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planes

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PLANE PERFORMANCE DOUBLES IN FIVE YEARS

Plane Makers Face Weight Problems

Designers of America's sleek jet fighters and bombers have become as figure conscious as any of the famous couturiers—Dior, Ceil Chapman or Claire McCardle. And, even though for an entirely different purpose, they are far more weight-conscious of their aircraft models.

The design engineer of one of this nation's largest aircraft manufacturers, for example, just recently ordered a streamlining of an electrical plug and receptacle. The redesigned items would weigh four tenths of an ounce instead of 3.2 ounces. With forty of the plugs to be used in a new jet fighter model, this would mean a total weight saving of 7.3 pounds.

Considering that these accessories are to be installed aboard a 30,000-pound jet fighter plane, saving 7.3 pounds doesn't seem like much to worry about. But that small saving of weight in the design of an electrical unit resulted in a reduction of $3,650 in the final cost of that fighter. Multiplied in terms of the hundreds of planes on order, the saving on this one item passed on by the aircraft manufacturer to Uncle Sam's taxpayer becomes a figure to reckon with.

The weight factor, therefore, is not only important in designing high speed, high performance planes, but it also has a tremendous effect on the aircraft cost picture.

One additional pound of equipment, aircraft engineers say, actually results in an increase of ten pounds in the final gross weight of a plane, because every extra pound requires additional fuel to carry it, and in most cases the structure of the craft itself must be made stronger and heavier. This equipment weight to gross weight ratio is called "growth factor" by the aircraft companies. At the rate special equipment is being added to our planes, this growth factor may increase even more.

By the "rule of thumb" measure, the cost of the average military plane is $50 per pound, and for every additional pound of weight added in equipment the cost of the plane goes up $500 when the growth factor is 10. This does not include the cost of the equipment itself in most cases. And if the growth fac-

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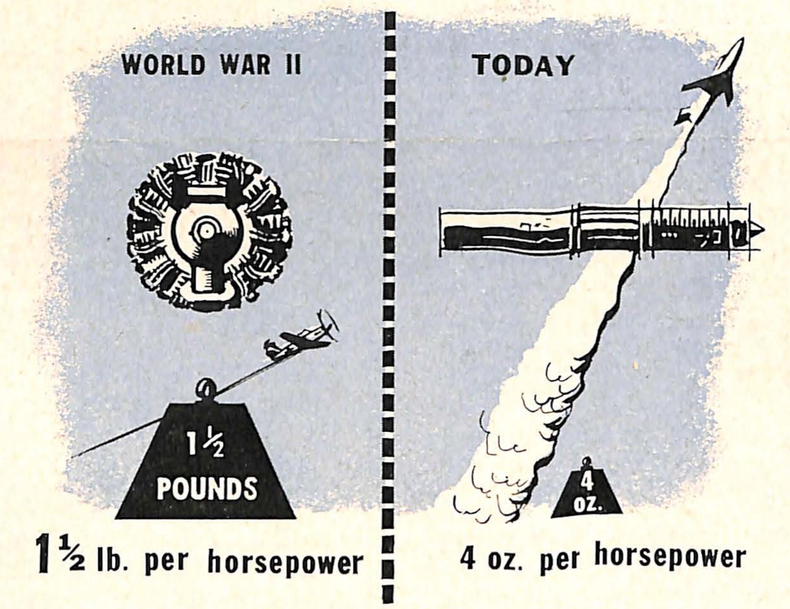
RESEARCH AND DEVELOPMENT PAYS OFF



The best aircraft engines of World War II produced 3,000 horsepower—1 horsepower per pound-and-a-half of engine weight. In the decade since, advanced research, engineering and manufacturing know-how of the U. S. aircraft engine industry has developed engines with thrust outputs ranging up to 25,000 equivalent horsepower—1 horsepower for each *four ounces* of engine weight.

PLANES

New Airport Design Study Calls For Streamlined Runways And Turnoffs

To increase the utilization of our nation's airports and at the same time to cut down on the cost of their construction and maintenance, the Civil Aeronautics Administration is considering a proposal to revise width limitations on runways and taxiways—downward!

With United States airports undoubtedly the busiest in the world—a luxurious airliner arrives or departs an airport somewhere in this great nation every 11 seconds day and night—this proposal, at first, might seem inconsistent.

However, according to the Airport Operators Council, who made the proposal, and the Civil Aeronautics Administration, whose preliminary study agrees, the plan is a sound one. Large airports near cities such as New York, Washington, Chicago and Los Angeles are already as congested as Main Street on Saturday, and with air travel constantly increasing, something must be done to solve airport congestion.

The proposal suggests that runway widths be cut down to 150 feet. Present requirements call for a 200-foot width. Another suggestion made by the group is to cut the width of taxiways from the present requirement of 100 feet down to 75 feet.

Inasmuch as only one airliner can land or takeoff on a runway at any one time, there is little need for extremely wide runways. And with airport runways being very greatly increased in length to accommodate larger and faster turbojet and turboprop aircraft, not only the construction cost of the runway, but its

(See RUNWAYS, page 3)

Big Advance Made By Air Industry

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

United States airpower, as year 1955 draws to a close, is 160 per cent greater in combat effectiveness than it was at the beginning of the Korean War in 1950. Aircraft speeds and altitudes have doubled, while firepower, with thermonuclear weapons and guided missiles capability, has increased almost beyond estimate.

In 1950 this nation entered the Korean War with an Air Force strength of 47 wings. Today the Air Force mounts 124 combat wings, and by year-end 1956 will have largely achieved its air strength goal of 137 wings. Naval aviation during the same period has grown proportionately.

At the beginning of the Korean outbreak, United States bombers were, for the most part, piston-engined, war-weary types that had fought the enemy from Paris to Berlin and over the Pacific Islands to Tokyo. The Communist air forces outnumbered United Nation's by four-to-one.

The U. S. aircraft industry once more was ordered into high gear to meet and overcome the aggressor's lead. But it wasn't until early 1952—nearly a year and a half later—that powerful new U. S. jet fighters began in numbers to sweep Korean skies clear of the enemy. Later that year, the United Nations plane-kill ratio over that of the enemy began to climb to an eventual 14-1.

Following World War II, the United States aircraft industry, despite the lessons of World Wars I and II, was all but completely demobilized. In 1946, the Air Force and Navy combined were taking delivery of only 139 aircraft per month. The Air Force, given the job of policing far-flung U. S. outposts, did not have even one complete operational combat group available for U. S. defense.

Not until the Communists invaded South Korea did this nation begin a real build-up of modern jet aircraft for the Air Force and the Navy. Instead, the merits of and need for adequate airpower were in Congressional debate, as they had been since

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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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Building Better Mouse Traps

A great many years ago, to serve his needs, a man built a mouse trap. Not long after, a competitor went into the business. But the first man, with experience and know-how, improved his automatic mouser and, as the saying goes, "The world beat a path to his door. . . ."

Our American forefathers apparently took that fabled lesson to heart, for no where in the world today is the spirit of industrial competition keener than in the United States. And certainly, our record of production achievements, particularly in the aircraft industry, clearly indicates that this nation, *so far*, remains unchallenged in "know-how."

Today, with the security of the free world threatened, the search for new know-how has assumed tremendous importance in the United States. In the aircraft industry the term, refined to its essence, is called "manufacturing methods."

While manufacturing methods developed by all elements of the aircraft industry in the last decade alone have made possible numerous record-breaking achievements—engines of greatly increased power, air frames of improved aerodynamic design, reliable and accurate electronic equipment and components—the realm of the aeronautical frontier is barely pierced.

Performance requirements for upcoming aircraft, with their intricate equipment and components, and the incredible engines that power them, stagger the imagination. Yet, in the race for aerial supremacy, if the free world is to survive, these demands placed upon the aircraft industry by the Air Force and Naval Aviation must be met.

In the few short years since World War II, the world has witnessed a transformation to reality of a great number of technological advances in aircraft manufacturing methods. But behind these accomplishments has been a vast development in materials and in their methods of processing. The impact of new forms of existing materials, has produced an inevitable chain reaction in all types of products. But their practical application to aircraft manufacture has been slow.

In the race for jet aircraft supremacy, new alloys are needed to withstand higher temperatures, and other metals are required that combine high strength with low weight. We need to know a great deal more about ceramics, powder metallurgy, welding, aerodynamics, thermodynamics, fuels, plastics and a host of others.

As our airplanes and missiles need to climb higher, fly farther, and faster, the demands upon our production engineers to develop new manufacturing methods become intensified. Many of the intricate components of aircraft now on drawing boards *will require development of completely new manufacturing methods.*

Technology in aircraft research, development and production has never advanced as rapidly as it is advancing now. Our industrial capacity for producing war materials has twice exceeded the expectations of both our enemies and ourselves. This astounding scientific prowess and industrial productive might has reached a threshold of learning that is challenging the combined scientific, engineering and tactical skills of industry, government and universities.

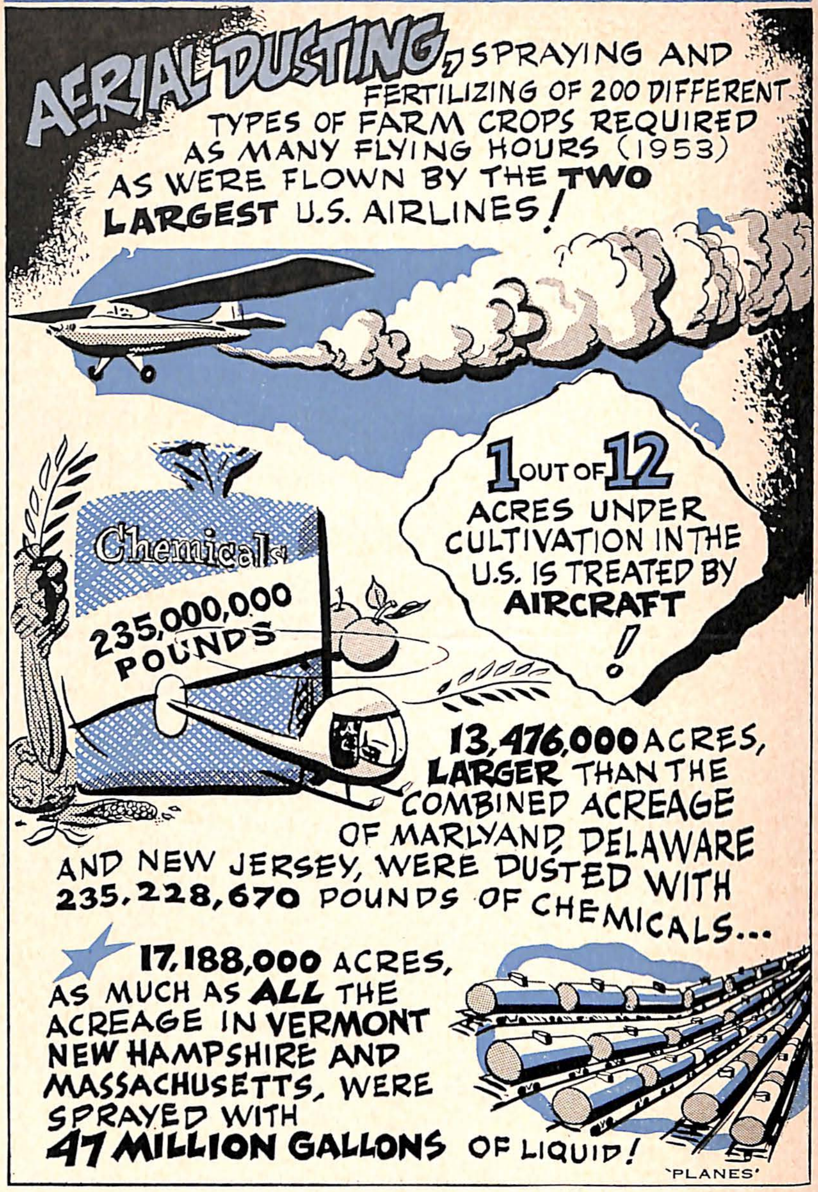
To maintain military and civil aeronautical superiority we must keep ahead in the basic research which provides the reservoir of new knowledge from which to draw the fundamentals of aeronautical progress.

We must keep ahead in our skills of developing designs suitable for modern production methods and for use under the severe environmental conditions confronting today's and tomorrow's aircraft.

Most of all we must keep ahead in our manufacturing technology to get the utmost from our resources of manpower, materials and machines.

The United States aircraft industry and government are doing their utmost with known techniques, materials and machines, but it forever remains the exciting task of youth armed with knowledge to probe the endless aeronautical frontier . . . "To build a better mousetrap."

PLANE VIEWS



If You've Ever Squeezed Boggles—Here's News

In this age of mechanization, a fellow can't even squeeze a boggle anymore. There's a machine that will do it for him—it's called a "boggle squeezer."

The "boggle squeezer" was devised by an aircraft company employee who, prior to his clever innovation, had to squeeze boggles by hand all day.

A boggle is a sponge rubber wireholder in a metal clamp, which holds in place some of the 30 miles of electrical wires found in one of today's complex military bombers. To open and close the clamp, the boggle formerly had to be squeezed by hand. With the new boggle squeezer, however, a whopping big savings in man-hours will be effected.

The squeezer is actually a pair of pliers which are ground down so that the plier nose will fit into two rivet holes on the boggle clamp. The pliers, besides increasing plant economy, will save a lot of sore fingers too.

PLANE FACTS

• Student pilot licenses issued by the Civil Aeronautics Administration indicate reviving interest in private flying in 1954, with 43,393 issuances made. Postwar low was in 1952 with only 30,537 tickets issued, while 37,397 were issued in 1953.

• A jet engine silencer, which can be turned on or off at will by the pilot, changes low roar of exhaust to high-pitched hiss. This seems less noisy because much of the sound is transferred beyond range of human hearing. Pitch is raised by forcing gases through many small openings in the engine tail pipe instead of one large hole.

• A retractable ski-wheel landing gear now makes every beach in the world a potential airfield. On land, the ski-wheel landing gear operates as conventional wheeled plane. On water, retractable skis work like sportsmen's water-skis. In mud or snow, skis prevent sinking.

Each Pound Of Equipment Adds Ten Pounds To Plane Gross Weight

(*Continued from page 1*)

tor should increase to 20, every additional pound of equipment would cost $1000.

That is why aircraft manufacturers all over the country are finding new ways to cut down weight by taking advantage of every advance made in the development of engineering practices and materials. Titanium, a relatively new construction material, has been helpful in this regard.

Another way is to simplify or actually eliminate parts in structural design and equipment. The new procedure of machining complicated sections in one piece instead of building them up from many parts is an example. The practice of making each component do as many jobs as possible is being stressed more and more, such as, wing structures that also serve as fuel tanks; use of one large engine instead of several smaller ones; three-wheeled instead of four-wheeled landing gears. Also, repackaging present equipment into a more compact unit has become very important.

American planes are famous throughout the world for their safety devices and systems—and they have paid off. But at the same time, our safety equipment has also had a tremendous impact on the aircraft weight problem. Safety features are generally composed of secondary systems which go into action in event the primary system fails. It is becoming a question whether secondary systems are becoming so complicated that more time should be spent in the design of the primary system. The objective would be a primary system so reliable that there would be no need for the secondary systems—there would be fewer parts, less weight and less cost as a bonus.

An example of how lighter equipment can save taxpaying dollars is a newly designed air conditioning unit weighing 5½ pounds (as compared to the old type unit weighing 17½ pounds) has reduced the production cost of one plane by $6,000. Another manufacturer redesigned a high pressure coupling weighing 50 pounds. It presently tips the scales at 15 pounds and lops $17,500 off the delivery cost of each aircraft. And the change from a low voltage electrical system to a high voltage system in a jet bomber saves 242 pounds and $121,000.

These are just a few of the reasons why our aircraft manufacturers are using extreme caution to insure that today's planes do not become over-weight. Cutting down weight means stretching the taxpayer's dollar.

Runway Streamlining Plan Under Study

(*Continued from page 1*)

maintenance, is rapidly becoming needlessly prohibitive.

The final suggestion made by the Airport Operators Council is that taxiway designs be reviewed to see if a gain could be made in high-speed turn-offs. This would result in more traffic in landings per runway.

Air traffic control studies reflect a definite need for landing aircraft to be clear of the runway in 45 seconds or less after touch-down, in order to maintain maximum traffic flow with safe separation.

High speed taxiway turnoff design studies involving only piston engine aircraft have been conducted over a period of years. Investigations by the C.A.A. and analyses by the Franklin Institute, Philadelphia, and the University of California, show that to accommodate turnoff speeds of 40 miles-per-hour, turnoff taxiways should intersect the runways at a 30 degree angle, and for speeds of 30 miles-per-hour or less, a 45 degree angle intersection is sufficient. Studies by the Military are under way with turbojet aircraft to determine the practicality of turnoffs exceeding 40 miles-per-hour.

New Photo Device To Save Plane Dollars

The U. S. aircraft industry has made another stride forward in its continual effort to save the taxpayer's money, with the use of a newly developed precision photocopying camera which promises to save at least $10,000 per month in one large aircraft plant alone.

The new precision camera makes sharp, clear, reduced-sized copies of any type of original material on a continuous-flow basis. The "smaller-size" copy can be used as the master for further reproduction by blueprinting or any other duplicating process.

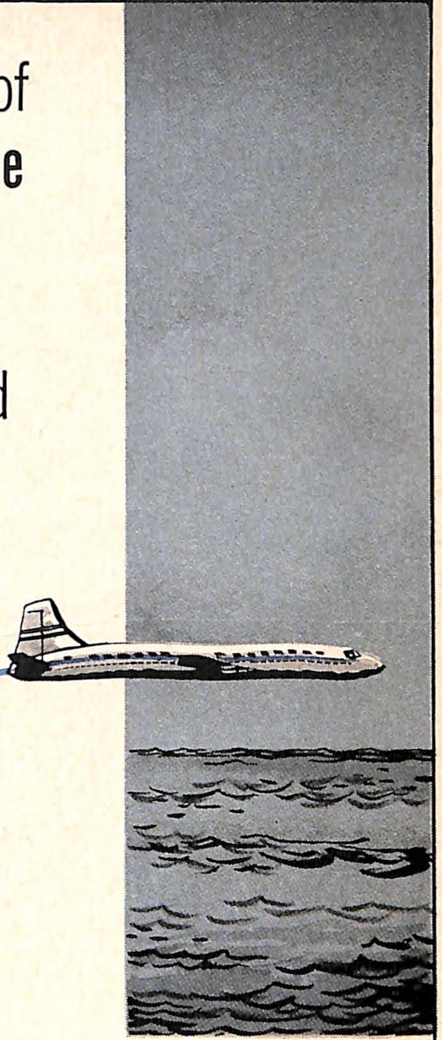
All large size drawings as they are released for production by this aircraft company are now copied by the camera before blueprinting. The device makes half-size paper negatives of engineering drawings on a continuous-flow basis, and the blueprints are then printed from these half-size negatives.

Now only 25 per cent of the square footage of blueprint paper formerly required for printing full size blueprints, is necessary. This means a 75 per cent saving in the consumption of blueprint paper. The half-size blueprint paper has reduced the blueprint requirements of this one large aircraft factory from two million square feet per month to 250,000 square feet per month.

Other economies also result from the half-size blueprint. Because the dimensions of the blueprints are reduced by 50 per cent, twice as many drawings can be printed per hour. Also, only about 30 per cent of the filing space previously needed is now required.

AIR-OCEAN TRAVEL

In 16 years of operation, **one** major U.S. **airline** has safely carried **2,021,483** passengers across



more than **20 million miles** of ocean . . .

This is the equivalent of moving the entire population of Philadelphia to the moon and back 435 times. This dependability, safety and reliability of American-made aircraft and engines has established this nation as the world's leader in commercial as well as military air power.

'PLANES'

High Frequency Sound Used In Engine Parts Cleaning Saves Time, Money

The airline industry is eliminating its engine maintenance "wash day blues" through new application of ultra high frequency sound in cleaning airplane parts.

What's more, it is estimated the cleaner will effect savings of about $14,000 for one commercial airline during its first year of utilization. Developed by the aircraft industry as a result of its constant endeavor to cut costs and increase operating efficiency, the use of ultra high frequency sound to clean tiny intricate machinery and equipment will probably reduce engine maintenance time by more than 60 per cent.

Complex instruments can now be cleaned without disassembly. Pump, carburetor, and fuel system components—including valves and injector nozzles that involve time-consuming hand cleaning—can be cleaned faster and better in batches, and with greater consistency.

The sound cleaning units have achieved 100 per cent cleaning effectiveness with inexpensive water-detergent solutions, compared to 40 to 70 per cent effectiveness of former more expensive cleaning methods.

The latest reports indicate that labor costs have been reduced as much as 75 per cent and, in many cases, solvent costs as much as 98 per cent.

Basically, a unit consists of two parts: a cabinet which houses an electric high power generator and a cleaning unit, which holds the cleaning solution and also converts the electrical energy into high-frequency sound.

It operates by transmitting selected low high frequency sound waves through the water-detergent solution to achieve a high penetration of ultrasonic energy on the part to be cleaned. The cleaning solution literally wraps itself around the part —penetrating areas which resist all other methods of industrial cleaning.

U. S. Air Industry - Science - Military Team Is The Best In The World

(*Continued from page 1*)

1945. That we needed airpower was not in doubt, but how much and what kind was an issue.

The Russians, meanwhile, had speeded research and development and were turning out jet fighters and light jet bombers at a high rate —and had been since 1946. The United States began the Korean War with a military aircraft production rate of 215 planes per month—far less than its 1940 production rate activity.

Congress, late in 1950, appropriated funds for a 58-wing Air Force. A few months later, in 1951, it authorized 68 wings. Subsequently, the Air Force began planning for 95 wings, and production of aircraft on a full-scale basis was planned for and begun.

As the seriousness of the Korean War became clear, the President and the Joint Chiefs of Staff authorized the Air Force to begin a build-up toward 143 wings, this total to be reached in late 1954. Later, however, executive decision was made to stretch out attainment of this goal to late 1955.

As the Korean War drew to a close, the free world found that it must gird itself anew for the "long pull in an age of peril" and a continuation of the cold war. So, U. S. airpower strength was revised slightly downward and stretched a little more to 137 wings and proportionate Navy air by July 1957.

Aircraft Developments

Less than five years have passed since the World War II type piston engined bombers were pounding the Chinese Communists in North Korea. Yet aeronautical science of the United States aircraft industry since that time has progressed so rapidly as to border on the incredible.

Multi-engined jet bombers slip through the air at speeds close to sonic, and each possess a bomb carrying capability more destructive than that of all of the bombers of World War II combined. American-manufactured jet fighters are the finest in the world, qualitatively, and their fire-power has infinitely increased over their World War II predecessors. United States Air Force and Navy jet fighters, today, for the most part are capable of speeds in or beyond the sonic range, and their powerful American jet engines can ram them from a standing ground start to 10,000 feet in one minute or less.

USAF Wing Structure

Included in the current 124-Wing Air Force are 48 Strategic Air wings. Several of these are equipped with the world's largest and longest ranged piston engined bomber. These, although considered "first line," are gradually being replaced by a giant eight-jet bomber just now coming into operational use. This new jet bomber possesses high subsonic speed characteristics. Medium strategic bomb wings are completely jet bomber equipped. These aircraft coupled with aerial refueling and forward bases, give our strategic air forces the capability of striking all targets in any nation that threatens our security.

The light bombers and fighters of USAF's tactical forces also possess nuclear weapons capabilities and may be refueled while in flight. There are 34 wings in Tactical Air, and their fighter elements are being equipped with supersonic fighters.

There are 29 Air Force wings in Continental Air Defense Command, and while these comprise the bulk of that command, these forces are greatly augmented by naval air units. The Air Defense interceptor system is all jet-equipped and will soon become a completely supersonic force, armed with deadly air-to-air missiles.

The remaining 13 Air Force wings are troop carrier units.

Emphasis on Quality

The main concern of the aircraft industry and the government for the coming years is the quality of our aerial weapons system. This depends upon the state of U. S. technology. American aircraft and guided missiles of 1960 or 1965 may be scientific marvels, but this nation can take pride in them only if they are better than the weapons in the hands of a potential enemy.

Today, the public forecast for America's aerial future is bright. It is expected that an artificial satellite will be launched next year; atomic powered engines and aircraft to carry them are in final stages of development; turbojet and turboprop powered airliners will whisk passengers from New York to Paris and Los Angeles in less than five hours; and scientists speak seriously of space travel.

Yet, the Soviets are threatening to surpass the United States in quality, as well as quantity. Their scientific, technological and production skills have increased greatly in the decade since World War II.

While this nation disarmed itself and slashed its aircraft research and production budgets almost to nothing following the war, the Soviets dismantled neither. Instead, the Soviet Union concentrated on the development of new aircraft and other aerial weapons, and began turning them out in impressive quantities.

Of greater significance, the Soviets placed great stress on securing and holding the interest of Communist youth in technological careers. They broadened their entire educational base and emphasized technical fields. Russia is currently turning out scientists and engineers — well trained ones—at about twice the rate of the United States.

The United States has an air transportation system, an aircraft and engine industry, an atomic capacity and a machine tool industry without peer in the world. So far, this nation has an industry-science-military team that is unbeatable technologically.

While government economic and military authorities are of the belief that the technological capabilities of the Soviet Union are not yet equal to ours, it is apparent that the Soviets are expending every effort to overcome this nation's present superiority.

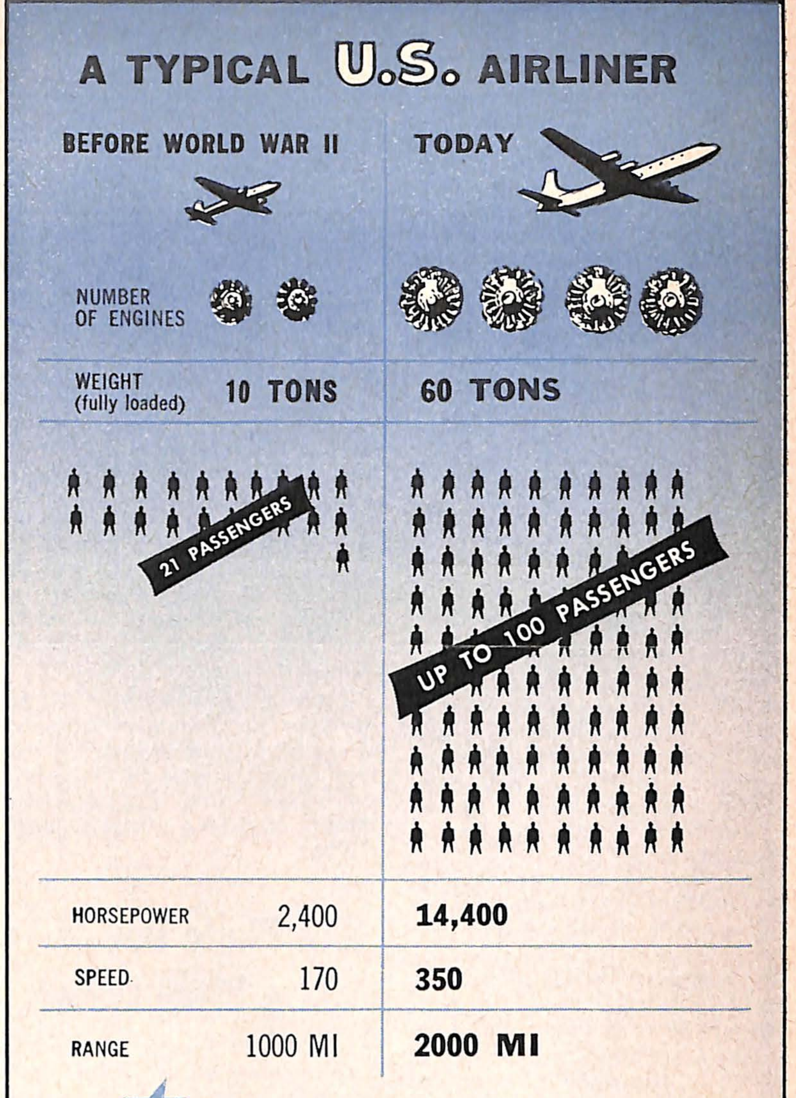
In this technological race, the United States has wisely discarded any attempt to race for quantity. The aircraft industry could, of course, probably out-produce any aggression-minded nation. (Our World War II record is witness.) But our government has long since ordered a leveling off in production of aircraft and other aerial weapons for the long pull. There is no intention to match the Soviets plane for plane, bomb for bomb or man for man.

Instead, this nation is attempting to maintain a qualitative superiority in aircraft, engines, equipment and components. These combined, along with experienced industry management teams, are the essential factor in holding a secure peace as well as a prosperous economy.

Pandora's 'Air' Box

Newly designed aircraft parts can be "flown" to an altitude of more than 22 miles in a 5-ton box that never leaves the ground. Engineers of one large aircraft company use the 64-cubic foot test chamber to reproduce atmospheric conditions that range from hot air of the tropics to the dry, subzero cold found in the upper stratosphere.

AIR TRAVEL PROGRESS



Since December 1945 the airlines have invested more than $850 millions for modern, fast and safe, luxurious aircraft equipment and facilities to meet the needs of the air travelling public. Yet, despite this enormous expenditure, the price of the average domestic airline fare is only 3.7 per cent higher than it was in 1939 and the average international airline fare is nearly 25 per cent less than in 1939. These low fares are due to engineering and production know-how of the aircraft industry and operations know-how of the nation's airlines operators.

'PLANES'