

● Commonwealth of Kentucky ●  
**EDUCATIONAL BULLETIN**

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**PLANNING AIR AGE  
EDUCATION**

Revised



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Published by

*Ky.* DEPARTMENT OF EDUCATION  
BOSWELL B. HODGKIN, Superintendent of Public Instruction

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### "PLANES AND PEACE"

The child sees it simply:  
'How high in the sky—  
How fast it can fly!'

Lad, it takes more than speed and 'blue yonder'  
To run an airline by worthwhile plan;  
Always, this we must ponder:  
The plane's but the tool of man.

But this tool knows no conscience  
Nor morals to guide its flight;  
The challenge is for People  
To use it for the Right.

Yes, the meaning of flight should be plain  
To even the lad's young mind:  
What matters is who or what rides in the plane  
And where to, for the good of mankind.

(From Air Age Education News, March, 1946; upon  
permission of American Air Lines, Inc., New York)

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## FOREWORD

This Bulletin was prepared under the direction of the Division of Teacher Training and Certification in the Bureau of Instruction, through efforts of a State Committee on Air Age Education. Dean J. J. Oppenheimer, University of Louisville, served as Chairman of this committee. The purpose of the committee was to work out a plan for the integration of Air Age Education in the entire educational program.

The degree to which the Air Age is a boon or a curse to mankind will depend a great deal on how well the schools accept their responsibility of preparing young people to live and to work in their aera in which air travel is a major influence. The suggestions contained in this Bulletin provide a brief outline to help school systems develop their own plans for integrating education for the Air Age in the total curriculum. Teachers will find many opportunities for expanding these suggestions to meet the needs of particular groups of children and young people.

In the preparation of the materials contained in this Bulletin, the State Committee received valuable assistance from classroom teachers, college staff members, and laymen. To each member of the Committee and to each person who made a contribution sincere appreciation is expressed.\*

BOSWELL B. HODGKIN  
*Superintendent of Public Instruction*

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\* All persons contributing to this publication are listed on page 367.

## MESSAGE

This Bulletin, *Planning Air Age Education*, is the result of cooperative efforts of many teachers and laymen interested in introducing the study of a new mode of transportation in the curriculum of schools.

Much of this material has already been tried out in the classrooms. It is, therefore, more than a theoretical piece of work.

The charge has frequently been made that the schools lag behind in improvements in modern life. This publication represents a serious attempt to bring into the curriculum of the schools materials concerning the significance of the airplane in times of peace. The airplane certainly is revolutionizing many aspects of modern life.

It is the sincere hope of the committee that the teachers of Kentucky will endeavor to use this bulletin in bringing into the classroom new materials which will inspire the children of Kentucky to have better understanding, improved attitudes, and deeper skills in thinking concerning air transportation and its implications for the future development of our Commonwealth and our Nation.

J. J. OPPENHEIMER, *Chairman*  
*Committee—Air Age Education*

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## AVIATION IN EDUCATION

Air Age Education is, in a sense, a rather unfortunate term. It seems to imply the need for sweeping changes in education of a sensational nature with almost futuristic implications. We in education cannot afford that sort of thing even if it be desirable. But we are and must be concerned with *Aviation*.

The place of aviation in the present world is one of great significance. The airplane is a real entity, its activities are dynamic, it is affecting all phases of our modern day living. As an economic instrument it has developed a new transportation system of fantastic speed, which moves uninhibited by surface barriers. As a social instrument it is increasing and expanding our cultural contacts and our internal and international mobility. Politically, the airplane has become an instrument of national and international policy subject to governmental control. The militaristic significance of aircraft is far too well known to warrant comment.

American education cannot ignore the great implications of Aviation! There is, I am sure, general agreement as to its significance and our need to know and to use it in education. The pressing question is: How shall we use it and with what goals in mind? Two lines of thought have been developed. The first we might call: *education in aviation*. This is education for technical skill in the production, flight, and use of aircraft. It has received the greater emphasis to date, but clearly it involves very sizeable expenditures and, more importantly, technical aviation is for the few rather than for the masses of public school pupils. The second line of thought might be called: *aviation in education*. It is as yet less organized and still very much in the experimental stage. But it involves a broad, non-technical approach to the use of aviation. It implies the use of aviation data which fits into and cuts across the subject matter areas of the present, existing curriculum of public school instruction. It is for all levels and for all pupils. This is the line of thought which will best fulfill our present educational needs.

From the point of view of the educator, aviation is a great motivating force among pupils at all educational levels. Aviation makes a tremendous appeal to the minds of all youngsters irrespective of age; they love airplanes, they are stimulated by many of its phases, they are articulate and seriously concerned about it, they enjoy it.

How, then, can this motivation be capitalized upon, both toward the goal of developing an understanding and appreciation of aviation and its contributions, and, at the same time, toward the goal of better motivated general education? The answer clearly would seem to lie in greater and more adequate use of aviation topics and materials in the general curriculum; to use, in other words, aviation as the instrument of teaching other things.

Why then is aviation so little used? We have pupil interest, we have available many materials; but we are not utilizing them. Where is the bottle-neck? Interestingly enough, but not so surprising when one comes to think about it, is the fact that at the moment the bottle-neck seems to lie at the teacher level. Many teachers are frankly disturbed by the topic. They often believe that their pupils know more about aviation than they do, which belief is erroneous and without justification. In many cases teachers lack adequate information; in even more cases they lack what we might call a "feel for aviation" or an awareness of its truly great significance as well as its pupil interest. If this analysis be true, we can scarcely with intellectual honesty, ignore pupil motivation because of teacher fears or teacher lack of interest. In like token, we should and can alleviate, if not overcome, the teacher problem by broadening the concepts of aviation into non-technical areas which can easily and adequately be handled by most teachers at appropriate levels and in varying subject matter areas. Then the teacher can welcome additional information and comment by the rabid, rocket pilot of the future and turn this enthusiasm into useful channels.

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## FUNDAMENTAL BELIEFS

### Kentucky Teachers Believe . . . . .

That their pupils should learn that democracy entails fundamental respect for human personality.

That democracy as a way of life can be learned thru study and actual participation in cooperative and responsible living in the classroom.

That pupils shall learn to have genuine regard for the democratic tradition as it is revealed in our national history.

That pupils should learn about and hold in deep respect the people of all nations, races and cultures.

That pupils should learn about various promising efforts that are now being made to bring about greater international understanding and good will in order to ensure an enduring peace and better standards of living.

That pupils must learn that ways of enduring peace are made "in the minds of men."

That pupils must learn about their own natures and how to live effectively and harmoniously with others.

That pupils should learn what science and the scientific method have added to our common heritage and how human life has been enhanced, but that this great instrument should always be used for the improvement of the good life of all peoples.

That the great improvements in rapid communication and transportation have increased the *possibilities* of greater unity, goodwill, and mutual welfare of all the peoples of the world. These have made one world an attainable ideal.

That with greater concern for well-being of all, have come greater opportunities for the individual and greater individual responsibilities.

That our common society should be so organized that increasingly the individual citizen has greater opportunities for personal growth and for greater community service.

That learning is of greatest value when the learners see in the process greater meanings and genuine significance to their living better lives in the present.

That the ends to be attained thru education are moral values.

## THE OBJECTIVES OF AIR-AGE EDUCATION IN KENTUCKY

Immediately following the end of World War I the people of America were faced with readjustment problems accruing from the experiences and developments of the war years of 1914-1918. The horizons of the individual members of the American democratic society were broadened to include not only the immediate community, but the entire country. New means of transportation and communication made New York as close to Kentucky as Tennessee was before the war. Because of the closer association it became as necessary to know how the people of New York lived and thought as it was to know how the next door neighbors lived and thought.

Today the people of the entire country have become even more closely associated and interdependent. And this interdependency has been broadened to include *all* the peoples of the world. The same problem of readjustment to broadened influences is today facing the peoples of every nation.

Kentucky, the other states of the nation, and all the nations of the world *must* live together. Due to the scientific advancements and developments of the recent war years this need has become imperative. No longer is any person or group of persons able to retire into a shell and need no help from any other person or group of persons. Nor is any nation free from fear of every other nation until it is a friend to every other nation. This problem of interdependency and living together is the most vital one facing the world today.

If the people of Kentucky and of the nation are to live in peace and freedom from fear, they must be able to count as friends all the other nations of the world. Education can light the way to a new understanding of other nations that will lead into enduring friendships. The schools must take the lessons learned in the scientific developments of atomic fission, rockets, and airplanes and turn them toward peaceful, beneficial uses.

In light of these facts, the first objective of air-age education in Kentucky should be to provide the children and youths of the state with the opportunity to learn how all the other peoples of the world live. The provision for this understanding will point the way toward means of living with these other peoples of the world.

The second objective of air-age education in Kentucky should be to help children and youths think and act intelligently about matters

pertaining to the resulting from recent scientific advancements and developments in aviation and related fields. The responsibility for this task belongs to teachers in every subject field and in every grade.

The third objective of air-age education in Kentucky should be to provide additional pupil experiences and activities that will lead to a better understanding of the scientific advancements and developments of the air age. Although primarily an objective of the secondary schools, it can be carried out to a limited degree in the elementary schools also.

The fourth objective of air-age education in Kentucky should be to provide training for vocational competence in the newly developed fields resulting from the air age. This would be primarily a function of the secondary schools or the institutions of higher learning.

The fifth objective of air-age education in Kentucky should be to provide opportunities for adult members of the American society to learn of their responsibilities for and pleasures derived from the air age.

## THE ESSENTIAL FACTS REGARDING AVIATION IN KENTUCKY

The Commonwealth of Kentucky has not just recently entered into the field of state-fostered and ruled aviation. It began its program in 1926, and has made steady and constant progress until at the present time Kentucky has a simplified set of Laws, Rules and Regulations which, without unduly burdening anyone, gives the Commonwealth its control, the fliers freedom of operation, and the general public assurance of safety and adequateness; not only of the planes in which they ride, but of the airports from which these planes operate.

The Kentucky Aeronautics Commission was created by the General Assembly in 1926. At that time the Commission was known as the Air Board of Kentucky. In 1940, the regular session of the General Assembly created the Kentucky Aeronautics Commission which was to be a bi-partisan group of six members, each of whom was required to be at least twenty-five years of age, and at least two of these members were required to be affiliated with aviation. The Commission was authorized to employ such agents and employees, including a Director, as it deemed necessary. It was also authorized to prescribe such rules and regulations as it deemed necessary. The Commission has since been charged with the general supervision of all airports, landing fields, and schools of aviation within the Commonwealth; and is further charged with the fostering and promotion of the aviation industry throughout Kentucky.

Kentucky stands astride the continental airline routes both East and West, and North and South, with only five cities with facilities that can handle present day commercial planes. These cities are reaping the fruits of air travel and air express. The Civil Aeronautics Board, as of June 1, 1947, had certificated thirty-six airlines to transport passengers and freight on regular schedules throughout the United States. On this same date there were pending before the Civil Aeronautics Board three hundred and seventy-two applications for permission to commence the transportation of persons and freight on scheduled routes throughout the United States. Although Kentucky now has only one certificated intrastate airline, there are many applications pending before the Kentucky Aeronautics Commission

those applications made by persons seeking to engage in intrastate scheduled airline service. At present Kentucky is served by five interstate airlines which provide transportation to all major points throughout the United States. Only forty-seven percent of the counties in the United States have airports at this time. Until airports are brought within easy reach of the potential fliers and are spotted near all points to which they would want to fly for recreation or business, the public will hesitate to buy airplanes. The greatest field for the immediate expansion of civil aviation exists in the development of personal flying. Today personal flying, as an industry, is best compared to the automobile twenty-five years ago. In 1903, there were 32,920 automobiles registered in the United States. In 1945, there were approximately 30,000 aircraft certificated by the Civil Aeronautics Administration in the United States. It is possible to foresee a thirty percent annual increase in aircraft as they acquire greater utility and more airports are provided. At this rate, there will be more than 400,000 civil aircraft in use in the United States by 1955.

Since 1940, the Civil Aeronautics Administration has administered a program of building airports for National Defense, spending some four hundred million dollars. This money was spent on building some of the country's largest airports. On May 13, 1946, President Harry S. Truman signed the National Airport Act, which authorizes annual appropriations amounting in the aggregate to \$500,000,000 to be spent over a period of seven years. Under this Act, the Federal Government will match local funds up to fifty percent for the construction of publicly owned airports; also, the gross maldistribution of airports that exist today will be eliminated, and instead, the United States will have a highly developed system of airports.

On December 28, 1946, an amendment to the Veterans' training bill became effective permitting flight training. Under this amendment the individual states are responsible to the Veterans Administration for determining what schools are qualified to offer this training. For the Commonwealth of Kentucky this responsibility has been given to the State Department of Vocational Education. Realizing that the Aeronautics Department was the logical one to handle the aviation training, this responsibility was delegated by the Department of Vocational Education to the Kentucky Aeronautics Commission. Under close supervision, this program has expanded until at the present time forty-five flight schools in Kentucky are teaching approximately 1000 veterans. In addition to these flight schools, several of the larger colleges have been approved and are offering flight

training to the student who elects to take the course. College credit is allowed upon completion of the course.

Today when aviation or aeronautics is mentioned, or when a person is asked if he would like to enter the field, the tendency is to think of it, visualize it, in terms of flying the planes. As in other industries, people tend to idolize the colorful, masterful figure at the controls. Many people feel that they cannot meet the requirements of a pilot, and therefore, that they cannot actively participate in aviation. That is far from the truth. Actually, many thousands of people will participate in aviation in other ways than in flying. The field of aviation is large and offers a wide range of opportunities. There is no field today which offers a more exciting future or a greater variety of opportunities for a life's career than does aviation.

The airplane has not only brought the people of a nation closer together—it has made a neighborhood of the world. This will mean that an enormous number of persons will become, in one way or another, associated with the industry. The influence of the aviation industry will be felt by nearly everyone in whatever part of the world he lives.

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## **AIR AGE EDUCATION IN ELEMENTARY SCHOOLS**

### **Goals, Materials, Methods and Procedures in Aviation Education in the Elementary School**

Education should be directed toward the making of a good life in a society that is increasingly dominated by the use of air. It is vital that the elementary teacher develop in the child the understanding that the airplane has made one world and that cooperation with others is essential if we are to survive.

The problem is made easy because children have a keen interest in anything pertaining to airplanes and no artificial stimulation is required.

In this chapter no effort has been made to list the understandings, the activities and bibliography according to grades; however, they are listed according to difficulty. This was done because the background and previous experience of children rather than the grade level should determine the type of activity suited for a particular group.

### **Understandings for the Teacher to Develop in the Elementary Schools**

1. Different types of airplanes and their purposes
2. The part that modern inventions and science have played in aiding and developing air-transportation
3. Airports and air terminals
4. The effect on airplane performance of atmospheric conditions and physical features of the earth
5. The qualifications and the duties of a pilot
6. Importance of pilots and stewardesses keeping physically fit
7. The history of the development
8. Improvement in safety of flying through radio and radar
9. Necessity of a swift means of transportation in the age in which we live
10. The increased opportunities in utilizing the natural resources of the world through research and distribution offered by airplanes
11. The commercial possibilities of air-transportation

12. The possibilities for rapid and frequent transportation of peoples and goods, the dissemination of diseases and improvement of physiological conditions and requirements for health, comfort and safety
13. How the airplane has opened up the interiors of continents and established new transportation routes
14. The fact that air-transportation is tending to draw all people together thus developing our Good Neighbor Policy
15. The relationship of air-communication to other means of communication
16. Great feats performed in the air
17. The issues involved in creating freedom of the air for all nations.

#### **Experiences Children in the Elementary Schools Should Have**

This is a list of suggested experiences which elementary children might have. No one teacher will attempt to use them all, but will choose those she finds suitable to the environment, background, maturity, and interests of her pupils.

#### **Airports and Personnel**

1. Collect and classify pictures of airplanes under types (wings, motors, landing gear, uses, etc.).
2. Study diagrams of airplanes and learn names of main parts.
3. Watch planes flying over and try to identify them.
4. Describe to the class the airplanes seen.
5. Describe trips made by airplane.
6. Learn common markings of airplanes.
7. Collect pictures showing as many different uses of airplanes as possible. (Mail, passenger, express, disease and fire control, photography, etc.)
  - a. Visit post office and express office to learn about air mail and air express service.
8. Visit an airport.
  - a. Observe kinds of airplanes and parts of airplanes.
  - b. Inspect a commercial plane (galley, seating, baggage compartment).
  - c. Interview pilot, stewardess, ground crew about their work. If possible follow a pilot preparing for flight as he secures weather reports, charts, directions from the control tower.
  - d. Watch airplane warm up and taxi.
  - e. Watch airplane being serviced by ground crew.



9. See movies and film strips of airplanes.
10. Ask military pilots, navigators, gunners living in the community to visit school and tell about their experiences.
11. Learn physical, mental, and educational qualifications for pilots, navigators, stewardesses, etc. Discuss importance of and reason for these requirements.
12. Construct model airplanes.
13. Demonstrate maneuvers with model airplanes.
14. Demonstrate maneuvers of airplanes to music, gliding, banking, etc.
15. Make movie strip showing types and uses of airplanes; uniforms and duties of pilots, stewardesses, etc.
16. Write poems or stories about airplanes.
17. Dramatize the story of an emergency flight.
18. Take an airplane ride if possible.

#### Airports and Airways

1. Learn where located and why; compare with locations of railway terminals.
2. Visit airport.
  - a. See plan of the port—taxi strips, apron, length and direction of runways, hangar, control tower.
  - b. Visit terminal—inspect restaurant, rest room, shops, other services offered.
  - c. Inspect wind tee and wind sock.
  - d. Watch airplanes in traffic pattern (taking off and landing).
3. Construct wind tee and wind sock (upper grades).
4. Make diagram or floor model of airport.
5. Observe navigation facilities in the community.
  - a. Rotating beacons.
  - b. Radio beam.
  - c. Intermediate landing fields.
  - d. Course lights.
  - e. Roof markings.
  - f. Lights on planes.
6. Make graph showing height airplanes must fly in city, open country and over water.
7. Write to air lines for a copy of traffic rules.
8. Dramatize a "blind" landing.

9. Make an Air Age dictionary

aileron	biplane	fuselage
airway	ceiling	streamline
altimeter	cockpit	taxi
amphibian	elevator	visibility, etc.

**Airlines**

1. Learn the names of large lines, Pan-American, American, Eastern, Delta, etc.
2. Make world and United States maps showing routes of these lines in different colors.
3. Write letters to these lines, municipal chambers of commerce, and aircraft factories for materials.
4. Find out services rendered by these companies.
5. Compare fares with those of surface transportation.
6. Make Air Age exhibit for the school.
7. Plan an imaginary trip on one of these lines: cost, time required, baggage, dress, weighing in of passengers, passports, people and places to visit; keep log of trip; make map showing route and airports visited.
8. Read time tables and compute flying time from various points to other places of interest.

**Effect of Atmospheric Conditions and Physical Features of the Earth on Flying**

1. Visit weather bureau.
  - a. Find out how weather (temperature, pressure, moisture) affects flying.
  - b. Get samples of weather maps and learn to read them.
  - c. Ask about services bureau offers.
2. Study weather—clouds, rain, fog, wind.
  - a. Make rainfall gauge.
  - b. Keep temperature chart, check temperature near floor and near ceiling of school room.
  - c. Learn how to find wind direction.
  - d. Learn to read a thermometer and barometer.
  - e. Observe clouds, learn their names, make clouds by boiling water.
3. Study some properties of air.
  - a. Learn that air is made of oxygen, nitrogen, carbon dioxide.
  - b. Learn that there is dust in the air; observe dust particles in a ray of sunlight.

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- c. Learn that there is water in the air; place water in dishes, one near radiator, one in cool place; note that water evaporates from both, faster from the dish by the radiator. Water condenses from the air; watch moisture form on pitcher of ice water.
  - d. Learn that air occupies space; push an inverted glass into a bowl of water and note that the water only rises part way in the glass because air occupies the rest of the space.
  - e. Learn that air exerts pressure; feel the wind blow, place a piece of paper over a full glass of water, note that the water does not spill when the glass is inverted.
  - f. Learn that air rises when heated; fasten paper streamers in an open window, near top, near bottom, note warm air blows streamers *out* at the top, cold air blows them *in* at the bottom.
  - g. Learn that moving air will lift a curved surface as it flows by it; hold a sheet of paper over a pencil at mouth level and blow. Watch the paper rise.
  - h. Make small parachute; watch it float down on air.
4. Observe air travelers; birds, insects, seeds.
  5. Apply results of these experiments and observations to aviation.

### The History of Aviation

1. Read stories and legends of early efforts to fly.
2. Collect pictures of early airplanes.
3. Make a scrap book of famous airplanes and flyers.
4. Visit a nearby museum and see aviation exhibits.
5. Make a frieze showing the progress of aviation.
6. Make maps showing early flights.
7. Make a *Who's Who in Aviation*.

### World Importance of Aviation

1. Compare on a globe the distance from one country to another by air with the distance by surface transportation.
2. Make graphs showing the time required to cover certain distances (1) on foot, (2) by train, (3) by car, (4) by plane.
3. Compare the time it took Peary to reach the North Pole with Byrd's time.
4. Discuss how air travel binds the world closer together.
5. Collect news articles telling of trips made by plane to distant places in comparatively short times. (General Marshall's

- flight to Moscow, President Truman's visits to his mother, trips from Kentucky to New York for a day's shopping.)
6. Collect new polar projection maps and discuss why aviation has made this type map more important.
    - a. Why is the Arctic Ocean now called the Mediterranean of the World?
  7. Ask some returned service men to talk to the group on the dangers of aviation to a world which does not follow the Good Neighbor Policy.
  8. Note how aviation has made formerly inaccessible parts of the earth more important.
  9. Discuss the question: Why do we now speak of places being hours away rather than miles away?
  10. Give an informational program for parents and other grades in which the implications of the Air Age for the future are discussed.

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<sup>1</sup> These bibliographies are not complete.

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## AVIATION EDUCATION IN THE JUNIOR AND SENIOR HIGH SCHOOLS

An ideal approach for direct aviation education on the junior high level is model airplane building. Students in the seventh grade should start on kit models and progress to models which will really fly well. They can learn to design and build such models as gliders, R.O.G. (rise off the ground) models, outdoor fuselage models, or gasoline powered models. Many such models are described in current aviation magazines such as *Model Airplane News* and *Air Trails*. As a basis for a course in model building, books such as *Riding On Air* or *Model Airplane Design and Theory of Flight* might be used. Students can continue to build models as members of a model building club open to all interested.

### General Course In Aviation In High School

A course in "pre-flight" aviation was offered in many Kentucky high schools during the recent war as a war-emergency measure. It was designed primarily to give high school students a background for entry into the aviation branches of the Armed Forces upon completion of their high school training. Letters of appreciation written to school authorities by those responsible for the further training of these students demonstrate that the "pre-flight" aviation course served its purpose well.

Many schools have dropped "pre-flight" aviation from their curriculum because the war-time objective has been met. And yet the indoctrination of future air force personnel is only one of the objectives of a peace-time aviation program in the schools. It is, perhaps, uncomfortable to live at such a turning point in the history of man, but it is also a challenge. The slogan "that the future belongs to those who prepare for it" can well be used today. It is the duty of educators to present, to the best of their ability, the facts about this new air age and to indicate the potentialities and the dangers which face America and the rest of the world. A course which possesses many of the unit titles found in the war-time pre-flight aeronautics, but also includes consideration of the impacts of aviation on everyday life, meets the needs of youth in a peace-time aviation education program.

An elective course can be offered without pre-requisite in the tenth, eleventh, or twelfth grades. It can be taught as a one semester course, or a full year course. In either event, the same units are covered, but the subject matter in the year course can be covered more thoroughly. It should be a general course in aviation and not categorized as a science or vocational subject so that it may be generally available to the majority of students. It should carry credit toward graduation and be acceptable for college entrance.

A recommended outline for such a course is given below:

### Proposed Course Sequence

		CLASS PERIODS	
Unit Presentation		Year Course	Semester Course
I.	The Air Age .....	15	8
	A. Evolution of the Air Age		
	B. Geographic concepts		
	C. World politics		
	D. Significance of universality of airplane		
II.	Aircraft Structures* .....	15	7
	A. Familiarization with nomenclature and position of the parts of the airplane		
III.	Aircraft Power Plants* .....	15	8
	A. History of aircraft power plants		
	B. Component parts and systems of aircraft power plants		
	C. Determining power plants operation		
	D. Rockets and jet propulsion		
IV.	Why an Airplane Flies (Aerodynamics) .....	20	10
	A. Basic concepts of air as a medium of flight		
	B. The four forces affecting flight		
	C. Control of an airplane around its axes		
	D. The four fundamental flight paths		
	E. Stability in aircraft		

\* The approach to the study of aircraft structures and aircraft power plants should not be vocational. They should be conducted from the viewpoint of their relation to the airplane and flying as a whole.

V.	How an Airplane is Flown (Flight Techniques) .....	10	7
A.	Sense organs and flight		
B.	Attitude flying Control of the airplane about its three major axes and the re- lation of power to attitude. Attitude flying defined is the control of the airplane's flight by reference to the relation- ship between the nose and wings of the airplane and the natural horizon.		
VI.	Weather (Meteorology) .....	30	15
A.	Effects of weather on industry, on the individual, and on aviation		
B.	The air ocean		
C.	Observing and reporting weather		
D.	Primary causes of weather		
E.	Weather services		
VII.	Navigation .....	30	15
A.	Aeronautical charts		
B.	Methods of navigation Actual plotting of courses for pilotage and dead reckoning. Instrument flight should be only briefly outlined. Celestial and present day trends should only be mentioned.		
VIII.	Communications and Control .....	30	12
A.	The airport		
B.	The control of air traffic		
C.	Air traffic regulations		
D.	Communications The approach to the study of communications and control should be to develop an under- standing in air traffic safety.		

### Miscellaneous

Testing .....	5	4
Summary .....	10	4

There are no suitable texts now available for a general course in aviation although some are in process of development. However, the textbooks prepared for the "pre-flight" courses may be used as references along with CAA bulletins and other books recently published.

The time allotments have been made on the basis of a school year of 180 class periods. They are not critical and are listed to aid in the organization of the course. In making the allotments emphasis was placed upon the fact that the course is of a general nature, intended to develop an understanding of aviation and its implications. Thus, those units which serve most readily as vehicles for the implications have been given greater weight.

The unit sequence is the result of careful consideration of many combinations. This one, it is felt, lends itself to a complete organization of ideas, a logical progression of learning experiences, and the maintenance of student interest. It is not, however, to be regarded as inflexible. Rearrangement is possible and may, in some situations, be preferable. If rearrangement is contemplated, the following two points must be remembered: first, the students' interest is in the airplane itself; second, that units such as "Navigation," "Weather," etc., can be functional only if this interest is satisfied.

Approximately one-third of the allotted time should be devoted to laboratory experience. It should include several trips to an airport to familiarize the student with equipment and procedure there. Four hours of actual flight experience is recommended but not necessary. Where such flight experience is possible, it should be contracted for through a reliable flight operator to permit the student to get the "feel" on the controls. A short cross country trip would make navigation principles more real and give the student a better understanding of meteorology and Civil Air Regulations. The purpose of such flight experience is to demonstrate principles studied in the classroom and not to instruct students to fly.

Insurance for such flights should be demanded from the flight contractor. The Civil Aeronautics Administration has made an extensive investigation of such insurance and school boards wishing to include laboratory flight experience should consult with the CAA with regard to the type and cost of such insurance. Parents' permission should be demanded, no opportunity for misunderstanding can arise.

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Suitable motivating devices for regular class work, as well as laboratory experience, should be provided. An outstanding example of this is the school type "Link" trainer. This device, which embodies the suggestions of educators, has the appearance of a small airplane and full sized cockpit. All such can help to overcome the two dimensional limitations of textbooks and blackboard presentations.

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## ENRICHMENT OF SECONDARY TEACHING THROUGH AVIATION

The curriculum of the secondary school should provide educational experiences which help students to understand the impact of aviation on our modern world. This is not to be construed as an argument for the introduction of a series of new courses into the curriculum of the schools, although some such courses might be appropriate on the secondary level. It is the opinion of the committee that an adequate program of general aviation education could be provided by the infiltration of aviation-education objectives, experiences, problems, and materials into existing courses in the social studies, sciences, mathematics, literature, and arts so as to vitalize and enrich them. It is therefore, recommended that an effort be made by the schools to introduce aviation materials into existing courses and activities so as to vitalize and give increased significance to these courses. These activities should include sufficient trips to airports, air traffic control centers, airplane plants, and weather bureaus, to familiarize the student with equipment and procedure.

Since progressive teachers make use of current materials and pupil interest in instruction, this report makes no attempt to outline procedures in detail. These are but brief suggestions in the respective fields.

### Biology

Teachers of biology should emphasize the physiological effects of flight.

A few topics and activities which might be considered are:

1. The origin of flight.
2. The navigation of birds and insects.
3. Effects of altitude, acceleration, temperature, and oxygen supply upon the human body.
4. The sense organs and orientation in flight.
5. Physical requirements for flight.
6. A study of the airplane as a means of controlling insect pests through dusting and spraying.
7. Air travel and disease control.

## General Science

The wealth of instructional materials available in the science field presents a problem in the selection of appropriate materials on the different grade levels. A course in senior science could use the same topics and activities but should develop them more in detail.

The following topics and activities are but a few of those which might be regarded as important:

- I. An understanding of the weather elements and how they affect flying
  - A. Weather Factors
    - a. What is the atmosphere?
    - b. What is temperature? How is it measured?
    - c. What causes differences in air temperature?
    - d. How can air pressure be measured?
    - e. What causes winds? Meaning of Beaufort Number.
    - f. The importance of humidity and how it is determined.
    - g. What causes precipitation?
  - B. Storm Areas and their relation to flight
    - a. What are local storms?
    - b. What are general storm areas?
  - C. Weather Forecasting
    - a. Cloud types and their meaning
    - b. Air masses—origin and properties
    - c. Frontal weather—characteristics
    - d. Weather maps—how they are made and the interpretation of data.
  - D. Hazards to flying
    - a. Fog, hail, ice, and thunder-storms
- II. What is the nature and use of the more important parts of the airplane?
  - A. Parts of the plane
  - B. Forces acting on the plane
  - C. Control surfaces and function
  - D. Airplane instruments
    - a. Principle of operation
    - b. How they are used to control the airplane in flight.
  - E. Internal combustion engines and transmission of power
    - a. Gasoline, diesel, turbine, turbo-jet, and rocket.
  - F. Less common types of aircraft and how they operate
    - a. Blimps, dirigibles, autogiros, and helicopters.

- III. An understanding of the changing concepts in time, distance, and place in the air-age.
  - A. A study of projections and their adaptability to air travel.
  - B. A comparison of maps and charts used for automobile, plane, and boat travel.
  - C. The importance of an understanding of time zones in the air-age.

### Physics

Physics offers many opportunities to use aviation materials to motivate the pupil and enrich the subject matter.

The following topics are some to be considered:

- I. Mechanics of fluids.
  - A. Air pressure and its relation to flight.
  - B. The airfoil and Bernoulli's theory.
  - C. Archimedes' principle applied to lighter-than-air-craft.
  - D. Pascal's law as applied to the hydraulic system of aircraft.
- II. Force and Motion.
  - A. Newton's laws of motion as applied to flight.
  - B. Kinds of energy—potential, kinetic, electrical, chemical, mechanical and heat; and how they are utilized in flying a plane.
  - C. Center of gravity and moments.
  - D. Vectors as applied to forces acting on plane.
    - a. Drag, thrust, lift, weight, drift, glide angle, and trajectory.
- III. Engines.
  - A. Principle of operation.
  - B. Types and adaptability to aircraft.
- IV. Heat.
  - A. Aircraft engine cooling systems.
  - B. Principle of carburetion, compression, combustion, and power transfer.
  - C. Methods of heat transfer as related to weather.
    - a. Humidity, clouds, precipitation, fog, frost, and icing.
- V. Electricity.
  - A. Ignition systems.
  - B. Airplane electrical circuits.
  - C. Radio and its use in aerial navigation and traffic control.
  - D. Proposed use of airplanes in television transmission.



VI. Sound.

- A. Problems of sonic and supersonic speed.
- B. Explanation of Dopplers Effect.
- C. Noise level problems of the areonautical engineer.

VII. Light.

- A. Optical instruments used on aircraft.
  - a. Sextant, astro-compass, drift-meter, bomb-sights, and aerial cameras.

### Mathematics

Teachers of mathematics will find in aviation excellent problem material which will stimulate the interest of the students in both mathematics and aviation. Aviation provides many opportunities to present problem materials and experiences in which students see mathematics being applied to the solution of problems which they regard as important.

Since the science of flight and the engineering involved in airplane design are based on physics and mathematics, it is not difficult for the teacher of mathematics to make many interesting references to aviation in existing mathematical problems and to provide a multitude of applications of fundamental theorems to current aviation practice.

Listed below are a few of the possibilities but this is by no means complete. Reference materials in this field are unlimited and good teachers can relate many other phases of secondary mathematics to aviation.

#### Algebra—First Year

1. GRAPHS (a) straight line—converting miles per hour to feet per second—nautical miles to statute miles.  
(b) bar graph—air temperature changes at various altitudes.
2. VERBAL PROBLEMS (a) time, rate and distance; (b) area of runways; (c) cost of air transportation.
3. EVALUATING FORMULAE

(a) wing loading =  $\frac{\text{gross weight}}{\text{wing area}}$

(b) power loading =  $\frac{\text{gross weight}}{\text{horsepower}}$

#### Algebra—Advanced

Ratio and proportion and variation can be enriched by the lift formula ( $L = CL^d S V^2$ ) and all the formulas derived from it. Also the pressure, volume, temperature relationship provides interesting problems.

Because the values substituted in the lift formula are often decimals and large numbers, evaluating the formula is a laborious task and should be an incentive to learn logarithms and the slide rule.

### **Conic Sections—Graphs**

Examples of the parabola—reflectors of beacon lights and head lights; trajectory of a bomb falling from a plane in flight.

Example of the ellipse—the area of action when the plane returns to a second airport, without wind.

### **Plane Geometry**

Angles of aeronautics: sweepback; attack; bank; glide; drift; dihedral.

Vectors—their definition and their application in the parallelogram of forces and in the velocity triangle. Specific example of the use of a plane geometry theorem:

Circumferences vary directly as their diameters or as their radii. Example: Show why the tip of a propeller blade travels faster than a point nearer the hub.

### **Solid Geometry**

The minimum surface enclosed in a given volume is the sphere. Example: The top of most cylinders is in the shape of a hemisphere so that the combustion chamber will have a minimum surface for its volume.

Three points determine a plane.

The intersection of two planes is a straight line.

Example: Show why a great circle arc projects into a straight line on polar projection maps.

The celestial sphere offers many fine examples for spherical geometry: spherical triangle, measurement of spherical angles, lunes, zones, azimuth, altitude, declination.

### **Trigonometry**

Many fine examples of numerical trigonometry are found in the aeronautics material: finding the lift of an airplane in a banking turn; finding the centripetal force needed to hold it in the turn; finding the angle of glide or angle of climb; finding the height of a cloud base.

The parallelogram of forces and the velocity triangle may be solved by the law of cosines or the law of sines, depending on the information given.

Spherical trigonometry is used in celestial navigation. The development of the haversine formula for great circle arcs is very interesting.

## Social Sciences

With the advancement of the air-age comes the demand and necessity for new and greater emphasis on our social, economic and political problems; both national and international. New problems will be presented and must be met by the teacher of the social studies. A list of these problems, subject to expansion, are presented here:

- I. Political
  - a. National and international regulations governing travel and commerce.
  - b. Changed concepts of time and distance.
  - c. National security.
  - d. A greater need for international cooperation due to destructive power of air forces.
  - e. Natural boundaries become less important in the air-age.
  - f. National agencies to properly regulate the air ways.
  - g. History of political development.
- II. Social
  - a. A better understanding of the language, institutions and customs of other people of the world.
  - b. Greater opportunity for recreation.
  - c. More efficient health service due to ability to reach remote places in a short time.
  - d. To promote safety of air travel.
  - e. An aid to national and international police.
  - f. An aid in development of suburban areas.
  - g. Cultural contribution of air travel.
  - h. History of social development.
- III. Economics
  - a. Effect on other methods of transportation.
  - b. New source of employment.
  - c. Will contribute to decentralization of industry.
  - d. Building of new air bases.
  - e. New industries based on growth and development of air power.
  - f. Use in combating destructive forest fires, plant diseases, etc.
  - g. Rapid transportation of "critical" and perishable goods.
  - h. Trade with foreign countries.
  - i. History of economic development.

### The School Library and Aviation Education

Any library is obviously a storehouse of materials on aviation, which include much more than actual books alone. A well rounded

book collection is not limited to technical texts. Histories of the development of air travel are always of interest. These should not begin merely with our Wright brothers, but should go all the way back to the studies of flight made by Leonardo da Vinci, and the early balloon ascensions.

Biographies of outstanding men and women are popular and will often serve also as outside reading for English courses. A few samples are Byrd's "Alone" and "Skyward," Sikorsky's "Story of the Winged-S," "Heroines of the Sky," and "Last Flight" about Amelia Earhart.

Technical books and texts must be within the comprehension of teen agers. Their extent may depend on the amount of machine shop and field resources available in the school.

The countless books on the part the airplane played in the recent war still are being devoured by boys and girls. Even those few titles from the first world war were read steadily up until this war, and are still in demand. Rickenbacker's "Fighting the Flying Circus," and Nordhoff and Hall's "Falcons of France" have been worn out and had to be replaced in many school libraries.

Few school libraries have any books on model plane construction which gather dust on the shelves.

There is a world of free and inexpensive pamphlet material for keeping up-to-date on recent developments. The airlines and the government are sources of many fine and well illustrated pamphlets. Libraries subscribing to the Wilson Vertical File Service and the A. L. A. Booklist have two good sources for locating such material.

Maps of airlines and famous flights are not only of interest to children, but are good for bulletin board displays, and many are attractive enough to serve as permanent wall decorations.

While some of the magazines in the field are rather technical for students, Laura Martin in her "Magazines for High School Libraries" reports that "Flying" is far and away the most generally popular with aviation enthusiasts.

Model plane builders are legion, and with the least encouragement will bring their work to school for exhibit. The library is a central place for such displays. The librarian who lets it be known that she thinks the smaller models look well as decorations for unused bookshelf space will find herself swamped with such gifts. Pupils like to feel that their library is air minded, and this is one way of demonstrating it.

With careful planning and imagination, the library bulletin board can be used for many interesting displays about aviation.

## English

Since language is the prime factor in the learning of all subjects, an addition to the curriculum can be correlated to a greater or less extent with the subject of English.

The correlation between aeronautics and English is not so close as that with mathematics and other sciences, but whenever opportunity arises in English classes, such correlation as is possible should be made. In the high school the nature of the material used will depend upon the individual interest of the members of each class.

Many of the suggestions which follow apply more particularly to courses in general and business English, where vocational interest can be given more time than can be allotted to them in courses in college preparatory English. However, in any English course there are times when poems, novels, and books of actual experiences in the field of aviation, as well as composition exercises, both oral and written, can be introduced.

The following list of activities is merely suggestive, and many others will occur to the resourceful teacher.

### Literature

1. Poems such as "High Flight," "Darius Green and His Flying Machine," and Tennyson's prophecy from "Locksley Hall."
2. Books giving accounts of experiences, such as "Wind, Sand and Stars," "We," and "North to the Orient," and biographies of noted figures in the field of aeronautics.

### Composition—Oral and Written

1. Reports on the experiments of Leonardo da Vinci and others to show how long man worked before he was successful in air navigation.
2. Reports, both oral and written, upon types of planes, model-building, materials used in planes, and related subjects.
3. Accounts of airplane trips and of trips to air fields or airplane factories.
4. Research themes on various phases of aeronautics as term papers in senior English for students especially interested in the field.
5. Credit in English for papers of merit written in science classes on subjects related to aviation, such as studies of vocational opportunities in the field and qualifications and training required for workers.
6. The part played by the airplane in making this "One World."
7. The part the airplane has played in emphasizing the need for a universal language.
8. The vocabulary of aeronautics and spelling of terms.
9. Discussions of the importance of aviation in daily life; for examples, air-mail, air-travel, and transportation of goods.
10. Letters asking for pamphlets or for information concerning jobs.

## BIBLIOGRAPHY

### Audio-Visual Aids

Castle Films, 135 S. La Salle St., Chicago 3, Illinois

Department of Commerce, Civil Aeronautics Administration, 608 South Dearborn Street, Chicago 5, Illinois

(A very comprehensive listing of films and film strip for loan.)

Encyclopedia Britannica Films, Inc., 20 N. Wacker Dr., Chicago, Ill.

Jam Handy Picture Service, 2900 East Grand Boulevard, Detroit 11, Michigan

University of Kentucky Extension Department, Lexington, Kentucky  
(Many very good films available)

There are many excellent audio-visual aids which may be used in air-age education on all levels. Many very fine films may be secured through the educational division of industrial concerns without charge. For titles and sources consult the Aviation Source Book.

### Periodicals

The following periodicals are suited for use at the secondary school level:  
*Aero Digest*, Aeronautical Digest Publishing Corp., 515 Madison Ave., New York (Somewhat technical)

*Air Trails, the Model Builder's Guide*, 79 Seventh Ave., New York.

*Current Aviation*, American Education Press, Inc., 400 South Front Street, Columbus, Ohio (Excellent for class-room use)

*Flying*, 540 North Michigan Avenue, Chicago, Illinois.

*Skyways*, Henry Publishing Company, 444 Madison Avenue, New York City.

Outstanding Aviation reference materials on secondary school level.

#### AIR-AGE EDUCATION SERIES:

The Macmillan Company, Chicago

*Science of Pre-Flight Aeronautics*, Rev. (Aviation Education Research Group, Teachers College, Columbia University)

*Elements of Pre-Flight Aeronautics for High Schools* (Aviation Educational Research Group, Teachers College, University of Nebraska)

*Human Geography in the Air Age* (Renner)

*Social Studies for the Air Age* (Bartlett)

*Globes, Maps and Skyways* (Bauer)

*Flying High* (Anthology) (Cohen)

*Wings for You* (Anthology) (Cross)

*The Air We Live In* (Renner and Bauer)

*The Airport* (Arey)

*The Biology of Flight* (Fitzpatrick and Stiles)

*Mathematics in Aviation* (Osteyee)

*Education for the Air Age* (Engelhardt)

*Physical Science in the Air Age* (Manzer, Peake, Leps)

*Geographic Education* (Renner)

*Aeronautics in the Industrial Arts Program* (Wilber and Neuthardt)

*Bibliography of Aviation Education Materials* (Cartwright and Others)

- Elementary School Science for the Air Age* (Arey)  
*Teachers' Manual for Science of Pre-Flight Aeronautics for High Schools*, Rev. (Stover, General Editor)  
*Teachers' Manual for Elements of Pre-Flight Aeronautics for High Schools* (Aviation Education Research Group, Teachers College, University of Nebraska)  
*Teachers' Manual of the Biology of Flight* (Fitzpatrick and Stiles)  
*Aviation Education Source Book* (for teachers) Hastings House, Publishers, New York 18, N. Y.  
*Air Scout Manual*, Boy Scouts of America, New York  
*Air Transportation*, Air Transport Association of America, 1107 16th Street, N. W., Washington, D. C. (An excellent statistical report on air transportation)  
Jordanoff, Assen. *Jordanoff's Aviation Dictionary*, Harper and Brothers, New York  
Selected References and Teaching Aids for the Study of Aviation Department of Commerce, Aviation Training Service, Aviation Education Division, Washington, D. C.  
Vetter, E. G. *Let's Fly; an A. B. C. of Flying*, Wm. Morrow and Company, New York  
Vetter, E. G. *Visibility Unlimited*, Wm. Morrow and Company, New York
- Booklets  
*A Power Primer*—General Motors  
*Power Goes to Work*—Education Division, Detroit, Michigan  
(These are excellent books, well adapted for use in general science and physics.)  
Consult General Bibliography for more complete listing of materials.

## AVIATION IN VOCATIONAL EDUCATION

The objective in vocational aviation education is to train individuals for occupations in the field of aviation. The occupational opportunities in the aviation industry are many and varied. Air transportation alone offers unlimited opportunities as it requires a vast organization of highly skilled individuals. The aviation industry and the airlines have a big responsibility. They must make certain that this great vehicle is safe and that their products and services have real utility for all who use them.

In commercial aviation alone, the number of persons employed on the ground is more than 150 times the number engaged in actual flying. The advent of air travel is remaking our society, economy, and world organization. The development and direction of this means of transportation toward the attainment of a happier life for mankind may prove to be the greatest opportunity and most important challenge for youth today.

### Aviation Offers Numerous Occupational Opportunities

The concensus of opinion is that occupational opportunities in the field of aviation are limited to those involving pilots, aircraft mechanics, aircraft engine mechanics, hostesses and various jobs in the aircraft manufacturing plants. However, in addition to these, there is a large number of positions open in the field of airport operations and other related fields. Many of these positions will be open to capable individuals who have had no more than high school education followed by some specialized training which can be provided through vocational education. Some of the openings in the aviation field are listed below. Distribution of Domestic Airlines Personnel for 1944—

Pilots .....	1,282
Co-pilots .....	1,567
Stewardesses and Stewards .....	1,304
Mechanics and Riggers .....	7,419
Dispatchers, Hangar and Field Personnel.....	5,246
Office Employees .....	12,056
All Others .....	2,220
Total.....	31,075



### Suggested Vocational Aviation Program for Kentucky

It is suggested that only centers in the state that can develop Civil Aeronautics Administration approved schools for training certified aviation and engine mechanics should be urged to develop programs now. A few good programs started as soon as possible are much better than a great number of small set-ups not able to meet CAA standards. A program of this sort cannot ordinarily be justified in the average city school system because the facilities required for a bona fide program are rather extensive, the instructor requirements rigid, and the number of mechanics needed comparatively limited.

Proper understanding must be established between the regional CAA representative, the State Vocational Department, and the local school, as a pre-requisite to developing such a program. Such relations should promote the highest standards obtainable.

It is desirable to develop good programs especially in cities already offering vocational training in engine maintenance and repair. In developing the curriculum for such work, all current guides should be examined carefully with reference to their use in approved aviation and engine schools.

Factors to be Considered for Locating Aviation Training Programs:

1. Is there an airline terminal?
2. Probability of private flying contacts.
3. Potential development of the city as an aviation center as revealed by CAA plans.
4. Potential trainee and employee supply.
5. Type of aviation training now in operation.
6. Supervisory and staff personnel now available.

Units of Instruction for Aviation Mechanic Training:

1. Power Plants\*
  - A. Engine
  - B. Propeller
  - C. Fuel and induction systems
  - D. Ignition and electrical systems
  - E. Lubrication system
  - F. Cooling system
  - G. Hydraulic system

\* It should be understood that the word "Engine" does not mean the same as "Power Plant." In aviation the term "Power Plant" implies not only the engine with its usual accessories, but the cooling apparatus, the supercharging equipment, the propeller, the propeller drive gears, pitch control, etc.—in fact everything that has any relation to the propulsion mechanism.

## 2. Airplane

- A. Assembly and disassembly
- B. Rigging
- C. Sheet metal
- D. Fabric and wood work
- E. Dope and paint

It is imperative that students make an occupational choice before being admitted to a vocational course. Admittance should be restricted to those who are physically and mentally able to do the work. They should also possess the qualifications necessary for employment in the type of work for which training is offered.

Prerequisites for entrance should include one semester each of any of the recommended industrial arts courses in metal work, auto mechanics or machine shop; one semester in each of any two of the courses in mechanical drawing, woodwork, or electricity.

## AVIATION EDUCATION FOR THE COLLEGE AND TEACHER TRAINING

(Teacher Education for the Air Age)

The Air Age presents new responsibilities both in education of prospective teachers attending colleges and universities and in the education of teachers already in service. If the program of aviation education envisaged for the State of Kentucky is to be realized, the teachers of the State, both prospective and those in service must be educated accordingly. Unless excellent teacher education is provided through the college and teacher-training facilities, instruction in aviation in elementary and secondary schools over the State will suffer serious handicaps. Teachers need to be informed of aviation materials and of the implications of the Air Age. They need special courses in aviation science and in social and economic phases of aviation. They need to be prepared to develop and interpret aviation education materials and to achieve the necessary curriculum integration to the end that they may do more effectively their job of promoting learning on the part of all children of the State.

The responsibility for adequately preparing teachers through acquainting them with the problems of living in an Air Age and through providing them experience with these problems does not imply that all colleges will be obliged to introduce far-reaching programs in aeronautics. Some colleges will undoubtedly plan to incorporate in their curricula programs in aviation education and consumer aviation comparable to those recommended for the senior high schools. Others will offer more extensive and specialized vocational and technical courses, but no college in the State in the interest of its total student body can afford to remain altogether oblivious to the presence of the Air Age—nor can it take for granted that all students now entering college as freshmen will have had brought home to them the far-reaching effects of aviation upon society.

Upon examination of the program of teacher education on the elementary, secondary, and vocational school level and evaluation of the aims and objectives sought through Air Age education emphasis, the following recommendations are made:

1. Teachers must prepare themselves to understand the consequences of the airplane upon our western civilization and be

stimulated to make up their minds what they can and are willing to do about it as teachers and as citizens. Preparing teachers to know and understand the technical processes, practical problems, and flight vocabulary is not sufficient. *Teachers are citizens in an Air Age; they are teaching children who will live in a world made more precarious in all its interrelationships because of the potentialities of the airplane for good or evil.*

2. All elementary and secondary teachers of the public schools need to modernize their training and education so as to enable them to utilize effectively Air-Age materials and the Air-Age interests of children. Consequently, curricula for teacher education should be modified accordingly.

3. Elementary and secondary teachers and those in preparation need to be informed persons and teachers in such areas as weather, air-age geography, handicrafts, theory of flight, the history and development of aviation as transportation, aviation materials and processes, vocational requirements and opportunities in the field of aviation, and the social problem created by their development.

4. *On the Junior-Senior Level*—In schools of education and teachers colleges in Kentucky and on the in-service training levels there is an immediate need for spot courses in fundamentals of aviation. The purpose of such courses is to acquaint prospective teachers with concepts and skills. To younger students, it is contemplated that there will be presented a more complete curriculum—a reorganization and infusion of air age implication and materials into the diverse fields of subject matter courses.

5. The values for aviation education inherent in their several fields of subject matter—English, Sciences, Mathematics, Physical and Health Education, Music, Art, Social Sciences, and Geography—will be more effectively realized through cooperation of the departments concerned. It is, therefore, proposed that on a given campus instructors representative of the curricular areas be organized to study, identify and delimit for the several subjects the segments thus to be utilized. The Education Departments and instructors in Methods of Teaching may offer valuable service in coordinating and allocating aviation materials to the appropriate subject-matter areas. Advanced student groups through methods courses may be in position to contribute valuable experiences to the proposed program if properly guided.

6. Colleges and universities should make available to public schools those facilities of staff and equipment which will best encourage the in-service education of teachers now employed. The fol-

lowing should be provided upon request from the school administrators:

- Visual-aid equipment
- Films
- Publications of books
- Pamphlets
- Free and low-cost materials available from commercial sources
- Consultation services for either general or specialized aviation subjects

There may be provided on the college campus for the in-service teachers:

- Workshops
- "Aviation Education Day"
- Conferences
- Special summer session advanced methods courses in aviation education for elementary teachers, or
- A course in the science of aeronautics for secondary school teachers.

Off campus the extension service should direct any of the above plans. Such courses as the above may be accompanied by supervised visits to local airports or other commercial aviation facilities.

7. Flight experiences for prospective and in-service teachers should be made more readily available whenever possible. Such experiences should be tied into the regular training and made an integral part of the college program.

8. Commercial firms and agencies should be encouraged to assist in this program of teacher education as follows:

- a. By sending to schools or to teacher conference group meetings mobile demonstration units and visual-aid equipment and materials.
- b. By opening their plants and facilities for school visitors.
- c. By furnishing professional and technical consultation and counsel to teacher groups.

9. If aeronautics is to be taught as a separate subject in the high schools, teachers need to have a broad point of view indicated in the more general courses recommended, but they also need basic courses in the following:

- a. Aerodynamics
- b. Meteorology
- c. Navigation
- d. Communication
- e. Civil Air Regulations
- f. Actual flight experience

Colleges in the State should provide content courses in the above subjects wherever the need exists.

10. Teachers in vocational high schools need specific qualifications for the specific jobs for which they are training children. The colleges and universities of the State should attempt to provide vocation and technical training and to equip prospective and in-service vocational teachers in so far as their facilities permit.

11. Salaries should be adequate—

- a. to encourage teachers to prepare for specialized work as vocational teachers in the area of aviation;
- b. for personal re-education as teachers of special courses in aviation subjects at the secondary level;
- c. for summer school or workshop courses in general aviation methods for elementary teachers;
- d. and even to train as pilots if we are to attract experienced and capable personnel for the teaching profession.

12. Every effort should be made through the college and university public relation channels to interest in Aviation Education the local units of government, civic clubs, and community organizations. This should awaken Air Age consciousness in the administrators of the State and cause them to consider the importance of Air-Age education in their public schools.

#### FILMS FOR USE IN AIR AGE EDUCATION

Air-Age Education Research  
100 East 42 Street  
New York 17, N. Y.

“Flagships in the Air”

Describes a trip by airline  
Black and white sound film, 2 reel film.  
About 25 minutes

Write for a list of motion  
picture films produced by  
American Airlines, Inc.

“Flagships on Parade” . . . Color film  
Takes you on a visit to the hangars at  
LaGuardia Field  
2 reel film. About 25 minutes

\* \* \*

American Museum of Natural  
History. Dept. of Ed.-Film Divi-  
sion, Central Park West at 79th  
St., New York, N. Y.

“Theory of Flight”

“Problems of Flight”  
Present some of the aerodynamic prin-  
ciples which underlie flight.  
One-reel sound films, produced by  
Erpi. Charge \$1.50 covers one day’s use.

\* \* \*

Same

“The Airplane Changes Our World  
Map.” Portrays the problem of map  
projection distortion; latitude and  
longitude; and distance contracts be-  
tween points on the globe by land,  
water and air travel routes.  
One-reel sound film  
Charge \$1.50 covers one day’s use.

Bell Aircraft Corporation  
Director, Motion Picture Division,  
2050 Elmwood Avenue  
Buffalo 7, New York

"The Bell Helicopter"—sound, color, 15 min. Shows Bell Helicopter in action and describes the new principle in helicopter design on which they are based.

"B-29's over Dixie"—sound, 20 minutes. Takes the audience behind the scenes in one of the plants producing B-29's. Here are seen the great assembly lines with the huge ships standing nose to tail. The intricate machinery of the aircraft and the skill of the men and women who build it from this story of production.

"Cannons on Wings"—sound, color 25 minutes.

All 16 mm.

"Report on Jet Propulsion"—color, sound, 25 minutes

Shows the development, construction and secret flight testing of the first jet propelled airplane in the U. S., the Bell P-59A Airacomet; and traces jet propulsion's history in England and America

\* \* \*

Brandon Films, Inc.  
1600 Broadway  
New York 19, New York

"Global Air Routes"—14 minutes  
Presents an adult approach to the problems of post-war air control. Shows how the airlines will eventually link the various industrial and agricultural centers of the world. Opportunities in the airplane field are discussed.  
Rent \$3.00. Sale \$72.00.

\* \* \*

Civil Aeronautics Administration,  
608 S. Dearborn Street  
Chicago 5, Illinois  
Attn: Asst. to Regional Administrator for Aviation Training

A large selection of motion pictures and filmstrips prepared by the Civil Aeronautics Administration as well as the War and Navy Departments.  
All films deal with subjects of importance to the study of aviation and its related fields.

\* \* \*

Write for the free catalogue available from Civil Aeronautics Administration

(They are available on a free loan basis to schools, colleges, universities, commercial airlines and others interested in the study of aviation.)

Companies distributing ESSO  
Aviation Products

B. Goodrich Company  
Aeronautical Division  
Akron, Ohio

Same

Pan American Airways  
Educational Director  
135 E. 42nd Street  
New York 17, N. Y.

Write for a list of leading  
University film libraries

Supervisor, Audio-Visual Aids  
Extension Services  
Pennsylvania State College  
State College, Pennsylvania

Piper Aircraft Corporation  
Lock Haven, Pennsylvania

Write to distributors of Piper  
Cub. In N. Y. write to  
Safair Distributors, 332 W.  
57 St., New York, N. Y.

"Power and Octane"

Deals with the proper use of high octane  
aviation fuels.

16 mm. black and white sound film 33  
minutes. Loaned without charge. Cop-  
ies of an illustrated text of the same  
name as the film are available in quan-  
tity.

\* \* \*

Slidefilms—35 mm. reading slide films.

"De-Icers and Design"

"The Development of the De-Icer"

"De-Icer Servicing and Installation"

Free of charge for permanent posses-  
sion.

\* \* \*

"Ice Formation and De-Icer Operation"

"Inspection and Maintenance of De-  
Icers"

"Removal and Storage of De-Icers"

"Installing De-Icers"

16 mm. Black and white with sound  
track.

\* \* \*

"Wings Over Latin America," 40 min.

"Wings to Alaska," 25 min.

"Weekend in Bermuda," 15 min.

Travelogs may be obtained from lead-  
ing University film libraries.

\* \* \*

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"The Construction of a Light Airplane"

"How to Fly"

(These are Piper films)

\* \* \*

"Aircraft and How They Fly"

"Motions of a Plane"

"Starting, Taxing, Take-Off"

"Flying The Turn"

"Landing"

"Advanced Maneuvers"

16 mm. black and white, silent, Bray  
films—about 10 minutes each.

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Sikorsky Aircraft  
Liason Department  
Bridgeport 1, Connecticut

"Sikorsky Helicopter"  
16 mm. black and white sound film  
25 minutes.

\* \* \*

Sperry Gyroscope Company,  
Inc., Great Neck, Long Island  
New York

"Attitude Gyro"—2 reels. Loan  
This film reviews the laboratory re-  
search work which went into perfecting  
the attitude gyro and explains the prin-  
ciples of operation of this instrument.  
The various scenes of flight maneuver-  
ing show how instrument flying is made  
easier and attitude flying safer.  
(May be purchased from Audio Pro-  
ductions, Inc., 630 Ninth Avenue, New  
York 19, New York for \$30.00.)

\* \* \*

United Air Lines, Inc.  
Dept. of School & College  
Service, Palmer House, Room  
305, Chicago 3, Illinois

"Of Man and Wings"  
Commemorates the 25th anniversary of  
coast-to-coast air mail. 16 mm. black  
and white, sound narration and musical  
accompaniment. 18 minutes.

*Slidefilm*

"Air Transportation Jobs . . . and You"  
Gives an over-all picture of jobs in Air  
Transportation; the basic qualifications  
necessary for employment, and what  
benefits Air Transportation offers each  
of its employees.

An illustrated teacher's manual accom-  
panies this excellent slidefilm.

\* \* \*

Wright Aeronautical Corp.,  
Public Relations Division  
Peterson 3, New Jersey

"Powerhouse of Aviation"  
Designed for high school or vocational  
school use. Describes production and  
testing of Wright Cyclone Engines for  
such planes as the Boeing B-29, 16 mm.  
sound motion picture. 40 minutes.

\* \* \*

Division of Visual Aids  
U. S. Office of Education  
Federal Security Agency  
19th and D Streets, N. W.  
Washington 25, D. C.

A series of 36 sound motion pictures  
covering the basic skills and under-  
standings necessary in the training of  
airplane mechanics. These films range  
from an orientation picture, "The Air-

(Also may be purchased or rented from Castle Films, Inc. 30 Rockefeller Plaza New York 20, N. Y.

Write to Office of Education for list of motion pictures and filmstrips released by U. S. War and Navy Dept. to them.

The Association of Commerce Federation Building Elmira, New York

plane Mechanic" to pictures such as "Patching Fabric" and "Repairing Aircraft Tires" which show how to perform specific jobs step by step. Coordinated with the motion pictures are filmstrips which review and clarify important points in the motion pictures. There is also an instructor's manual which summarizes the content of both motion pictures and filmstrips and gives practical suggestions for using these visual aids.

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Film showing sailplanes and gliders in action at Harris Hill and views of Harris Hill and the National Soaring Contest. 16 mm. technicolor. No sound.

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## SOURCES OF FREE AND INEXPENSIVE MATERIALS ON AVIATION AND THE AIR AGE

The following materials are interestingly and simply presented. They will be found useful by all teachers and students regardless of subject matter area or age group. Many of the publications include suggested teaching techniques.

### Air Age Materials

Information on Air Age Geography; Political, Social and Economic Implications of the Age of Flight; Air Transport Industry; Aircraft Industry; Air Express; History & Development of Aviation and Private Flying:

- |   |  |
|---|--|
| Air Age Education Research<br>100 E. 42nd St.<br>New York 17, N. Y.                         | Send for descriptive folder of materials available. An excellent source for maps, instructional charts, globes, etc. (Free and Inexpensive)  |
| Aircraft Industries Assoc. of<br>America, Inc.<br>15th & H. Sts. N. W.<br>Washington, D. C. | Free Booklets on economic, social, political aspects of aviation—good.   |
| Air Express Div.<br>Railway Express Agency, Inc.<br>230 Park Ave.<br>New York 17, N. Y.     | Information on Air Express shipping—good—especially the "Shipping Estimator" (Free)—also a new test with a novel twist—"Series of Questions and Answers on Air Express Shipment." (Free) |
| Air Transport Assoc. of<br>America<br>1515 Massachusetts Ave., N. W.<br>Washington, D. C.   | "Little Known Facts"—a pamphlet giving facts and figures on the Air Transport Industry (Free)  |
| Air World Education<br>101 W. 9th St.<br>Kansas City 6, Missouri                            | Units of study for elementary and secondary levels, pictures, maps, etc.—good booklet—"What's Your A. Q.?" (Free)  |
| All American Aviation, Inc.<br>200 W. 11th St.<br>Wilmington, Del.                          | "The Air Pickup"—the "Airway to Everywhere" and other materials describing air pickup service. (Free)  |
| Curtiss-Wright Corp.<br>Airplane Div.<br>Buffalo, N. Y.                                     | "Men and Wings"—an excellent booklet on the history and development of the airplane. 50c.  |

Likaglobe  
405 Temple St.  
New Haven, Conn.

An easily assembled globe that makes the presentation of Air Age geography easy—\$1.00

Shell Oil Co. Inc.  
W. 50th St.  
New York 20, N. Y.

Fine booklet on civilian flying—"Civilian Wings for Everyone." (Free)

United Airlines  
5059 S. Cicero Ave.  
Chicago 38, Illinois  
Attn: School & College Service.

Excellent teacher-student kits for primary, intermediate, and senior high levels—additional materials—send for full list of publications. (Free and Inexpensive)

#### AVIATION INSURANCE

Associated Aviation  
Underwriters  
90 John St.  
New York 7, N. Y.

Information on aviation insurance, policies, rates, etc. (Free)

#### AIRPLANE INSTRUMENTS

Eclipse-Pioneer  
Div. Bendix Aviation Corp.  
Teterbore, N. J.

Numerous colored wall charts of airplane instruments and descriptive literature. (Free)

Kellsman Instrument Division  
Square D. Co.  
80-08 45th Ave.  
Elmhurst, N. Y.

A booklet on aircraft instruments. (Free)

Sperry Gyroscope Co., Inc.  
Great Neck  
Long Island, N. Y.

Booklet—"Elmer" and "The Gyroscope Through The Ages"—on gyroscopes also additional literature on Sperry products. (Free)

#### AERIAL NAVIGATION

Supt. of Documents  
Govt. Printing Office  
Washington 25, D. C.

A very useful, up-to-date booklet on navigation called "Path of Flight." 60c

#### AIRPLANE POWERPLANTS

Aerojet Engineering Corp.  
Azusa, California

"Report from Aerojet"—An excellent explanation of the development and use of jet power in military and civilian aviation. (Free)

Continental Motors Corp.  
Aircraft Engine Div.  
Muskegon 82, Mich.  
Attn: Service-Dept.

Manuals & Operators handbooks on aircraft engines. (Free)

Curtiss-Wright Corp.  
Propeller Div.  
Caldwell, N. J.

Excellent booklet "Propeller Theory" that explains simply how propellers work. (Free)

Fairchild Engine & Airplane Co.  
Farmingdale, New York  
Ranger Aircraft Engines  
Attn: Public Relations

Operations handbook and specifications on Ranger aircraft engines. (Free)—also (2) free 16 mm. color, sound movies available on loan—on aircraft and engine mounting.

General Motors Corp.  
Detroit 2, Michigan  
Attn: Educational Service  
Public Relations Dept.

(3) fine booklets on powerplants (Free)

Hamilton Standard Propellers  
Div. United Aircraft Corp.  
East Hartford 8, Conn.  
Attn: Service Publications

Service manual on propellers and a booklet entitled "Prop Tips." (Free)

Lycoming Division  
The Aviation Corp.  
Williamsport, Penna.

Advertising Folder (Free)

Thompson Products, Inc.  
2209 Ashland Rd.  
Cleveland 3, Ohio

Excellent booklet on Jet Propulsion. (Free)

Wright Aeronautical Corp.  
Paterson, N. J.  
Attn: Public Relations

(5) booklets covering Wright aircraft engines—good material. (Free)

#### AIRPLANE STRUCTURES

Aeronca Aircraft Corp.  
Municipal Airport  
Middletown, Ohio  
Attn: Public Relations

Colored booklets and pictures on the Aeronca—good booklets—"101 Answers and Questions About Learning to Fly." (Free)

B. F. Goodrich Co.  
Akron, Ohio  
Aeronautical Div.

Booklets on de-icers, airplane tires and other aeronautical products. (Free)

Chance Vought Aircraft  
Stratford, Conn.  
Attn: Publicity Representatives

Series of excellent airplane pictures and written data.

Douglas Aircraft Co., Inc.  
Santa Monica  
California  
Attn: Publicity Dept.

Colored photographs and descriptive materials. (Free)

E. I. Dupont de Nemours & Co.  
626 Schuyler Ave.  
Arlington, N. J.

Pamphlet describing the role of plastics in airplane construction. (Free)

Ercoup-Engineering and Research Corp.  
Riverdale, Maryland

Federal Aircraft Works  
3456 N. Mississippi Drive  
Minneapolis 12, Minn.  
Attn: Sales Manager

Lockheed Aircraft Corp.  
Burbank, California  
Attn: Public Relations

Piper Aircraft Corp.  
Lockhaven, Penna.  
Attn: Sales Department

Weather Bureau  
Dept. of Commerce  
Washington, D. C.

Supt. of Documents  
U. S. Govt. Printing Office  
Washington 25, D. C.

Materials about Europe. Fine drawing-reprint from Skyways magazine—July 1945. (Free)

Descriptive material on airplane skis. (Free)

Materials, pictures, specifications on latest products. Good charts on how an aircraft factory is run. (Free)

Excellent material on light-plane flying, airports, etc. (Free)

#### WEATHER

A kit of weather information including weather maps, clouds, pictures, etc. (Free)

Colored booklet on Weather called "Realm of Flight." An excellent simplified presentation—40c.

#### CLASSROOM NEWSPAPERS

Air Age Education Research  
100 East 42nd St.  
New York 17, N. Y.

Tennessee State Dept. of Educ.  
Aviation Education Division  
Nashville, Tennessee

Superintendent of Documents  
U. S. Govt. Printing Office  
Washington 25, D. C.

Pan-American World Airways  
Educational Director  
135 East 42nd St.  
New York 17, N. Y.

Link Aviation Devices Inc.  
Binghamton  
New York

The Aviation Press, Inc.  
113 West 42nd St.  
New York 18, N. Y.

American Education Press, Inc.  
400 S. Front St.  
Columbus 15, Ohio

"Air Age Education News." (Free)

"Aviation Education News Letter." (Free)

"CAA Journal." 50c per year

"Classroom Clipper." (Free)

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