the airplane.

40. Make a scrapbook on a phase of aviation.

41. Report on man's ingenuity in adopting landing gear to various geographical conditions.

42. Illustrate on the blackboard the stresses on an airplane in flight.

43. Draw an instrument panel for a small plane and describe the function of each instrument illustrated.

III. POWER FOR FLIGHT ACTIVITIES

A. Internal Combustion Engine: Engines that burn the fuel mixture within the engine. Also known as the reciprocating engine.

1. Define the term internal combustion.

2. Make a list of other devices that use internal combusion engines: cars, lawn mowers, boats, airplanes, etc.

3. Demonstrate the action of a reciprocating engine by comparing it to movements involved in riding a bicycle.

4. Make a study of the strokes in a piston engine.

5. Construct a simple engine motor model.
   a. air intake
   b. combustion chamber
   c. exhaust outlet

6. Discuss the function of a carburetor.

7. Make a model to show the action of a carburetor.

8. Make a diagram of an internal combustion engine.

9. Make diagrams showing the four-stroke engine.

10. Report on the types of propellers

B. Jet Engines: Engines that provide thrust based on the principle of equal opposite reaction to action.

1. Jets provide thrust with reaction engines.

2. Review Newton's Third Law of Motion.

3. Inflate a balloon and suddenly release it. Discuss result.

4. Make a drawing of a ramjet engine.

5. Discuss the functions of the sections of a ramjet engine.

6. Compare the functions of a ramjet to the five-cycle event of a reciprocating engine.

7. Make a drawing of a turbojet.

8. Compare the turbojet to the ramjet engine.

9. Discuss the purpose of the turbine and the compressor.

10. Make a drawing of a turbojet.

11. Compare the turboprop engine to the turbojet.

12. Explain the action of the propeller in a turbojet.

13. State some differences in a turbine engine and a reciprocating engine.

14. Explain how the amount of thrust is measured in jets.

15. Name four types of jet engines and the advantages of each.

C. Rocket Engines: A reaction engine which operates on the same principle as the jet engine. The rocket carries its own fuel and oxygen (oxidizer).

1. Discuss the early history of rockets.

2. Discuss uses of rocket engines; experimental aircraft, satellites, space exploration.

3. Discuss the function of:

    a. combustion chamber
    b. exhaust nozzle

c. liquid fuel intake

4. Discuss fuel mixture for the liquid fuel rocket.

5. Discuss the propellant in solid fuel rockets; its composition and shape.

6. Determine the purpose for building rockets in stages.

7. Discuss ways that jets and rockets are alike.

8. Discuss ways that jets and rockets ard different.

9. Construct model rockets from kits.

10. Obtain a launch pad and hold a rocket launch.

VI. VOCABULARY

Acceleration
aerobatics
aileron
airfoil
airspeed
airworthiness
altimeter
angle of attack
angle of incidence
artificial horizon
altitude
automatic pilot
axes of an aircraft
bank
Bernoulli's Principle
burble point
camber
carburetor
center of gravity
drag
elevator
empennage
feathering
flap
fuselage
g force
horsepower
inertia
landing gear
leading edge
left
Link trainer
load
manifold pressure
Newton's laws
oscillation
pitch
propeller
pulse jet
ramjet
relative wind
roll
rudder
spoiler
stability
stabilizer
stall
supercharger
tachometer
thrust
trailing edge
trim tab
Venturi tube
yaw

UNIT III: REALMS OF FLIGHT

This unit is designed to help each student:

1. Develop a fundamental knowledge of the causes and effects of weather.
2. Understand motion and pressure relationships.
3. Understand the vertical and horizontal flow of air and the effects on stable flight.
4. Understand the various changes of moisture control and the visual and mechanical problems involved with flying in moisture-laden air.
5. Decode weather information accumulated from various weather stations.
6. Understand how instruments are used for calculating and predicting weather conditions.
7. Be aware that there are unpredictable weather conditions that affect light.
8. Understand that different conditions exist in rarefied air and the vacuum of space.

I. OUTLINE OF UNIT CONTENT

A. Atmospheric conditions

1. The nature of air
   a. Two arbitrarily named flight layers.
      (1) Troposphere
      (2) Stratosphere
   b. Gaseous composition
      (1) Nitrogen, oxygen, carbon dioxide, and inert gases.
      (2) Density-altitude relationship.
2. Air pressure
   a. Depends on
      (1) Altitude-1 in/1000ft.
      (2) Temperature - 3 1/2 degrees F/1000 ft.
      (3) Density
   b. Barometric measurements at sea level and 59 degrees F.
      (1) Weight - 14.7 lbs/sq. in.
      (2) Equivalents -
         (a) 29.92 inches of mercury
         (b) 1013.2 millibars
   c. Decreases with altitude
   d. Rate of lift proportional to density
3. Air motion
   a. Circulation
      (1) Uneven heating of the Earth's surface.
         (a) Warmer air rises creating reduced pressure area.
         (b) Cooler air sinks creating high to lower pressure
         (c) Air moves from higher to lower pressure
      (2) Coriolis effect.
      (3) Movements.
         (a) Horizontal
         (b) Vertical
      (4) Wind indications on maps.
         (a) isobar gradients

(b) Wind arrows.
(5) Obstructions
(a) Direction
(b) Velocity

4. Moisture and temperature

a. Basic relationships
(1) Cooler air holds less moisture.
(2) Warmer air holds more moisture.

b. Relative humidity
(1) Moisture capacity of air at given temperature.
(2) Indicated as percent of capacity.

c. Density
(1) Dry air less dense than moist air.
(2) Moist air less dense than dry air.

5. Air masses and fronts

a. Classification
(1) Polar, arctic and tropical
(2) Maritime and Continental

b. Characteristics
(1) Cloud types
(2) Ceilings
(3) Visibility
(4) Stability of air

c. Movement of air masses in United States
(1) Tropical toward northeast
(2) Polar toward southeast

d. Warm fronts
(1) Warmer air replaces colder.
(2) Movement usually over colder air.
(3) Characteristics; ground fog, drizzle, long duration.
(4) Hazard; low ceilings and poor visibility.

II. SUGGESTED PUPIL EXPERIENCES, ACTIVITIES AND DEMONSTRATONS

1. The nature and significance of clouds is determined by temperature, turbulence, foreign particles (condensation nuclei) and water vapor content.
a. Learn to identify clouds and determine their significance.
b. Observe and record types of clouds in the area for several successive days or weeks.
c. Discuss cloud seeding.
d. Cold fronts
(1) Cold air replaces warm air.

2. Demonstrate unequal pressure by collapsing a can. Reduce pressure within the can with a vacuum pump or fill can with stream and condense the steam after capping the can.

3. Boyle's Law: The volume of a gas varies inversely with the pressure and temperature, remaining constant.

$K = PV$ P = absolute pressure
V = volume
K = constant

4. Place a partially inflated balloon in a vacuum jar and evacuate the jar. Note the increase in the size of the balloon. Discuss.

5. Discuss how the principle illustrated above can apply to aviation.

6. Examine an aneroid barometer and explain the action of it in view of this principle.

7. Explain why weather balloons burst upon reaching very high altitudes.

8. Show convection currents by using the heating system of a school. For a demonstration, burn smoke paper to show air circulation.

9. Explain how rising warm air creates a lower air pressure and cooler air replaces the warmer air. Show that "nature abhors a vacuum" with example such as vacuum cleaner, syringe bulb.

10. Demonstrate uneven heating of the Earth's surface by exposing materials with smooth, rough, light and dark surfaces to the sun or a heat lamp; after equal time exposure measure surface temperature of each material.

11. Show uneven heating of the Earth's surface with a radiometer demonstration.

12. Air has weight and mass.

    a. Blow up a paper bag and burst it.
    b. Push inverted glass with dry paper in the bottom of a pan of water.
    c. Pour air from one beaker to another under water.
    d. Measure the volume of a balloon by releasing its air into a graduate cylinder inverted in a pan of water.
    e. Compute the weight of air in a room.
    f. Determine the density of air.
    g. Compute the force with which air tends to crush your body.
    h. Discuss the meaning and effects of pneumothorax.

13. Report on the jet stream and explain how it influences the weather front.

14. Report on highs and lows and how the Coriolis force affects their rotations.

15. Illustrate the Coriolis effect by using record turntable with record and attempt to draw a straight chalk line on record while turntable is rotating.

16. Demonstrate relative humidity with the psychrometer, hair bygrometer, hemp rope, etc.

17. Demonstrate dew point with a glass of ice water or dew point apparatus with thermometer and evaporation bulb.

18. Demonstrate the formation of precipitates with a cloud chamber device.

19. Show that barometric readings need to be adjusted by comparing Weather Bureau reading with unadjusted mercurial barometric readings; then from the difference calculate height above sea level.

20. Compare maps of winds aloft with surface winds.

21. Examine tables that show a decrease in air pressure with an increase in temperature.

22. Examine tables that show a decrease in air pressure with an increase in altitude.

23. Compare the length of runways required for a given airplane at various altitudes at the same temperature.

24. Discuss the relationship of squall lines to fronts and the conditions a pilot might expect along a squall line.

25. Discuss the various conditions that occur when two unlike air masses meet.

26. Atmospheric conditions have great influence on aviation. The Airplane: discuss factors to be considered in taking off in thin air such as ground speed to

achieve lift, rate of climb, distance to gain altitude.

27. Archimedes' Principle: A body in a fluid is buoyed up by a force equal to the weight of the displaced fluid.

    a. Weigh a body of known volume in air and then in water. Calculate the difference in weight under these two circumstances. Compare this with the weight of the displaced water.

    b. Determine the weight of air by first weighing a metal sphere of known volume containing an evacuation valve. Evacuate the sphere with a pump having a closed tube manometer so that the percentage of evacuation can be determined. With the weight of air.

    c. Discuss the manner in which Archimedes' Principle applies to lighter-than aircraft.

28. Pascal's Law: If we increase the pressure in a liquid that increase will be transmitted equally and undiminished in all directions to the confined liquid.

    a. Obtain a hydraulic jack and study its' construction and action.
    b. Fill a large plastic bottle with water. Force a stopper in the opening. Continue to apply pressure on the stopper until the bottle bursts.

29. Charles' Law: The volume of gas varies directly, its absolute temperature, pressure remaining constant.

    $K = V/T$ V = Volume
    T = absolute temperature

    1. Fill a balloon with cool air and place it near a radiator. Observe.
    2. Obtain an air thermometer. Explain its action.
    3. Discuss the first balloon ascensions made by open-bottom canopies filled with hot air.

III. VOCABULARY

anoxia
barometer
  aneroid
  mercurial
climate
clouds
  altocumulus
  altostratus
  cirrocumulus
  cirrus
  cumulonimbus
isotherm
  cumulus
  nimbostratus
  stratocumulus
  stratus
convection
cyclone
dew
dew point
drizzle
exosphere
fog
front
  cold
  warm
  stationary
  occluded
frost
glaze
gust
  haze
  high
humidity
hypoxia
  ice
  ice rain
ionosphere
isobar

low
  millibar
  mist
precipitation
  psi
  saturation
squall
standard
  atmosphere
stratoform
stratosphere
troposphere
turbulence
  visibility
weightlessness

UNIT IV: NAVIGATION AND COMMUNICATION

This unit is designed to help each pupil:

1. Realize the importance of navigation and communications to modern air travel.

2. Understand the major principles used in navigational equipment.

3. Understand the various methods used in air navigation.

4. Develop an understanding of the communications used in air travel and the types of equipment.

5. Become familiar with some of the more important rules and regulations necessary for safe and efficient air travel.

I. OUTLINE OF UNIT CONTENT

A Navigation aids

1. Aeronautical charts

    a. Types
    b. Content
        (1) Airways
        (2) Radio facilities data
        (3) Relief
        (4) Airport information
        (5) Miscellaneous aeronautical information.

2. Electronic equipment

    a. VOR, VORTAC, TACAN
    b. Radio ranges
    c. Homer beacon
    d. Doppler
    e. Radar (transponder, GCA)
    f. Loran

B. Methods of navigation

1. Dead reckoning
    a. Maps and charts
        (1) Symbols
        (2) Scales
        (3) Variation
    b. Navigational computer
    c. Plotter
    c. Wind triangle

2. Basic navigation, including electronic

    a. Instruments
        (1) Artificial horizon
        (2) Turn-and-bank indicator
        (3) Compass
        (4) Directional gyroscope
        (5) VOR and glide slope indicator
        (6) ADF indicator (radio compass
        (7) Rate-of-climb indicator
        (8) Altimeter
        (9) Airspeed indicator
        (10) Autopilot

    b. Types
        (1) LF radio navigation
        (2) Omni range
        (3) Ground controlled radar

3. Celestial Navigation
    a. Navigational stars
    b. Sextant
    c. Celestial charts

d. Air Almanac

C. Communications

1. Equipment
   a. Two-way radio
   b. Light signals

2. Air traffic control towers
   a. Purpose
   b. Problems

3. Enroute traffic control

D. Rules and regulations

1. Sources
   a. NOTAMS
   b. Airman's information Manual
   c. Airport directory
   d. Federal Aviation Regulations

2. Flight plans

3. Airways system

4. Agencies
   a. FAA (Federal Aviation Administration)
   b. FCC (Federal Communications Commission)
   c. NTSB (National Transportation Safety Board)
   d. U.S. Weather Bureau

II. Suggested Student Experiences and Activities

1. Visit an air traffic control tower. Report your understanding of the operation to the class.

2. Visit an FAA flight service station.

3. Dramatize a cross-country flight to demonstrate air traffic communications with students playing the role of: departure, enroute, approach controllers.

4. Plan a cross-country flight using an aeronautical chart.

5. Report on the CAB findings of the "probable cause" of an aircraft accident.

6. Dramatize the radio conversation which might occur between the control tower and a plane; first normally, and then as if the plane is in trouble.

7. Demonstrate the principles of the gyroscope by using a toy gyroscope.

8. Show the action of an artificial horizon indicator with a "+" marked on the round portion of a boiling flask.

9. Make a model of an airport showing traffic patterns, runway lighting, etc.

10. By means of tables or graphs, compare the cost and safety of air travel with that of automobile travel.

11. Invite an airline travel agent to talk to the class.

12. Invite a flight attendant to talk to the class.

13. Make cardboard models of the various instruments used for instrument flying and show their indications for different aircraft altitudes.

14. Demonstrate instrument flight in a Link trainer or other flight simulator.

15. Use time problems to understand what is involved in flying through time zones.

16. Make a display showing the various types of navigational maps and charts.

17. Use wind triangle problems to teach the cause and effects of drift.

18. Make a list of all of the different types of information available on a sectional chart.

19. With a plotter determine the distance and magnetic heading to several other cities in your state.

20. Using a computer, figure time, distance, and gas consumption problems.

21. Use a wind triangle to show how you can compute the extent of a search flight (i.e., out and back) on a given supply of fuel.

22. Show how a radio compass can be used to determine the time and distance to a radio station.

23. Show how several radio compasses at different locations can be used to locate "lost" aircraft.

24. Using two portable radios try to determine the location of a local radio station.

25. Dramatize the procedure which might occur between a radar operator and an aircraft making a Ground Control Approach(GCA).

26. Demonstrate the operation of a sextant.

27. Make a star chart and show on it those stars which are used for navigation.

28. With a flashlight and colored cellophane paper, demonstrate the light signals a tower might use.

29. Using FAA forms, show different types of flight plans.

30. Plan a cross-country VFR and/or IFR flight from coast to coast.

31. Obtain aeronautical charts of your state from the State Department of Aeronautics and demonstrate their interesting features.

32. Prepare a report that traces the history of navigation from the early days of sailing ships to the most modern means of transocean jet flights.

33. Give examples of how every person uses some form of navigation in his everyday life. Discuss the different types of navigation that might be used.

34. Discuss the safety features that are built into air traffic control procedures.

35. Investigate the possibility of "all-weather flying" for commercial aircraft in the near future.

III. VOCABULARY

ADF
Airman's Information Manual
airway
altimeter
knots
approach
attitude indicator
autopilot
azimuth
beacon
beam
bearing
CAB
chart
compass
compass rose
computer
contact flying
great circle
ground speed
gyro
heading
homer
IFR
latitude
log
longitude
loran
magnetic north
meridian
NOTAMS
parallel
phonetic alphabet
plotter
quadrant
radio direction finder

course
dead reckoning
deviation
directional gyro
drift
Doppler
FAA
VOR
FCC
Fix
flight path
GCA
sectional
sector
sextant
track
variation
visibility
VFR
WAC
wind tee
wind triangle
zulu time

UNIT V: IMPACT OF THE AEROSPACE AGE

This unit is designed to help each pupil:

1. Understand the global impact of aviation as a means of transportation

2. Develop an appreciation and awareness of the practical aspect and future potential of aviation as a means of transporting goods and people.

3. Understand that aviation and space exert great influence upon the economic, social, political and military activities of mankind.

OUTLINE OF THE UNIT CONTENT

A. Economics

1. Aerospace manufacturing industry
   a. Aircraft
   b. Engines
   c. Aircraft and spacecraft parts and accessories
   d. Rockets and missiles
   e. Spacecraft

2. Air transport industry
   a. Domestic scheduled airlines
   b. Domestic trunk carriers
   c. Helicopter airlines
   d. International and Overseas airlines
   e. Third level carriers
   f. All-cargo airlines

3. General aviation
   a. Business flying
   b. Commercial charter flying (includes all types of charters such as inspection, photographic survey, sales, etc.)
   c. Agricultural flying
   d. Instructional flying
   e. Personal or pleasure flying

B. The Social Aspect

1. Population distribution
   a. Population concentration shifts due to business and industry
   b. Research and development of natural resources
   c. Relocation of military personnel

2. Education
   a. Curriculum change in schools
   b. Vocational education
   c. Education for citizenship in the aerospace age
   d. Aerospace courses of study

3. Family life

a. Increased vacation possibilities

b. Increased travel, both domestic and abroad

c. Freedom to relocate without weakening family ties

d. Increased sporting activities

C. The Political Aspect

1. Military operations

a. National defense

b. High mobility of military forces

c. Rapid transportation of wounded

d. Greater vulnerability of nations as the result of faster aircraft and flying polar routes

2. International relationships

a. Decrease in the isolation of individual nations.

b. Dynamic force in bringing representatives of nations together

(1) United Nations
(2) UNESCO
(3) Cooperation between nations in the establishment of world airways

c. Diplomacy and international relations discussed intelligently by the average citizen.

(1) Oneness of man
(2) Individual responsibility of making informed decisions to shape the future of the world

3. Local Politics

a. Changes in the manner of campaigning

b. More direct contact of the candidate with the voter.

c. Availability of officials to disaster areas

d. Control of disease - distribution of medical aid

II. SUGGESTED STUDENT EXPERIENCES AND ACTIVITIES

1. Construct a bulletin board that will show the impact of the aerospace age on the economic, social and political aspects of human endeavor.

2. Teacher and class contact the following sources for assistance

throughout the study of aerospace science.

a. Federal Aviation Administration
b. National Aeronautic and Space Administration
c. Civil Air Patrol
d. Local Community Resources
e. Local airport operators, aircraft dealers, airline representatives, military aviation personnel, aviation manufacturing firms, and organizations such as the Experimental Aircraft Association, flying and modeling clubs.
e. Field Trips
Airports: control tower, maintenance facilities, navigation and communications facilities; aircraft dealers; airline facilities; weather bureau.

MAGNET SCHOOLS

Since man's first efforts to fly there have been students and teachers interested in learning more about aviation and the resulting forces that influence society.

Innovative teachers and highly motivated students learned to use aviation both as a subject of study and as a tool to facilitate learning. In the beginning there were very few resources available to teachers. They had to design and create their own. As of 1993, there are many resources available for any student, teacher, administrator, volunteer who wants to learn about aviation, aerospace, transportation and the educational implications of these technical and scientific developments.

In this section, there is a listing of some of the sources of information, teaching materials and resources for those interested in planning and conducting aviation and related educational magnet activities, projects, programs or courses at all levels of education. These resources include government agencies, industries, industry organizations, private organizations, volunteer organizations and special groups devoted to aviation and space.

Today there are more resources available to further aviation, space, transportation education programs than at any time in history other than during World War II when huge resources of education and training were made available to focus on winning the war. In 1993, there is a different war facing the nation. It is a war against ignorance, poverty, racial and ethnic segregation and isolation and teen-age unemployment. Magnet school programs have demonstrated the capability of dealing successfully with some of these problems.

The resources described in this section do not represent all such potentials for providing help to educators. They are illustrative of such support available either free or at low or reasonable cost.

Among the greatest resources are the thousands of volunteers who are ready, willing and able to be of help if asked.

Any school system in the country can marshal the resources to plan and carry out an aviation magnet program by calling on some of the sources of help identified in this section.

B. THE AUGUST MARTIN SECONDARY SCHOOL

PURPOSE AND OBJECTIVES

This is a brief description of the philosophy underlying August Martin High School; how it came to be created, the techniques of its community involvement, and its curriculum approaches. Other school systems will want to look at this institution both as an inspiration and, either in part or in total, as a model that can be duplicated in another locale.

The objectives are to: (A) Develop educators' awareness of the thematic approach to aviation education; (b) Provide guidance for the planning of a thematic aviation education program; (C) Provide an example of a thematic aviation education curriculum; and (D) Provide information for the implementation of a thematic aviation program.

BACKGROUND OF THE AUGUST MARTIN HIGH SCHOOL

August Martin - The Man

The Civil Air Patrol has developed an activity book and autobiography packet which includes many of the details of the life of August Martin in whose honor the August Martin High School was named. August Martin was born in Los Angeles, California on August 31, 1919. He graduated from New York City's DeWitt Clinton High School in 1938 and returned to California where he attended San Mateo Junior College and the University of California. While he was at San Mateo, he worked at the Oakland Flying Service to earn money for flying lessons. By the time he graduated from the University of California, he had achieved his Flight Instructor Rating. From his job as civilian flight instructor in the Navy V-12 program at Cornell (New York), he joined the Army Air Corps in 1943, receiving his flight training at Tuskegee, Albama. He became a B-25 pilot, but World War II ended before he could be sent overseas.

Following World War II, August continued his aviation career. He took a job with Willis Air Service in Teterboro, New Jersey. Between 1946 and 1955, he flew part time for Buffalo Skylines, El Al Airlines, and World Airlines. Martin holds the distinction of being the first black Captain of a DC-3. Between 1955 and 1968, Captain Martin flew the DC-3, DC-4, Lockheed Constellation, and Canadair CL-44 for Seaboard World Airlines.

Captain Martin felt strongly about helping the emerging nations of Africa and often used his vacation time to fly needed supplies to their struggling people. Typical of his dedication to helping others was the mercy mission that he was flying in Biafra on behalf of the Red Cross when he was tragically killed on July 1, 1968 while trying to land on a highway during a rainstorm.

August was one of the pioneer black pilots employed by scheduled U.S. Airlines. Few people in their lifetime have the opportunity to be of the service which August Martin demonstrated as he gave his life helping others. Equally significant, few find that their efforts are

memorialized in an institution which touches as many lives as August Martin High School, which is a living memorial that honors August Martin -the Man.

FORMATION OF THE AUGUST MARTIN HIGH SCHOOL

In the early 1940's, Woodrow Wilson Vocational High School was opened in the Baisley Park section of Queens, New York. By 1948, the Woodrow Wilson School had 3,100 students in a main building and three annexes. Within seventeen years, by June 1965, enrollment had declined to 802 students officially listed on the rolls. Average daily student attendance had also declined from a high of over 80% to only approximately 50% of the student enrolled attending classes daily by the late 1960's. Woodrow Wilson High School students no longer took the State and Regional Examinations in subjects based on city-wide tests in either academic, shop, or vocational courses.

In the late 1960's, parents, leaders from the aviation industry, community organizations, labor, and education formed a committee to see what could be done about the deteriorating Woodrow Wilson Vocational High School. It should be noted that the high school was located near John F. Kennedy International Airport, thus, the representatives of the aviation industry had an interest in helping assure that the program offerings took advantage of the rich vocational career and academic offerings of aviation. The key aviation leadership for evaluating Woodrow Wilson High School was provided by the Aviation Development Council of New York City. This organization represented the principal airlines and related aviation industries in the greater metropolitan New York area.

The committee, looking at solutions for remedying the problems at Woodrow Wilson High School, determined that a dramatic change had to be made. Thus, on October 3, 1969, this committee obtained a resolution from the New York City Board of Education permitting "the conversion of Woodrow Wilson High School into a comprehensive high school with emphasis on air-transport careers.

Immediately following this action, a planning committee was created by the community of interests outlined above and a set of sub-committees was established to work on such topics as curriculum development, administrative selections, industry union relationships, work-study opportunities, needed plant expansions, program development, staff training, and public and community relations. The planning committee and the various sub-committees spent nearly two years of detailed intensive planning to create the new school.

One of the guidelines of the task force and planning committee was that the new comprehensive high school in Queens, New York, designed to replace the traditional Woodrow Wilson vocationally oriented high school, would be exciting for parents and students, but with an innovative and educationally sound program. Thus, the committee adopted aviation first as a magnet to attract interested students from throughout the city, then because aviation education by definition provided

a structure related to all facets of the academic and occupational or career programs that it had anticipated the new high school would offer its students.

RATIONALE FOR AN AVIATION THEMATIC SCHOOL

Those responsible for planning the August Martin High School recognized that to be attractive, the new school had to relate to the world of today and tomorrow while being tied to the real world of work. Thus, the group decided to use aerospace as the central theme, motif, or core running through the offerings.

AUGUST MARTIN TODAY

Currently the curriculum provides the students with a basic education in the theory and the practical aspects of flight. Starting in the freshman year, the students are given the Aerospace Workshop in which they build model planes while learning the basic principles of flight and what actually makes a plane fly.

In addition to the above, classes are offered in Flight Theory and flying lessons at Republic Airport. State University of New York (SUNY) at Farmingdale provides the practical component of the program. Flight students log an average of 8 hours flying time per year and become quite proficient in take-offs, landings and flight maneuvers. The course culminates with the written portion of the FAA private pilot's examination.

Approximately 100 students per year take advantage of the flying program. One basic requirement is that a student must be passing in all his/her subjects or he/she cannot go flying. The actual flying takes place at Republic Airport where students fly under the tutelage of FAA certified flight instructors. All students keep an official log book and their flying time is credited toward earning their private pilots license, if they choose to pursue that route after graduation.

Some have earned scholarships to Tuskegee, where they participated in a two week workshop of intensive flight training and classroom activities. Some graduates have gone on to study aviation at Florida Institute of Technology, Embry-Riddle, Dowling, the Academy of Aeronautics and SUNY Farmingdale. Over the years, they have won many first and second prizes in the yearly "Fly-In" citywide competition among the high schools, and many of our graduates have gone onto pursue careers in engineering, business and the aviation industry including, FAA and American Airlines.

Innovative educators have always used attractive methods to help students learn. As Dr. Nolan Estes has pointed out, 1635 marks the earliest identified magnet school -Boston Latin.

Using aviation as a central theme to facilitate learning only five years after the Wright Brothers pioneered the discovery of powered, controlled flight in 1903, a creative physics teacher, H. LaVonne Twining, in 1908, used aeronautical science and mathematics examples in his classes.

In the early decades of this century, many school systems designed technical or vocational trade schools designed to prepare high school students for various technical trades. Today area vocational-technical schools provide similar career training opportunities. But relatively few, compared to the entire nation-wide public education system, make use of aviation or aerospace as a central theme. However, there are more and more school systems looking at the role of aviation, space, transportation as thematic approaches to education.

Magnet themes for elementary and secondary education are growing at a rapid rate. Many specialized topics provide core themes for a magnet approach to education. The U.S. Department of Education in a 1991 publication entitled: Magnet Schools: Promoting Equal Opportunity & Quality Education lists seventy-one "Magnet Curricular Themes and Learning Environments Supported Under the Magnet Schools Assistance Program."

Magnet school programs have evolved in recent years as a result of a number of initiatives. In many instances a creative teacher has used his or her specialized knowledge to introduce a core theme in traditional subjects to make the teaching more interesting and effective. This has been happening more and more in classes in elementary and secondary schools by teachers who have learned the value of aerospace in enhancing learning in all traditional subjects or disciplines.

An example of one of the early aerospace magnet schools is the August Martin program in New York.

C. Listed below are magnet schools addresses and contact persons.

1. South Mountain High School
5401 South 7th Street
Phoenix, AZ 85040
Contact: Lewis Davis
Curriculum: Aerospace magnet school, grades 9-12

2. Aviation High School
36th Street & Queens Blvd.
Long Island, NY 11101
Contact: Dr. Eileen B. Taylor
Primary Curriculum: Aviation high school

3.August Martin High School
156-10 Baisley Blvd.
Jamaica, NY 11434
Contact: Leslie Gurka
Curriculum: 4-year magnet school in aviation, communication, computer science, law

4.Washburn High School
Minneapolis, MN 55409
Contact: James Colby
Curriculum: Aviation and aerospace magnet school, grades 9-12

5. Highland Springs Technical Center
15 South Oak Avenue
Highland Springs, VA 23075
Contact: Richard Upchurch
Curriculum: Aviation technician and pilot programs for grades 11-12

6. Catalina High School
3645 East Pima Street
Tucson, AZ 85716-3399
Contact: Robert L. Reynolds
Curriculum: Emerging aviation magnet program grades 9-12

7. East High School CAB/VCC/East
215 North First Avenue, East
Duluth, MN 55802
Contact: Jim Arndt
Curriculum: Aerospace technology, grades 11,12

8. Southside Center for Applied Technology
1784 Harrodsburg Road
Lexington, KY 40504
Contact: Wayne King
Curriculum: 2-year aviation technology program

9. Winston-Salem/Forsyth County Schools
P.O. Box 2513
Winston-Salem, NC 27102-2513
Contact: John Smoot
Curriculum: Aviation Technology course as part of
vocational education program

10. Samuel F.B. Morris High School
6905 Skyline Drive
San Diego, CA 92114
Contact: John Shacklett
Curriculum: Aerospace magnet program for high school students

11. Suffolk Aviation Academy
2705 Smithtown Avenue
Ronkonkoma, NY 11779
Contact: Michael Weisz
Curriculum: Aircraft maintenance, pilot training

12. Westchester High & School
7400 Manchester Avenue
Los Angeles, CA 90045
Contact: Ronald Keating
Curriculum: Math science aerospace magnet program for grades 9-12

13. William Fleming High & School
3649 Ferncliff Avenue, NW
Roanoke, VA 24017
Contact: Tam Pearman
Curriculum: Aeronautical Science Technology, grades 6-12

14. Lakewood High & School
Long Beach Unified & School District
4400 Biercrest Avenue
Lakewood, CA 90714
Contact: Dean C. Gilbert
Curriculum: Aerospace technology magnet, grades 9-12

15. Walter F. George High & School
800 Hutchens Road, S.E.
Atlanta, GA 30354
Contact: Jim Berto
Curriculum: Transportation magnet

16. Shawnee Aviation High & School
4018 West Market Street
Louisville, KY 40212
Contact: Michael Rowland
Curriculum: Aviation careers

17. Delcastle Technical High & School
1417 Newport Road
Wilmington, DE 19804
Contact: Albert E. Leonard
Curriculum: 4-year vocational technical school

18. Aviation High & School
4101 North Marginal Road
Cleveland, OH 44114
Contact: Joseph Takacs
Curriculum: Aviation magnet school, grades 9-12

19. Mr. Rick Deppe, Administrator
Special School District
12110 Clayton Road
Town and Country, MO 63131

20. Mr. Ron Snyder
Alternative School #1
11530-12th Avenue, NE
Seattle, WA 98125

21. Mr. Jerry Smith
Skyline High School
Career Development Center
Aeronautical Cluster
7777 Forney Road
Dallas, TX 75227

22. Ms. Essie Johnson
Alfred E. Beach High School
3001 Hopkins Street
Savannah, GA 31405

23. Mr. Eugene A. Santoro
Minuteman Regional Vo-Tech School
758 Marrett Road
Lexington, MA 02173

24. Mr. Harry Batty
Polytech High School
Kent County Vo-Tech School District
P.O. Box 97, Road 30
Woodside, DE 19880-0097

25. Mr. Robert S. Mullgardt
Science Department
Clayton High School
#1 Mark Twain Circle
Clayton, MD 63105-1613

26. Mr. Gardner Soule
Edison Tech & Occup. Educ. Center
655 Colfax Street
Rochester, NY 14606

27. Mr. Bradley Ports
Gateway Technology Institute
5101 McKee Avenue
St. Louis, MD 63110

D. U.S. DEPARTMENT OF TRANSPORTATION (DOT) - FEDERAL AVIATION ADMINISTRATION (FAA) RESOURCES

FAA AVIATION EDUCATION REPRESENTATIVES:

In the Washington headquarters of FAA there are Aviation Education Specialists. In each FAA Region as well as at the FAA Aeronautical Center in Oklahoma City, Oklahoma and the Technical Center in Atlantic City, New Jersey there is a person designated to provide technical advice relating to aviation education. In order to determine which Regional Aviation Education Representatives one should request help from, the following listing should be consulted to determine which states the FAA Regional Representative serves.

Dept. of Transportation/FAA
Phillip S. Woodruff, AHT-100
Director, Office of Human Resources Management
Latisha Ferguson
Patsy Vicks
DOT/NASSIF, Room PL-100
400 7th Street, SW
Washington, D.C. 20590
(202) 366-7500

Aeronautical Center
Robert Hoppers, AAC-5
Room 356, Headquarters Bldg.
P.O. Box 25082
Oklahoma City, OK 73125
(405) 680-7500

Technical Center
Michele Pareene, ACM-1 W
Atlantic City International Airport
Human Resource
Management Division
Atlantic City, NJ 08405
(609) 485-6032

Alaskan Region
Mary Lou Wojtalik, AAL-5B
222 West 7th Avenue, Box 14
Anchorage, AK 99513-7587
(907) 271-5293

Central Region
Patrice Shalda, ACE-5
601 East 12th Street
Federal Building, Room 1501
Kansas City, MO 64106
(816) 426-5836
STATES: Iowa, Kansas, Missouri and Nebraska

Eastern Region
Jim Szakary, AEA-17
JFK International Airport
Federal Building #111
Jamaica, NY 11430
(718) 553-1056
STATES: Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, Virginia and West Virginia

Great Lakes Region
Lee Carlson, AGL-5A
O'Hare Lake Office Center
2300 East Devon Avenue
Des Plaines, IL 60018
(312) 694-7042
STATES: Illinois, Indiana, Michigan, Minnesota, North Dakota, Ohio, South Dakota and Wisconsin

New England
Shelia Bauer, ANE-8
12 New England Executive Park
Burlington, MA 01803
(617) 273-7064
STATES: Connecticut, Maine, New Hampshire, Rhode Island, Vermont and Massachusetts

Northwest Mountain Region
Shelly McGillivary, ANM-5E
1601 Lind Avenue, SW
Renton, WA 98055
(206) 227-2804
STATES: Colorado, Idaho, Montana, Oregon, Utah, Washington and Wyoming

Southern Region
Joe Sidney, ASO-17.4
3400 Norman Berry Drive
East Point, GA 30344
(404) 763-7500
STATES: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico and the Virgin Islands

Southwest Region
Debra Myers, ASW-5
4400 Blue Mound Road
Ft. Worth, TX 76193-0005
(817) 624-5804
STATES: Arkansas, Louisiana, New Mexico, Oklahoma and Texas

Western-Pacific Region
Hank Verbais, AWP-5
P.O. Box 92007
Worldway Postal Center
Los Angeles, CA 90009
(310) 297-1431
STATES: Arizona, California, Nevada and Hawaii

E. FAA AVIATION EDUCATION RESOURCE CENTERS (AERCs):

FAA AERCs are established at colleges and universities, museums and other locations to provide a focal point for resources including aviation education programs, publications, software and videotapes. These centers are repositories of materials and distribution centers. They are designed for students, teachers and researchers and they provide materials to enhance aviation education. New AERCs are added by FAA from time to time. The following list is based on the information available in mid-1994. The latest list of AERCs may be obtained from your FAA Regional Aviation Education Representative.

Alabama

Alabama Aviation
Technical College
Ms. Megan Johnson, Director
Learning Resource Center
PO Box 1209
Ozark, AL 36361
(205) 774-5113

University of North Alabarna
Ms. Michele R. Walker
Programming Coordinator
UNA Box 5145
Florence, AL 35632-0001
(205) 760-4623

University Aviation Association
Mr. Gary W. Kiteley, Exec. Dir.
3410 Skyway Drive
Opelika, AL 36801
(205) 844-2434

Alaska

University of Alaska Fairbanks
Mr. Dennis Stephens
Collection Development Officer
Elmer E. Rasmuson Library
Fairbanks, AK 99775-1006
(907) 474-6695

Alaska Pacific University
Dr. Rusty Myers, Project Director
4101 University
Anchorage, AK 99508
(907) 564-8207

University of Alaska Anchorage
Ms. Barbara Sokolov
Library Director
3211 Providence Drive
Anchorage, AK 99508
(907) 786-1825

Arizona

Embry-Riddle Aeronautical Univ.
Ms. Karen Hudson
Educational Program Coordinator
3200 N. Willow Creek Road
Prescott, AZ 86301
(602) 771-6673

South Mountain High School
Mr. Lew Davis, Program Mngr.
Center for Aerospace Education
5401 S. 7th Street
Phoenix, AZ 85040
(602) 271-3439

Pima Community College
Mr. Tony Gulielmino
Aviation Department Chair
1668 South Research Loop Road
Tucson, AZ 85730
(602) 884-6186

Flandrau Science Center
Mr. Gilbert McLaughlin
University of Arizona
Tucson, AZ 85721
(602)621-4515

Arkansas
Crowley's Ridge Education
Service Coop.
Mr. Louis Midkiff
P.O. Box 377
Harrisburg, AR 72432
(501) 578-5426

California
Apple Valley Science & Tech.
Cntr.
Mr. Rick Piercy, Coordinator
P.O. Box 2968, 15552 Wichita
Apple Valley, CA 92307
(619) 242-3514

San Jose State University
Mr. Nick Milichevich, Chairman
Department of Aviation
1 Washington Square
San Jose, CA 95192-0081
(408) 924-6580

Museum of Flying
Mr. Harvey Ferer
2772 Donald Douglas Loop N.
Santa Monica, CA 90405
(310) 392-8822

San Bernardino Co. Super. of Sch.
Ms. Nancy Harlan, Coordinator
Instructional Services Division
601 North E. Street
San Bemardino, CA 92410-3093
(714) 387-3152

Riverside County Office of Ed.
Ms. Mary Ann Liette, Cord. of
ERC
3939 - 13th Street
Riverside, CA 92502-0868
(909) 788-6684

Fresno Unified School District
Intructional Media Center
Karen Tozlian
3132 E. Fairmont
Fresno, CA 93725
(209) 441-3672

Colorado
U. S . Space Foundation
Dr. Jerry Brown
Educational Director
2860 S. Circle Drive, Suite 2301
Colorado Springs, CO 80906-4184
(719) 576-8000

Metropolitan State
College of Denver
Mr. Jonathan R. Burke
Assistant Professor
Aerospace Science Department
Campus Box 30
P.O. Box 173362
Denver, CO 80217-3362
(303) 556-2923

Connecticut
Connecticut DOT
Bureau of Aviation and Ports
Mr. Robert Stepanek
Education Director
New England Air Museum
Bradley International Airport
Winsor, CT 06096
(203) 623-3305

Platt/Sikorsky School for Aviation
Vivian Manzione, Assist. Director
Great Meadow Road
Stratford, CT 06497
(203) 381-9250

Delaware
Delaware Teachers Center
Ms. Stephanie Wright
Claymont Education Campus
3401 Green Street
Claymont, DE 19703
(302) 798-3806

Florida
Embry-Riddle Aeronautical Univ.
Ms. Patricia Fleener-Ryan
AvEd Teacher Resource Center
Daytona Beach, FL 32114
(904) 226-6499

Florida Institute of Technology
Dr. Ballard M. Barker, Head
Department of Aviation Studies
The School of Aeronautics
150 West University Boulevard
Melbourne, FL 32901-6988
(407) 768-8000 ext. 8120

Florida Memorial College
Mr. J. Anthony Sharp, Director
Division of Airway Science
15800 Northwest 42 Avenue
Miami, FL 33054
(305) 623-1440

Center for Mgmt. Development
Mr. Larry Hedman,CMD- 373
4500 Palm Coast Parkway, SE
Palm Coast, FL 32137
(904) 446-7126

Georgia
Conyers Middle School
Ms. Viki Dennard
Assistant Principal
335 Sigman Road
Conyers, GA 30207-3699
(404) 483-3371

Museum of Aviation at Robins AFB
Ms. Joyce Carlton
Director of Education
P.O. Box 2469
WarnerRobins, GA 31099
(912) 926-4242

East Cobb Middle School
Mr. Charles "Chuck" Nyren
380 Holt Road
Marietta, GA 30068
(404) 971-8397

Southern College of Technology
Georgia Youth Science & Technology Center
Mr. Anthony Docal, Director
1100 S. Marietta Parkway
Marietta, GA 30060-2896
(404)528-6272

Hawaii
Mid-Pacific Institute
Ms. Veronica Balsa, Director
Aviation/Space Resource Center
2445 Kaala Street
Honolulu, HI 96822-2204
(808) 973-5000

State of Hawaii
Department of Transportation
Mr. Rodney M. Kuba
Airports Division
Honolulu International Airport
Gate 29, EWA Service Court Road
Honolulu, HI 96819-1898
(808) 836-6542

Idaho
Idaho State Bureau of Aeronautics
Mr. John Maakestad
Safety/Information Officer
Chief Pilot
3483 Rickenbacker Street
Boise, ID 83705-5018
(208) 334-8775

Illinois
Northeastern Illinois University
Dr. Jerry Olson
Associate Dean for School Relations
Chicago Teachers Center
770 N. Halstead, Ste 420
Chicago, IL 60622

Parks College of St. Louis Univ.
Mr. Paul McLaughlin
Associate Vice Pres. and Dean
500 Falling Springs Road
Cahokia, IL 62206
(618) 337-7575 ext. 364

Southern Illinois University
Dr. Elaine Vitello
College of Technical Careers
Room 222
Carbondale, IL 62901
(618) 453-8821
State of Illinois
Division of Aeronautics
Mr. Richard M. Ware
One Langhorne Bond Drive
Capital Airport
Springfield, IL 62707-8415
(217) 785-8516

Indiana
Indiana College of Placement &
Assessment Center
Mr. Hassan Chaharlang
ICPAC Hotline Director
2805 E. 10th Street
Bloomington, IN 47408
(812) 855-8475

Iowa
The University of Northern Iowa
Ms. Julie Wilkinson
IRTS
222 Schindler Education Center
Cedar Falls, IA 50614-0610
(319) 273-2717

Kansas
Hutchinson Community College
Mr. Edward E. Berger, President
1300 N. Plum
Hutchinson, KS 67501
(316) 665-3505

Kansas State University-Salina
Ms.Karlene Propst
Tullis Library
2408 Scanlan Avenue
Salina, KS 67401
(913) 825-0275

Cloud County Community
College
Dr. Patricia Altwegg
Box 1002, 2221 Campus Drive
Concordia, KS 66901
(1-800)729-5101

Kentucky

Shawnee Aviation High School
Mr. Michael Rowland
4018 W. Market Street
Louisville, KY 40212
(502) 473-8689

Louisiana

Louisiana State University
Dr. Marlon Abbas, Director
Transportation Systems Group
Louisiana Trans. Research Center
4101 Gourrier Avenue
Baton Rouge, LA 70808
(504)767-9127

Northeast Louisiana University
Mr.Ernie Bruce
Room 103, Chemistry & Natural
Sciences Building
Monroe, LA 71209-0590
(318) 342-1784

Maine

Kennebec Valley Tech. College
Ms. Sue Doner
92 Western Avenue
Fairfield, ME 04937-0020
(207) 453-9762

Biddeford School Department
Ms. Sara Jane Poli
Maplewood Avenue
Biddeford, ME 04005
(207) 282-8280

Penobscot Nation Tribal Admin.
Mr. Mark Sanborn, Asst. Director
Vocational Training & Education
6 River Road, Community Bldg.
Indian Island, ME 04468
(207) 827-7776

Northern Maine Technical Center
Mr. Timothy D. Crowley
Dean of Students
33 Edgemont Drive
Presque Isle, ME 04769
(207) 769-2461

Maryland

Univ. of Maryland Eastern Shore
Mr. Abraham D. Spinak, Director
Airway Science Program
Princess Anne, MD 21853-1299
(401) 651-6489

Massachusetts

Bridgewater State College
Mr. Bill Annesley
Management Science & Aviation
Science Department
Bridgewater, MA 02325
(508) 697-1395

North Shore Community College
Dr. Robert Finklestein
One Ferncroft Road
Danvers, MA 01923
(508) 762-4000 ext. 6296

Lexington Public School System
Dr. Nicholas Tzimopoulos,
Director
Curriculum/Science Education
1557 Massachusetts Avenue
Lexington, MA 02173
(617) 861-2484

Westfield State College
Ms. Maureen McCartney
Director of Career Services
Ely Campus Center
Western Avenue
Westfield, MA 01086
(413) 568-3311 ext. 206

Massachusetts Aero. Commission
Dr. Toby Penstlen
Transportation Library
10 Park Plaza
Boston, MA 02116-3966
(617) 973-8000

Michigan
Oakland University
Ms. Karen Conrad, Interim Director
Aviation & Space Center
216 O'Dowd Hall
Room 216
Rochester, MI 48309-4401
(313) 370-2485

Project STARS
Ms. Barbara Koscak
Box 450082, Building 814
Selfridge ANG Base, MI 48045
(313) 466-4884

Michigan Department of Trans.
Bureau of Aeronautics
Mr. Thornas Krashen, Manager
2700 East Airport Service Drive
Lansing, MI 48906
(517) 335-9977

Minnesota
Minnesota DOT
Office of Aeronautics
Mr. Gordon Hoff, Director
Aviation Education Relations
222 East Plato Boulevard
St. Paul, MN 55107-1618
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FAA Resource Center
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Warwick Public Schools
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Clinton Junior College
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(803) 327-7402

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Mr. Chip Harris, Director
Office of Planning and Development
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(713) 639-1847

University of Texas at El Paso
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(915) 747-5426

Texas State Technical College
Campus Librarian
Aerospace Technologies
3801 Campus Drive
Waco, TX 78708
(817) 799-3611

Palo Alto College
Mr. Bruce Hoover
Aviation Department
1400 West Villarette
San Antonio, TX 78224
(512) 921-5162

Frontiers of Flight Museum
Mr. Olin Lancaster, Director
Love Field Terminal, BL-38
Dallas, TX 75235
(214) 350-3600

Utah
Utah Valley State College
Dr. P.R. "Ron" Smart
Director, Aviation Science Dept.
800 West 1200 South
Orem, Utah 84058-5999
(801) 222-8000 ext. 8436

Vermont
St. Johnsbury Academy
Mr. John Barney
Vocational Director
St. Johnsbury, VT 05816
(802) 748-8171

State of Vermont
Mr. Rick Sylvester, Aviation Instr.
RM A-322 Burlington Tech. Center
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(808)864-8424

Virginia
Virginia Aviation Museum
Ms. Betty P. Wilson
5701 Huntsman Road
Sandston, VA 23150-1946
(804) 225-3783

Washington
Museum of Flight
Mr. Gregory Moyce
Education Program Manager
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Salem-Teikyo University
Dr. Ronald Ohl, President
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Experimental Aircraft Association
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Department of Transportation
Bureau of Aeronautics
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F. THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION (NASA) EDUCATION PROGRAMS

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NASA Headquarters
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CONTACT:
NASA Ames Research Center
Moffett Field, CA 94035

_____, Aerospace Education Defined a programmed learning exercise, Civil Air Patrol National Headquarters, Maxwell Air Force Base, Alabama, 36112-5572, 1986.

_____, Airway Science Curriculum Proposal- Proposal Information and Instructions, Section One (Advance Copy), Federal Aviation Administration, Washington, ., January, 1993.

Adams, S. (1990). (May-June). Written on the Wind. TIES Magazine. pp. 19-21

The study of aerodynamics using a wind tunnel helps students develop an understanding of the basic scientific concepts of lift, drag, and stability and their applications. Directions for building a wind tunnel in the classroom and activities for using the tunnel are provided.

Bacon, Harold R., Schrier, Michael D., McGill, Patricia F., Hellinga, Gerald D., Aerospace: The Challenge, (Third Edition), Civil Air Patrol National Headquarters, Maxwell Air Force Base, Alabama, 1989.

Bell, T.E. (1991). Chasing the Moon's Shadow. Science PROBE!. 1(2), 80-90.

Provides experiences with lunar activities.

Bergstrom, Dr. Scott J, Distance Education for the Airway Sciences: Promises and Challenges, Report Delivered at Dowling College Transportation Forum, January 7, 1993.

Blank, Rolf K., Dentler, Robert A., Baltzell, D. Catherine, Chabotar, Kent, Survey of Magnet Schools- Analyzing A Model for Quality Integrated Education, Prepared by James H. Lowry and Associates, Abt Associates, Inc., Subcontractor, Final Report of a National Study for U.S. Department of Education, Office of Planning, Budget and Evaluation, Contract No. 300-81-0420, September, 1993.

Bondurant, Jr., Dr. R. Lynn, Olson, Curt, Peterson, Pamela K., Sauk Rapids High School-Secondary Aerospace and Applied Technology Business- Education Partnership, Sauk Rapids, Minnesota, Second Draft, 1991.

Larson, L. & Grant, R. (1991). The Airplane Experiment. Physics Teacher. 29(9), 564-65.

Presents an experiment to investigate centripetal force and acceleration that utilizes an airplane suspended on a string from a spring balance. Investigates the possibility that lift on the wings of the airplane accounts for the differences between calculated tension and measured tension on the string.

McGerald, J. (1993). Aviation Career Education: An Exciting Option. Clearinghouse. 67(2), 103-04.

Considered the possibilities of the field of aviation as a source of employment for today's graduates. Described the Aviation Career Education program of the Federal Aviation Administration and its Academy Summer Camp. Recommends this and similar experiences for potential career aviation students.

National Coalition for Aviation Education. (1993). A Guide to Aviation Education Resources Ed 359341.

This resource guide details the services and materials available from the National Coalition for Aviation Education (NCAE) member organizations. An alphabetical listing of 15 NCAE member organizations provides in each case the name of a contact person, address, telephone and fax numbers, and a very brief description of whom or what the organization represents or of the organization's purpose. NCAE member organizations are: Aircraft Electronics Association; Aircraft Owners and Pilots Association; American Helicopter Society; Aviation Distributors and Manufactures Association; EAA (Experimental Aircraft Association) Aviation Foundation, Inc.; General Aviation Manufactures Association; Helicopter Association International; International Association of Machinists and Space Workers; National Aeronautic Association; National Air Transportation Association; NASAO (National Association of State Aviation Officials) Center for Aviation Research and Education; National Business Aircraft Association; Opportunity Skyway; Professional Aviation Maintenance Association; and aviation education programs sponsored by the Federal Aviation Administration(FAA).

Brna, P. (1989). Programmed Rockets: An Analysis of Students' Strategies. British Journal of Educational Technology. 20(1), 27-40.

Describes a computer simulation designed to examine secondary school students' strategies in solving a physics problem involving the velocity of a rocket.

Busey, Admiral James B., FAA Administrator, Aviation Education Policy Statement, Washington, D.C., 1991.

----------. Remarks Before Aerospace Education Center, Little Rock, Arkansas, April 12, 1991.

Conway, Lee, "Classroom in the Sky: A Power Trip for Disadvantaged Youth," Phi Delta Kappan, May, 1976.

Crain, Robert L., Heeber, Amy L., Si, Yiu-Pong assisted by Jordan, Will J., Kiefner, David R., Teachers College, Columbia University, The Effectiveness of New York City's Career Magnet School's: An Evaluation of Ninth Grade Performance Using An Experimental Design, National Center for Research in Vocational Education, University of California at Berkeley, 1995 University Avenue, Suite 375, Berkeley, California 94704, Study Supported by the Office of Vocational and Adult Education, U.S. Department of Education, April, 1992.

Estes, Nolan, Levine, Daniel U, Waldrip, Donald R. Magnet Schools Recent Developments and Perspectives, Morgan Printing & Publishing, Inc., 900 Old Koenig Lane, Suite 135, Austin, Texas 78756, 1990.

----------, Federal Register/Volume 48, No. 137/Friday, July 15, 1983/Notices, Office of Personnel Management, Demonstration Project: Airway Science Curriculum

Fraknoi, A. (ed.) (1989). The Moon: It's Just a Phase It's Going Through. Universe in the Classroom. Winter(2), 1-4.

Discusses the orbit, motion, and phases of the moon. Describes three activities on the moon: "How Soon Can You See a Crescent Moon?"; "When is the Moon Visible?"; and "Lunar Eclipses".

Franknoi, A. & Freitag, R. (1992). Women in Astronomy: A Bibliography. Mercury. 21(1), 46-47.

Bibliographic guide of women astronomers and their work.

Gerhab, G. & Eastlake, C. (1991). Boundry Layer Control on Airfoils. Physics Teacher. 29(3), 150-51.

A phenomena, boundry layer control (BLC), produced when visualizing the fluidlike flow of air is described. The use of BLC in modifying aerodynamic characteristics of airfoils, race cars, and boats is discussed.

Goldberg, Isadore, Randall Aerospace and Marine Science Project (RAMS) An Evaluation Study, An Aviation Education Publication, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., September, 1977.

Gould, L. & Waiveris, C. (1991). Estimating the Speed and Distance of an Airplane. Physics Teacher. 29(2). 108-11.

A procedure for estimated the speed and distance of plane, assuming the speed of sound and the velocity of the plane are constant, is described.

Helmick, Edward F. and Davis, Lewis, Mastering Flying Basics in the Simulator Or How to Reduced the Cost of the Private Pilot Certificate, Frasca International, Inc., 906 East Airport Road, Urbana, Illinois, 61801, November 18, 1991.

Jenkins, R.A. (1993). Measuring Model Rocket Acceleration. Physics Teacher. 31(1), 10-15.

Presents an experiment that measures the acceleration and velocity of a model rocket. Lift-off information is transmitted to a computer that creates a graph of the velocity. Discusses the analysis of the computer-generated data and differences between calculated and experimental velocity and acceleration of several rocket types.

Kastner, B. (1992). It All Depends on Your Attitude. Quantum. 3(2) 12-17,82.

Presents six learning exercises that introduce students to the mathematics used to control; and track spacecraft attitude. Describes the geocentric system used for Earthbound location and navigation, the celestial sphere, the spacecraft-based celestial system, time-dependent angles, observer-fixed coordinate axes, and spacecraft rotational axes.

Keeports, D. (1990). Numerical Calculation of Model Rocket Trajectories. Physics Teacher. 28(5), 274-80.

Discussed is the use of model rocketry to teach the principles of Newtonian Mechanics. Included are forces involved; calculations for vertical launches; two-dimensional trajectories; and variations in mass, drag, and launch angle.

Page, B.R. (1991). The Rocket Experiments of Robert H. Goddard, Physics Teacher. 29(8), 490-96.

Recounts the contributions of Robert Goddard from the years of 1911 to 1930 to the development of the physics of rocketry. Discusses the results of Goddard's series of rocket experiments endorsed by the Smithsonian Institute and Goddard's claims to priority in the development of rocket theory.

Parrish, B. & Lea, L (1991). Overcoming Stereotypes: Women in a Aviation. Initiatives. 54(2), 23-33.

Analyzes how certain traits become associated with women in aviation. Uses media of popular culture to compare prevailing cultural misconceptions to the reality of research studies and personal experiences. Offers four recommendations to dispel myths

and to encourage more women to participate in rewarding nontraditional careers in aviation.

Passow, M.J. & Smith, D.R. (1991). A New Front in Weather Education. Science Teacher. 58(9), 19-21.

Provides a summary of atmospheric science resources available to help science teachers develop up-top-date units on weather.

Pentti, Frank W., Deputy Director, Office of International Transportation, U.S. Department of Transportation, Address to New York Chapter. Transportation Research Board, November 5, 1992.

Powell, Margaret L., Manager, Airway Science Curriculum Project, Information Paper: Airway (AWS) Curriculum Program, Federal Aviation Administration, Office of Training and Higher Education, 400 7th Street, SW, PL-100, Washington, D.C. 20590, February, 1993.

Preston, Edmund, Agency Historian, Federal Aviation Administration, Information Provided from the Draft Revision to the FAA Historical Fact Book in letter to Dr. Mervin K. Strickler, January 19, 1993.

----------, Public Law 100-297 - April 28, 1988, Title III-Magnet Schools Assistance, 20 USC 3023.

Racosky, Major Richard J. "Rico" (ANG), dreams + action = Reality Programs, 1992, Actiongraphics Publishing, International, P.O. Box 186, Mount Clemens, Michigan 48046-0186.

Rivera, Fanny, Remarks, at Second Annual Aviation Magnet School Conference, Phoenix, Arizona, November 20, 1992.

Rossing, T.D. & Hull, J.R. (1991). Magnetic Levitation. Physics Teacher. 29(9), 552-62.

Discusses the principles of magnetic levitation presented in the physics classroom and applied to transportation systems. Topics discussed include three classroom demonstrations to illustrate magnetic levitation, the concept of eddy currents, and lift and drag forces on a moving magnet, magnetic levitation vehicles, levitation with permanent magnets and superconductors, and magnetic bearings.

Schaff, F. (1990). Seeing the Sky: 100 Projects, Activities, and Explorations in Astronomy. Science Activities. 27(1), 24-36.

Fourteen astronomy activities are presented including classroom procedures and questions. Topics include different investigations of the moon, planets, stars, sunsets, light pollution, and rainbows and halos. Additional information on measurements used for observations in astronomy, and rainbow characteristics is included.

Simpson, Dr., Ronald P., Letter to Dr. Mervin K. Strickler, Jr., March 23, 1993, reporting that the first phase of the National Magnet School Survey is completed, Kansas City, Missouri. Report to be published by Magnet Schools of America, College of Education, University of Houston, 401 Farish Hall, Houston, TX.

Smith, Maxine, Information Packet on Castlemont Aviation High School Program, Oakland, California, November, 1992.

Smith, P. S. & Ford, B.A. (1994). Interpreting Weather Maps. Science Activities 31(2), 13-18.

Presents a brief introduction of our atmosphere, a guide to reading and interpreting weather maps, and a set of activities to facilitate teachers in helping to enhance student understanding of the Earth's atmosphere.

Strickland, Patricia, The Putt-Putt Air Force- The Story of the Civilian Pilot Training Program and the War Training Service- 1934-1944, published by Aviation Education Staff, U.S. Department of Transportation, Federal Aviation Administration, Washington, D.C., 1970.

Strickler, Jr., Mervin K., Background Paper for First National Leadership Institute on Aerospace Education Magnet Schools, Aerospace Magnet Schools-Past-Present-Future, Little Rock, Arkansas, November 21, 1991.

----------, (ed.), An Introduction to Aerospace Education, New Horizons Publishers, Inc., Chicago, 1968. Chapter 2: The Scope of Aerospace, Raymond J. Johnson and Jean F. Blashfield. Aerospace Education History Material is Adapted From Chapter 19:History of Aerospace Education, by Mervin K. Strickler, Jr.

Strickler, Jr., Mervin K., and Dobson, Charles L, Learning through Aviation, Prepared for Publication for the George R. Wallace Research Center, Embry-Riddle Aeronautical University Daytona Beach, Florida and also published by: Office of General Aviation, Federal Aviation Administration, May, 1978.

Studebaker, John W., and Hinckley, Robert H., Air-Conditioning Young America, Published by Civil Aeronautics Administration (CAA), U.S. Department of Commerce and U.S. Office of Education, Federal Security Agency, May, 1942.

Texas Department of Aviation. (1991). Aviation & Space Education. Austin, Texas: The Department of Aviation.

_____, U.S. Department of Transportation (DOT), Federal Aviation Administration(FAA), Office of Public Affairs, Aviation Education Program, A Model Aerospace Aviation Curriculum Based on August Martin High School, Manuscript By: Mervin K. Strickler, Jr., Washington, D.C. (Developed for FAA in conjunction with the Center For Aerospace Education Development, Civil Air Patrol Headquarters, Maxwell Air Force Base, Alabama, Originally Published 1980, Reprinted by FAA, 1991.

_____, U.S. Department of Education, Office for Civil Rights, Washington, D.C. 20202-1100, Magnet Schools: Promoting Equal Opportunity and Quality Education, May, 1991.

Usabar, K. (1992). Pioneers of Aviation. Science Scope. 15(5), 26-29.

Presents an activity in which students explore the geography, science and technology, and societal issues related to the historic flight of James Banning and Thomas Allen; the first African-American men to fly across the United States in 1932. Provides a lesson plan and a geographic map that traces the flight.

Watts, E. (1989). The Flying Newsboy: A Small Daily Attempts Air Delivery. Washington, DC: Association For Education in Journalism and Mass Communication.

For 10 months in 1929-30, subscribers to "The McCook (Nebraska) Daily Gazette" (a daily newspaper serving 33 towns in southwestern Nebraska and northeastern Kansas) received their newspapers via air delivery with "The Newsboy" a Curtis Robin cabin monoplane.

Weltner, K. (1990). Bernoulli's Law and Aerodynamic Force. Physics Teacher. 28(2), 84-86.

Explains the lifting force based on Bernoulli's law and as a reaction force. Discusses the interrelation of both explanations, Considers accelerations in line with stream lines and perpendicular to stream lines.

----------. (1990). Aerodynamic Lifting Force. Physics Teacher. 28(2), 78-82.

Describes some experiments showing both qualitatively and quantitatively that aerodynamic lift is a reaction force. Demonstrates reaction forces caused by the acceleration of an airstream and the deflection of an airstream. Provides pictures of demonstration apparatus and mathematical expressions.

Wilkinson, R.S. ( ). Astronomy for Schools. Selected Teaching Aids. ED354150.

The teaching materials listed in this annotated bibliography emphasize an observational and "hands-on" approach to awakening students' interest in their universe. The sources, which are for teachers and students, can be used to create courses, units, or concepts to stimulate learning. Individual and class projects range from instructive visual activities to the construction of telescopes.

Video

ABC Wide World of Flying. (1992).Wonderful World of Flying [Videocassette]. New York: Aviation Media, Inc.

AIMS Video. (1992). The Pilots and The Astronauts. [Videocassette]. AIMS Media.

Archival footage and news clips are employed to help trace a history of flight from the Wright Brothers to the space shuttle, in this program. Risks taken by early aviators, test pilots, and astronauts are discussed.

Freedman, R. (1992). The Wright Brothers: How They Invented the Airplane. [Videocassette]. American School Pubs.: SRA School Group.

This is an informative biography of how the Wright brothers, Orville and Wilbur took to the sky.

Traditional Images. (1994). Let me tell you all about planes [Videocassette].

York Associates and Encyclopedia Britannica Education Corp. (1993). [Videocassette]. Star Trekking: Summer North. Winter South.

York Associates and Encyclopedia Britannica Education Corp. (1993). [Videocassette]. Star Trekking: Autumn North, Spring South.

These two videos familiarize the viewers of the orientation of some major stars and constellations. Several concepts like: seasonal perspective, pulsars, and novas are introduced.

WHYY-TV. (1994). The Great Comet Crash.

This videocassette features the Shoemaker-Levy Comet and its 1994 crash into Jupiter. The pictures come from the Hubble Space Telescope. This video received high ratings (4 stars) from the Video Rating Guide for Libraries

Williams, R. D., (1992). Lindbergh's Flight to Paris Instructional Video, Inc.

Film Robin D. Williams traces the course of Lindbergh's historic flight from Garden City, New York to Paris, France. He visits these sites, interviews mechanics who worked on the "Spirit of St. Louis."

Juvenile Literature

--------- (1992). The Visual Dictionary of Flight. New York: Dorling Kindersley.

GOVERNMENT RESOURCES

The Eisenhower National Clearinghouse is to:

encourage the adoption and use of k-12 curriculum materials and programs which support national goals to improve teaching and learning in mathematics and science by providing better access to resources for all who are interested in creating an effective learning environment.

The Clearinghouse will accomplish this by:

creating and maintaining a comprehensive, multi-media collection of materials and programs which will be distributed in a timely manner
through a national system using both traditional formats and advanced computing and telecommunications technologies.

Federal Aviation Administration. (1994). Guide to Federal Aviation Administration Publications. Washington, DC: U.S. Department of Transportation.

A helpful guide to current FAA publications.

AN INVITATION TO CREATIVE AVIATION EDUCATORS:

The Northeastern Illinois University - FAA Curriculum Committee is interested in ensuring that the FAA guides are as up-to-date and creative as possible. We are looking for experiments that have been written and designed by teachers to assist their students in grasping the concepts included in these aerospace documents. If you have developed a particularly successful lesson you are invited to submit it for consideration by the committee for upcoming revisions. For your effort, you will receive a certificate stating you have submitted an aerospace lesson to the Northeastern Illinois University-FAA Committee. If your lesson is selected by the committee, your initials will appear at the end of the lesson and your name will be listed among contributors at the end of the document.

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