



planes

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U.S. MUST MAINTAIN SUPERIORITY IN AIR

NACA Expert Sees 'Urgent' Necessity For Research in Aircraft Powerplants

By Abe Silverstein
Associate Director
Lewis Flight Propulsion Laboratory
National Advisory Committee for Aeronautics

Since the end of World War II, great advances have been made in aeronautics.

Our research airplanes, once supersonic flight was attained, have gone on to Mach numbers of 2 and 2.5 (2 and 2½ times the speed of sound). The first of our tactical faster-than-sound fighters have taken to the air. We have so accelerated the development of guided missiles that several are currently in service use.

Yet, despite these spectacular accomplishments, we are beginning an era of even more sensational achievements.

New Ideas

Never in the history of aeronautics have there been so many fruitful ideas to be explored by research and never has there been a greater need for exploitation of those ideas. Urgency is a consideration which, increasingly, must affect the thinking and actions of our aeronautical team.

Because of the very large amounts of thrust required to reach higher supersonic flight speeds and provide greater range, the need for greatly improved power plants has become critical. Somehow, the military services, the manufacturers, and the NACA—working as partners—must find ways to accelerate the process of transforming ideas into the useful developments upon which our country's aeronautical progress depends.

Basic Supersonic Problems

In considering the current state of the aeronautical art and where we must seek to project it, it may be helpful to redefine the basic problem of supersonic propulsion. In simplest terms, it is to produce a tremendous amount of power in a small, lightweight engine, with efficiency.

(See ATOM PLANE, page 4)

Miles of Wires Installed In Late-Model Airliners

Electrical systems installed in the big transports operated by the nation's airlines contribute much to the efficiency and safety of modern air transportation.

In one late-model transport, the wiring required would stretch over 27 miles. To complete installation in a single plane, 7,224 individual pieces of wire must be used, in addition to 144 electrical wire harnesses and 85 radio harnesses.

New Peacetime Peak In Aircraft Exports Reached During '53

More than \$880.5 million worth of aircraft and parts were exported by the U.S. aircraft industry to 71 countries last year—making 1953 the biggest peacetime export year in American aviation history.

Dollar volume of exports was 46 per cent above the 1952 figure, and is more than 3½ times the value of exports in 1950, the year the Korean War began.

Last year, the total aircraft products sent abroad by the U.S. aircraft industry represented 5.6 per cent of all American merchandise shipped to foreign buyers. Few industries ship a greater portion of their production to foreign markets than does the aircraft industry. In normal years, exports account for about 25 per cent of aircraft industry production; the average for all American industries is less than 10 per cent.

Exports for 1953 break down as follows: New passenger transports, \$79,309,000; new and used utility aircraft (under 3,000 pounds), \$6,- (See 90% of TRANSPORTS, page 3)

Aircraft Industry Is Top Employer In Manufacturing

The aircraft industry is the largest manufacturing employer in the United States.

Revised figures on U.S. employment, released by the Bureau of Labor Statistics, show that the aircraft and parts industry today employs approximately 823,000 Americans. This compares with 786,000 working in the automobile industry, (See TWO-MILLION, page 2)

Adm. Soucek Says Navy Emphasizes Aircraft Quality

By Rear Adm. Apollo Soucek
Chief, Bureau of Aeronautics
U. S. Navy

Two major problems confront America's strategic planners — the threat of global war, and the threat of small-scale peripheral wars on the borders of the free world.

To meet these challenges, this nation must have highly organized, flexible military forces.

National Policy

These forces, as a matter of national policy, are not intended to match in quantity the masses under arms in the Communist-dominated world.

If, therefore, we are to be successful in containing the threat to world peace and our national security, we must maintain an overwhelming ratio of qualitative superiority—both in personnel and in weapons.

To this end, the Department of Defense is spending approximately \$1.3-billion this year for research and development, in an effort to achieve the technological superiority upon which our national security rests. This compares with \$630-million spent in the fiscal year immediately preceding the Korean War.

Strides in Science

In the past few years, tremendous strides have been made in science—not only in this nation, but in other parts of the world. As these profound technological changes have occurred, we have been faced with an increased atmosphere of urgency in development of infinitely complex weapons.

This has been particularly true in the field of aeronautics—for which I (See MODERN, page 3)

New Hangar Has Nation's Largest Single Doorway

A new hangar, in which a major aircraft company's \$5,800,000 flight test facility is located, has the largest unobstructed doorway in the U.S.

The hangar door is 780 feet long and 65 feet high, with 13 vertical lift doors.

The new flight test facility is fitted to advance the pace at which new airplanes can be proved and developed.

AMERICA'S STRIKING POWER

ONE MODERN BOMBER

CARRIES A MILLION TIMES THE PUNCH

OF ALL THE B-17'S

THAT BOMBED BERLIN IN WORLD WAR II

The retaliatory power of America's long-range bombers is one of the greatest deterrents to Communist aggression.

'PLANES' SOURCE: AIRCRAFT INDUSTRIES ASSOCIATION

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.

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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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ALL MATERIAL MAY BE REPRODUCED—MATS OF ALL CHARTS ARE AVAILABLE FREE

The Fourth Industry

By DeWitt C. Ramsey (Adm., USN, Ret.)
President, Aircraft Industries Association

There is an age-old axiom that only three industries have been necessary to human life—food, shelter and clothing. At this time in history it must be recognized that another has been added, forced upon humanity by totalitarianism and the fearful power of air-delivered nuclear weapons. This industry is defense.

No mutation in science is yet visible which could alter the fact that, from now to eternity, there is no such thing as isolation on this earth. There is no spot, no population, which cannot be struck with devastating force in a matter of hours. Hydrogen and atomic bombs today can be delivered at sonic speeds. Tomorrow they will move at multiples of the speed of sound. Atomic bombs which destroyed cities in 1945 were but forerunners of more awesome things to come. The A-Bomb of Hiroshima was the equivalent of 20,000 tons of TNT; the power of the H-Bomb of Eniwetok is measured in millions of tons of TNT. Yet, science now envisions the cobalt bomb, which would multiply the deadliness of the H-bomb many times.

Only six years ago, when the United States had exclusive possession of atomic weapons, the Congressional Aviation Policy Board said in its report:

“Until men of all nations can meet in good will in the council chambers of the world, anything less than this complete supremacy in air power is self-deception.”

Today we know that Russia has both atomic and hydrogen weapons, and an air force greater, at least numerically, than our own. She has a large submarine fleet, she has guided missiles, she has a vast army. Soberly, President Eisenhower has warned that “our very survival as a nation depends upon our instant preparedness to resist aggression.”

Thus we come face to face with our fourth necessary industry—an industry which must guarantee our very lives by devising and supplying adequate defenses against the power of potential enemies, and more especially in devising and supplying even greater force in retaliation. Only the certainty that he can be destroyed in turn will deter an enemy, dedicated to the violent overthrow of freedom, from unleashing against us the incredible destruction of nuclear weapons.

The keystone of this fourth industry is air power. Korea proved that America has the finest combat airmen in the world, and qualitative superiority in aircraft. But we dare not lower our guard. New jet fighters and new long-range jet bombers have been seen in Communist skies. The Russian arsenal of nuclear weapons is conceded to be large. We must retain our own momentum of research, development and production to meet such progress.

Our fourth necessary industry must be kept active and healthy because, as the President recently said, “You and I can logically deduce that we must have adequate force-in-being the day the war begins—or we will have no need for any other.”

PLANE VIEWS



A NEW GYROSCOPE FOR PLANES CAN DETECT MOTION 3000 TIMES SLOWER THAN THE MOVEMENT OF THE HOUR HAND ON A WATCH...

ALTITUDE

158 MILES!

A SINGLE-STAGE AMERICAN ROCKET HAS FLOWN AN ESTIMATED 4300 MILES AN HOUR & REACHED AN ALTITUDE OF APPROXIMATELY 834,240 FEET!

3 POUND SUPERMAN

A 3-POUND MECHANISM WHICH ACTUATES TRIM TABS, MOVING RUDDER AND AILERONS, ON A MODERN PLANE CAN PRODUCE A FORCE EQUAL TO 100 TIMES ITS OWN WEIGHT. IF A MAN HAD THAT WEIGHT-TO-POWER RATIO HE COULD LIFT FIVE AUTOMOBILES!



BY AIRCRAFT INDUSTRIES ASSOCIATION

Almost Two Million Directly Dependent On Aircraft Payroll

(Continued from page 1)

which previously has ranked at the top of U.S. manufacturing employers.

Third-largest manufacturing employer in the nation is the blast furnace, steel works and rolling mill industry, with 594,900 workers; fourth are producers of communications equipment, with 503,700 workers; and fifth are broad-woven fabric mills, with 489,900 workers.

Including families of workers, approximately 1,900,000 Americans are directly dependent upon the aircraft and parts payroll.

Average weekly earnings for production workers in the aircraft and parts industry in March (latest month for which figures are available) were \$84.25, compared with an average of \$70.71 for all manufacturing industries.

During World War II, the aircraft industry was the largest user of manufacturing manpower in the nation—but in 1946, immediately following the war, it ranked 16th.

PLANE FACTS

- In World War I, it took fighter planes an hour to climb to 6,000 feet. Today, Navy carrier-based fighters can reach altitudes greater than 10,000 feet in less than two minutes.
- Engineers in the Measurements Standards Laboratory of an aircraft engine manufacturer daily make measurements to within one-thirtieth of the thickness of a human hair. These engineers have responsibility for the accuracy of master gages, master gears and measuring rods used in engine production.
- In 1953, domestic scheduled airlines accounted for 65 per cent of all air/pullman travel.
- More than 200 reinforced-plastic parts go into a sweptwing jet fighter-bomber.
- Out of every dollar spent by a typical helicopter manufacturer last year, 49 cents went to employees in wages and salaries.
- In six years, Military Air Transport Service planes have logged nearly 5,265,000,000 miles.

Modern Naval Air Arms Vital During Years of Tension Ahead—Adm. Soucek

(Continued from page 1)

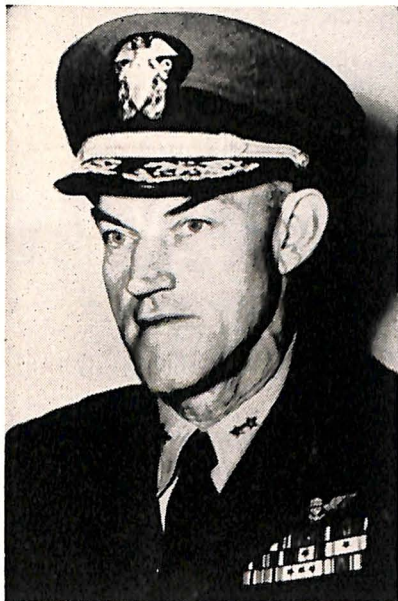
have a basic responsibility in the Navy.

We are well aware that creative, bold imagination is required to keep pace with our potential enemies in the highly complex field of new aeronautical development. Emphasis on inventiveness and scientific leadership must pervade the military services.

In the creation of Naval air power, the aircraft industry is confronted with a continuing challenge and a great responsibility—for development of new and better aircraft, for fulfilling assigned schedules and commitments, and for practicing the most stringent economies in production.

World's Finest Equipment

We believe that the Navy has access to the finest aeronautical equipment that has ever existed. From the operator's viewpoint, the present-day airplane, including its engine, its electronics gear, and its armament devices are almost unbelievably fine. Very little credit for that can be



ADMIRAL SOUCEK

taken by my immediate organization. Most of that has been developed by engineers and technicians in the aircraft industry.

Because this nation's security rests on maintenance of our margin of qualitative superiority, it is imperative that the military services and the aircraft industry—working as partners—place increasing priority on this requirement for the world's most modern air arms.

In numbers, the aircraft strength

International Baseball Takes to the Airlines

Baseball teams in three countries are playing 154 regular games this year—with most of their trips by airplane.

With some league cities 1,500 miles apart, players in the International Baseball League—whose home bases are in Canada, Cuba and the U.S.—are using air transportation almost exclusively for team travel.

of the Navy is scheduled to remain at approximately the current level over the next few years. Today, we are operating 9,941 aircraft—with more than 3,000 additional planes in logistical support. This aircraft inventory is rapidly being modernized. About 44 to 45 per cent of the planes are modern today; by the end of next December, about 65 per cent of the Navy's planes will be modernized. By the end of calendar 1956, our modernization will be on the order of 85 to 87 per cent.

Years of Tension

To keep these contemplated force levels equipped with late-model planes over the years of tension which lie ahead will require an annual production for the Navy of between 2,100 and 2,200 new aircraft annually. The cost of such a program will be between 2½ and 3 billion dollars per year.

In the creation of these forces, the 823,000 Americans who today constitute the aircraft industry must work in the closest partnership with the military services. We shall depend upon them for a continuation of the pioneering spirit which has led to the present high state of the aeronautical arts in this country.

90% of Transports On World Airlines Built in America

(Continued from page 1)

953,000; new helicopters, \$4,873,000; new aircooled engines under 400 horsepower, \$709,000. Because of military security, no breakdown is given on the \$788,790,000 worth of military, cargo and used transport aircraft, engines of 400 horsepower and over, propellers, instruments, and all accessories, spare parts and ground handling equipment.

The largest dollar value of civil aircraft business was in passenger transports. Ninety per cent of all transports flying world airways in 1953 were produced in the United States.

The Netherlands, which has led all other foreign buyers in total purchases of U.S. heavy transports for the past five years, topped the list again in 1953 by buying 15 of these big airliners. France, however, with a purchase of 14 planes led in dollar value with a sum close to \$21 million.

In total numbers of all types of aircraft, Western Hemisphere countries were the biggest customers. Canada imported 242 American-built civil aircraft to lead the list, with Mexico second with 241 planes.

Use of Airplanes For Troop Moves Saves Millions

"We have already established that air movement of personnel is more economical in the long run because of the time that is saved."

Gen. Nathan F. Twining
Chief of Staff, U.S. Air Force

If the average American saved each year the amount he pays in Federal income taxes, it would take him 124,645 years to put aside an amount equal to the \$44 million saved by the military forces in 1953 through the use of air transportation.

This startling figure is based on the man hours saved by transporting military forces by air from one base to another, instead of using slower (and in some cases, more costly) surface transportation.

88 Million Man Hours

Savings last year amounted to more than 88 million man hours—the equivalent of 4,072 troops working 24 hours a day, seven days a week for one entire year!

These figures do not include the men moved overseas from the East and West Coasts, although savings on these movements are equally impressive.

As an example, it costs the Air Force \$155 to transport a serviceman to Europe by Military Sea Transport Service—and the trip takes seven and a half days. The same trip by air costs the Air Force between \$75 and \$105 per man—and the trip takes only a day and a half.

This military traffic is comparatively new to the airlines. For over 35 years, between 98 and 99 per cent of all military passenger travel was handled by the railroads. Since 1951, however, the scheduled airlines, the non-scheduled airlines, the rail and bus lines are all invited by the Department of Defense to submit bids when troops are to be moved—with the movement going to the lowest bidder.

Daily Movements

It is not uncommon for the scheduled airlines alone to move as many as 650 men from coast to coast during a day. And on shorter flights groups numbering up to 1,500 have been moved in a 24-hour period. During Christmas week, 1952, the scheduled airlines had their own operation, called "Santa Claus," during which 5.5 million passenger miles were flown in getting Korean veterans home in time for the holidays.

Tiny Gas Turbine Engine Weighs Only 115 Pounds

A tiny 50-h.p. engine developed by an aircraft company operates at a speed of roughly 40,000 r.p.m. (almost 20 times that of an average auto engine). A gas turbine, it is smaller than a two-foot cube!

Among other uses, it serves as an airborne electrical generator.

INSPECTION FOR PERFECTION

INSPECTION SHEET No. 28,000

PLANE NO. _____ DATE _____

SECTION _____

GRADE NUMBER _____

TEMPERATURE _____

DESC. _____

INSPECTOR W.K.

Production of modern aircraft is one of the most complex operations of present-day technology. To insure highest quality, thousands of inspections are performed by manufacturers. The builder of a late-model troop carrier plane reports that each aircraft goes through more than 28,000 different inspections prior to first acceptance flight. Each of the more than 22,000 parts of the plane is inspected. In addition, more than 6,000 assembly-line inspections are made.

PLANES SOURCE: AIRCRAFT INDUSTRIES ASSOCIATION

Fleet of 157 State-Owned Planes Speed Official Business, AIA Survey Reveals

Annie the antelope never had it so good!

The day was when everybody hunted these graceful animals with steaks or roasts for the dinner table foremost in their minds. But, thanks to economy-minded state government officials, this is not so in today's air age.

In the State of New Mexico, men hunt antelope in order to keep a close tally on the size of the herds and to prevent their extinction. And they do it with airplanes.

This is but one of more than 20 different tasks that 37 of the 48 states in America have found they could accomplish more quickly and cheaply by using aircraft, according to a survey just completed by the Aircraft Industries Association.

States Own 157 Planes

Altogether these states own a total of 157 planes, including nine twin-engined aircraft which transport up to 10 persons. The other planes are single-engined and carry from one to five passengers.

A total of 89 agencies in the 37 states own and operate their own planes, and each year a total well in excess of 34,000 hours—more than 4.25 million miles—are flown in carrying out the various agencies' missions.

One state rents and operates 12 other single-engined planes in addition to the five that it owns, and another state leases and operates four others in support of the two aircraft it owns.

The survey reveals that 39 of the 48 states have permanent aeronautical commissions or divisions within the state government. The AIA survey covered 46 states; no replies were received from the states of Georgia or Michigan.

Civilian Air Power

Each year these planes play an increasingly important role in the affairs of the various states and at the same time they are an integral part of the civilian air power which is available as a transportation reservoir in case of any national emergency.

The complete list of the uses the states have found for these versatile

200-Ton Bomber Jumps Logs in Ground Test

To test the strength of the landing gear on a 400,000-pound heavy bomber, the giant plane was run over a series of logs at 90 miles per hour!

Crews reported the aircraft had a "fantastic" appearance as it successfully went through the tests, typical of rigorous investigations given new aeronautical developments for civil and military use.

"The wing center section (almost immediately above the main landing gear) seemed to hump up like a cat confronted by a dog," crew members said. "And the wingtips seemed to remain at the same distance from the runway, while the center section humped over every log."

utility aircraft, based on the figures submitted in the AIA survey, includes:

Fire patrol, personnel transfer, highway patrol, transporting state executives, map making, photography, aviation promotion, transporting prisoners between states, airfield inspections, aircraft inspections, disaster work, aerial application (dusting and spraying), planting fish, search and rescue, game patrol, engineering, charters, inspecting restricted landing areas, accident investigation, training and research work.

List of Aircraft

The states reporting and the number of planes they own are: California, 5; Colorado, 5; Connecticut, 2; Florida, 4; Idaho, 1; Illinois, 6; Indiana, 2 owned, 4 rented; Iowa, 2; Kansas, 1; Kentucky, 5; Louisiana, 11; Maine, 10; Maryland, 2; Massachusetts, 2; Minnesota, 14.

Mississippi, 5; Missouri, 5 owned, 12 rented; Nebraska, 5; New Mexico, 5; New York, 7; North Dakota, 4; Ohio, 9; Oklahoma, 4; Oregon, 1; Pennsylvania, 4; Rhode Island, 1; South Carolina, 3; South Dakota, 1.

Tennessee, 2; Texas, 9; Utah, 1; Vermont, 1; Virginia, 7; Washington, 3; West Virginia, 3; Wisconsin, 3; and Wyoming, 2.



AIR POWER TARGETS

137 WINGS — 100% MODERN 1957
 127 WINGS — 99% MODERN 1956
 120 WINGS — 94% MODERN 1955
 115 WINGS — 80% MODERN 1954

"The advantages in armed manpower and in geographical position possessed by the USSR and its satellites must be compensated for by our qualitative superiority . . . Quality is the keynote of the Air Force program. Our aircraft inventory must be kept as modern as U. S. technology can make it."—Gen.

Nathan F. Twining, Air Force Chief of Staff.

'PLANES'

SOURCE: AIRCRAFT INDUSTRIES ASSOCIATION

ATOMIC PLANE RESEARCH UNDERWAY

(Continued from page 1)

ciency high enough, or fuel consumption low enough, to provide the desired range capabilities.

Three engine types, the rocket, the ramjet, and the turbojet, are of special interest in immediate efforts to meet the supersonic propulsion requirements of fighters, bombers, and both short- and long-range missiles. To a varying degree, each engine type satisfies certain supersonic propulsion requirements. Each can be improved beyond its present state of development.

Turbojet Thrust Gains

In the case of the turbojet, for example, considerable gains in thrust can be realized by increasing airflow through the engine, and by increasing turbine-inlet gas temperature. Improved turbojet compressors have been built and tested which not only have greater air capacity and are lighter, but in addition develop higher pressure ratio and have higher efficiency.

Experimental combustors have been developed which operate at high efficiency at the higher air flows. Work with cooled turbines is providing information necessary to permit engine operation at increased inlet temperatures.

Increased Power Output

Incorporation of such improvements in a turbojet engine will provide increased power output, with less weight, to propel tomorrow's supersonic aircraft at faster speeds.

But what about long-range requirements for our faster-than-sound aircraft?

The power required to propel an airplane at supersonic speeds is very large, as much as five times the amount needed to sustain the same airplane at subsonic speeds. It has become increasingly apparent that if supersonic aircraft are to possess

the long-range capabilities required, a way must be found to breach the fundamental limits inherent in engines using chemical fuels.

One obvious way to extend the range of supersonic aircraft would be to use nuclear energy for propulsion. Fission of a single pound of uranium will produce as much heat as burning 2,000,000 pounds of gasoline. Stated another way, the total energy which can be obtained from the "burn-up" of a single pound of uranium equals the energy in 3,500,000 pounds of coal, yet the uranium would be a one and one-half inch cube against 32 railroad cars of coal.

Both experimental and analytical investigations of the many problems of nuclear aircraft engines are necessary. Often problems are so complex as to require development of novel facilities which can be used to split them into their several parts for piecemeal study and solution.

Atomic Air Potential

The performance capabilities to be realized from harnessing nuclear energy for aircraft propulsion would be nonstop supersonic flight to any point on the face of the earth, and return. With so large a gain the goal, industry, the Atomic Energy Commission, the Military Services, and the NACA are participating in vigorous, sustained attacks on the formidable technical problems that must be solved. Our national security requires that the research and development of nuclear power plants for aircraft be carried forward with unceasing effort.

Air Quotes

"In addition to a ready force we have a tremendous asset in our industrial capacity. Despite Soviet progress in the production



and development of weapons, we possess and must maintain a margin of qualitative superiority. To keep this superiority we must continue to place great emphasis upon research and development in quest of more effective weapons. Our ability to counter the disparity in manpower between the free world and the world of aggressor lies only in better weapons and sounder organization."—Air Force Secretary Harold E. Talbott, November 19, 1953.