



Nov. 29, 1957

Vol. 13, No. 11

# planes

OFFICIAL PUBLICATION OF THE AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA

★ All material may be reproduced with or without credit.  
★ Mats of all charts available free.

## LOGISTICS SPEED KEY TO MISSILE PROGRAM

### Military, Industry Launch 'Rocket Age' Supply Plan to Insure Efficiency

By Major General James F. Phillips, (USAF-Ret.)  
Guided Missiles Committee, Aircraft Industries Association

The success of missile operations, and particularly ballistic types, pivots on the efficiency and immediate responsiveness of their logistics support systems. A military-industry effort of tremendous scope is now under way to insure that the ultimate in logistics is established for our missile systems. In an air-atomic age, the logistics system can no longer be an afterthought, a "tail-end Charlie" of military planning. It is a full partner in the urgent priorities for materials and management talents assigned to the research, development and production of the weapon itself.

The integration of ballistic missiles into military inventories represents a unique challenge to the services and to industry. If certain components of a manned aircraft fail to function properly after leaving on a mission, well-trained crew members can fill the gap or make adjustments that will permit the mission to continue. The ballistic missile is a different breed of weapon. A split second after countdown "zero," the missile is on its own and must function perfectly or not at all. There is only one passing grade in ballistic missile operations—100 per cent.

The present system of logistics for manned aircraft, cast against the all-or-nothing requirements of ballistic missile operations, is obviously inadequate. Although progress is being made continuously in our over-all support systems, its sheer size and complexity does not permit dramatic gains in efficiency. For no other reason than this alone, new ideas are added gradually to avoid upsetting this system. But with ballistic missiles our military and industrial planners have a logistics problem that admits novel and fresh solutions, not only because of the nature of the weapon itself, but because the program is a problem of manageable size. Our nation has invested billions of dollars and priceless scientific and engineering talents to speed ballistic missiles to operational status. Development of these new weapons should be carried out under the weapon system management plan. Positive control of every facet of research, development and production is essential.

Our nation has invested billions of dollars and priceless scientific and engineering talents to speed ballistic missiles to operational status. Development of these new weapons should be carried out under the weapon system management plan. Positive control of every facet of research, development and production is essential.

(See LOGISTICS, Page 7)

### Mach 4 Speed Forecast for Turbojet Planes

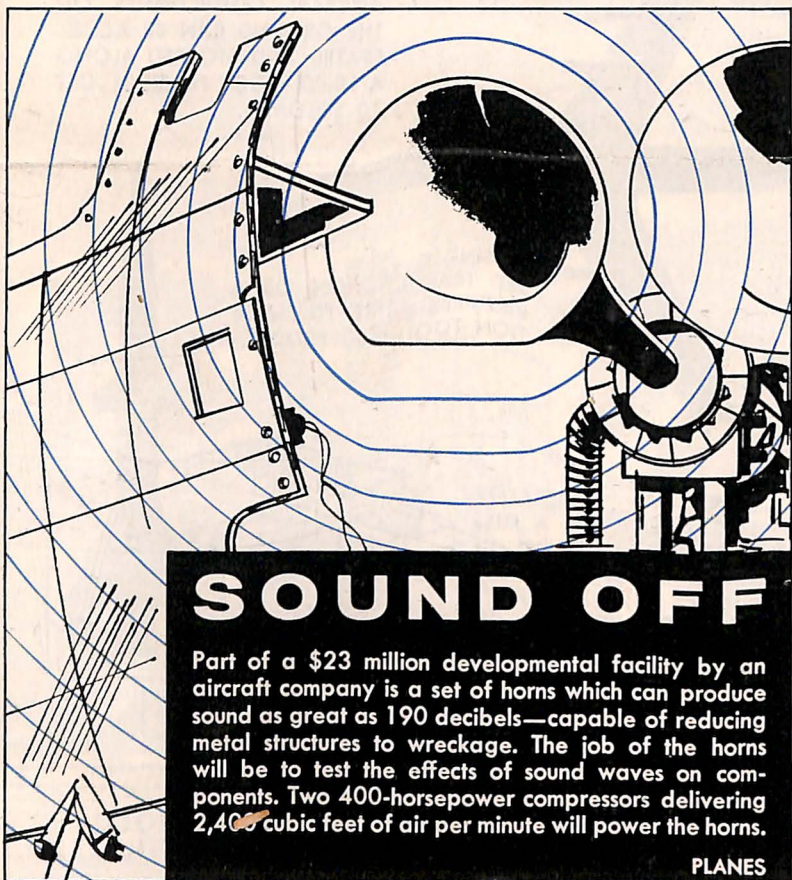
Speeds of 2,600 miles per hour at altitude for turbojet-powered aircraft are being forecast by scientists of the National Advisory Committee for Aeronautics.

Significant progress has been made in the development of turbojet engines in the U. S. since the first turbojet engine was flown 15 years ago. The aircraft engine industry today is producing engines capable of propelling aircraft in sustained flight at twice the speed of sound, and engines of even greater power are in the experimental stage. The U. S. has built nearly 100,000 gas turbine engines—more than any other nation in the world.

Today's engines have more than three times the power, at least twice the efficiency and far greater dependability than the first models produced. Weight has been kept down along with these performance increases and, in some cases, has been reduced.

Studies indicate that an important factor in the success of a turbojet engine capable of powering a plane at Mach 4 (four times the speed of sound) is the design of inlet and exhaust systems.

Thrust is reduced primarily by pressure losses in air intake systems, drag due to inlet flow conditions, and shock or over-expansion losses in the exhaust nozzle. Variable inlets and exhaust nozzles, even though they add weight, will be necessary on the Mach 4 turbojet. With fixed inlet and exhaust nozzle, the engine would be unable to propel a plane faster than Mach 1.4 and takeoff itself would be marginal.



### SOUND OFF

Part of a \$23 million developmental facility by an aircraft company is a set of horns which can produce sound as great as 190 decibels—capable of reducing metal structures to wreckage. The job of the horns will be to test the effects of sound waves on components. Two 400-horsepower compressors delivering 2,400 cubic feet of air per minute will power the horns.

PLANES

### Industry Must Make \$781,250 Sale to Replace Machine Purchased for \$22,000 Ten Years Ago

Inflation has had the effects on the aircraft industry that American housewives have felt so acutely. Prices of food, clothing and automobiles have nearly doubled since 1947.

In the aircraft industry, a milling machine—one of the "bread and butter" tools of manufacturing—has increased in cost from \$22,000 in 1947 to \$52,000 today. According to the Internal Revenue Service, the useful life of the milling machine is 12 years and the purchase cost may be depreciated over that period of time. Certain amounts of the total cost may be tax deductible over the 12-year period to pay for the replacement of the machine when its useful life is over.

This sounds like a good break for industry except for one hitch: The replacement price of the milling machine has increased \$30,000. The only possible source for this amount is earnings. With the tax rate on corporate profits being over 50 per cent, the company must earn about

\$52,500 to net the \$30,000. This means the aircraft company must sell \$781,250 worth of aircraft, spares or service just to replace a machine that cost only \$22,000 ten years ago.

Multiply the cost of replacing a milling machine by the number of machines required; crank in the requirement for the new, ultra-precise equipment in aircraft and missile manufacture and you get a general idea of the problems facing the aircraft industry.

### Larger Airports Needed

There are approximately 6,000 airports in the United States. Of this number, just 592 may be considered "modern" with runways from 5,000 feet to 7,900 feet in length. Only 53 airports in the United States have runways of more than 8,000 feet and most of these are military bases located in Texas, Florida and California.



## 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.

Publication Office: 610 Shoreham Building, Washington 5, D. C.  
New York Office: 150 East 42nd Street, New York 17, New York.  
Los Angeles Office: 7660 Beverly Boulevard, Los Angeles 36, California.

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

## Glimpse of the Future

By Orval R. Cook

President, Aircraft Industries Association

General Curtis LeMay's record-breaking flight between Buenos Aires and Washington in a turbojet tanker-transport demonstrated much more than the powerful global defense capabilities of the Strategic Air Command: The world for the first time received a vivid glimpse of the magnificent potential of our commercial jet transports when they enter service late next year.

The tanker-transport, although a military aircraft, closely resembles the commercial transport version. The powerplants are similar; the exterior configuration is alike and the lift capabilities are similar. The principal difference will be in the vastly increased comfort for passengers in the commercial types. And the commercial version of the tanker-transport is only one of several models of jet transports that will soon be coming off the production lines of America's aircraft industry.

The trouble-free flight made by Gen. LeMay was not simply luck or happenstance. Engines of the type used on this jet transport will have accumulated 4,500,000 flight hours before they lift the first commercial version off the runway and throw wide open the doors to a new era of travel. The soundness of the designs of U. S.-built jet transports has been abundantly proven—in laboratories, wind tunnels, test tanks and, of course, thousands of hours of actual flight time.

President Eisenhower fully realized the great future of the commercial jet age when he wrote to General Pedro Eucencio Aramburu, President of Argentina, on the occasion of the non-stop flight:

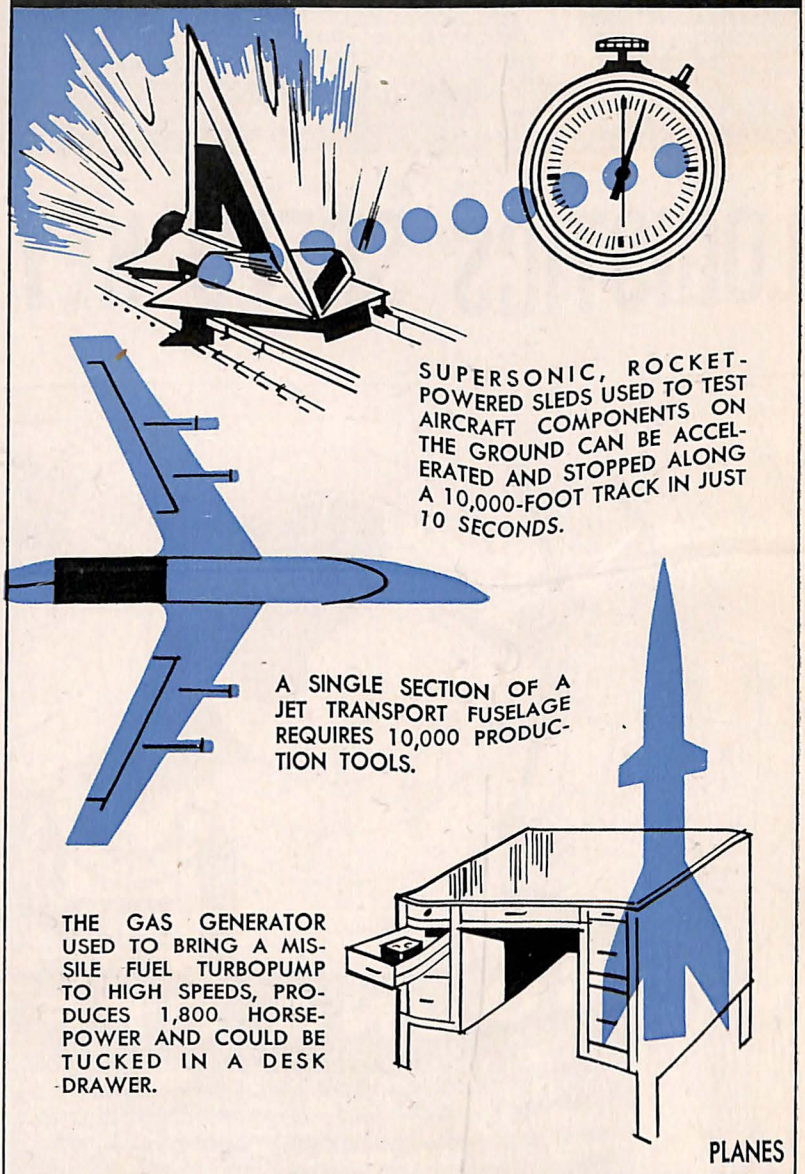
"General LeMay's flight is a graphic demonstration of how rapidly technology is reducing the once formidable barriers of time and distance in communication between countries. It is stimulating to consider that in the very near future, travel of the long distance between the United States and Argentina will require less than half a day and to realize what this portends for relations between peoples. With science and technology thus creating in effect a smaller world, common interests and mutual understanding become even more important."

The direct flight distance between Buenos Aires and Washington is 5,204 miles; Gen. LeMay's tanker-transport spanned this distance in 11 hours and 5 minutes. By steamship route between these two points, the distance is 6,000 miles, and the fastest ocean liner would require 10 days for the trip. The jet transport covered the distance in approximately the same time it would require the ocean vessel to clear the port entrance and reach the high seas. If one new jet transport is used for only 450 trips a year, it would be able to carry more than 60,000 passengers across the Atlantic. This nearly equals the number of passengers carried by the *SS United States* in the same period, and that vessel cost \$70 million when it was built four years ago.

U. S. manufacturers of commercial turbojet and turboprop aircraft today have orders for 523 aircraft from 41 airlines, including 23 foreign carriers.

The preference for American aircraft is long established. Eighty-five per cent of the aircraft flown by all the world's airlines were built in America. There are no tricks of foreign trade or national preference involved in this record. American aircraft were chosen for no more complicated reason than they are the best aircraft obtainable. Dependability, excellent servicing arrangements and competitive pricing still are the overriding factors in airline choice whether the carrier operates in South Africa or South America. American jet transports set the standard for these factors.

## Plane Views



SUPERSONIC, ROCKET-POWERED SLEDS USED TO TEST AIRCRAFT COMPONENTS ON THE GROUND CAN BE ACCELERATED AND STOPPED ALONG A 10,000-FOOT TRACK IN JUST 10 SECONDS.

A SINGLE SECTION OF A JET TRANSPORT FUSELAGE REQUIRES 10,000 PRODUCTION TOOLS.

THE GAS GENERATOR USED TO BRING A MISSILE FUEL TURBOPUMP TO HIGH SPEEDS, PRODUCES 1,800 HORSEPOWER AND COULD BE TUCKED IN A DESK DRAWER.

PLANES

## Turbojet Pilot Becomes 'Flying Executive'

The coming of the propjet airplane is changing the pilot from a "lever and button pusher" into a "flying executive."

Because of increasing speeds of turbine powered planes, it is humanly impossible for a pilot to manually operate the numerous controls. But this hasn't simplified the pilot's job. It has just changed it. Instead of working as an "operator," the pilot must become a highly skilled aircraft commander who understands thoroughly each function of the numerous electrical systems in the airplane so he can stop the automatic cycle if anything goes wrong.

As manager, the pilot monitors and must be continuously ready and able to receive, interpret correctly, and act upon the information offered by every indicator in the cockpit.

Because of tremendous increase in the amount of electricity generated and distributed throughout the airplane, operating difficulties experienced in the past may be corrected on the modern airplane in a few minutes.

Ground time necessary for maintenance and service of the propjets is expected to be much less.

## Air Quote

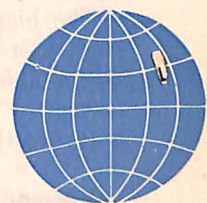
"During the last few years, the Air Force problem of maintaining a successful deterrent force has been rendered most acute by the fact that the nature of the forces themselves is changing. While we are maintaining in being proven weapon systems that we know can do the job, we have been at the same time building and testing the radically different weapons of the future.

"It is largely in the search for new weapons and better combat capabilities, both offensive and defensive, that much of your money has been used by the Air Force. More and more Air Force funds are being put into this field.

"Future deterrence depends to a great extent upon our success in a technological race. The Air Force recognizes the need to move fast, but at the same time, through long experience, we recognize the need to move positively and to prove before we accept. I want to stress the word *prove*. When a weapon has been proven it will be incorporated into the Air Force arsenal and trusted to guard our security, but only then."—Gen. Thomas D. White, Chief of Staff, USAF, November 15, 1957.



## WINGS FOR THINGS



By Harmar D. Denny  
Member, Civil Aeronautics Board

HARMAR D. DENNY was first appointed by President Eisenhower in April, 1953 to the Civil Aeronautics Board, the independent Federal regulatory agency governing all U. S. civil aviation. He was named Vice Chairman of CAB following his appointment, and was reappointed to a full six-year term in 1954. He was a pilot with the Army during World War I and with the Training Command of the Air Corps during World War II. Colonel Denny served in the 82nd Congress, representing the 29th District of Pennsylvania. An attorney in private life, Col. Denny also served as Director of the Department of Public Safety in Pittsburgh, and is active in many national organizations, including The American Legion, the Boy Scouts of America and Society of the Cincinnati.



pointed to a full six-year term in 1954. He was a pilot with the Army during World War I and with the Training Command of the Air Corps during World War II. Colonel Denny served in the 82nd Congress, representing the 29th District of Pennsylvania. An attorney in private life, Col. Denny also served as Director of the Department of Public Safety in Pittsburgh, and is active in many national organizations, including The American Legion, the Boy Scouts of America and Society of the Cincinnati.

EVERYWHERE in the U. S. today and in many parts of the world, shippers are making use of a new kind of service that makes possible the movement of goods from place to place at speeds man never dreamed of before.

Day and night, in the cargo bins of passenger airliners and in big all-cargo airplanes, thousands of tons of freight are moving along the airways.

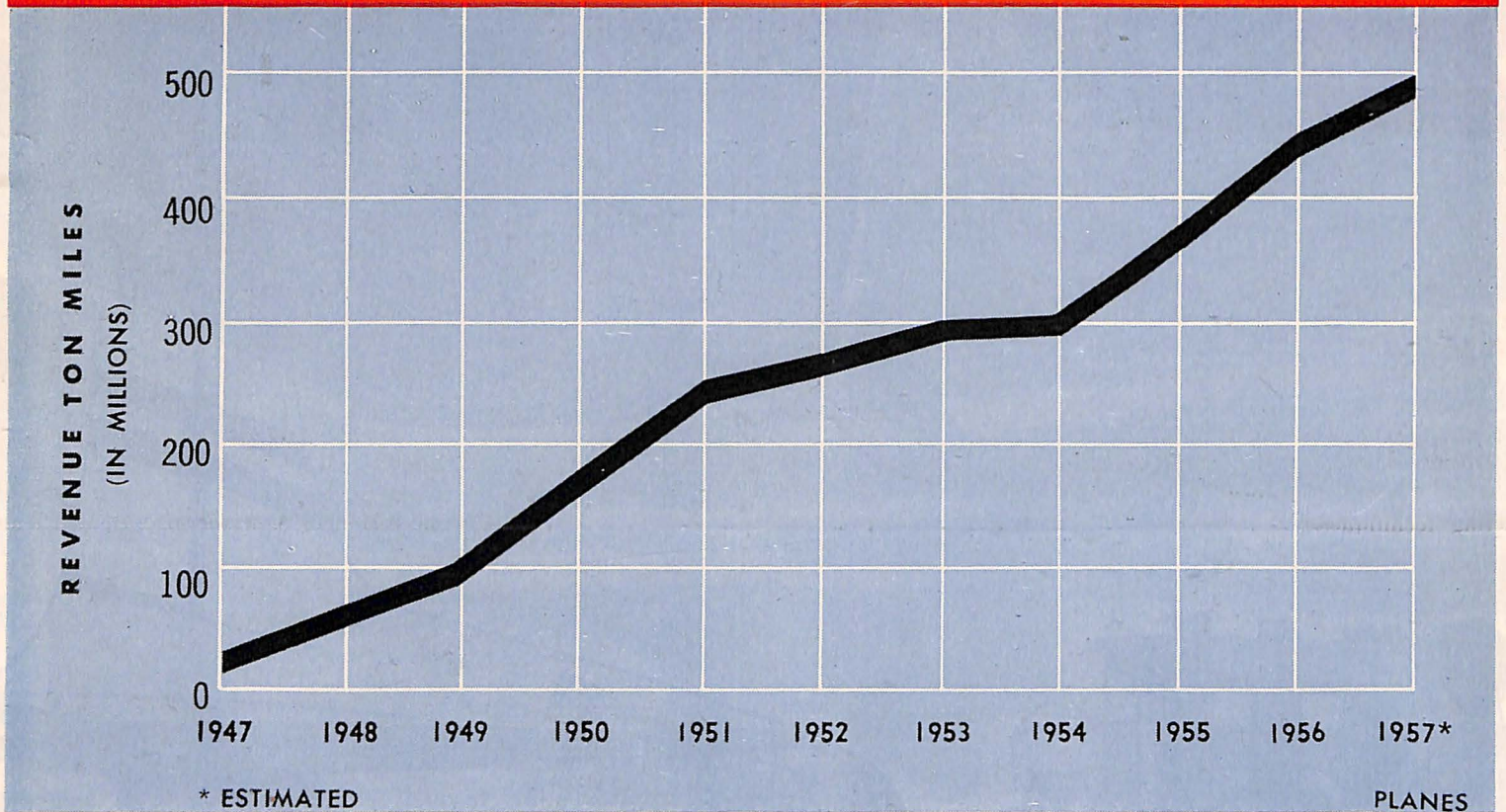
Air freight is coming of age.

It is no longer a glamorous, mysterious service, something to marvel at or something out of the ordinary. Shipping by air today is as common as shipping things by box car, moving van or sea-going freighter.

The manifest for the typical aerial freighter lists virtually every kind of item.

Planes carry planes (smaller ones) and pianos and pumas. Elephants fly, and so do

# GROWTH OF AIR FREIGHT



snakes and giraffes and tropical fish.

The old belief—that if it's heavy, it goes by surface transport; if it's light it goes by air—is like saying the bumble-bee can't fly.

Heavy machinery for farm and factory, precision tools and delicate time-pieces, drugs and dynamos, perishables and palatables, fashions and flowers—all are shipped by air.

The biggest of today's air freighters will carry more than 21 tons of cargo. Anything that will fit into the fuselage of an airplane can go by air freight. The fact is, planes can carry anything that will fit in a railroad box car.

Everything that an airplane hauls, passengers excluded, is classified as *air cargo*. That means *air mail*, *air express* and *air freight*. But *air freight* is a separate and distinctive service. It is the only *air cargo* operation performed exclusively by the airlines without a tie-in with the Post Office Department or the Railway Express Agency.

Things by air really began shortly after the advent of the first balloon. The first air mail letter, for example, was carried by Blanchard and Jeffries on their balloon crossing of the English Channel in 1785. But it is generally recognized that the first commercial aerial shipment of goods was in 1911, when a bolt of silk was flown from Dayton to Columbus, Ohio, in an early Wright Brothers' plane. Scheduled air freight service, as we know it today, was born in 1944 after experience in World War II had proved the airplane could airlift virtually anything.

By the end of 1947, the scheduled airlines had flown a total of some 38 million ton-miles of freight. But within five years the air freight ton-mile figure for the total scheduled air-

lines industry exceeded 100 million. And in 1957 the airlines will fly a total of *half a billion* freight ton-miles, an increase of almost 1,400 per cent in ten years.

(A ton-mile is the industry's yardstick for measuring freight movements. It means simply—airlifting one ton and moving it forward one mile.)

Of course, the volume of air shipments is far below that of surface transport—less than 1/20th of one per cent—if we include freight that moves by all other common carriers. But then, air freight is the youngest of our air cargo services and it is just now beginning to attract the attention it deserves.

Air freight moves at speeds with which no



A shipper in Grand Island, Nebraska, can send an air freight shipment to Djakarta, Indonesia, and obtain the only waybill necessary at the point of shipment.

surface transport can compete.

By ocean-freighter, for example, it takes a shipment 32 days to go from Stuttgart, Germany to Gary, Indiana. By air it is only 36 hours transit time. Motor freight moves coast-to-coast at best in about 10 days. An air freight shipment makes the trip in less than 12 hours. The average freight train speed is 18.6 miles per hour. The aerial freighter speeds through the skies at better than five miles a minute!

**T**HINGS get there quicker by air. And it is this factor more than anything else that has been responsible for the increasing use of air freight as an everyday shipping service.

The fact is, air freight, because it is the fastest practical means of transport, has become a completely new medium of distribution. Shrinking time and distance, it has revolutionized previously known and accepted marketing techniques.

Businessmen have found that shipping by air is the cheapest, safest, most dependable—as well as the most expeditious—way of doing business.

Wings for things has changed the concept of commerce. And air freight has turned the new concept into a system of transport which has set a whole new kind of trade in motion.

Air freight has set up a new relationship between buyer and seller. It has rewritten the law of supply and demand. For it has opened up new markets and widened old ones. In the process it has created a whole new merchandising concept.

The concept, it has been said, may be likened to the "touch of Midas," for alert executives have discovered that the speed of wings means more profit out of a firm's operating capital.

Consider what happened, for example, in the case of the California flower growers. Because shipment of cut flowers brought eastern markets within their reach "overnight by air," revenues to the growers mushroomed from \$2,000,000 to \$20,000,000 annually in the short span of five years.

Or, take the case of the precision machine people in Cincinnati—precision lathes and

dies and presses that weigh as much and more than a bull elephant. It was discovered that air shipment decreases the hazard of jiggling and jarring common to surface travel and yard movements—and also eliminated the time and money for specialists needed at destination points to readjust the delicate precision tools.

Shipping things by air has helped businessmen to wring more profits out of a firm's operating capital, as well as opening up new areas of sales in new markets. In many cases, they have been able to reduce the investment needed to finance their operations. Other businessmen have found they can do more business, without increasing their investment. And there are many who have parlayed the ability to do more business in less time into substantial increases in both the percentage and the amount of profit.

Air freight is more than transporting things by wings. It is a complete service package. The air journey that a shipment makes from one airport to another is only part of the service provided. Air freight also means pick-up and delivery. It is a door-to-door service.

As we all know, it would not help much if we simply put a shipment aboard a plane and it moved at better than 300 miles per hour from airport to airport only to sit around at one end or the other of its journey eating up the time saved by air transport. Consequently, today's air freight service breaks down into two major operations: the "air haul" and the "ground haul." The wing and the wheel have been linked together to expedite shipments on the ground and in the air.

**T**HE whole system of air freight today centers around the airplane itself, its ability to carry great loads, its capability to hurdle geographical barriers and the speed with which it flies. But air freight moves in many kinds of planes, including helicopters.

There are, for example, more than 1,700 airliners in the combined fleets of our scheduled airlines. Their total freight capacity is something like 3,500 tons a day. But virtually every scheduled airline flight that operates daily over the U. S. domestic and inter-

national air routes carries some air cargo, either mail, express or freight.

**F**REIGHT rides in the cargo bins of the passenger planes. Cities that enjoy passenger air service also enjoy air freight service. In fact, the greatest percentage of all air freight tonnage moves in the combination passenger/cargo airliner. The remainder is carried by the air freighters which haul nothing except cargo.

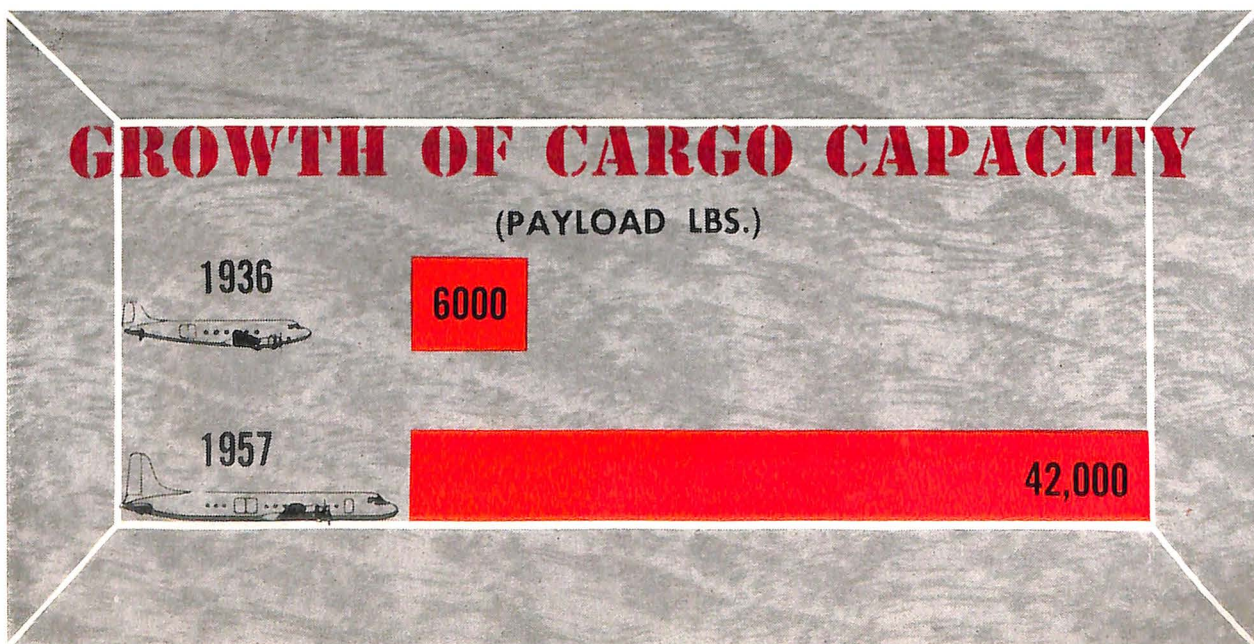
These all-cargo planes have been especially modified for air freight operations. Outwardly they look like any other airliner—same size, same power, same performance. But inside their interiors have been stripped down, floors have been specially stressed, and the shell is a maze of nets and hooks and fittings to accept and make possible securing the freight that comes aboard.

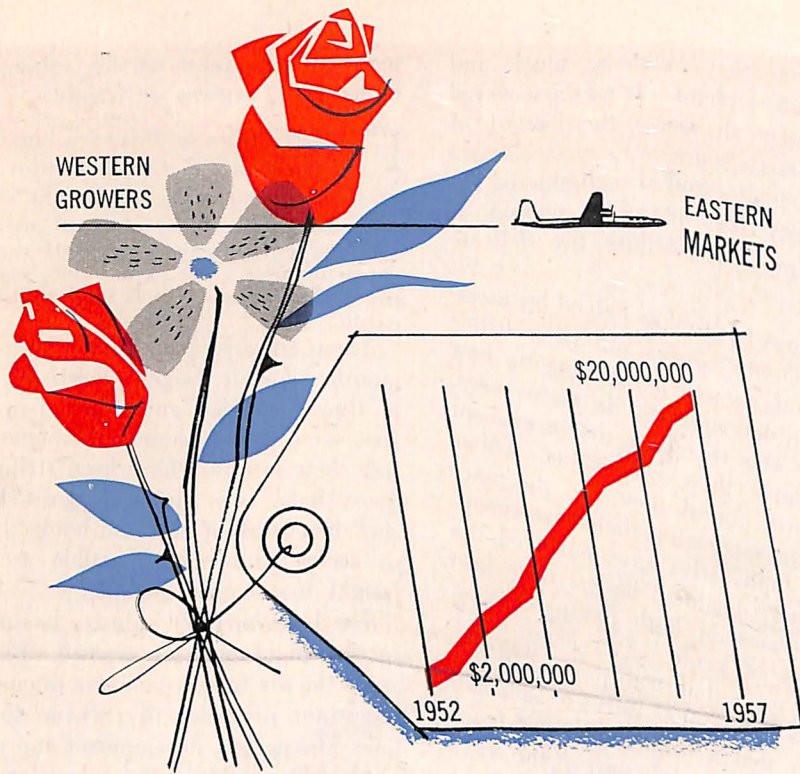
The U. S. aircraft industry has produced a succession of superior aircraft which has enabled the air freight business to emerge as an important producer of revenue for the airlines. The design, development and production of aircraft capable of flying heavier loads over longer distances at economical operating costs has been the prime factor in the growth of air freight from 38 million ton-miles in 1947 to an estimated 500 million ton-miles in 1957.

The scheduled airlines have their own separate organization, which has some 350 cartage contractors that perform door-to-door pick-up and delivery service. "Ground haul"—as its name implies—means fast movement by motor freight to the nearest airport. And the shipment is placed aboard the first outbound flight available.

Beyond this local drayage service, the airlines also have "air bus" and "air truck" services with surface lines which provide extended service to every town and hamlet. In short, air freight service, today, means service from address to address anywhere in the United States or in the world.

When you use air freight service, you pay for only that part of the service which you actually use. In other words, if it's more convenient for you to deliver your shipment to the airport or pick it up, you don't pay for





Revenues of California flower growers increased from \$2,000,000 to \$20,000,000 in five years because eastern markets are within overnight reach.

any door-to-door service. The "air haul" and the "ground haul" are separate cost items; although for the convenience of the shipper you can be billed for both on the same invoice.

A shipment tendered to an airline in Bangor, Maine will be accepted for delivery at any point and moved to any destination on a single air waybill, the air shipping document. The tariffs governing not only the air transport service, but also the pick-up and delivery service are available in a single book, readily obtainable and useful to shippers.

By the same token, a shipper in Grand Island, Nebraska can send air freight to Djakarta, Indonesia, and can get the only air waybill he needs when he tenders the shipment at Grand Island.

These worldwide services are possible by virtue of working agreements not only between the airlines in the United States, but also between practically all of the airlines in the free world.

Air freight service is probably the only direct carrier system offering such a worldwide service. The benefits are enhanced by a comparison with the normal international movements of cargo. A shipment from Grand Island to New Delhi by surface carrier would involve one or more transactions from Grand Island to New York; at least a second transaction—and a second transportation document—for the water voyage from New York; and a third transportation arrangement would have to be made when the shipment arrived at Bombay. These transactions are reduced to one via air freight.

The air freight shipment gets special handling and requires specialized equipment on the ground as well as in the air. An airplane's shape and size has necessitated the de-

sign and use of new type machinery for loading and unloading the cargo freighter.

Some freight—mostly boxed shipments—goes aboard the freighter on long conveyor belts. Other, heavier freight, requires the use of the fork-lifts to hoist it up to the plane's cargo-door. The very heaviest shipments are put aboard with a "jack truck" in which the entire body of the truck is raised to the plane floor level.

With such equipment it takes less than 40 minutes to load the biggest of the skyfreighters. More important, the air shipment is handled by a minimum of personnel. It "clears the deck" speedily and efficiently.

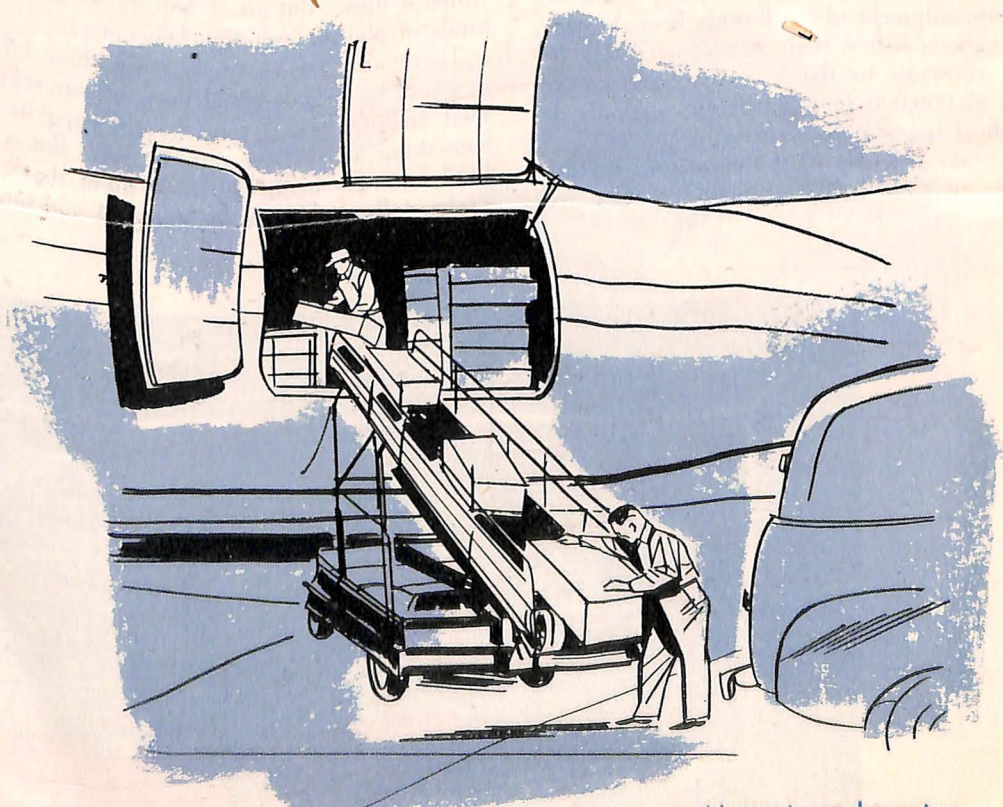
Growth of air freight has also brought about the construction of docks and special terminal buildings and warehouses at some of the major airports. These air freight terminals have refrigerated storage rooms, special animal shelters and their own customs clearance stations. Docks are built to plane level so that cargo can be rolled on, the same as they load a boxcar or semi-trailer.

The reason for all of this is to avoid delays on the ground which would slow up delivery time; for the speed of door-to-door delivery depends a great deal upon the loading and off-loading techniques employed.

With the coming of the commercial jet transports, air freight is going to take on a new dimension. Flying times will be cut in half between the major freight terminals.

The speeds of the jets will mean that a shipment can be put aboard a plane in New York after the opening of a business day and be delivered in Los Angeles that same afternoon before the close of business!

The airlift capacity will be greater both in the combination cargo/passenger plane and the all-cargo airliner. One of the new jet airliners scheduled for service in 1958-59 will be able to carry almost five tons of freight in addition to its passenger load. The jets will more than double the swiftness of the "air haul" and we know that this alone is a bright promise.



Speed of commercial jet transports means that a shipment can be put aboard a plane in New York in the morning and delivered in Los Angeles before the close of business of the same day.

# Logistics Requires Top Management

(Continued from Page 1)

tion must be vested in the weapon system manager, assisted by highly competent teams of military and civilian personnel. Lack of similar positive control of logistics, possible in the weapon system management plan, would be an incredible waste of the money and talents devoted to the development and production of ballistic missiles.

The weapons system concept must be extended to embrace the logistics of these new weapons. Logistics plans have been made in concert with research and development progress to insure that logistics keeps pace with weapon capability.

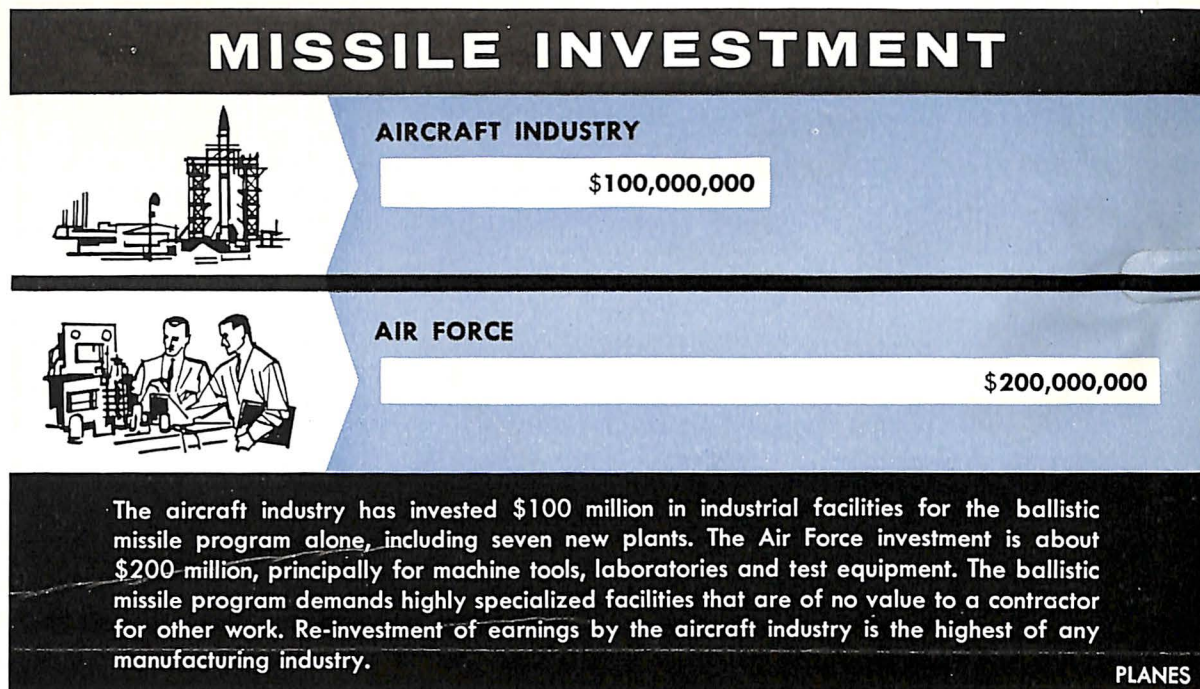
The plans for "rocket-age logistics" are based upon minimum stock levels, optimum use of contractor maintenance, direct support from industry to user, minimum pipeline time and a minimum of supply administration at the operating unit level. Increased emphasis on the aircraft industry for supply and maintenance of ballistic missiles is a key part of the plan.

## Shift of Emphasis

Ideally, system components would be at one of two locations: At the operational site ready to go or, in a support area being inspected, calibrated or repaired. The pipeline supply system of World War II and Korea—which often had a time stretch of 200 days from manufacturer to combat unit—would be completely discarded. The shift of emphasis is forward to operating sites where materials are ready for instant use rather than in transit or in intervening depots for storage and issue. To cut down on transport time, air lift will be used to supply parts, components and sub-assemblies to ballistic missile units in the United States and overseas bases. Another integral part of the streamlined system is the use of mobile teams for maintenance support. These teams would move from site to site to perform work beyond the maintenance capability of operating units, but not sufficiently difficult to require shipment back to the manufacturer.

The heart of this fast-moving logistics system will be electronic data processing. Electronics will give logistics an efficiency and flexibility never before possible. The Air Force will be able to keep an up-to-the-split-second inventory of every one of the thousands of parts involved in a ballistic missile system. It will tell the weapon system logistic manager more than just how much. Electronic data processing will tell where the spares are, the best method of shipping them where they are needed. It will automatically re-order parts when stocks fall below a pre-determined level. And the electronic system will accomplish these tasks in a fraction of a second, tasks that would require weeks under a manual supply system.

In addition, the electronic data processing system, along with a



communications system, will link the weapon system manager, the operating squadrons, a storage site for common items of supply and the plant of the contractor responsible for supplying the part.

Coupled with air transportation, this gives the field commander assurance that the part he needs now is available now and not a week or even a day later.

The logistics plan developed for the air-atomic age for ballistic missiles points the way to an even closer relationship between the military and industry—a tighter meshing of user and builder that probably will be utilized for advanced weapon systems still in the initial design stages.

## 'Ion Gun' Analyzes Causes of Corrosive Deposits Made by Combustion of Fuel in Engines

An amazing new tool to produce better rocket fuels has been developed by the aircraft industry with the manufacture of an electronic device that can instantaneously complete an analysis of the chemistry of an explosion.

Called a "Time-of-Flight Mass Spectrometer," the instrument gives aircraft research engineers a means of analyzing the many intermediate molecules produced in an instantaneous chemical reaction such as the explosion of rocket fuels in a combustion chamber.

The heart of the new instrument, which can complete a chemical analysis in one ten-thousandth of a second, is an "ion gun." The gun is a metal vacuum tube approximately 4 feet long. In operation, electrically charged molecules of the elements being analyzed are pulsed like radar signals from one end of the tube to the other, and their speed (time of flight) is measured electronically and appears as a certain wave pattern on a picture tube.

The combustion of fuel in almost any type of power plant—including nuclear reactors, jets, diesels and piston engines for aircraft and automobiles—causes corrosive materials

## Unique Apparatus Tests on Ground Heat Effects of Hypersonic Flight

Missile testing is a hot subject these days—and finding out just how much heat the missile will stand has produced some ingenious ideas.

One test required two years of planning and six months to set up while the test lasted only 30 minutes. But the 30 minutes provided invaluable data to the missile engineers. The test told them how hot the missile's electronic and electrical circuits get during flight and how much change in temperature occurs.

The data of missile performance

during actual flight is handled by telemetering instruments. They send back messages of temperatures, speed and stresses via radio signal during flight. But so far as temperatures are concerned the information is skimpy and expensive to obtain.

The friction of the air causes the skin of the missile to reach a frying-pan sizzle, and the electronic systems create heat of their own. The best way to ensure the right answer on temperature is to recreate the atmosphere of a firing on the ground where it can be exhaustively measured and studied.

The engineers put together a dummy electronic section of the missile being tested and placed it in a cylinder which contained 96 heat reflectors. Each reflector backed two 1,000-watt infra-red lamps used for a heat source. Using the cylinder as an enclosed oven, the engineers were able to bring the missile section up to aerodynamic temperatures in just two minutes.

The engineers were able to observe the missile's cooling system, a compact refrigerator, and the variations in temperatures within the missile. This is important since a component may work well at specific temperature extremes, but it may not operate adequately if those temperatures fluctuate rapidly.

## Jet Engines to Be Used as Electric Power Source

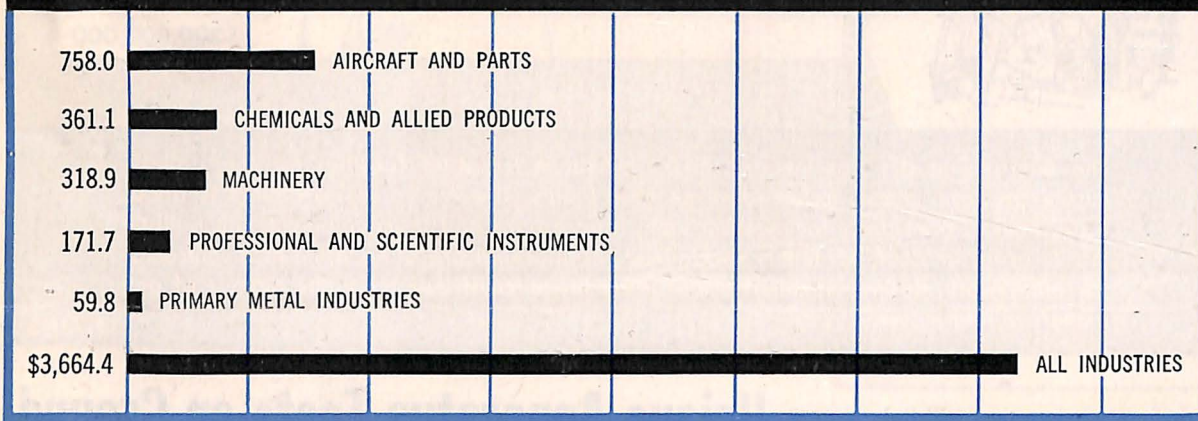
In the near future powerful turbo-jet engines, already "prime movers" of the nation's military aircraft and luxurious new airliners, will be harnessed for electric power generation.

These great engines, built with watch-like precision by America's aircraft engine manufacturers are expected to be the means to change energy from nuclear reactors to usable electric energy.

In modern America, a community's airport may fairly be regarded as its gateway to the future.

## COST OF PROGRESS

Total cost of industrial research and development (in millions)



Expenditure for aircraft research and development in 1953 amounted to more than 20 per cent of the total cost of all national research and development, a survey by the National Science Foundation shows. The figures, which are the latest available, reveal that research and development projects costing \$758 million were performed by the aircraft industry out of an over-all cost of \$3.6 billion. Research and development, the fountainhead of progress, is a vital facet of the aircraft industry's activities in maintaining superior air power. The chart shows expenditures by other selected industries.

'PLANES'

## Electronic Testing Is Vital Task

The reliability of an Air Force or Navy fighter plane hurtling through the sky faster than the speed of sound depends upon the integrity of its electronic systems—often the equal in complexity of a small television station—and these complicated systems, involving miles of wires, relays and “black boxes” must, in turn, be tested by the aircraft firm which builds the fighter in order to assure the reliability of our military aircraft.

In some cases, the electrical test equipment used by aircraft manufacturers is more complex than the systems it is designed to check out. Such test equipment must be designed and manufactured (in the original sense of the word: hand-made) by the aircraft company itself, since there are no off-the-shelf models available.

Electrical test equipment has come a long way in the last decade. The first operative system was built by a West Coast airplane maker in 1947. The man who put it together recalls that the early electrical checker “was a rather clumsy piece of equipment by today's standards, but it reduced the necessary testing time from three weeks to less than three hours.”

The savings in aircraft production time, the ease of repairing trouble spots prior to installation, and the improvement of schedule planning are even better today, ten years later, thanks to the foresight and engineering skill of the men who design and build the complex test equipment to check out the complex electronic systems of the world's finest military aircraft—built in America.

## 'Flip The Switch' Saves \$1,000 Each Month

No economy measure is overlooked by the U. S. aircraft industry in its endeavors to save the taxpayer's dollar. Recently, one aircraft plant informed its personnel not to forget to “flip the switch.”

The company pays more than \$75,000 a month to cover its electrical bill. A breakdown of the electrical-cost picture shows that only 8,000 kilowatts of energy is burned in the lighting system. That represents about \$16,000 monthly.

Most of the electrical cost is located in factory areas, where machinery and other heavy equipment are situated.

Company officials pointed out that certain machines can be shut off between their jobs instead of allowed to run idle. As for the office areas—extra electrical accessories, such as fans and desk lamps, should be shut off when not in use.

Through the simple action of “flipping the switch,” multiplied several thousand times, the aircraft plant can save more than \$1,000 monthly.

## Jet Transport Plays Dual Role as Troop Carrier or Aerial Tanker

The U. S. aircraft industry has added built-in versatility to its product with the development of a “convertible” transport plane which will serve multi-purpose missions. The propjet-powered plane will change from troop-cargo carrier into in-

flight refueling tanker and back again.

In recent tests an in-flight refueling kit was installed in the cargo-troop carrier, and, over a period of six weeks, 70 hook-ups were made with jet fighter planes flying at altitudes of 15,000 to 25,000 feet.

Most of the tests were made without fuel, simply to determine how well the probes on the nose or wing of the fighter planes would connect with the refueling lines trailing from the wings of the tanker.

The portable in-flight refueling kit installed in the test plane included hose reels and drogues housed in pods attached to the wings, and two 500-gallon fuel tanks in the cargo compartment—but production models could contain 6,000 gallons of fuel.

## CAA Predicts New Jet Airliners Will Be Quiet as Piston Transports When Service Starts

“Progress to date justifies the forecast that the new jets will make no more noise than present-day piston-engine transports, and quite possibly will be quieter. Even if their level of noise is the same, the total impact of the noise certainly will be less, since jets will climb more rapidly than present-day transports, and their higher speeds will keep them overhead for a shorter period of time.”

The statement above comes from the Civil Aeronautics Administration, in its new booklet, “Upstairs Neighbors” (available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at 10 cents a copy).

The booklet points out that “The CAA has no legal authority to control noise. Its regulatory powers are limited to matters of safety. Never-

## Army 'Copters Rescue California Cherry Crop By Blowing Off Water

Army helicopters “saved the day” for California cherry growers this season when heavy rains threatened to ruin the entire Central Valley cherry crop.

Blowing water off cherries to prevent the sun from causing them to burst is an old commercial helicopter trick, but the huge area to be covered in the valley made it impractical to call on the few civilian ships nearby.

So in an unprecedented action, the U. S. Army authorized use of fifteen helicopters in California's Central Valley to whirl over hundreds of acres of cherry orchards and blow rain off the fruit which would have ruined most of the big crop.

At least 50 per cent of the crop was saved amounting to more than two and one-half million dollars.

## Pressure Tests Use Latest Safety Ideas

Research and development activities of one midwestern aircraft plant will be housed in a brand new hydraulic and pneumatic pressure test building which boasts the latest safety features known.

The new structure has seven specially-built test cells for aircraft research, development, and component evaluation tests, which are arranged around a central control room where test operations can be observed through “bullet-proof” glass observation windows.

This will provide means for simultaneous operations in the various test cells, with the tests being watched and data recorded in the central control room.

Heavy steel doors separate each cell from the central control room. The hydraulic test cells have special roof hatches which will act as “blow-out plugs.”

The entire building is equipped with a deluge sprinkler system, a grounding system, a fire alarm system, and with acid-resistant spark-proof floors in test cells.

Engineers will be able to conduct hydraulic tests within a temperature range of plus 500 to minus 65 degrees Fahrenheit at pressures up to 5,000 pounds per square inch.

This centralization of the plant's pneumatic and high temperature hydraulic testing is expected to result in greater economy—a constant factor in aircraft industry operations.