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planes

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Combined Civil-Military Production

INDUSTRY TO BUILD 16,700 PLANES IN '53

Variety of Skills Needed to Build Jet Powerplants

It takes 8,854 parts and 87 different kinds of specialists to create one of the big jet engines that power America's latest military aircraft.

These 87 types of specialists—all highly-skilled in their professions and trades—perform several thousand different engineering and precision manufacturing jobs.

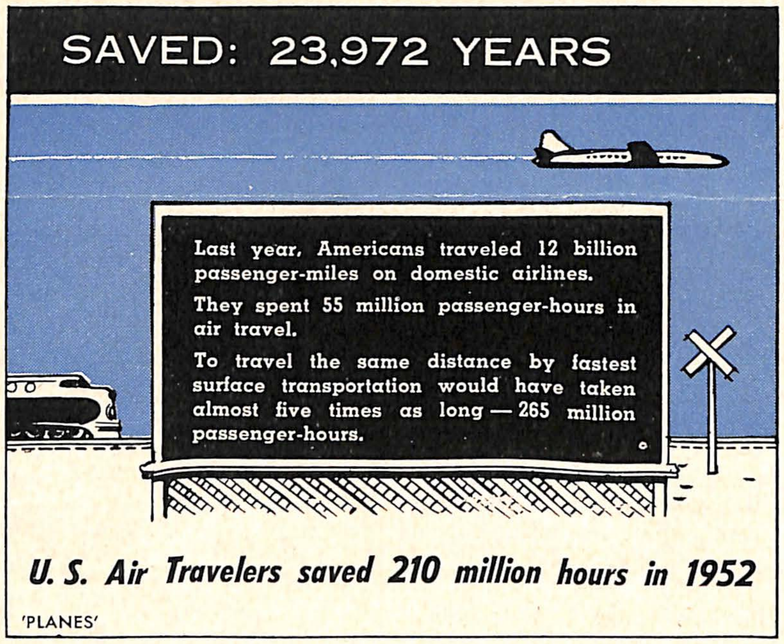
Hundreds of workers in each specialization may be needed. For example, more than 600 design and application engineers are now working in a single engine plant.

Additional Specialists

And behind the direct engine production workers are hundreds of other specialists employed by subcontractors and suppliers who produce many of the jet powerplants' 8,000-plus parts. One company reports that its subcontractors and suppliers number more than 4,000 independent firms.

The concentration of highly-skilled talent required for designing, developing, building and testing these engines is one factor in the increase in unit cost of today's powerplants. Yet the inventive and production skill of modern engine-builders has resulted in more power per dollar of cost than in a typical piston-engine. Based on one engine with afterburner, for example, the cost per horsepower is only $2.56, compared with approximately $17 per

(See JET ENGINE, page 4)



Production Economies Shave Costs In Building U. S. Military Airplanes

—An aircraft engine manufacturer's new method for testing jet engines will result in savings to the American taxpayer of approximately two million dollars a year.

—An airframe manufacturer's development of a new-type support for aircraft wiring will cut the cost of building late-model transport-type aircraft by an estimated $269,500 during the total production run.

These are typical examples of savings accruing to the American taxpayer from the all-inclusive cost-reduction campaign underway in the U.S. aircraft industry.

Broad Program

Adm. DeWitt C. Ramsey, president of the Aircraft Industries Association, in commenting on the cost-reduction efforts undertaken by manufacturers, has pointed out:

"It is not only essential to our national economy to keep our air power costs at a minimum, but in the industry's view, it is also good business practice based on the American free enterprise and free competitive system."

He outlined the six general areas of production in which intensive efforts are in progress in an attempt to produce more air power per dollar:

- *Management.* Management is reducing costs by (1) strict budgetary controls, (2) exchange of production, technical and manufacturing information within the industry, (3) close cooperation between design, tooling and manufacturing, (4) emphasis on cost consciousness on the part of every employee—from production line to executives.
- *Engineering.* Engineering costs

(See AIR POWER, page 4)

Over 50 Million Persons To Use Airlines in '53

More than 50 million persons will fly on world airlines during 1953, predicts the International Air Transport Association.

That's 5 million more passengers than were carried last year.

The average airline passenger is flying farther, too, the world airline organization reports. In 1953, average length of trips is 547 miles — as contrasted with 536 miles last year. The longer flights are attributed by IATA to long-haul tourist operations.

Electronics Get Rough Workout During Flight

On a typical mission flown by 30 heavy bombers, the planes' vacuum tubes operate a total of 1,500,000 hours.

That's equal to running a home radio for 30 straight years.

But, says the tube manufacturer, "bomber conditions also mean that this same home radio should be in a 200-degree oven and dropped on the floor every 10 minutes!"

These tough, special-purpose tubes play a major role in modern aircraft performance.

Military Output At Approximate Scheduled Peak

With production approximately at the peak rate contemplated under present military schedules, the U.S. aircraft industry today is building some 48 new military aircraft every working day—with well over half of the planes jet-powered.

These new aircraft—which are being added to the nation's air arsenal at the rate of some 230 per week—are the products of 30 airframe manufacturers, 20 engine builders, 10 propeller makers, and several hundred companies building instruments, electronics equipment, and other aircraft components. Behind this primary industry are approximately 60,000 subcontractors and suppliers, located in every state in the nation.

Value of Production

The industry is presently producing more than $900 million worth of aircraft, engines, parts and propellers (including civil products) per month. This figure does not include other aircraft components and accessories.

At this rate, it is estimated that during this year aircraft manufacturers will build:

- Approximately 12,000 military aircraft (over half of them jets).
- Approximately 4,700 civil transports and utility aircraft.

Twenty-three types of combat jets (15 of which are fighters) are now in production for U.S. military services. In addition, several turboprop transports are being built for the armed forces, and at least one commercial jet transport prototype is under construction.

Geographic Distribution

Geographically, the basic aircraft industry is widely dispersed. Key airframe production centers are in Southern California; Dallas-Fort Worth, Texas; Kansas; Long Island and Buffalo, New York; St. Louis, Missouri; Seattle, Washington; Hagerstown and Baltimore, Maryland; Marietta, Georgia; and Tulsa, Oklahoma. Major centers of engine production are in Connecticut, Indiana, New Jersey, Missouri, Ohio and Michigan. Electronics and other components production is widely

(See AIR OUTPUT, page 3)

PLANES

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

The purpose of *Planes* is to:

Foster a better public understanding of Air Power and the requirements essential to preservation of American leadership in the air;

Illustrate and explain the special problems of the aircraft industry and its vital role in our national security.

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

Air Education—

— A 'Must' in the Air Age

Today, despite the fact that the aeronautical science is at perhaps its most spectacular stage, aviation careers may have lost the interest of American youth.

Modern aircraft, flying at breathtaking speeds and at altitudes beyond human sight, fail to capture the imagination of youngsters as did the slow, comparatively cumbersome low-altitude craft of the pioneers.

And the undramatic efficiency with which air commerce plys the air ocean with safety and dependability has rubbed the glamour from the pilot—and left, in its place, the badge of the professional man.

Aviation has grown from a sport—and a cow-pasture business for barnstormers—into one of America's largest industries.

One result has been that, while the airplane plays an ever greater part in the life of the nation, we are increasingly confronted with shortages of trained aeronautical engineers, technicians, military pilots and scientists. These shortages are symptoms of youth's lagging interest in aviation careers.

Even more important, perhaps, is the danger that a generation of Americans whose destinies lie in the air could reach maturity without a full understanding of the impact of aviation on the social, economic and scientific fabric of their world.

For this reason, the success of widespread aviation education programs, aimed at placing in perspective the startling aeronautical advances and revolutionary changes of the first 50 years of powered flight, has never been more important.

Such programs are already underway on several fronts, sponsored by such groups as the National Aviation Education Council, the Civil Aeronautics Administration, the Civil Air Patrol, the Air Force, the Navy, the airline industry, the aircraft industry and others.

Leading national educators have joined, through the National Aviation Education Council, with the support of the Aircraft Industries Association, to prepare materials for the use of schools throughout the country.

Such active programs are long due—at a time when man's wings have changed the pace of the world, the concepts of commerce, and the tempo of communications.

Today, entire industries have been built upon air commerce. The world's travelers have turned to the air—to the extent that more international travelers entering and leaving the United States do so by air than by sea. More first-class travelers use the nation's airlines than use the nation's railroads.

Moreover, the airplane as a weapon of war has become a keystone of peace, a deterrant to aggression, and the major defense against attack.

In this year, the Golden Anniversary of the first successful powered flight, we have seen advances undreamed of in past decades. Some of our aircraft travel faster than bullets; they carry equipment that works faster than man's brains; they fly at heights that stagger the imagination; they carry tons of cargo at high speeds over vast distances.

It is a responsibility—because of the massive impact of aviation—for all Americans, especially those within the aviation industry and the educational field, to insure that the next generation is given the background and the foundation to use these great advances with intelligence and to continue them for man's betterment.

In our absorption with the problems of the moment, we can never lose sight of the fact that the distant goals of today must be achieved by the men of tomorrow.

PLANE VIEWS

by Aircraft Industries Association

No Sharp Increases In Air Industry Hiring Seen by Government

The sharp upsurge in employment in the U.S. aircraft industry, experienced between mid-1950 and the beginning of 1953, has begun to taper off, according to the Labor Department's Bureau of Labor Statistics.

Between the start of the Korean War and the first of this year, total aircraft employment tripled.

Between April and June, 1953, however—a BLS survey shows—employment in the industry rose only 1 per cent.

At present, the Aircraft Industries Association estimates total aircraft employment in the nation at about 750,000.

The BLS report predicts a slight overall increase in aircraft employment of 4.8 per cent in the months between June and December, 1953.

"Many difficult-to-fill job openings were listed," the report says, "but only three firms (of 208 surveyed) indicated that production was being impeded by manpower shortages."

Approximately one-half of the companies surveyed reported that they were experiencing difficulty in filling various jobs.

PLANE FACTS

- Lubricating systems, bearings and trouble-free accessories on modern aircraft must be able to operate eight to ten times as long without inspection as their World War II counterparts.
- During the first months of 1953, pilots of the Civil Air Patrol—unpaid volunteer auxiliary of the Air Force—flew an average of 78 per cent of the total hours and sorties flown on aerial searches for downed aircraft in the continental limits of the United States.
- A rocket-powered research plane recently set an unofficial altitude record by flying to 83,235 feet—well over 15½ miles above sea level!
- One of every four employees at a typical airframe plant is a woman. During World War II, more than half of all employees at this plant were women.
- A California game warden used a plane to stock 2,864,000 fish in 662 lakes last summer. Use of a plane cut costs by over $52,000—and took only 105 hours as contrasted with all summer when he used older methods.

Aircraft Output To Reach 16,700 In Calendar '53

(*Continued from page* 1)

scattered throughout the nation.

Measured in terms of employment, the central region of the United States has 40.1 per cent of the total, the West Coast 30.6 per cent, and the East Coast 29.3 per cent. This is in contrast to the distribution of aircraft business in the days prior to World War II, when the respective percentages were 4.5 per cent, 41.0 per cent, and 54.5 per cent.

In the Korean War period, the development of the Fort Worth-Dallas area as a major production center is perhaps the most outstanding single change in the geographical redistribution of the aircraft manufacturing industry.

Aircraft Backlog

In mid-summer, the backlog on the books of the aircraft manufacturers amounted to $18.9 billion, the highest figure since World War II, and represented orders which will be filled in the next one, two and three years. Of the total backlog, $12.4 billion was with companies building complete aircraft and parts, of which $11.6 billion was earmarked for U.S. military plane production. Backlog of the engine manufacturers was $5.3 billion, of which $5.1 billion was for the military. Backlog of propeller and other parts manufacturers was $1.2 billion.

On the basis of this backlog, a fairly high volume of business appears assured for the industry throughout 1954 and into 1955. What will develop thereafter will depend to a large degree on the international situation, domestic economic considerations, and the results of the current deliberations of the Joint Chiefs of Staff and the National Security Council on the entire national defense picture.

Sales of complete aircraft, aircraft engines and propellers were $4.2 billion for the first half of 1953, compared with $2.9 billion for the comparable period in 1952, and $811 million for the first half of 1949. This increase should result in higher aggregate earnings for the aircraft industry, although it is questionable whether the percentage of profit to sales will show any marked improvement over previous years.

Financial Position

Statistical difficulties preclude an analysis of the aircraft industry's financial position on all-inclusive basis, but Aircraft Industries Association figures for the 12 leading airframe manufacturers reflect the overall financial status of the industry. In 1952, latest period for which such information is available, the 12 largest airframe manufacturers (who produced over 90 per cent of all planes built) reported a sales jump of 88.5 per cent over 1951, but their net earnings of $81.7 million represented only a 2.2 per cent margin on sales—substantially below the national manufacturing average. The earnings rate of 2.2 per cent on sales compares with a 5.4 per cent margin for 1,783 manufacturing concerns surveyed by the National City Bank of New York.

It Costs Less to License Airplane Than Auto

The Civil Aeronautics Administration reports that it's cheaper to license an airplane than to license an automobile—and the whole operation doesn't cost the taxpayer a cent.

Last year, fees collected totaled more than $166,000.

CAA reports that it issued 34,704 registrations for new and used aircraft in fiscal 1952. That's substantially more than one-third of the 90,000 civil aircraft in the United States.

Sixteen Thousand U.S. Women Know How to Fly Planes

Harriet Quimby didn't know what she started—back in 1911 when she became the first American woman to hold a pilot's license.

Stemming from her first flight, made back in the days when women didn't even have the vote, have come flight instructors, crop-dusters, air-taxi pilots, glider pilots — and even seven helicopter pilots.

License Holders

Today, more than 16,000 U. S. women hold pilot's licenses, five times as many as during World War II, and that number is increasing at an annual rate of about 1,500 per year.

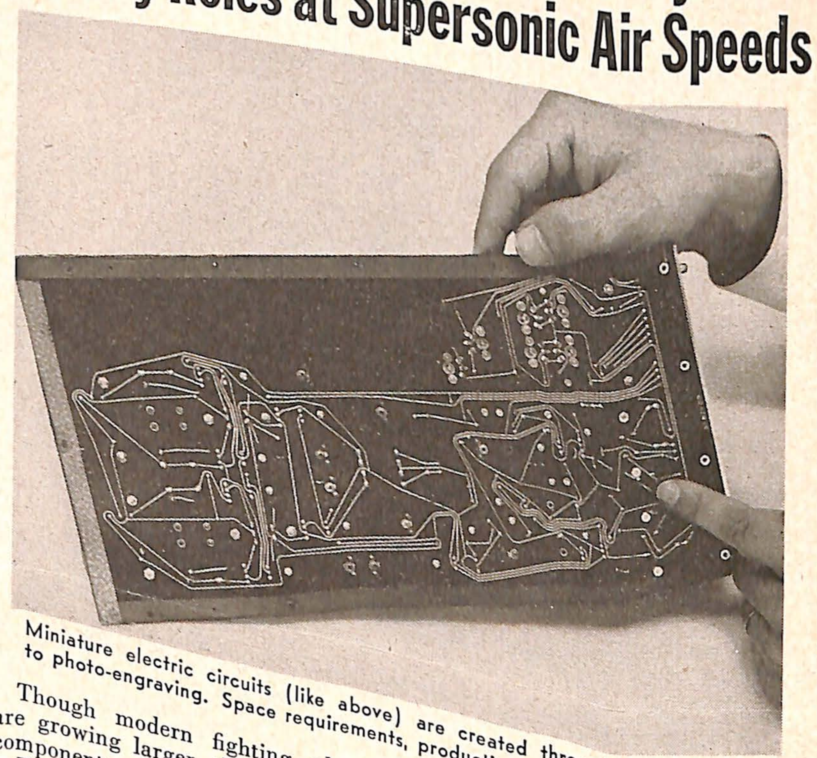
But instead of flying for fun, as did the redoubtable Miss Quimby, most of the modern women pilots are learning to fly for the reason their mothers learned to drive an auto — to get places quicker and return faster.

The majority of the certificated women pilots today hold private licenses — but six have the CAA Air Transport Rating certificate, qualifying them to handle today's huge transport aircraft, five of them are registered as glider pilots, and seven have the newest of all ratings —that of helicopter pilot.

CAA Certification

In addition to those who are flying the airways for business or pleasure, there are 3,649 more women holding down jobs which also require CAA certification and are necessary to the nation's civil and military airpower. There are nearly 1,900 female tower operators employed in the Federally-controlled Airways Traffic Control Towers. Another 1,294 are helping to teach others to fly, holding Ground Instructors certificates, while 415 are classified as Parachute Riggers. Another seven are licensed Dispatchers and 66 of them hold Aircraft and Powerplant Certificates, permitting them to perform all the overhaul required for an aircraft's Airworthiness certificate.

Aeronautical Engineers Build Tiny Parts For Key Roles at Supersonic Air Speeds



Miniature electric circuits (like above) are created through process similar to photo-engraving. Space requirements, production time are cut 20 per cent.

Though modern fighting planes are growing larger, their parts and components are getting smaller.

Reducing aircraft electronics and equipment to their very tiniest dimensions has become vital to today's enormously complex military aircraft. As a result, aeronautical engineers are designing thousands of small components, without sacrificing performance or reliability, for use in today's planes and missiles.

Make Parts Smaller

The business of making things smaller, called "miniaturization" in the industry, is increasingly important in aircraft manufacturing—as more and more equipment must be installed within the streamlined fuselages of high-speed planes.

Through miniaturization, for example, one manufacturer has produced tiny electric circuits that cut space requirements and production time by 20 per cent. These circuits are so small [see photo] that as many as 50 of them are sometimes fitted onto a plastic base measuring no more than three inches by three inches.

Technique Explained

Essentially, this particular miniaturization process involves a technique much like that of producing a photo-engraving for a daily newspaper. A photographic negative of the master circuit drawing is placed against a plastic sheet bonded with a sheet of copper 3/1,000ths of an inch thick. The copper sheet is covered with a photo-sensitive, acid-resistant enamel—and then negative and plastic sheet are exposed to arc lights. Black portions of the negative stop the light, while the colorless lines of the wiring diagram permit the light to go through and harden the enamel underneath. A bath in developing solution washes away the enamel not hardened by exposure; and another bath in an etching tank dissolves the copper not protected by enamel—thus leaving the wiring diagram in copper. The remaining enamel is removed with special scouring powder, and the circuit wiring is complete.

Thousands of these circuits can be made from one master drawing.

The process also turns out washer-like parts which are so small they can hardly be seen. Nearly 3,000 of them are stacked together to make a small resistor.

Other Projects

Among other recent examples of the hundreds of miniaturization projects in the aircraft industry are:

- Air turbine drives, starters, and gas turbine drives weighing as little as 1/5 pound per horsepower.
- Cabin pressure regulators that weigh only one pound, compared with 10 pounds during World War II.
- Electric motors for incorporation in actuators and other products with flea power of 1/2,000ths horsepower.
- Miniature intercommunication systems small enough to be held in a pilot's hand.
- Transistors — tiny substitutes for vacuum tubes—that are approximately the size of a pea.

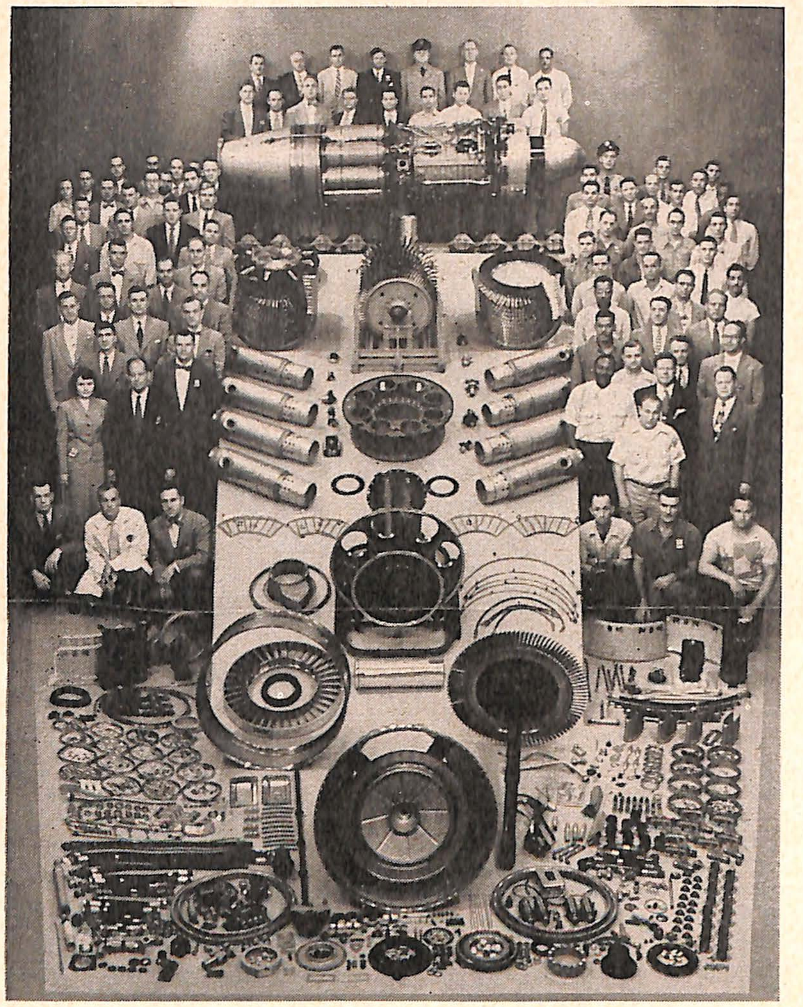
These latter — transistors — are among the most amazing advances in electronics in recent years. Unlike the vacuum tubes they eventually will replace, transistors do not need power for heating filaments. Consequently, they use much less current and generate very little heat. No cooling system is required to compensate for their heat. Use of such transistors promises considerable relief from the bulky burden of ever-increasing electronic equipment required for aircraft and guided missiles.

Blueprints by the Acre

Revolutionary advances in new aircraft designs make it necessary for a typical major aircraft manufacturer to produce more than two million square feet of blueprints each month.

That's enough blueprints to paper 2,000 five-room homes.

It Takes 87 Kinds of Specialists, 8,854 Parts to Build a Jet Engine



Eighty-seven persons (above) represent 87 different skills needed to design, develop, build and test jet engine. Also shown: engine's 8,854 parts.

(*Continued from page* 1)

h.p. on a reciprocating engine.

Among specialists required for jet engine production are:

Instrument engineers, chemists, test maintenance men, calculators, control system engineers, critical materials analysts, weight control analysts, field service engineers, augmentation engineers, stress analysts, flight test engineers, aerodynamics engineers, thermodynamics engineers, fuel systems engineers, lube systems engineers, afterburner controls engineers, engineering managers, test cell design engineers, accessory engineers, lab technicians, detail draftsmen, design consultants.

Engineering assistants, spectographers, combustion development engineers, draftsmen, preliminary design engineers, blueprinters, electro-mechanical engineers, turbine design engineers, metallurgists, metallographers, compressor design engineers, mathematicians, component test supervisors, development managers, vibration specialists, instrument calibration specialists, welding engineers, hydraulic component design engineers, X-ray technicians, administrative executives, quality control specialists.

USAF plant representatives, modification assemblers, time study specialists, general foremen, shop engineers, expediters, assembly foremen, laborers, security guards, sub-assemblers, toolkeepers, sound control engineers, inspectors, cost reduction specialists, can line packers, methods planners, technical writers, jitney drivers, timekeepers, maintenance specialists, machinists, test methods engineers, test cell operators, stock keepers, fluorescent part inspectors, toolmakers.

Pre-test inspectors, major parts assemblers, carloaders, packaging specialists, magnetic particle inspectors, engine handlers, manufacturing managers, subcontracting managers, crane operators, tube benders, training instructors, safety engineers, contracts and production planning managers, welders, financial managers, dynamic balancers, machine operators and sheet metal workers.

Air Power Costs Reduced by U. S. Industry Drive

(*Continued from page* 1)

are being reduced by: (1) design for minimum weight, easier production, product simplicity, and economical operation, (2) standardization and interchangeability of parts, (3) strict cost control, (4) careful scheduling of work load, (5) rapid dissemination of technical data to company personnel, and emphasis on employee training programs.

Cutting Tooling Costs

- *Tooling.* Tooling costs are being reduced by: (1) centralizing tooling management, (2) designing tools for multiple use and maximum number of operations, (3) adoption of production line methods where possible, (4) use of most economical materials, (5) strict budgetary controls.
- *Manufacturing.* Manufacturing costs are being reduced by: (1) tighter scheduling, (2) placing greater cost responsibility on foremen, (3) breakdown of major assemblies, (4) better use of factory space, (5) use of statistical quality control methods, (6) use of most efficient equipment and techniques.

Factory Burden, Materials

- *Factory burden.* Factory burden (includes such items as rent, utilities, maintenance, property taxes, and administrative overhead) costs are being reduced by: (1) tight budgetary controls, (2) simplification of paperwork, (3) better preventive maintenance, (4) control of shipping, utility and postage costs.
- *Materials.* Materials costs are being reduced by: (1) coordinating company purchases for most economical quantities, (2) stimulating competition among suppliers, (3) helping suppliers to reduce costs, (4) preventing waste, (5) reclamation.

Air Quotes

"Let's look at another facet of the Army's operation which, if geared to airlift, might effect our appraisal of costs. Within the Army alone at any given time, there are upwards of 100,000 people in a travel status. If these people could be moved by air rather than by present means of transportation, and if this faster method of travel decreased the time required for their journey by only 20% — a truly conservative figure — that would mean that the Army would have available for duty at any given time, 20,000 more soldiers —more than an entire infantry division—than we currently have. It is possible that there may— and I stress may—be some increase in travel costs in moving large groups by air. However, the savings which would result from having an entire division available for duty rather than in a travel status would certainly more than offset any additional costs."—*Earl D. Johnson, Under Secretary of the Army, August 21, 1953.*

Sub-Zero Air Conditioner Used to Test Plane Parts

The air-conditioner used by a West Coast components manufacturer to test aircraft accessories in subzero temperatures is powerful enough to cool a 145-room hotel.

It would take 440 household refrigerators to equal the system's output.

Only when accessories are fully tested at the sub-zero temperatures encountered at high altitudes (as well as tested under conditions of heat, shock, dust, humidity, fungus, and others) are they ready for actual use in modern aircraft.