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planes

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1954 U.S. AVIATION INDUSTRY EXPORT LEADS THE WORLD

Rough Flight Eased By Airborne Radar

Rough flight due to storms, cloud turbulence and other weather conditions will soon be almost a memory as America's safety-conscious and comfort-conscious airline industry installs weather surveillance radar.

With new radars, costing the airlines upwards of \$20,000 for each aircraft installation, pilots can detect thunderstorms and turbulence as far as 150 miles away and steer a safe course around them.

The radar does not actually "see" the clouds or the turbulence in the storm, but detects instead the raindrops. Meteorological research has determined, however, that turbulence is associated with rainfall. The pilot, therefore, can pick his way through a severe line squall or cold front by avoiding the centers of thunderstorm activity.

In theory radar is simple. A radio wave is transmitted along as narrow a beam as possible. Should it strike an object it can not penetrate, it will reflect an echo. By receiving this echo back and noting the time elapsed, the distance to the object may be known, since radio waves travel at a constant speed. The same principle is employed in sonar range measuring devices using a sound wave. Bats have been doing this for thousands of years, emitting sharp squeaks as they fly and reading the echoes off surrounding trees or cave walls.

Constant Watcher

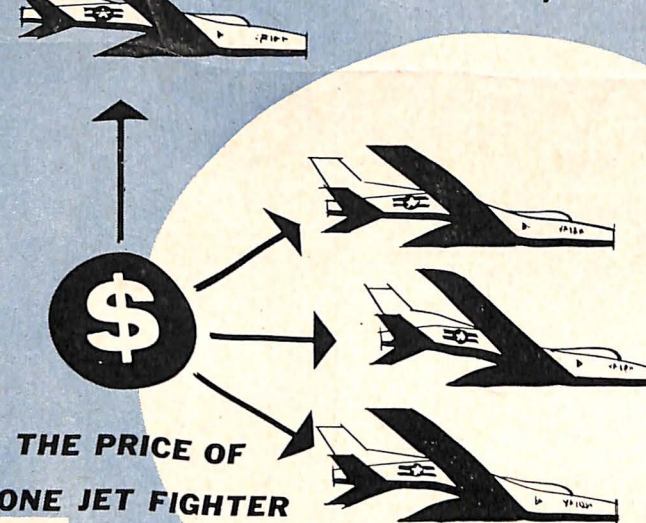
Radar "sees" objects by translating the return echo into opaque outline shapes very similar to a shadow on the radar scope, which is like the picture tube found in every television set.

The antenna in the nose of the airliner is rotated rapidly, all the while transmitting high frequency radio impulses and picking up their echo. This echo impulse is routed into the cockpit scope where its energy lights up a spot on the screen. The rapid scanning of the antenna, plus the hundreds of impulses transmitted every second, combine to flash a constant picture of weather activity for miles around.

This enables the pilot to pick out the path of least resistance for many miles. Looking "through" a cloud to see what is behind it is possible, since falling raindrops actually occupy a small portion of space. Radar (See RADAR, page 2)

AIR POWER ECONOMY

Volume Production Pays Off!



THE PRICE OF ONE JET FIGHTER NOW BUYS THREE!

Volume production and engineering know-how has reduced one aircraft manufacturer's cost of a modern jet fighter by two-thirds. Today the Air Force buys three of these fighters for the same price paid for one at the beginning of the program.

'PLANES'

U.S. World Sales Total Tops Half-Billion

By John H. Payne
Director, Export Services
Aircraft Industries Association

The American aircraft industry exported \$618.9 million dollars worth of aircraft and parts during 1954.

Although this is nearly \$260 million under the all-time high set for exports in 1953, it represents the second highest volume the industry has ever sent to the world market in one peacetime year. It is equal to well over three times the total dollar value shipped in all the years prior to World War II, and compares with total exports of \$156,940,900 by Britain, the principle competing country during 1954.

With American aviation equipment flying in all parts of the free world, the United States is the world's largest exporter of aeronautical products. American travelers and businessmen can fly in American-made planes on every continent as a matter of routine.

During the 12-month period of 1953, goods manufactured and sent abroad by the American aircraft industry represented 4.1 per cent of all merchandise sold overseas by American businesses. There are few industries that ship a greater portion of their products to foreign countries than does the U.S. aircraft industry.

Bulk Export to Military

The bulk of the 1954 sales, \$497 millions worth, represented classified items listed in a special category and distributed through military channels. These items, classified for security reasons, include all military, cargo and used transport aircraft, engines of 400 horsepower and over, propellers, instruments, all accessories, spare parts and ground handling equipment.

The remaining items, accounting for nearly 20 per cent of the industry's total dollar volume production, were sold to civil interests in 79 different countries and rose 33 per cent over the amount exported the year before.

Commercial air transports totaling 112 were sold to overseas buyers. Seventy-six of these were commercial airliners of a type which have established U.S. pre-eminence in air transportation around-the-world. (See U.S. EXPORT, page 3)

43 Non-Certificated Airlines Set 12-Month No Fatality Record For 1954

Forty-three U.S. non-certificated independent airlines flew approximately 1,300,000,000 passenger miles in 1954 without a passenger or crew fatality in domestic and international operations of these carriers, according to Aircoach Transport Association.

Most of these independents came into being after World War II and in large part are equipped with modernized versions of twin and four-engined workhorse transports developed during the late global war.

"With good maintenance and modernization proving the quality and superiority of American-built aircraft," H. B. Johnston, President of the Association said, "these aircraft keep flying reliably. Though they are not as fast as the new luxury

airliners coming from aircraft industry production lines today, these planes give comfortable low-cost transportation.

"The larger part of the work of the independent lines is flying military personnel and freight on official movements and unofficial furlough trips. For military flights, Aircoach Transport Association has a control board in Washington to record the movements of dozens of planes of member companies, so those nearest the points where needed can be flown and empty ferrying charges minimized.

"To provide better, more efficient service, this feature will soon be extended to civilian passenger (See INDEPENDENTS, page 3)

PLANES

Planes is published by the Aircraft Industries Association of America, Inc., the national trade association of the manufacturers of military, transport, and personal aircraft, helicopters, flying missiles and their accessories, instruments and components.

The purpose of *Planes* is to:

Foster a better public understanding of Air Power and the requirements essential to preservation of American leadership in the air;
Illustrate and explain the special problems of the aircraft industry and its vital role in our national security.

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Wanted: Airports

No forward thinking person in this modern day and age can possibly doubt that air transportation is having an ever-increasing and beneficial effect on the nation's economy. Shrinking distances, which just a few short years ago were measured in days and weeks, are now measured in minutes and hours. The use of the air for transportation by the airlines of the nation and individually by businessmen, and for the needs of industry and agriculture, is growing at an incredible rate.

Now a new and ambitious Federal airport construction program, which will make \$58 million dollars of federal monies available in each of the next four years, to help the nation catch up on its airport building program, is slated to go to the White House for signature as this issue of *PLANES* goes to press.

In 1946 the Federal government undertook a program of federal aid based on a National Airport Plan. Under this Federal Airport Act, the government, in seven years was to spend one-half billion dollars, matched by similar amounts of federal, state and local money in airport construction. It would have resulted in an adequate system of airports. Unfortunately, it was never fully implemented.

The results of making major population centers, such as are served by the airlines, accessible are readily apparent in the growth which has occurred in our airline industry, with incalculable benefits to the national economy and new horizons for the air travelling public.

However, though federal, state and local governments have invested many millions of dollars in major airport facilities, there has been little heed given to the need for a network of small airports. Adequate attention should also be paid to a national system of smaller airports designed to make every American community readily accessible by air.

In just the past ten years the airlines of the nation have grown more than five times in size. This year they will carry nearly 50 million passengers. The personal use of aircraft in general aviation has also evidenced a remarkable growth, accounting for almost 9 million hours of flying in 1954. Privately owned civil aircraft are flying two and one-half times more than do the airlines of the nation. The use of privately owned aircraft for business—an important segment of general aviation—soared to 3,900,000 hours in 1954. This means that American businessmen, in their own planes, flew 800,000 more hours than the airlines—a 50 per cent rise in volume from two and one-half million hours in 1949 to almost four million hours during the past year. All evidence documents the fact that these growth trends of civil aviation, both transport and general, are vigorous and will continue.

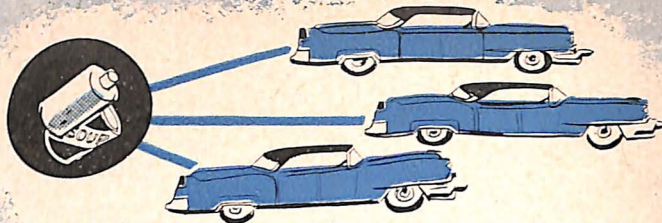
The United States aircraft industry has made enormous improvements in safety, speed and comfort of modern transport aircraft, which undoubtedly has a bearing on the rapid growth of transport aviation. And certainly, the fact that the cities served by the airlines had airports of a size to make them accessible also had significant bearing on these developments. This initial accessibility demonstrated the value of airline service, but ten years ago when the airlines began this rapid growth, less than 300 cities were offered scheduled airline service. Today, despite this enormous growth of the air transportation industry, less than 600 cities receive regular airline service.

There are today about 6,000 airports of various size in the United States, but there are several times this number of incorporated urban areas and vast rural areas which are still not on the air map.

More than ever, today, an adequate system of airports is a must to the betterment of the national economy—and security. The Federal government, which historically has aided new forms of transportation, has a substantial stake and responsibility in bringing about a national system of airports which is adequate for the further development of aviation for transport, for business, industry and agriculture.

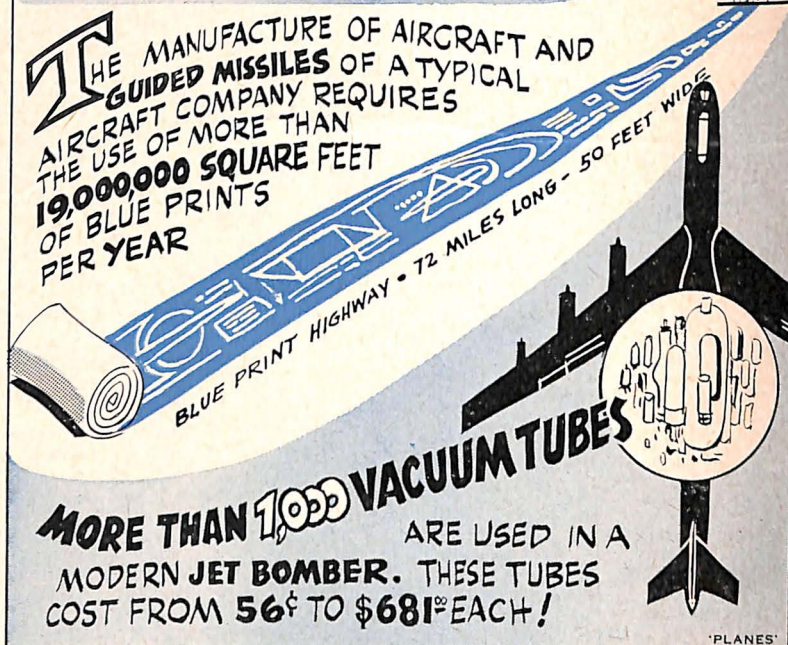
Suitable airports are essential to modern living. Moreover, in this age of peril, and with full knowledge of the potential devastation which could be wreaked upon cities and urban communities, an adequate system of airports is vital to the civil defense—a key to survival.

PLANE VIEWS



A TINY GAS GENERATOR DESIGNED FOR GUIDED MISSILES—NO LARGER THAN A CAN OF SOUP (4 in. by 3 in.) AND WEIGHING 3½ POUNDS—DEVELOPS 850 JET HORSEPOWER—MORE THAN THE TOTAL HORSEPOWER DEVELOPED BY THREE CADILLAC AUTOMOBILES!

THE MANUFACTURE OF AIRCRAFT AND GUIDED MISSILES OF A TYPICAL AIRCRAFT COMPANY REQUIRES THE USE OF MORE THAN 19,000,000 SQUARE FEET OF BLUE PRINTS PER YEAR



MORE THAN 1000 VACUUM TUBES ARE USED IN A MODERN JET BOMBER. THESE TUBES COST FROM 56¢ TO \$681⁰⁰ EACH!

Rough Flight Eased By Airborne Radar

(Continued from page 1)

dar beams which are not reflected off the falling raindrops pass on and pick up weather activity further away.

The amount of turbulence inside a cloud can also be determined with the new radar. Research indicates that turbulence is heaviest in a cloud when the rate of rainfall increases rapidly from its outer edge to its center. An ingenious device in the set permits the pilot to determine the relative amount of rainfall at certain points within the cloud and thus to estimate the gradient and the consequent degree of turbulence which might be expected.

World War II Discovery

Radar as a weather surveillance aid was discovered in World War II when bomber crews were quick to note that thunderstorms showed clearly on the scope. This military radar, designed for terrain mapping and bombing, was the basis for several years of intensive experimentation by electronic engineers leading to the improved commercial radar just now coming on the market for weather surveillance.

PLANE FACTS

- One modern jet bomber literally "flaps its wings" during flight. Air turbulence will often cause the tips of its highly flexible wings to move up and down while the body of the plane remains stable. In static wing load tests the wing tips were moved in a 20 foot arc without damage.
- Three-hundred gallons of jet fuel are required to taxi a current jet bomber from warm-up ramps to the end of a runway for take-off—generally a distance of about one and one-half miles.
- There is sufficient air conditioning capacity in one modern jet bomber to air condition five five-room houses. The heat required for the plane's cabin heating and deicing would heat 22 five-room houses.
- Each swept-back wing of a modern jet bomber contains 14,698 bolts and rivets—some with tolerances as small as .0015 of an inch.
- The wing of one modern jet bomber is so aero dynamically smooth that a scuffed upper surface has been known to decrease the plane's top speed as much as 20 miles per hour. For this reason ground crews are required to wear soft-soled shoes when walking on the surface of the wing.

New Standardized Milling Machinery Speeds Up Aircraft Production

New milling machines for aircraft industry plants will step up production of certain parts of airframes as much as eight to 10 times the present rate.

Under a program that is revolutionary in the manufacture of aircraft, America's plane builders will, for the first time in history, work with tools designed and standardized industry-wide specifically for aircraft production.

The majority of the machines currently in use are machines that were originally designed for production in other industry and converted for the manufacture of aircraft.

These new units will not only greatly increase the flow of essential parts for high speed aircraft, but they will:

- Provide greatly expanded mobilization capacity.
- Greatly reduce lead-time on certain integral parts.
- Provide for interchangeable tooling, permitting the same parts to be produced on the different machines.
- Broaden the production base by having standard machine specifications applicable to all aircraft plants.
- Reduce manpower, although in some cases creating a need for more skilled workers.
- Reduce the cost of aircraft.
- Reduce handling time of parts being worked.
- Cut floor space needed and the number of machines required.
- Make stockpiling of machine tools more feasible.
- Make possible the machining of the newer metals at greater speeds.

The specifications for these new milling machines are the result of two years of study by representatives of the aircraft industry, the tool industry and government officials. It is probably the first time in industrial history that consumers and producers have met together on such a scale to map out an industry-wide program. The idea was initiated by the Manufacturing Methods Committee of the Aircraft Industries Association, the association of aircraft manufacturers.

The program is both long-range and short-range. It is designed to get some machines into immediate production, but since it involves retooling by the industry the complete program will require several years.

The first production of prototype milling machines to be built to meet the new specifications will be purchased by the U.S. Air Force under the Department of Defense machine tool mobilization stockpiling program.

With the advent of new metals and the demands created by the mobilization program, it became essential that machines built specifically for aircraft manufacture be made available. In some cases it will be possible for present machines to be remodeled to meet the new specifica-

tions, but in most cases entirely new machines must be designed and built and new structures constructed.

Industry spokesmen say that by standardizing aircraft tools it will eliminate production bottlenecks which have occurred in the past, such as when one manufacturer, building its own airplane, purchased tools to meet its own requirements. With the new tools, it will be possible for other manufacturers to enter the production schedule of most any aircraft simply by interchanging the tooling components of the big milling machines.

Although the potential facilities for U.S. aircraft production are far greater now than they were in World War II, the nation's unparalleled productive capacity will be greatly increased with the new milling machines.

Independent Airlines Set Safety Record

(Continued from page 1)

groups and cargo by the Association's Air Charter Exchange," Mr. Johnston said, "subject to approval by the Civil Aeronautics Board."

"Back of the independent airline safety record are many cooperative programs between the companies, including continuous modifications and specialized pilot training programs aimed at keeping transport equipment modern, and crew personnel abreast of the latest developments to improve passenger safety and comfort.

"With the world-wide demands of air commerce taking the full output of U.S. aircraft industry production, the services of the independent carriers are rising in popular demand. This fleet of air transport planes," Mr. Johnston said, "is an important reserve for military or civilian emergency."

New York Leads Nation In Aircraft Traffic

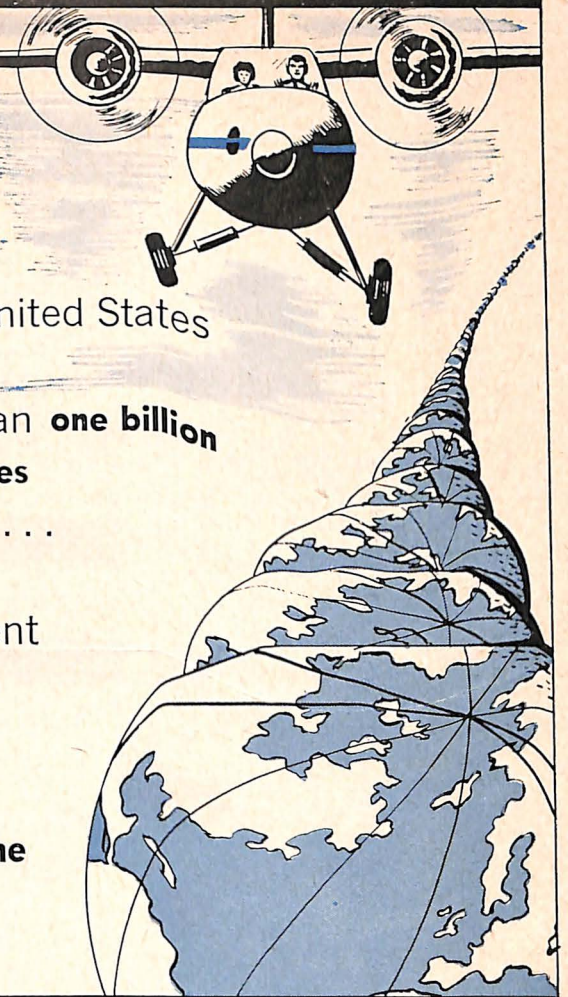
New York, Chicago and Washington, were the big three in air traffic for 1954, both for number of aircraft departures and number of passengers.

New York (including Newark) led with 137,833 aircraft departures and 3,836,634 passengers; Chicago registered 120,234 departures and 3,044,545 passengers; and Washington 78,524 departures and 1,509,963 passengers. Below these three cities the "large hubs," the next eight cities by rank and passengers departing their air terminals were: Los Angeles, 1,478,948; San Francisco, 1,131,004; Detroit, 891,863; Miami, 886,456; Atlanta, 853,968; Boston, 710,964; Dallas, 688,695; Cleveland, 688,096.

AIR TRAVELLING AMERICA

Private aircraft owners of the United States flew more than **one billion** plane miles in 1954 . . . This is equivalent to **42,000** trips around the world!

'PLANES'



U.S. Aviation Industry Export Leads Great Britain By 295 Per Cent

(Continued from page 1)

world. The dollar value of all transports sold overseas amounted to approximately \$96 million, up \$16.7 million over the preceding year.

The Netherlands, which has topped all foreign buyers for the past six years in purchasing America's larger commercial transports, dropped back on the list in 1954 and Canada moved into first place by taking delivery on nine of the big planes with a total value of \$15.4 million.

Additionally, Canada spent \$1.8 million dollars with U.S. manufacturers by purchasing 191 smaller aircraft of various types.

The efficient powerplants produced by the nation's engine manufacturers were as eagerly purchased in foreign nations as were other aviation products. Unclassified information on sales of these items is limited to engines rated under 400 horsepower and used principally in powering light aircraft used in general aviation. Military security precludes any enumeration of the larger, more powerful engines sold to foreign markets.

The number of the smaller engines more than doubled the number sold in 1953 with a total of 728 compared to 347 and valued in 1954 at \$1.5 million in sales.

A further breakdown of foreign sales shows: new utility, personal and liaison planes, \$4.5 million; rotary wing aircraft, \$4 million; and, used aircraft, \$16.2 million. While most of the rotary wing aircraft exported were of military type and therefore not reported separately, there were 74 such aircraft exported for civil use to 17 countries.

Over and above the impressive total values of American aviation products that were shipped to most of the World's markets by the manufacturers or, in the form of U.S. military aid, there is another indefinable segment, cloaked under security wraps.

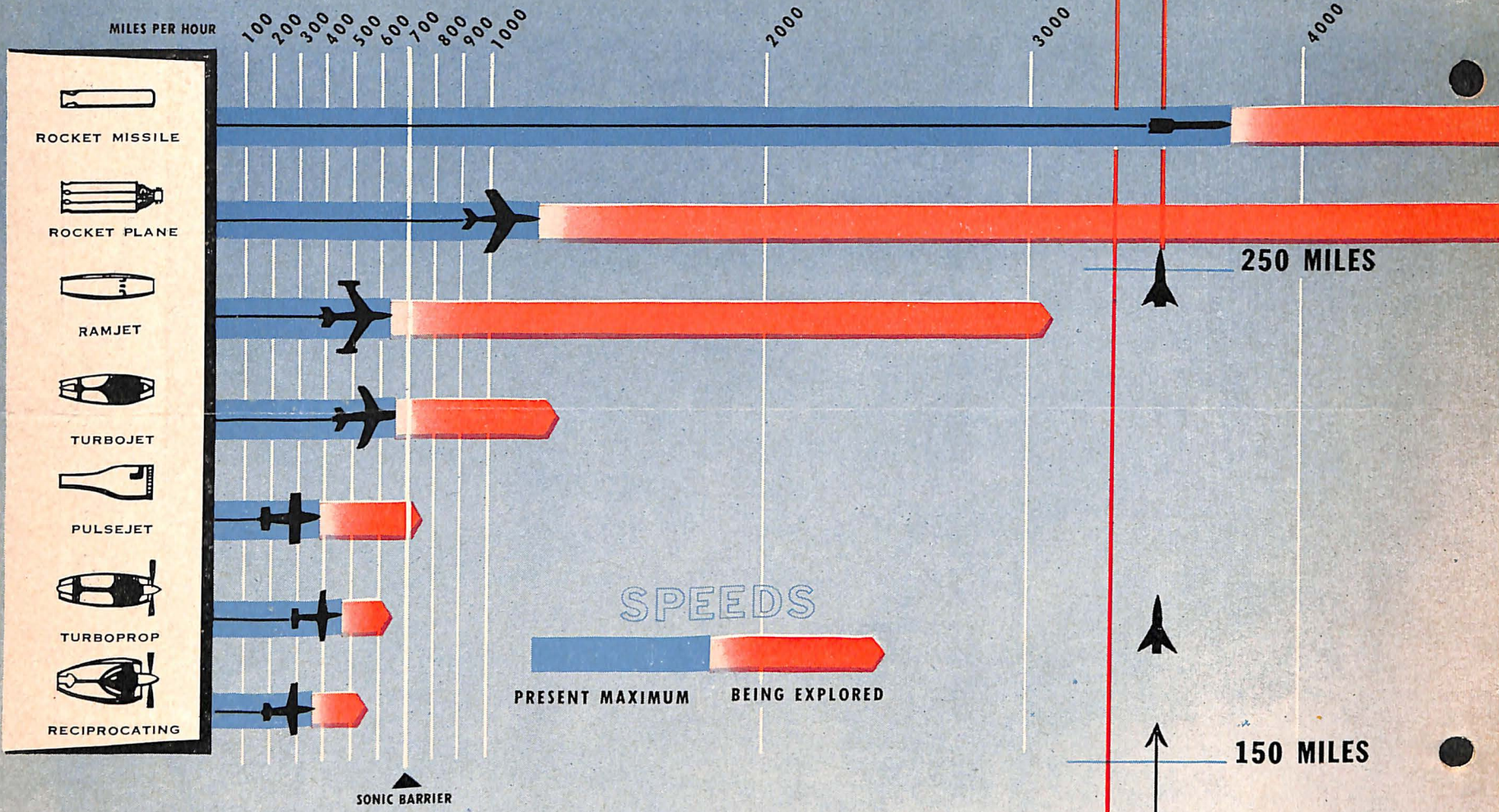
This aviation "export" could well represent approximately the value of published exports. These are the many hundreds, possibly thousands, of tactical and transport aircraft, with their supporting stores of spare engines, parts, etc., which, taken overseas by our military air forces for their own use, are subsequently transferred to the air forces, flying schools, airlines and other aviation operators abroad.

These "invisible" American aviation exports have no less of an impact in the building up of American aviation prestige abroad, than does the similar equipment that moves through more normal channels of international trade.

Research and Development key to—

SPEEDS AND ALTITUDES TODAY AND TOMORROW

America's aircraft industry, striving continuously to insure U.S. aerial supremacy, has made great strides during the last decade in the development and production of efficient, high performance engines for aircraft and guided missiles. But only an adequate, long-range research and development program will guarantee their continued progressive rise to meet the ever increasing demand of military necessity and civil economy.



SPEED The accomplishments of scientists and engineers of the aircraft industry during the last decade are reflected in this chart. In the realm of military aviation, World War II fighters, were hard pressed to reach 450 miles per hour. Today jets exceed the speed of sound with ease and piloted research planes have travelled at speeds upwards of 1,650 miles per hour—more than twice the speed of sound.

A decade ago, commercial piston-powered aircraft moved at cruising speeds up to 225 miles per hour. Today's luxurious airliners cruise at just under 400 miles per hour. Turboprop engines will bring these speeds up to just under 500 miles per hour, while turbojet power plants will make possible cruising speeds above 550 miles per hour.

Applications of the ramjet to planes and missiles will see speeds possibly to 3,000 miles per hour. Rocket engines, now in comparative infancy are virtually limitless in relation to speed. But solving the problem of the sonic barrier has been relatively simple in relation to solving the problem of the thermal barrier. The faster the speed within the earth's atmosphere, the greater the heat generated by the friction of the air over the skin surfaces. The problems are stupendous, but not insurmountable, and men and women of science and industry are working ceaselessly to find the answers.

ALTITUDE In military operations, altitude is almost as important as speed. During World War II, fighter planes were barely able to reach 30,000 feet, while today's fighters maneuver with ease at altitudes above 50,000 feet. Research aircraft have been flown at altitudes in the neighborhood of 90,000 feet—17 miles straight up.

Commercial aircraft of the decade past flew at altitudes seldom over 10,000 feet, while today's luxurious airliners cruise safely and comfortably at altitudes from 18,000 feet to more than 25,000 feet. Turbojet engines, just now being applied to passenger transport planes, will enable these new airliners to fly at altitudes of 45,000 feet—above all turbulence, clouds or storm.

The rocket engine, unlike any of the others, carries its own oxygen supply and is not limited to flight within the atmosphere. This, plus the enormous power-for-weight ratio, makes it the only known engine that can drive manned or unmanned vehicles into space. Altitudes reached so far are 136 and 250 miles for one and two-stage missiles respectively, but the rocket engine's ultimate ceiling is limited only by the amount of propellant it can carry.

