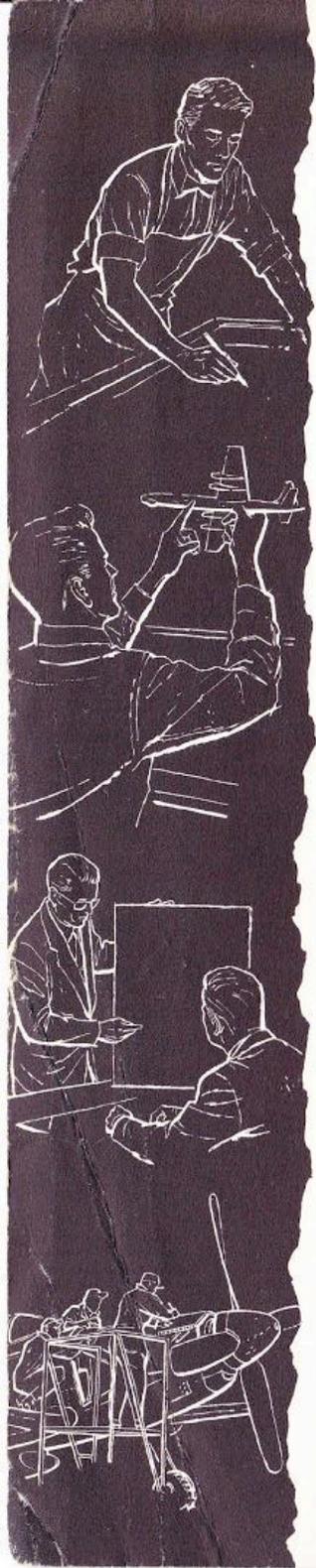


AVIATION



DESIGNED AND LITHOGRAPHED BY HENNAGE • WASH., D. C.

AND YOU



HAROLD E. MEHRENS
Writer

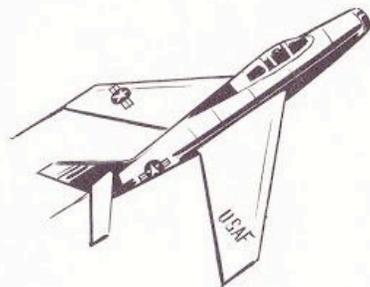
WILLIAM E. ROWLAND
Art Director

AVIATION AND YOU

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(Revised 1957)





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Foreword

The discovery of the secret of powered-flight inaugurated a series of technological and sociological changes which in a few short years have drastically changed our ways of life and consequently have imposed vast educational problems upon society.

Because its travel speeds make the world a smaller place, Aviation, paradoxically, has expanded our horizons, bringing individuals and nations into close contact with the language systems, ideologies, and cultures of other peoples and nations. International tensions are aggravated. Conflicts are inevitable, unless education fully recognizes the responsibilities an air age imposes upon it and takes steps to dispatch these as expeditiously as possible. The domestic as well as the international scene is likewise affected by aviation. This makes doubly important programs of aviation education for American youth.

Aware of (1) the urgent need for aviation education, (2) the fact that practical considerations may delay the introduction into local school systems programs of aviation education, and (3) the growing use by schools of the service of cooperating agencies, the Civil Air Patrol has undertaken two major tasks. First, it has inaugurated an air youth movement, its *Cadet Program*, and it maintains an aviation education program for its cadets. Next, it has established a school, college, and community service program. Within the framework of these programs instructional texts and audio-visual aids are prepared, teacher education projects in aviation education are initiated and served, and aviation curriculum consultation is provided upon request.

The series of booklets this foreword introduces will help place the goal of aviation education within the reach not only of the youth who are Civil Air Patrol Cadets but also of other youth enrolled in the nation's public schools. Those who make proper use of the series will have built a foundation for successful *living in the air age*.

WALTER R. AGEE
Major General, USAF
National Commander
Civil Air Patrol

CIVIL AIR PATROL • BOLLING AIR FORCE BASE • WASHINGTON, D. C.

Price / FIFTY CENTS / per copy



Preface

Aviation and You is one of a series of six booklets designed specifically for use in the aviation education programs of Civil Air Patrol. The booklets in this series are aimed at providing the reference reading and teaching materials necessary for completing portions of Phase II of the Civil Air Patrol Cadet Training Program outlined in Civil Air Patrol Manual 30-2.

An instructional 35 mm. color, sound filmstrip is available to help teach the materials in this booklet. Similar filmstrips will be provided to accompany the other booklets in the series.

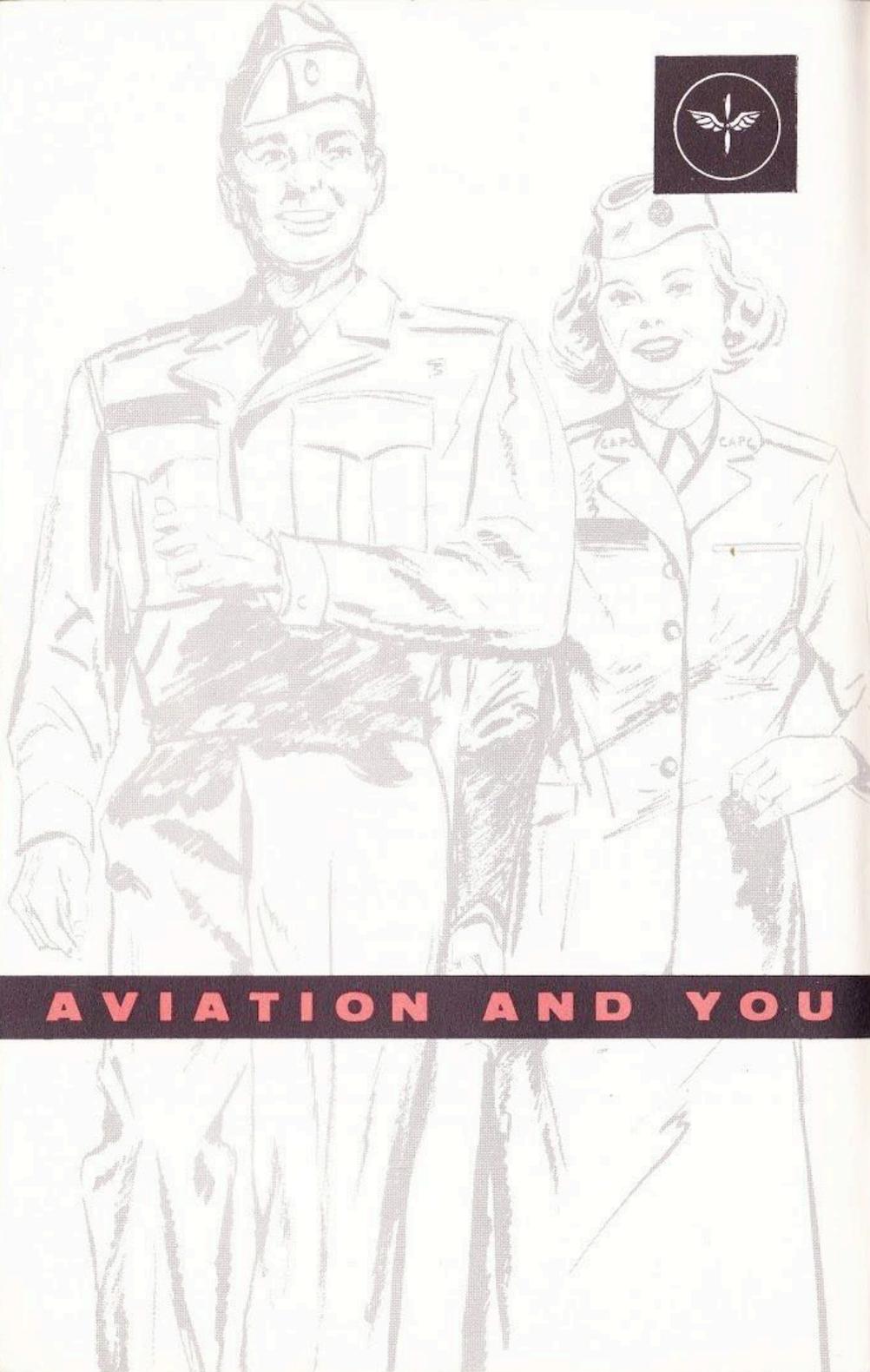
The materials of instruction such as the booklets and filmstrips in this series can be of value to students and teachers in any aviation education program. Those working with adults may also find this material helpful if the instructional or informational goal is general education as it relates to aviation.

It is the purpose of this booklet to discuss the importance of aviation, to reveal how it has influenced both man's thoughts and deeds, and to provide information concerning aviation careers. In effect, this booklet proposes to motivate toward further study in aviation those who read it or study its content. When used in conjunction with its complementary sound filmstrip, it will be found an excellent teaching instrument. Instructors should obtain from Civil Air Patrol the suggestions for students and instructors which supplement the booklet.

Although the first use of this booklet will be with Civil Air Patrol cadets, other uses will undoubtedly be made of it. For example, secondary schools will employ it as a source of basic information for aviation education elective courses or for programs of aviation education by integration or correlation. This booklet will be found of considerable value in both social studies and career-guidance type courses.

Special acknowledgments for the technical advice given are due the following persons: Frank W. Hansley, Colonel, USAF; Walter W. Thompson, Lieutenant Colonel, USAF; Seymour E. Latham, Major, USAF; and Evarice C. Mire, Major, USAF. I also wish to acknowledge the splendid cooperation received from the National Educational Advisory Committee of the Civil Air Patrol whose names are listed elsewhere in this booklet. The members of the committee offered many worthwhile suggestions which helped improve the quality of this publication.

MERVIN K. STRICKLER, JR.
Director of Aviation Education
Headquarters, Civil Air Patrol



AVIATION AND YOU

Your lifetime will be spent in a world dominated by aviation. Historians who observe the great and dramatic changes in human thought and action that take place as methods of transportation develop call our period of history the *Air Age*.



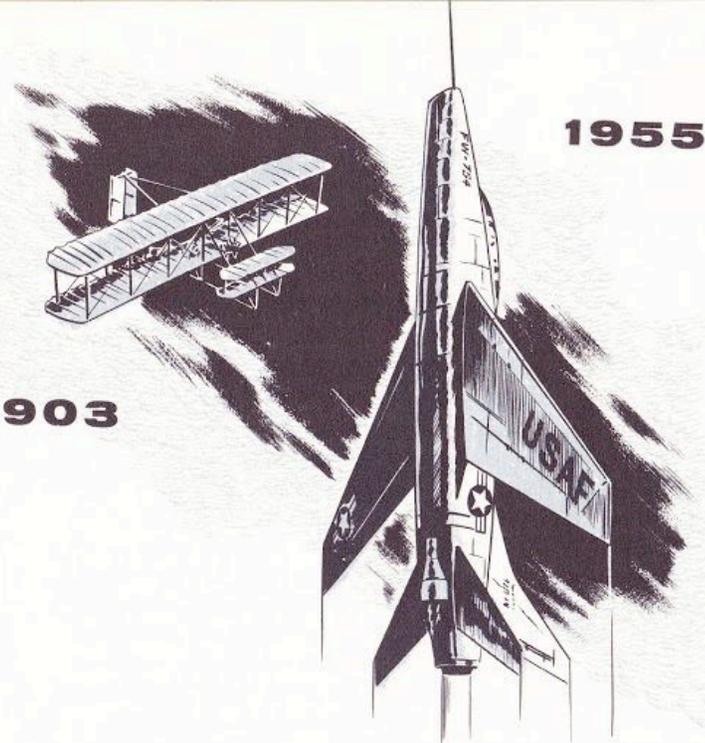
The major event which marked the birth of aviation happened in 1903; the major events which introduced the other great historical eras occurred before the dawn of history. The invention of the boat and of the wheel are examples of these. The boat made it possible for men to travel over the surface of the water, to trade with other men of remote, coastal communities and to exchange ideas and adopt the cultural practices of these communities. The wheel made it easy for men to travel over the surface of the land and to extend their influence to inland communities.

The discovery of the secret of powered-flight and the applications of this discovery more than any other comparable events are profoundly affecting the nature of the world in which you live. The invention of the aircraft wing; the invention of aircraft engines; the search for new sources of potential power, which led to the discovery of methods for releasing atomic energy; all these in concerted application give the Air Age its character.

A twelve-second airplane flight made by Orville Wright at Kitty Hark, North Carolina, on December 17, 1903, was a first stone laid in the foundation of your world. This flight, the first of a series in which Wilbur Wright also participated, covered a distance of only 120 feet. This achievement was possible because the Wright brothers built upon work done by others.

Mythology and history record early attempts by men to fly. History also reports that it was not until research became a tool of science that serious solutions to the problems of human flight were made by men of many nations. The research of Cayley and Pilcher,

1903



1955

Englishmen; Lilienthal, a German; Chanute, a Frenchman, as well as that of many other pioneer scientists of many nations contributed indirectly to the first flight of a heavier-than-air craft.

Since the Wright brothers, the discoveries of men engaged in scientific research and experimentation have brought about both rapid development in aviation and accelerating changes in whatever aviation affects. Travel and transportation speeds considered impossible a quarter of a century ago are demonstrated daily.

On May 21, 1957, the 30th anniversary of Lindbergh's historic flight, a United States jet aircraft (an F-100) followed the route to Europe that the Lindbergh flight followed. It took Lindbergh's aircraft thirty-three hours and thirty minutes to make the trip; the F-100 made the trip in six hours and thirty-five minutes.

The year 1957 also saw a number of other important aviation events take place. In January 1957 three jet-powered bombers of the United States Strategic Air

Command flew non-stop around the world. In May 1957 a twin-engine jet aircraft, the Caravelle, designed for use in commercial aviation, flew from New York to the Washington National Airport in 45 minutes, and two F-100's flew from London to Los Angeles via Jamestown, Virginia, in fourteen hours and fifteen minutes. They reached Jamestown eight hours after leaving London. Three hundred fifty years ago, it took 128 days for those who established Jamestown to travel from London to the shores of America.

There is a very close relationship between what has happened in aviation and what is going to happen in aviation. Consequently, the one who predicts the future of aviation with any degree of success must know the trends revealed by the history of aviation. This is as true of vocational opportunities in aviation as it is in other aspects of aviation. An expanding industry that in a half century created jobs for approximately one million people will very likely triple this number in another half century.

In this book you will find answers to some of your questions about aviation and aviation vocations. More often, you will find factual data about trends in aviation and related industries from which to draw your own conclusions about the future. In the other books of this series of six, and by means of the sound-film strips which supplement them, you will find answers to other questions about aviation. You may find answers to questions that you hadn't thought to ask. You will learn the things every Air Age citizen should know:

1. The airplane, its power plant, and all the equipment used by the pilot and those on the ground who make his flight possible illustrate the application of the principles and methods of the sciences and mathematics which you may already have studied in your high school classes.

2. Aviation has modified concepts and understandings taught in the social studies courses offered by your schools.

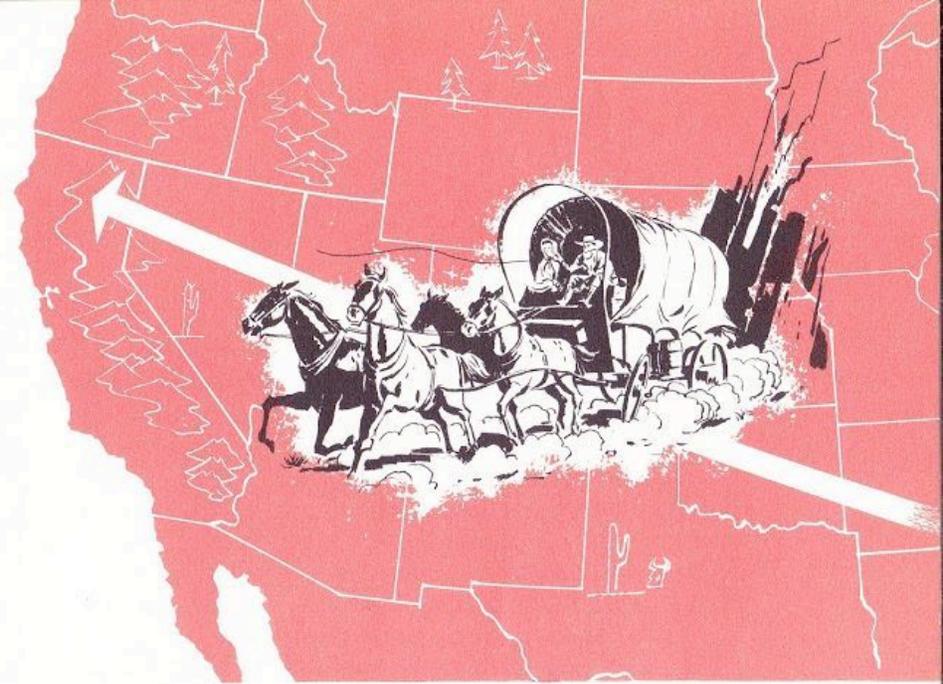
3. Aviation offers many career opportunities both civil and military to both young men and young women.

AVIATION

Your dictionary will tell you that *aviation* is the act and practice of operating heavier-than-air craft. Actually the meaning of the term has come to include much more.

Aviation may be defined from several viewpoints. To the pilot, aviation does mean operating his airplane or helicopter. To the sociologist, aviation is a social force. To the military man, it is a means of defense. The industrialist regards it as a solution to his transportation problems. The manager of an airline thinks of it as a business enterprise. The teacher considers it a worthy subject of study. You imagine it to be a fascinating activity with which you would like to become better acquainted. As a matter of fact the meaning of the term, aviation, includes not only the activity of flight but also all of the impacts of this activity. For it is the effects of aviation which have made it important.

Probably the most astounding thing about aviation is that it has become so important in such a short time. Yet it is easy to understand the rapid growth of aviation's influence if you remember that among other



things aviation means the air age—the age of the wing—a period of time characterized by air-travel and transportation. It is these two facts, that air travel knows few obstacles and that it increases the speed of long distance transportation so greatly, which have caused recent dramatic changes in the course of human events.

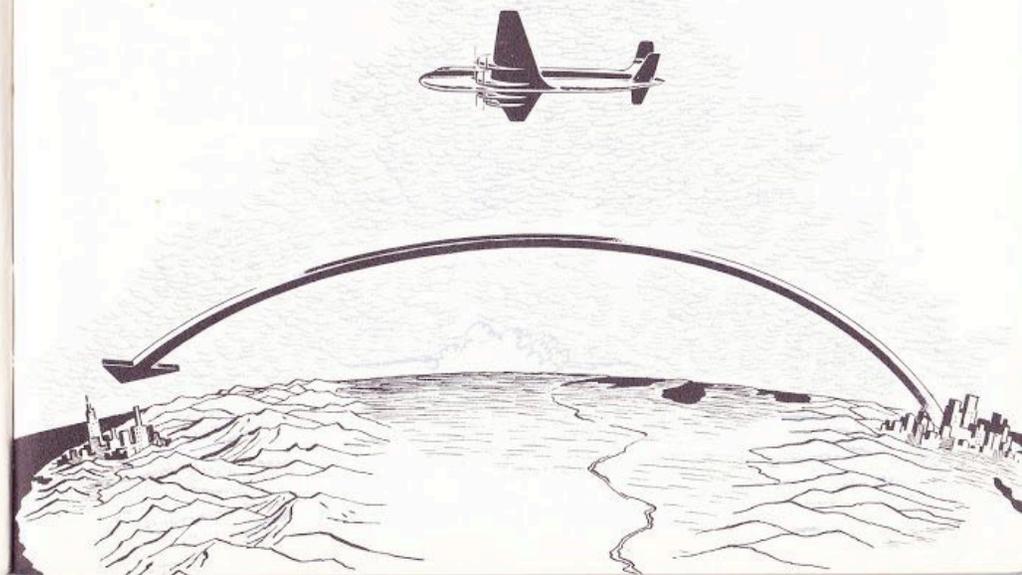
Soon you will be able to travel from coast to coast in six hours by commercial aircraft. Military aircraft already have flown this distance in four hours. It took the pioneers who expanded our country westward six months to travel from Independence, Missouri to San Francisco, a distance only half as great. In the days of “horse and buggy” travel, one who lived on a farm or in a village may have journeyed all day to reach the county seat. Today by airplane you can reach your nation's capital in less than one day, no matter where

you live. As a matter of fact you can reach by air any capital of any nation from any airport anywhere in the world more readily than George Washington could reach Philadelphia from Mt. Vernon by stage-coach.

Until the present century, people lived very much as did those who founded our country. These early pioneers and all others before them to the dawn of civilization lived in the age of the wheel. The age of the boat very likely preceded the age of the wheel. *You* live in the air age—the age of the wing.

The boat restricted transportation and travel, the conveyance of goods and people, to the surface of the water. During the age of the boat, cities were confined to coast lines and harbors. Early civilizations emerged along the waterways. Not until the invention of the wheel could men transport themselves and their produce readily over the surface of the land. Developments in the uses which could be made of the wheel enabled our forefathers to travel wherever railroads and highways could be built. But the invention of the airplane wing made it possible for men to travel through the air and over all obstacles, such as mountains, deserts, swamps, and ice caps which make surface travel slow and costly, if not impossible. Moreover, air transportation is swift beyond the most fanciful imagination of a generation ago.

Aviation's achievements are still so sensational that each day newspapers carry aviation stories. Orchids from Hawaii brighten your festive occasions; fresh, appetizing, and out-of-season foods from remote winter gardens appear upon your table; letters from friends in far away places are at hand almost the day after their mailing. Many of the movies you see, the books you read, and the songs you sing have aviation themes. Any day at any airport of any major city you can hear strange languages spoken by travelers from other lands. How different from our country's pioneer days when the visitor from another village or country was regarded as an outlander.





THE IMPORTANCE OF AVIATION

Aviation is of first importance to you in the ways in which it will influence your life. It will affect your life because it affects your social, economic, and political surroundings. It affects you because it affects the way all people live and work and because it has influenced greatly the nature of our relationship with other nations.

Sometimes aviation seems both a blessing and curse. It enables peoples the world over to travel with greater ease and to cover the globe with unique and beneficial contributions of their cultural systems. Yet at the same time it aggravates tensions that have long existed among different cultures. World leaders can readily assemble in conference. Yet such a conference does not

automatically assure that harmony of understanding will result from the meeting.

Aviation, however, has created a period of transition in which men and women are changing ideas about many things. We have come to measure distance not in miles but in terms of hours and minutes. The most direct route to the Orient requires that we head not west but north. We do not fly over the ground but through the air, and the shortest path to Paris at a given time may be through an air mass that drifts us many miles off a direct, surface course.

Perhaps the greatest changes in the ideas held by the average American are those about our relations with other countries. There was a time when the majority of our people believed we should be isolationists—"go it alone." However, since aviation has brought all nations so close together in terms of travel time, isolationism as a national policy is no longer given serious consideration. Moreover, aviation has helped to make our country one of the most powerful nations of the world and to place it in a position of world leadership.

While our forefathers were struggling to achieve freedom from tyranny and to establish a democratic way of life, other leaders in other countries, who disparaged democratic ideals, imposed a very different system upon the peoples they governed. The heirs of these men have acquired great power; their ideologies and their military strength offer ominous threats to our way of life.

If leaders in other countries of the world were responsible, as our leaders are, to the people they govern, we could relax our vigilance. Unfortunately, the vast majority of human kind is uninformed or misinformed about the processes of democracy. Hence those who comprise this majority can be readily exploited by unscrupulous men. Such men have seized great power. The threats this situation makes to our security must be countered by the best means at our command. For the first time in history, the American continent is vulnerable to attack by aircraft. By the same token, aircraft must help oppose such attacks.

Before aircraft reached their present stage of development, the countries of the Western Hemisphere were protected from outside attack by surface obstacles such as the ice cap over the Arctic area and by the oceans, east and west. Today attack, if it comes, will be from the skies. Rather than upon physical barriers, defense today rests upon air power and diplomacy.

The outcome of World War II was uncertain until the allied powers gained control of the airspace above enemy countries. The efforts made by the American people helped to gain this control and helped to win World War II. Our men and women built thousands of aircraft; our aviation schools, both civil and military, trained thousands of airmen—pilots, mechanics, and technicians. During this period of time, a half million young men and women throughout the United States studied about aviation, just as you are doing.

It was the efforts, during World War II, of the men and women who built aircraft, flew them and kept them in repair, and of the youth who studied, preparing to

take over such tasks when their turn came—it was the total of all these efforts which made the United States a world leader in aviation. It is important to the security of Western Civilization that we hold this leadership. Your interest is now essential if we are to keep it.

Aviation has brought into being two great industries—the aircraft manufacturing and the air transport industries. Together these two groups employ more people than any other industrial group. Moreover, these two great industries keep many smaller industries active. Some small businesses use aircraft exclusively in providing customer service and many major industries, when expanding the scope of their activities, have found aviation indispensable.

Each day many young people of this country are called upon to fill one or another kind of aviation job in military aviation, in an aviation industry, or in an industry or business affected by aviation. For this reason schools and colleges are involved. For if you seek an aviation career, you train in school or college—public, private, industrial, or military—to meet the requirements of such career. Should you seek a vocational career other than in aviation, you still need general understanding of the ways in which aviation is affecting your world and will affect you.

The following sections of this booklet will tell you more about the growth of both aviation and its influence. You will observe that the rapid growth of aviation has created many new jobs. Perhaps you will conclude that aviation offers you opportunities for both employment and patriotic service.



THE AVIATION MANUFACTURING INDUSTRY

The buildings in which aircraft are manufactured may cover an area as large as a dozen football fields. Among these structures are office buildings, warehouses, and factories. They will be near an airport. Some of them will have the appearance of the familiar hangar which you may have seen during an airport visit.

Should you wish to visit an aircraft manufacturing plant, such a visit must be arranged in advance. At the appointed time on the day of your visit, you call at the guest bureau. You will be assigned a guide who will explain to you some of the important things you will see.

Perhaps your guide will first show you the engineering section. This is the place where new types of airplanes are designed. Since a lot of planning goes into the building of an airplane, it may take several years from the time an engineer starts its design until an airplane makes its first operational flight.

A single aircraft manufacturing industry may employ as many as one thousand people in its engineering section. Many of these people help to improve the design of a new type of airplane.

Many of the young men and women employed in aircraft engineering were high school students only a few years ago. Some of these may have become interested in an engineering career during a visit to an aircraft manufacturing plant. Did you know that in 1957, the aircraft industry needed several thousand engineers in addition to the number available?

The chief engineer of an aircraft manufacturing firm explains to his assistants the things a new airplane should do—how high it should fly, how fast, the “pay-load” it should carry, and the fuel it should consume under different circumstances. He gets his information from prospective customers—the air-transport companies, or a branch of the military services.

The aeronautical engineers base design of an aircraft upon principles which study and practice have shown to be sound. The drawings they make serve the factory worker much as an architect’s blueprint serves a carpenter. These describe every detail of the aircraft to be built.

In order to avoid unnecessary expense, designs are first tested by small models built by hand to exact scale. That is, each part of the model is not only a replica of each part of the proposed airplane, but also all parts are constructed in exact proportion to those of the proposed airplane.

After the scale model is built, its “behavior” in flight is observed in a wind tunnel—a device for subjecting airfoils (aircraft wings or sections of aircraft wings or lifting surfaces) or models of airfoils to the forces they will experience in actual flight. When wind tunnel tests indicate inadequate performance, changes in the design of the model are made. Subsequent tests and subsequent changes will finally bring about the type of performance desired.

After wind-tunnel tests of the airplane model have been completed, a life-size replica of the proposed airplane is made of wood. This is called a mock-up and helps the production engineers solve the problems which they may encounter. Production engineers select and test the materials from which airplane parts are built. They also select airplane accessories, such as instruments and radios, and specify the location of these in the airplane.

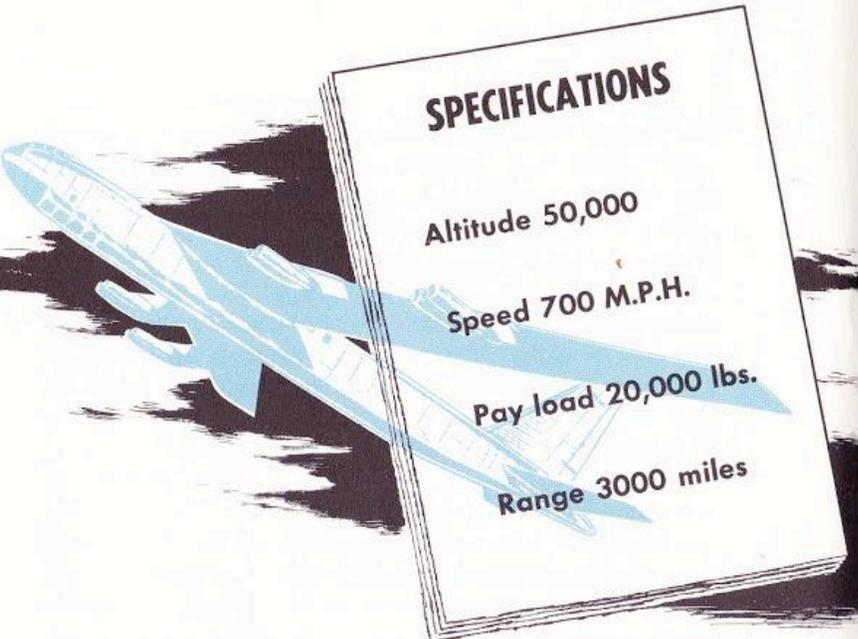
The first flying model of a new airplane is called a prototype. It is built before the new airplane goes into mass production. It is flown by a test pilot who may also be an aeronautical engineer. The test pilot observes, records, and reports the airplane’s performance during actual flight. Project engineers study test-pilot reports and data obtained by automatic cameras and other recording equipment installed in the prototype. When necessary to obtain proper performance, changes are made in the structure of the prototype. After the new airplane performs successfully during a series of test flights, it is put into production.

Once a new type aircraft is put into production, the work of many other people is required. The chief tool engineer and his assistants put the plant in shape to produce. The director of procurement and his assistants purchase some of the airplane parts from industries which contract to build these. Among such parts are engines, tires, radios, and electric cables. Among them are also aircraft, engine, and navigation instruments.

Other parts used in the construction of an airplane are built in the plant itself. Huge hydraulic presses are used to form wing-spar sections, bulkheads, and fuselage sections. Some presses exert as much as 3,000 tons of pressure, can stamp out twenty-four identical parts at one time, and require ten men to operate.

Along the assembly line, which extends the full length of the plant, fixtures hold the airplane’s parts in place while they are assembled. Assemblers, riveters, welders, and inspectors are among those who work on the assembly line. At one end of the line, first steps are taken to assemble the airframe; at the other end the aircraft emerges as a finished product ready to be test-flown.

There are approximately one hundred manufacturing corporations in the United States which make airplanes, airplane engines, or propellers. Some of the



SPECIFICATIONS

Altitude 50,000

Speed 700 M.P.H.

Pay load 20,000 lbs.

Range 3000 miles

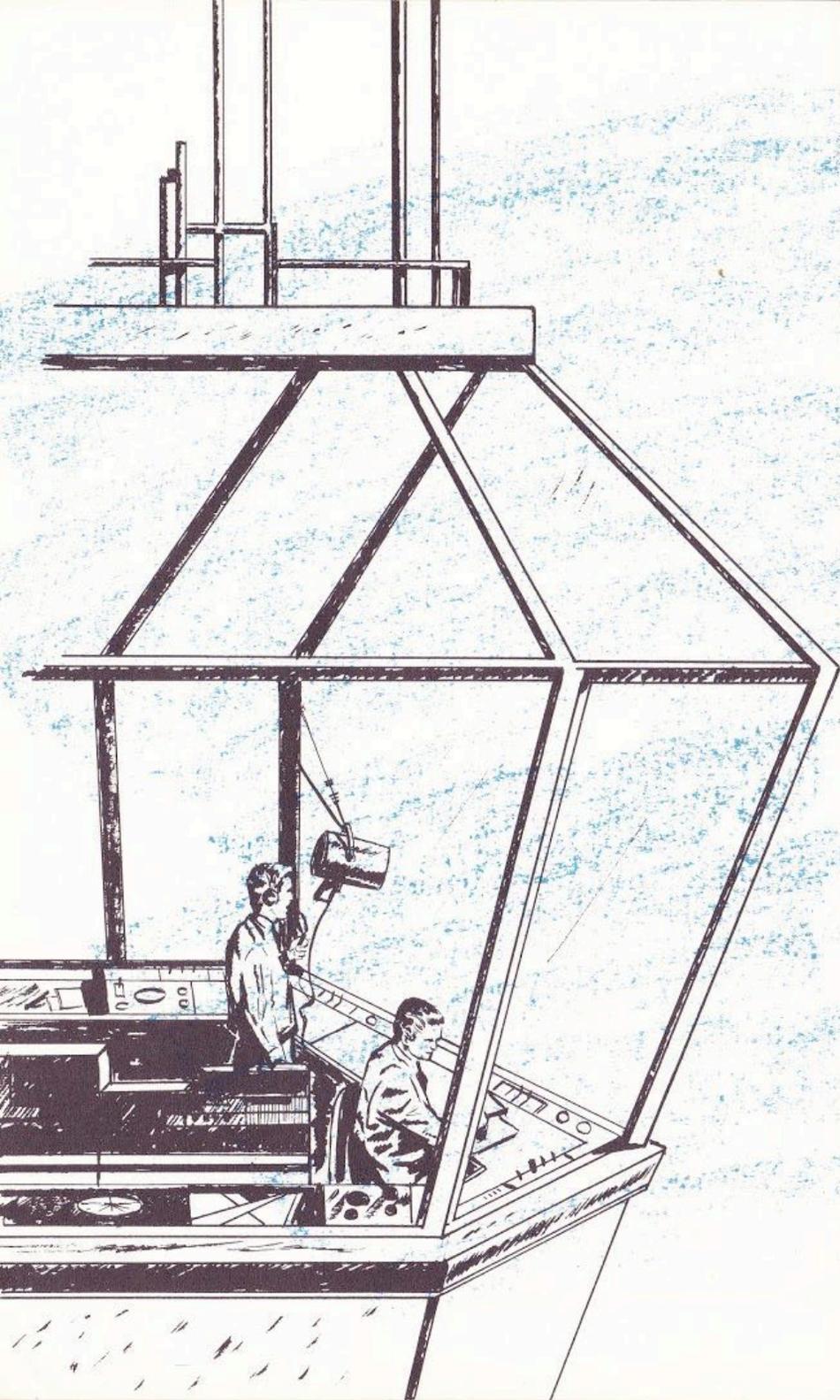
assembly plants build comparatively heavy and expensive type airplanes. But even these plants obtain engines, powerplant accessories, and the propellers they use from other manufacturers. To make these aircraft components and accessories takes many workmen, among whom are machinists, welders, woodworkers, electronic technicians, and electronic experts. Some of the larger plants employ as many as 20,000 men and women. The entire aircraft manufacturing industry in 1955 employed 800,000 men and women.

To help you understand the nature of aviation's growth since Wilbur and Orville Wright made the first successful airplane flights in 1903, it is necessary to reveal some important aviation facts. Since 1903, one-half million airplanes have been built. Between 1903 and 1938, a period of 35 years, only 50,000 airplanes

were built. Between 1939 and 1953, a period of 15 years, 450,000 airplanes were built. Had all these 500,000 aircraft been B-36's, and had they been placed wing tip to wing tip along the equator with only a few feet between wing tips, they would have encircled the earth.

In 1939, the value of all aircraft manufactured in the United States was about \$250,000. In 1953, \$8.5 billion worth of aircraft were built. \$16.5 billion worth of orders for aircraft placed that year could not be filled. In terms of the value of manufactured product, the aircraft manufacturing industry of 1953 was 34,000 times more significant than was the aircraft manufacturing industry of 1939. The manufacture of airplanes has become big business. The vocational opportunities offered by this industry should be thoroughly explored by you before you choose a career.



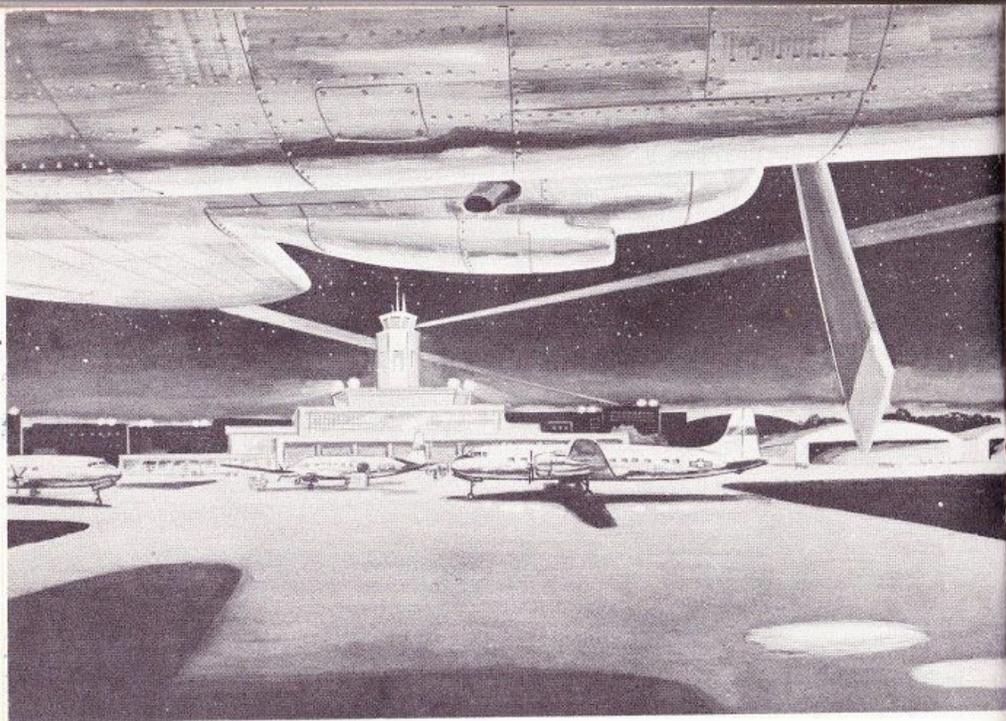


THE AIR TRANSPORT INDUSTRY

The operations office, the traffic offices, and the air-carrier maintenance shops and repair stations are the three departments of an airline found at a typical municipal airport. Many interesting activities are conducted at the airport. Another booklet of this series, called *Airports, Airbases, and The Paths of Flight*, will tell you about these in some detail.

Just as beforehand arrangements must be made by visitors at an aircraft manufacturing plant, so advance arrangements must be made by visitors at an air-carrier installation. The receptionist will then make certain that the visitor is shown through the installation and that each of its operations is explained.

Airline service includes transportation of passengers, mail, express, and freight. It is important not only to those who conduct the nation's business, but also to those in charge of the nation's defense.



The scheduled airlines maintain a Military Bureau which helps solve transportation problems of both military passengers and freight. In 1954 through the help of this bureau, almost a million military passengers were carried by the scheduled airlines alone. This resulted in a manpower saving which is the equivalent of 10,000 men working 48 hours a week for an entire year.

In 1954 the airlines of the United States carried 33,000,000 non-military passengers an average of 650 miles. To do this, they flew a total of 21.5 billion passenger miles. This is the equivalent of one aircraft carrying 43 passengers making 20,000 trips around the earth at the equator. Flying at 250 miles per hour and assuming no other obstacles, it would take over 200 years for the aircraft to complete these 20,000 flights. By 1957, the number of non-military passengers carried by the airlines of the United States had increased to 45,943,000.

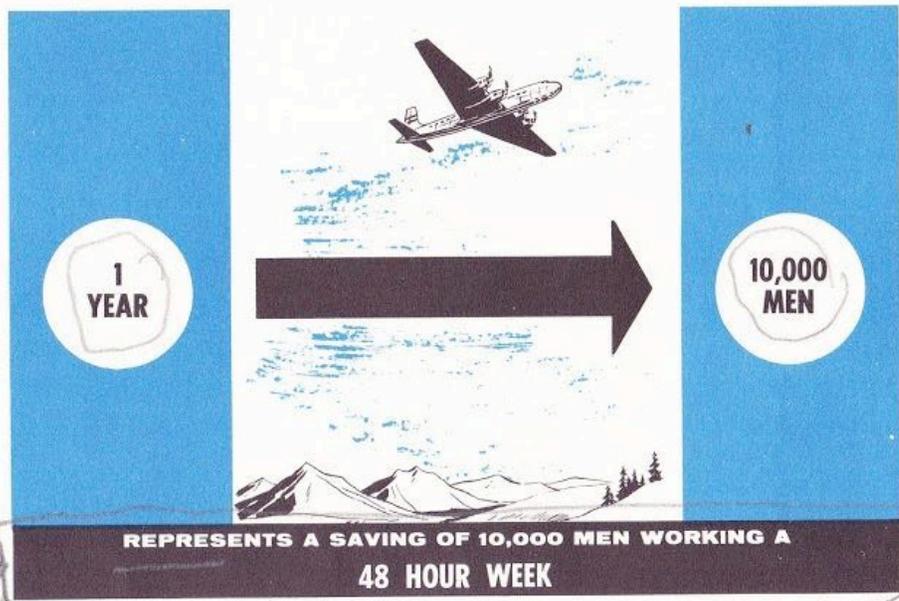
Without the teamwork of their employees, neither the type of service the airlines provide nor the unusual growth of the airlines and their services would have been possible.

It takes the cooperative efforts of those other than pilots and stewardesses, important as these are, to provide our nation's air transportation services. Pilots operate and navigate airplanes; hostesses make sure that the passengers are comfortable; but it takes many more employees performing many other jobs to keep air-carrier transports flying.

Airplanes must be kept in perfect mechanical condition. Passenger and cargo space must be sold. Reservations must be made. Passengers and baggage must be loaded promptly. Mail, express, and freight must be stowed in the aircraft properly, so that weight distribution is balanced. On some aircraft, navigators plot the course to be flown. Flight engineers must calculate fuel needs. Maintenance men must make sure that required amounts of fuel and oil, and no more than these amounts, are on board. Meteorologists must observe and forecast the weather. Communicators must give pilots-in-flight weather data and other essential information. Dispatchers, before they authorize the departure of a flight, need to make certain that all required conditions are met by the pilot, his crew, and his aircraft.

It takes both operating and administrative personnel to run an airline. In addition to jobs to be performed which keep the airliners flying, many other tasks must be performed by airline employees. Public relations people help the general public understand air-carrier service and the nature of aviation. Airlines find a use for legal counselors, for instructors who train pilots, flight engineers, and mechanics, and for a staff of accountants who keep financial records. Agents at every airline terminal sell tickets and "check-in" passengers before flight departure time.

To keep an airplane safe for flight, it must be properly maintained. A program of continuous maintenance is followed by all airlines. The details of the program differ from airline to airline, depending upon practices an airline has found satisfactory for its purposes.



All airlines check every aircraft and its powerplant before each flight; all conduct daily or "turn-around" inspection of equipment. However, the periodic service checks of equipment differ from company to company and with the type of equipment involved. One company checks its aircraft after each has flown 115 hours. This company rebuilds one-fourth of an airframe (an airplane without its accessories) after each 3,000 hours of flying time. At the end of 12,000 hours, the entire airframe will have been rebuilt. The mechanics then start all over again, and after the airplane has flown another 3,000 hours, they again rebuild the section which at this time will have logged 12,000 hours.

Some companies rebuild airframes after each 8,000 hours of flying time. Both airframes and engines are given complete overhauls after a specified number of operating hours has been logged. Engines are rebuilt after the engine has logged from 600 to 2,000 hours, depending upon the kind of engine in use.

During periodic checks and overhauls, every part of the airplane is inspected—the airframe, the powerplant, and the accessories. Parts that are worn beyond prescribed tolerances are replaced. Whenever repairs are needed, they are made. Some instruments are carefully overhauled; others, when found defective, are replaced by new ones; still others are replaced by new ones after a prescribed period of service, whether or not inspection reveals a faulty condition. It takes many crews of mechanics and technicians to keep an airplane safe for flight.

The men and women who repair and maintain aircraft must be trained for their job and skilled in its performance. A Civil Aeronautics regulation requires that major alterations and repair of aircraft and aircraft equipment must be made by mechanics certificated by the Civil Aeronautics Administration, or under the supervision of such mechanics. This requirement makes the airframe and powerplant mechanics very important people indeed.

AIRLINES ACCOMPLISHMENT FOR 1956

45,943,000

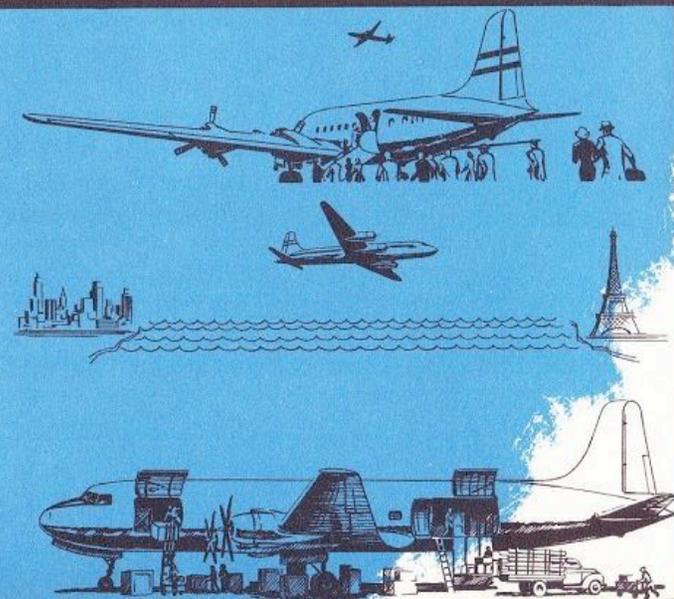
Non-Military Passengers

3,800,000

International Passengers

434,256,000

Ton Miles of Freight



As a further assurance to the general public that aviation services are safe, all civilian workers in aviation whose jobs are critical are examined and their skills certified by the Civil Aeronautics Administration. Among such airmen are mechanics, control tower operators, flight engineers, navigators, and pilots. Some airlines require an airman to hold more than one certificate. For example, a flight engineer is sometimes required to hold, in addition to his flight engineer certificate, either a mechanic's certificate with an airframe and aircraft powerplant rating or a pilot certificate. To qualify for a certificate and rating requires a candidate to make a satisfactory grade on the proper examination. This means study and practice; but it also means a challenging career and a good salary.

To the casual observer, the scene in a hangar or repair station might appear one of confusion. Actually, it is well-ordered with each group of workmen and each individual within a group having specific tasks and knowing very well how to perform them.

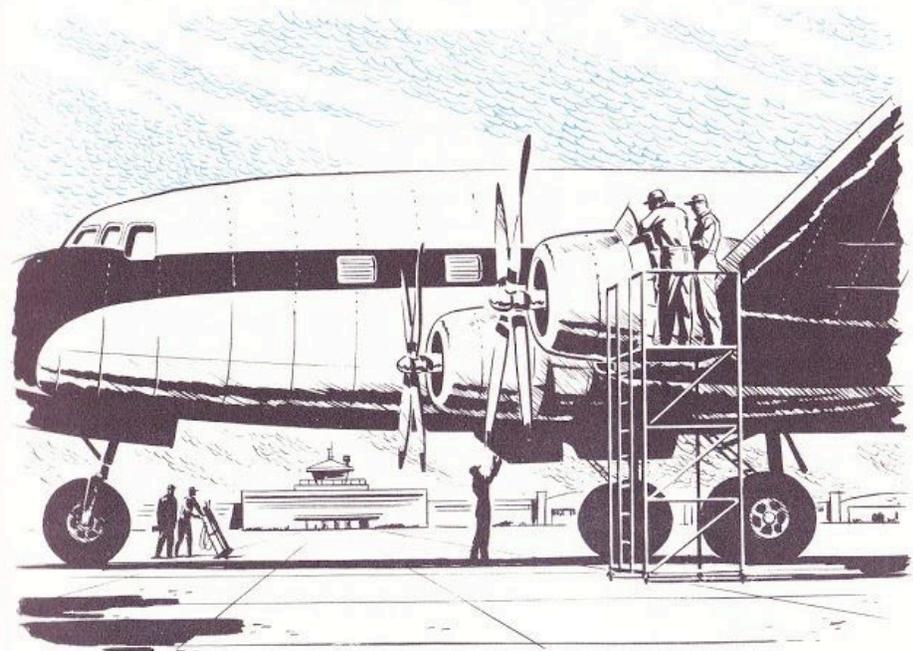
One group with the help of proper tools, large cranes, and overhead tracks removes the engines from an airplane. Another group removes accessories from aircraft engines. Another transfers engines or accessories to appropriate repair stations where other technicians do their work. While these activities are under way, airframe mechanics in the hangars inspect and repair the airplane, and technical experts at other stations are busy with propellers, instruments, electrical equipment, or hydraulic components.

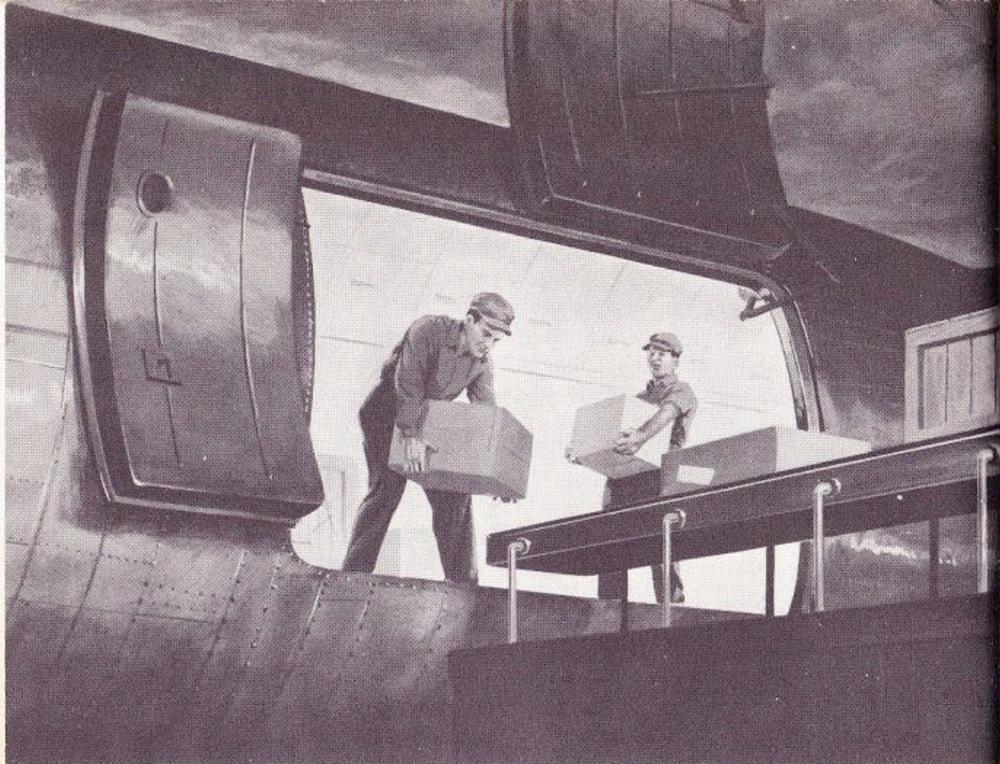
A young man or young woman who has mechanical aptitude and training can find interesting and challenging work with an airline. Should you, after you finish high school and college, want employment with an airline, you apply to the airline personnel staff. Members of this staff will study your application and place you in the job for which you best qualify. And, in many instances you are helped to succeed in this job. For, in-service training and instructional pro-

grams conducted by most airlines make it possible for employees to become increasingly proficient in the jobs they hold.

The air transport industry as well as the aircraft manufacturing industry has made great forward strides. To better understand this rapid rate of growth, let us compare the airlines of 1938 with those of 1954. In 1938, sixteen air carrier companies operated 260 airplanes with an average seating capacity of 14 passengers. In 1954, thirty-two airlines operated in scheduled flight 1,297 airplanes with an average seating capacity of 46 passengers. On the basis of passenger accommodations, the air transport industry of 1954 was 16 times as large as that of 1938.

In 1938, the scheduled airlines of the United States employed 1,135 pilots and 9,008 other trained personnel. In 1954, they employed 9,437 pilots and 109,392 other trained personnel. On the basis of employment opportunities, the air transport industry of 1954 was almost 12 times as large as that of 1938. By 1957, the people employed by the airlines numbered 127,000.





In 1938, only 34,879 miles of air routes were authorized for scheduled airline use; in 1954, such authorized air routes covered 78,384 miles—over twice the number authorized in 1938. In 1954, the scheduled airlines actually served 584 cities and flew 1,420,642 miles each day, in distance, the equivalent of 3 round trips to the moon.

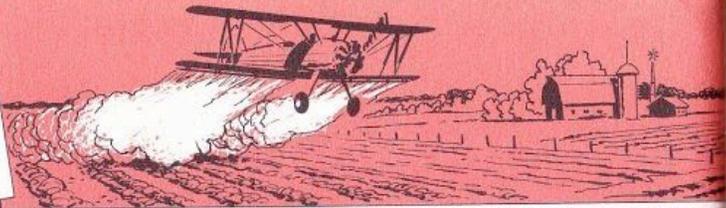
Twenty-five times more passenger miles were flown in 1954 than were flown in 1938. Ninety times as many express and freight ton-miles were flown in 1954 as were flown in 1938. In 1954, ten times as much air mail was carried by the airlines as the amount carried in 1938. Twenty-seven times the amount of fuel purchased in 1938 was used by the air carrier companies in 1954. In 1938, the net profit of the airlines was \$5 million; in 1954, it was \$100 million. In a period of 15 years, the air transport industry has increased the size of its profits twenty times.



INDUSTRIES AFFECTED BY AVIATION

Not only has aviation produced two unique industries, grown to be giants in only a few years and still growing, but it has affected also all the traditional industrial areas that reflect the interests and activities of mankind.

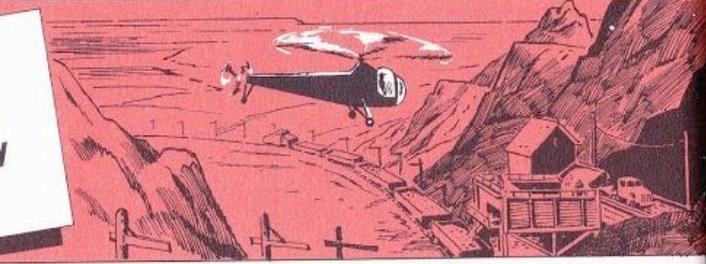
Farmers and ranchers grow and market grains, fruit, vegetables, and domestic animals. Fishermen harvest the natural resources of the seas; lumbermen the natural resources of the forests; miners reclaim the mineral resources of the earth. Manufacturers produce goods from the raw materials of farm, ranch, fishery, forest, or mine. Distribution and marketing place both raw materials and finished product in the hands of consumers. Aviation, which can be classified as a manufacturing industry and a transportation industry, both serves and is served by all industrial areas.



Agriculture



Lumber Industry



Mining Industry

The produce of farm, mine, and factory go into the production of an airplane. The needs of aviation have stimulated industrial and metallurgical research. Over 1,000 new companies have been created just to serve the aviation industries. These contract with aircraft manufacturing industries, the air transport industry, and the government. Among the goods they produce are aircraft parts, and components such as electrical and hydraulic devices and instruments.

Several industries which were well established before aviation reached its present importance now find the aviation firms among their best customers. Typical of these industries are tire manufacturers and the petroleum industry. In 1954, for example, the scheduled airlines alone used about 10 million gallons of oil and 1 billion gallons of gasoline. This is enough oil and fuel to keep 25,000 automobiles operating for 50 years.

GENERAL AVIATION

General aviation is the term that designates general uses of the airplane, such as those made by agriculture and small business. It includes all aviation enterprise, except the manufacture of aircraft and the operation of scheduled and non-scheduled air transportation companies. The scheduled and non-scheduled transportation companies of the United States maintain their service to the public with a total of only 1,802 aircraft. In 1956, *general aviation* by comparison operated 62,886 aircraft. It employed over 200,000 pilots who, in 1956, flew more than 10 million hours.

Farmers use airplanes to speed up the control of insect pests and weeds, to check erosion, and for quick trips to obtain needed supplies. Ranchers use aircraft to feed stock—particularly when heavy snowfall isolates hungry herds—to patrol fence lines, to facilitate prompt service to water pumps and windmills, to observe pasture conditions, and to locate strayed stock. Fishermen use aircraft to spot schools of fish, to which fishing boats are then dispatched. The forestry service uses aircraft to control insect pests which attack trees, and to reseed forest areas which have become eroded or have been devastated by forest fires.

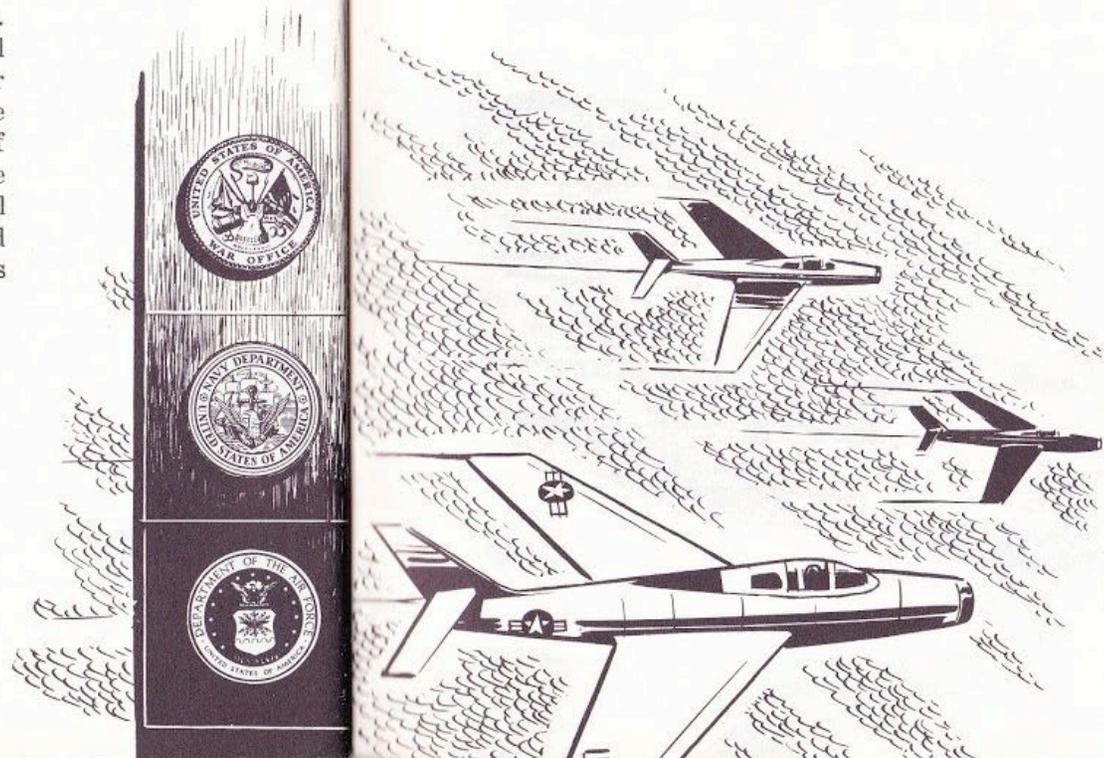
The mining industry uses aircraft to help locate mineral and oil deposits. Sometimes mining equipment is transported to mountainous areas inaccessible except by air. The patrol of pipelines can be done both speedily and effectively when airplanes or helicopters are used.

One of the most important uses which industry and business makes of the aircraft is to transport administrative personnel. In this way a company can extend its activities to include widespread domestic or international operation. Over 30,000 aircraft are used in business flying. Companies own 12,000 of these; individual business men own the remainder. Business aircraft are operated over 3 million hours each year.

Aviation's service to all industrial areas employs over 30 times the number of aircraft used by the airlines. These fly approximately twice the number of plane miles flown by the airlines of the United States. The facts about general aviation point up its importance and reveal further the career opportunities which aviation offers.

MILITARY AVIATION

The role of aircraft in World War II demonstrated conclusively that modern war could not be waged successfully if aircraft were not employed strategically, tactically, and logistically. In recognition of the importance of military aviation, Congress in 1947, by passing the National Security Act, gave air power equal organizational status with land and naval power. That year, 1947, saw both the President's Air Policy Commission and the Congressional Aviation Policy Board reaching identical conclusions concerning the importance of national air power. Both groups recommended the build-up of the USAF to seventy groups, with a corresponding strengthening of naval aviation. Moreover, practical necessity impelled other arms of the military services to continue, and some to expand, their use of aircraft. Any discussion of the general importance of aviation to the progress and welfare of the



nation would be incomplete if military air power were not considered.

The importance attached to military aviation is born out by the recent annual expenditures of the USAF and Naval Aviation. In 1953, USAF expenditures amounted to more than \$15,000,000,000; Naval Aviation expenditures amounted to almost \$3,000,000,000.

The personnel of the United States Air Force in 1957 numbered 915,000. Approximately 125,000 were officers; approximately 10,000 were aviation cadets. The other 780,000 were airmen who, like their civilian counterparts, perform numerous basic and highly important aviation tasks.

In 1951, the last year such information was available, the USAF had a total of 19,021 airplanes of all types. During 1952 and 1953, the USAF accepted from manufacturers 15,177 additional aircraft. In 1951, the Navy had 13,213 aircraft. During 1952 and 1953, the Navy accepted 4,737 additional aircraft. Aircraft, built since World War II, whether civil or military, have become much more complex than were the aircraft manufactured before 1945. This fact makes the work of the technical specialist in aviation increasingly challenging.

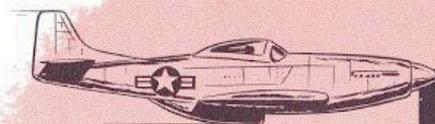
Any review of the career opportunities available to you would be incomplete were those opportunities offered by military aviation not considered. The United States Air Force has classified 43 career fields. The training and skills required by military aviation operation are virtually the same as those required by civil aviation. Consequently, training and experience in one generally qualify a person for a similar career in the other.

Military Aviation offers youth many career opportunities. One interested in an aviation career should make a comparative study of the rewards of civil and military aviation. The education and training benefits of a USAF, or a Naval Aviation career which are provided both airmen and aviation cadets are attractive.

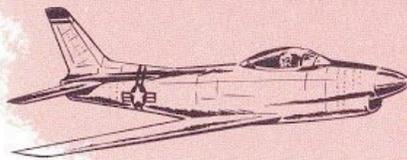
MILITARY AVIATION STIMULATES GENERAL PROGRESS IN AVIATION

Progress in the manufacture of aircraft may be illustrated by the following: In 1945, one of the speediest of fighter airplanes, the P-51, flew at speeds of 470 miles per hour; today's F-86 flies at 700 miles per hour. In 1945 one of the speediest bombers, the B-17, flew at speeds of 285 miles per hour; today's B-47 flies at 600 miles per hour. Experimental aircraft have flown at double the speed of sound! In 1945, commercial air transport aircraft had average speeds of 150 miles per hour; today, many air-carrier, transport aircraft have average speeds of 225 miles an hour. Moreover, air-carrier aircraft now in use which are equipped with turboprop engines cruise at over 400 miles per hour.

SPEEDS OF FIGHTER AIRCRAFT

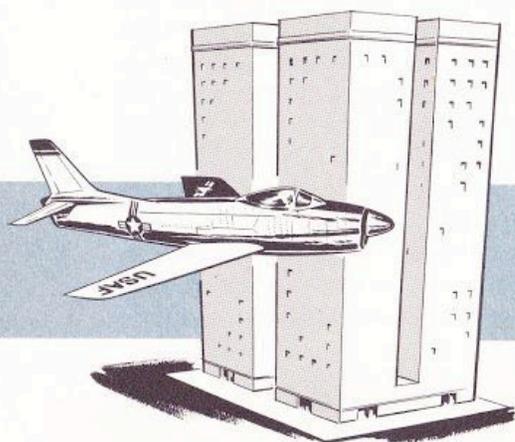


P-51-1945
470 M.P.H.



F86-D-1955
700 M.P.H.

The increasing speeds at which aircraft operate have been made possible as a result of research in many different fields. In order to manufacture engines that will supply necessary power, the metallurgist must be called upon. For no matter how efficient the design of a powerplant, the materials from which it is constructed must be able to withstand the great stresses imposed upon them. The metallurgist likewise serves the airframe manufacturer. Problems of refrigeration



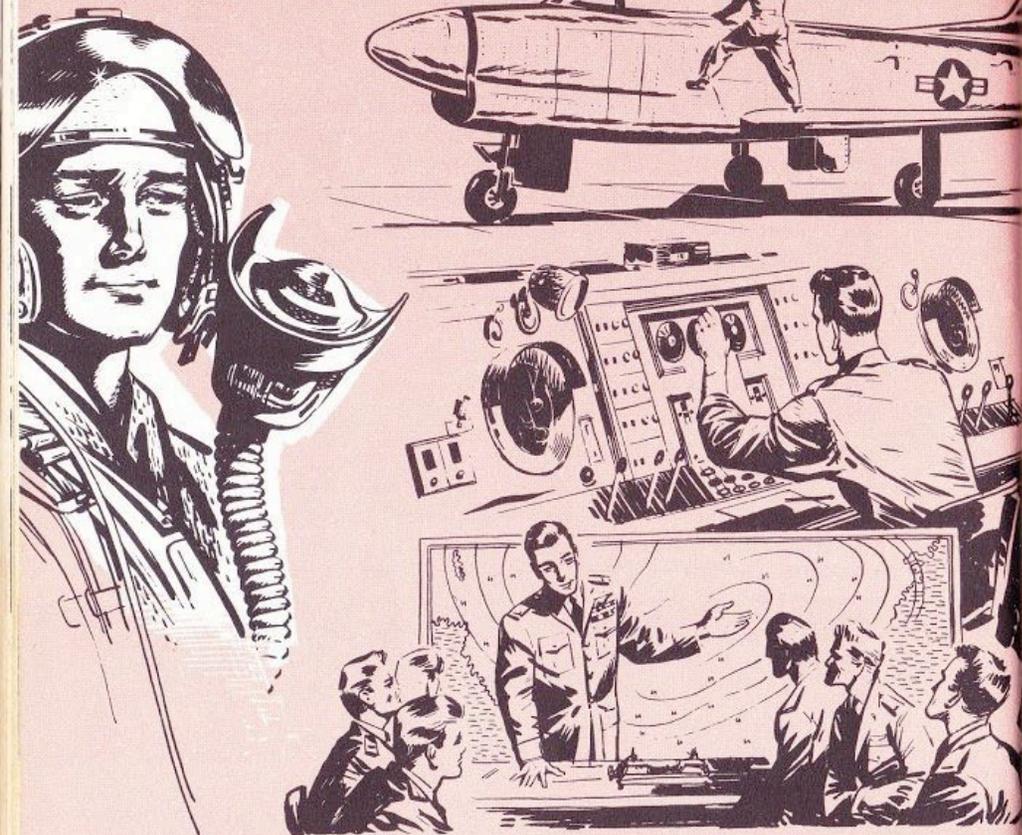
are enormous, when aircraft travel faster than the speed of sound. Friction caused by the rapid flow of the air over the craft generates white hot heat. The refrigerating equipment of an F-86 is capable of cooling a 25 room building during the warmest summer day. Much research also has been done to find solutions to fuel and lubrication problems. Even the professional areas of medicine, law, and education contribute greatly to aviation's advance.

In view of achievements in aircraft speeds, it may appear that the only opportunity for further pioneering in flight lies in the area of "space-travel." It is true

that interplanetary travel and its possibilities challenge the imagination of youth. Yet, many pioneer opportunities still exist for developments in flight through the earth's atmosphere. There is need for a commercial aircraft whose cruising speed is 500 mph and whose landing speed approaches zero. The helivector, the convertiplane, and other experimental types currently undergoing tests, are attempts to meet this need. Some day such craft may be used to serve you as the automobile today is used to serve the needs of your older contemporaries.

Whether or not you discover the principles basic to such aircraft design, or make similar pioneering contributions to a related field, there still remains opportunity for the use of your talents in the field of aviation. The changes in the world of reality which have been wrought by aviation are so dramatic, that flight no longer needs to depend upon fantasy in order to challenge the interest of youth such as you.



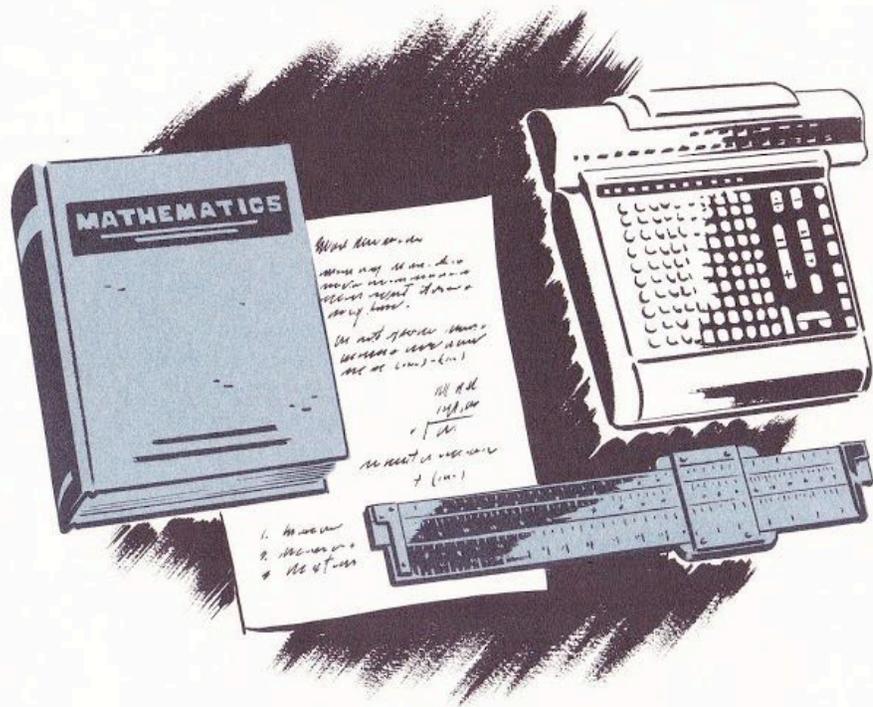


AVIATION IN EDUCATION

Education has felt the impact of aviation for two reasons. It has the responsibility for preparing youth to fill aviation jobs requiring highly skilled personnel. It must also modify its curricula to the degree that each curricular area has been affected by aviation. We find public schools, trade schools, and colleges conducting programs of aviation studies which qualify young men and women for aviation careers. And, we also find public and private elementary and secondary schools recognizing aviation's influence on general education.

There are in the United States many schools and colleges from which you can receive instruction in the aeronautical professions. At the most recent count 47 colleges conferred degrees in Aeronautical Engineering on the basis of a four-year curriculum; 22 colleges conferred such degrees on the basis of a five-year curriculum. Twenty-five colleges offered a program of studies in either Aeronautical Administration or other aviation service fields.

Aviation trade schools have been established in every state of the union. There are 68 airframe and aircraft powerplant mechanics schools. In 1956, these graduated 2,864 airframe and powerplant mechanics. There are 774 flight schools, 176 of which teach both flight and related subjects. The other 598 teach flight only.



Airlines, aircraft assembly factories, and aircraft engine plants all maintain schools or apprentice training programs. In 1954, 24,954 young men and women received training in aviation skills in aircraft assembly plants; 2,337 youth received such training in aircraft engine plants.

Civilian schools established to teach aviation skills and trades such as those of Air Transport Pilots, Flight Engineers, Commercial Pilots, Flight Instructors, Airframe Mechanics, Aircraft Power Plant Mechanics, and

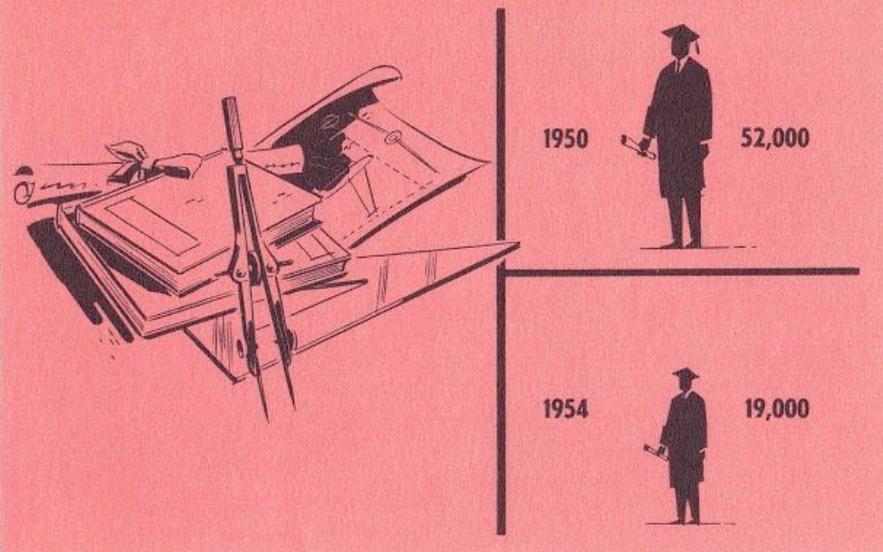
the like are certificated by the Civil Aeronautics Administration. The graduates of these schools are likewise certificated and rated on the basis of examinations prepared and administered by the CAA (Civil Aeronautics Administration).

In 1956, 45,036 student pilots and 16,399 private pilot certificates were issued. Many to whom certificates were issued were trained in flight schools. The 8,419 commercial pilots and the 1,172 air transport pilots, and all of the 6,993 receiving instrument pilot ratings in 1956 had completed formal programs of training.

The USAF offers a program of Aviation Training which is more extensive than the combined programs of public schools, trade schools, and airlines. This program is conducted on U.S. Air Force bases. There are 43 of these bases. Each day at many of these, hundreds of new students begin training in one or another of 43 career fields. Hundreds of airmen and civilian graduates of the USAF instructor schools teach the thousands of young airmen learning to do the work of aviation.

The need reported in 1956 for aeronautical engineers will likely cause the colleges of the United States to focus educational attention upon this area. Recent surveys show a serious decline in the number of engineering graduates from the professional schools of the United States.

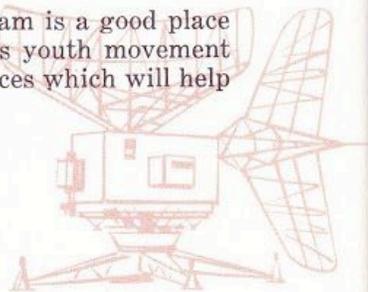
ENGINEERING GRADUATES



In 1950, 52,000 young men and women graduated from college with degrees in the field of engineering. In 1954, only 19,000 students graduated with such degrees. As a result, the current shortage of engineers is critical.

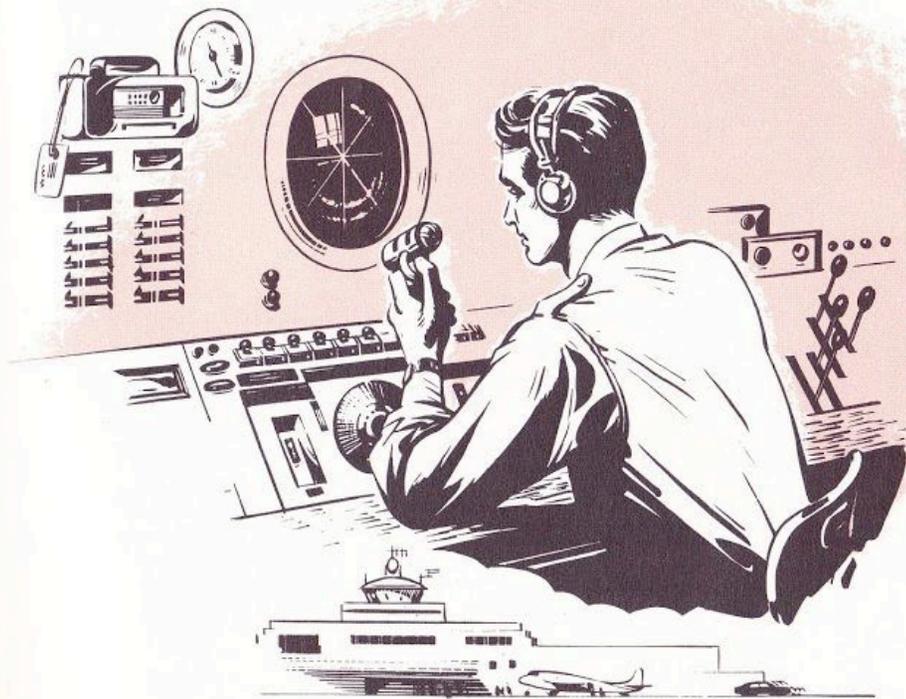
When the above figure is compared with the 35,000 engineers graduated in 1954 by the Soviet Union, the effect is a sobering one. It is reported that the number of engineering graduates in 1956 reached a total of 70,000 in the United States and 120,000 in the Soviet Union. These figures should stimulate both thought and action on your part and should help you or your friends decide upon an appropriate career.

The Civil Air Patrol Cadet Program is a good place to begin your aviation studies. This youth movement in aviation offers you many experiences which will help



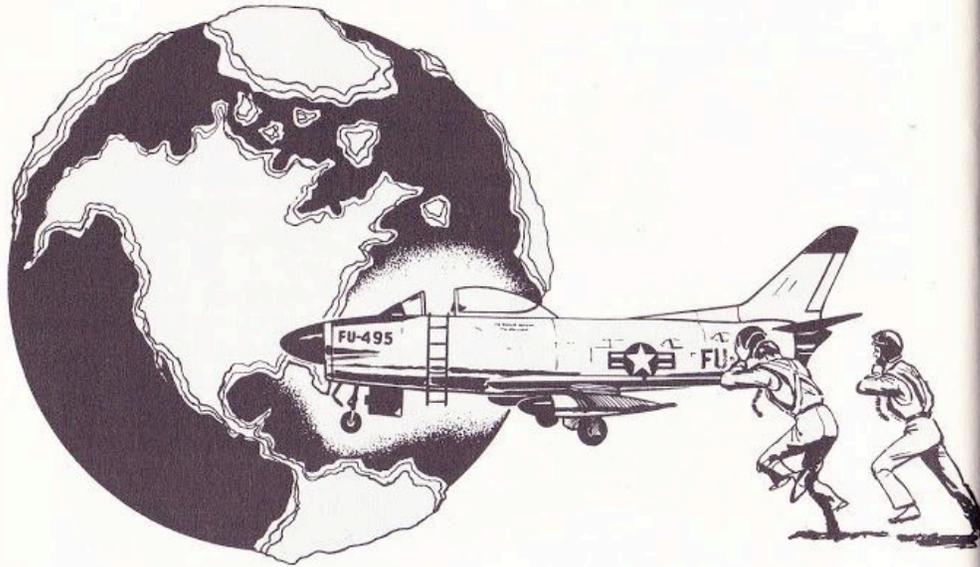
you decide whether or not you want to choose an aviation career and whether or not this should be in military or civil aviation. It will help you discover which aviation specialty has the greatest appeal for you.

As a Civil Air Patrol cadet, you have opportunities for many experiences: the orientation flights; visits to airports, airbases, aircraft assembly plants, air-carrier installations, and aircraft engine factories; excursions along the path of flight, into the realm of flight; and the many other challenging activities. These experiences with the Civil Air Patrol not only are fun but also display for you an array of interesting, pleasing, and profitable career possibilities.



SUMMARY

Aviation is important! Each aspect of aviation is important! But in what way are these important? Their importance stems from the fact they center upon you. Their impact is upon the world in which you live—upon the setting of your activities—upon the environment which shapes your destiny; hence, their impact is also upon you! The aircraft has affected your security. It has made the entire world your neighborhood. It makes your life more interesting than it might otherwise have been. It can be either your destruction or your safeguard. It has a potential for good in that it can speed the day when all the peoples of the world



reach respect for one another and understanding of cultural differences; it has a potential for evil in that it can aggravate the tensions that have kept half of human kind in fear and distrust of the other half.

Yet the airplane and the power derived from its uses make your world. The industries it has created offer you inviting employment opportunities. There is no career activity in which you might engage that has not felt its influence. You are confronted with the changes it has helped bring about, be these good or bad. Aviation is important because of the changes it has made in your surroundings. However, it is of greatest importance in the influence it has upon you. It is for this reason that you are faced with the task of learning to understand it, and of developing the attitudes, skills, and judgment which will enable you to operate it, maintain it, and control its effects.

