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## INDUSTRY OFFERS 5,400 TRAINING COURSES

### \$34 Million Spent During Year

By J. B. Cahill

Industry Planning Service,  
Aircraft Industries Association

The aircraft and missile industry is spending nearly \$135,000 each working day on formal training programs to teach the wide variety of new skills and techniques required in the development and production of today's complex air weapon systems.

A survey of these extensive training programs, conducted by the Aircraft Industries Association, covered AIA member companies, employing 650,000 workers, the bulk of total industry employment during a single year. The survey did not include routine orientation or "on-the-job" training.

The industry-wide survey made by AIA revealed these dramatic facts on the scope and size of its training programs:

1. More than 5,400 different courses were offered during one year.
2. More than 330,000 course completions were recorded.
3. Approximately 12,000,000 man hours were devoted to the courses.
4. Cost of the training programs was more than \$30,000,000.

These training programs covered factory skills, office skills, sub-professional skills, apprenticeships, management development, and engineering training. If on-the-job training had been included, the statistics would be substantially greater.

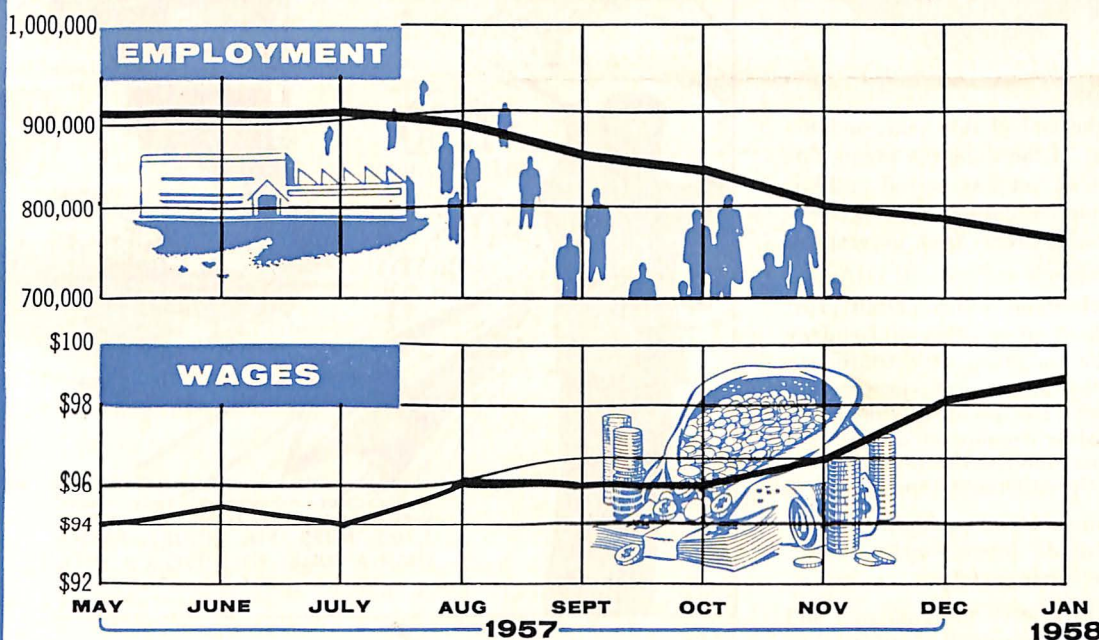
The balance of the survey covered courses of study in which the company reimbursed educational institutions for tuition and laboratory fees or paid for all or part of company-sponsored courses of study.

This part of the survey disclosed that 60,174 employees put in nearly 4,000,000 man hours in these courses at a cost of nearly \$4,500,000.

The aircraft and missile industry is governed by a chain reaction of its expansive technological progress, unparalleled in the history of

(See TRAINING, page 3)

### AIRCRAFT WAGES INCREASE; EMPLOYMENT DECLINES



Employment in the aircraft and missile industry has declined from 906,900 workers in May 1957 to 774,200 in January, a drop of nearly 15 per cent. Average weekly wages have increased from \$94.60 in May 1957 to \$98.82 in January 1958, although beginning in May overtime work was virtually eliminated. The employment decline started after the Department of Defense, in May, ordered the first of a series of contract cutbacks, stretchouts and cancellations for air weapons. However, the first important monthly employment drop did not occur until August 1957, since it takes several months for the effects of contract reductions to be reflected in employment. During the final months of 1957, the Defense Department greatly accelerated its orders for aircraft and missiles, but employment continued its decline. This is due to the long lead times involved in complex aircraft and missiles, and it will be several months before the new orders will result in an employment increase.

'PLANES'

## Service Manuals Cut Weapon Maintenance Costs

Progress in reducing the over-all cost of operating and maintaining air weapons is being made by the aircraft and missile industry through a comprehensive program of service manuals.

The Aircraft Industries Association, recognizing this important element of aircraft and missile manufacture, has a committee on service manuals made up of nearly 100 of the managers of service publications for major companies.

The aircraft and missile industry publishes more "books" during a year than the largest publishing houses, but none of them ever reach

the best-seller list.

These "books" are service manuals that describe to pilots, missile crew members and mechanics how to operate and maintain the complex aerial weapons being produced for the military services.

The cost for the manuals required to support all the aircraft of a single carrier-type model built during a four-year production run is approximately \$7 million. The initial cost of producing the manuals—roughly 250—is about \$500,000. However, as engineering changes are made throughout the production run to increase performance of the aircraft,

revisions are made in the manuals—each original page is revised an average of nine times in the course of the four-year production run.

The basic manuals include handbooks on flight, maintenance, operation, structural repair, illustrated parts and inspection requirements.

Missile handbooks differ in concept from manned aircraft. For example, one major missile manufacturer states that the checkout procedure for a missile requires a sequence of steps that must be coordinated among many technicians. The complete weapon and all of its sup-

(See MANUAL, 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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## Renegotiation Hearing Needed

By Orval R. Cook

President, Aircraft Industries Association

The present Renegotiation Act expires at the end of this year, and the Administration is seeking a two-year extension. If the Congress grants this extension, it will be the fourth since the original Act was passed in 1951. The intent of Congress in providing renegotiation legislation is sound: Deny clearly unreasonable, excessive and unconscionable profits from government contracts.

However, the Act is based on seven generalizations which permit great disparities in interpretation. The vital question of whether a company earned excessive profits is left entirely to the judgment of the five-man Renegotiation Board. They are not guided by any *specific* criteria for computing whether the earnings were excessive. The proof that the judgment of the Board must necessarily be arbitrary is demonstrated in several cases where the statutory Board in Washington differed sharply from the findings of its Regional Boards. In one case, the difference ranged from a determination made by a Regional Board of no excessive profits to a determination by the statutory Board that \$10 million was excessive profits. And both Boards used the *same figures* and the *same factors*.

Renegotiation is tardy. As long as four years after the company and the contracting service have agreed upon prices, made their readjustments, the Renegotiation Board enters the picture for still another determination on earnings.

But probably the most deleterious effect of renegotiation is the strangling of contractor incentive to cut costs. The military services, during the past 15 years, have developed contract techniques that are admirably suited to the requirements of defense procurement. The contractual technique favored by the military buyers is the incentive contract by which the contractor is rewarded for reducing target costs.

Lt. Gen. William F. McKee, vice commander of the Air Materiel Command, recently outlined the USAF viewpoint:

"Our own philosophy is that industry is entitled to a fair profit which will keep it in business—if it earns that profit. We do not believe that the award of a government contract should automatically guarantee profit or that we can afford to assume all of the risk all of the time. Both cost-plus-fixed-fee contracts and advance fixed-price contracts operate ultimately in accordance with policy of earned profit. We do feel, however, that more can be done in the use of incentive formula contracts which will place the highest possible premium upon the contractor's own management skills."

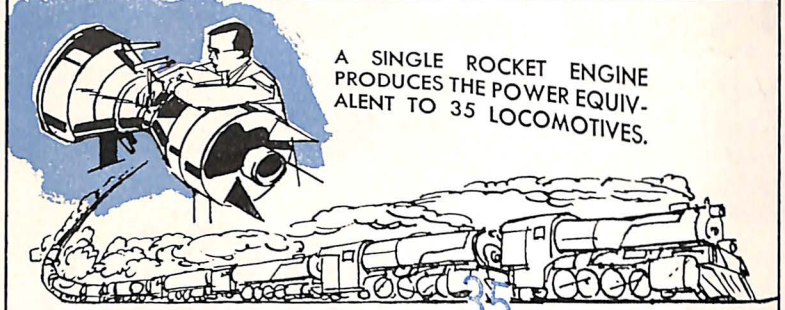
The aircraft and missile industry heartily supports this procurement philosophy.

But the incentive technique is largely negated by the current actions of the Renegotiation Board in its earnings determinations.

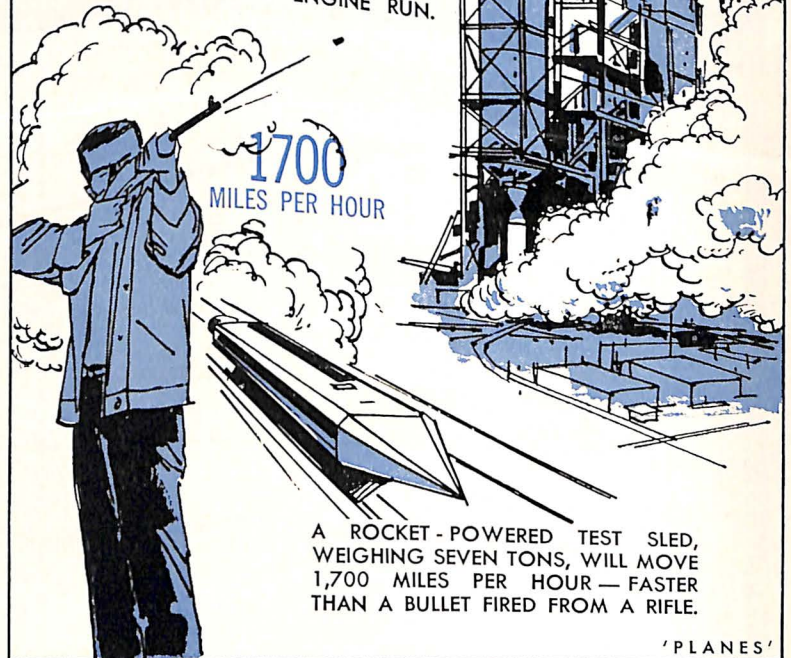
The Aircraft Industries Association believes that the appropriate Congressional committees should schedule early hearings on the request to extend the Renegotiation Act, hear testimony from the military services that do the actual procurement, hear testimony from the Renegotiation Board on its interpretation of the Act, and hear testimony from industry representatives.

With these facts at hand, the Congress will be able to amend the Act, provide more specific instructions to the Renegotiation Board that will eliminate confusing, shifting interpretations and replace arbitrary determinations with factual findings.

## Plane Views



TO KEEP A STEEL EXHAUST DEFLECTOR ON A ROCKET ENGINE TEST STAND FROM MELTING, 30,000 GALLONS OF WATER ARE USED DURING A 60-SECOND ENGINE RUN.



'PLANES'

## 'Copter Pours Cement, Speeds Construction

The versatile helicopter has taken on a new task—pouring cement from the air—and is saving time and money in the construction of power lines across a mountain range.

In a similar job last fall, the helicopter carried steel girders to mountain sites where crews erected towers on cement pilings. The cement was carried to the site by truck at that time.

This year the helicopter was used for almost the entire project. First, it carried crews to the mountain construction sites where holes were prepared for the cement footings. The helicopter then picked up hoppers of wet cement at the base camp and returned to the site where it was poured directly into the holes while the helicopter hovered.

Next the helicopter brought up the prefabricated tower sections and lowered them onto the footings.

Weight of the cement load was about 3,000 pounds and the tower sections weighed about 3,500 pounds. Estimated savings in time ranged from hours to days.

## AIR QUOTE

"Although all facets of the Soviet military strength are great, our *priority* task must be to maintain the capability to fight and win the air battle. I join with you in hoping such a battle will never be fought. I do not think it will be fought if our air power stands supreme—and our determination to use it, if necessary, is known.

"To maintain the capability to fight and win the air battle, the Air Force believes in the old adage that the best defense is a good offense. That is why we have built strong strategic strike forces which can attack targets anywhere in the world. . . .

"Air Force experience in three wars has demonstrated that a determined air offensive cannot be stopped. Today, we have better equipment, more effective techniques and better trained personnel. With this combination we possess the capability to penetrate to the very heart of an enemy's target system."—Gen. Curtis E. LeMay, Vice Chief of Staff, U. S. Air Force, April 10, 1958.

# Training Reduces Production Costs

(Continued from page 1)

manufacturing. Aggressive research programs of the industry consistently produce revolutionary concepts for aircraft and missiles that require new materials, new production methods and, of course, new skills.

Providing these skills is the goal of the aircraft industry's training program. Without these skills, the most advanced designs would remain only "paper" projects, incapable of being translated into hardware for the operating units of the military services. And there is no reservoir of talent to draw upon—the aircraft and missile industry must provide these skills through resourceful, comprehensive training programs.

## Computers Cause Change

Typical of the technological changes the industry must cope with to meet performance and production requirements is in the computers used in airborne electromechanical guidance systems. Until recently, the analog computer was used in the system, but a major technological change caused the replacement of analog computers with digital computers. The change was due to the fact that it is much cheaper to produce a very accurate digital computer than an equivalent analog computer.

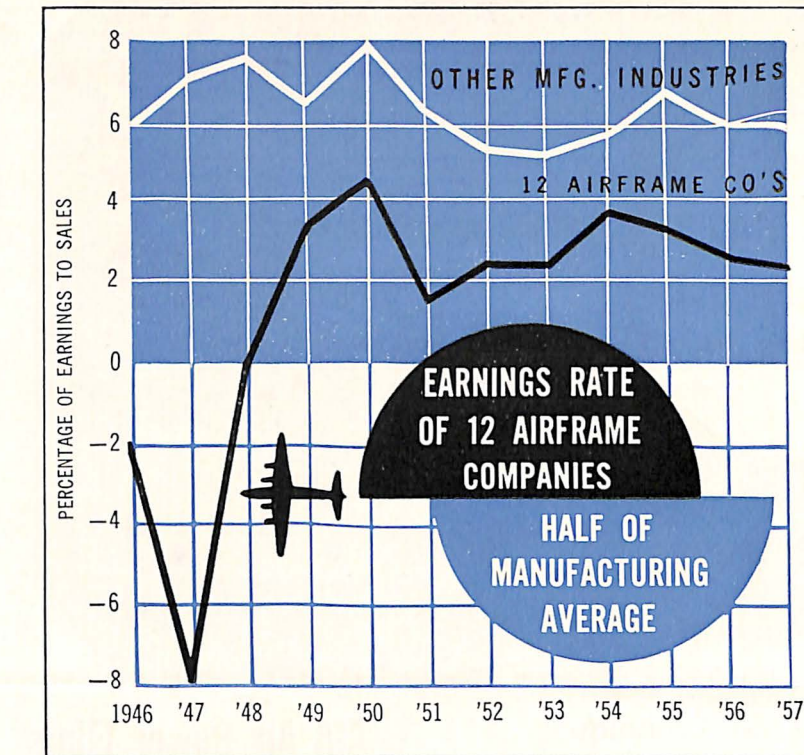
First, engineers designing equipment for digital computers had to be trained. Second, project engineers assigned to include the digital computers in the system would benefit from the training, and technicians assembling, testing and maintaining the computers required instruction. Training courses were arranged, lasting from 40 to 128 hours.

The company estimated that the training course contributed greatly in meeting production schedules and that the training costs were minor compared with the saving in engineering conference and study time that would have been necessary without organized digital computer courses.

## Variety of Courses

The courses available range from learning to operate a motor scooter to the great skills involved in assembling or servicing the inertial guidance system of an intercontinental ballistic missile. Entrance requirements to the courses are geared to the subject to be studied. Courses are available for the lowest and highest skilled employees.

One airframe company made a detailed survey of several job classifications which graphically illustrates the benefits that accrue to employees participating in training programs. Every fourth name was selected from a payroll sheet and the employee's record was checked from his first day of employment. In the sampling



Rate of earnings for the 12 major airframe companies during 1957 was 2.4 per cent, based on sales, less than half the earning rate of 5.9 per cent of other major manufacturing industries for last year. This compares with an earnings rate of 2.8 per cent for these airframe companies in 1956 and 6 per cent for other manufacturers. However, sales of the 12 airframe companies increased from \$5.6 billion in 1956 to \$6.9 billion in 1957. The earnings on defense sales for most of the 12 companies for the past four years still are subject to renegotiation and the earning rate could decline even further.

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## Manual Changes Made Quickly

(Continued from page 1)

port, including personnel, are thought of as one system, not as separate pieces of equipment.

The publications unit of the missile manufacturer handled the production of manuals in this fashion:

Source material is furnished to the technical writers by the project supervisors. As the blueprints, specifications and engineering data are converted into manuscripts, require-

of 33 senior toolmakers, it was found that all but two had been trained by the company, and these two men had received their training at other aircraft companies. Twenty-three of the group were unskilled when hired and had progressed through 11.3 labor grades to reach the top skill.

In the category of senior plaster pattern makers, 79 per cent gained their top experience at the airframe company; among maintenance machinists, 69 per cent were hired as beginners or in semi-skilled jobs; all of the flight line crew chiefs had been hired as beginners or in semi-skilled jobs and had attained their status through company training.

## Increased Production

A related study showed that graduates of a company-sponsored machine shop training school were promoted six to nine months earlier than employees who did not have the formal machine shop training. The training program is a two-way street: the company has the services of more skilled, productive employees and the employees gain the benefits of substantially higher wages for their new skills. The training programs have been a major contributor to increased productivity at economical costs which, in turn, permit wage increases.

ments for illustrations are generated. The illustrations unit prepares the required drawings and also prepares the illustrated parts catalog the maintenance technicians use to define the replacement parts required. The production unit does the job of inspecting and printing the book.

In this particular missile program, 65 handbooks, consisting of 15,000 pages were prepared. Manual preparation is geared to move quickly. During the advanced research and development phase of a missile, handbooks can be revised within 72 hours of the receipt of a change.

The handbooks are nearly always written by engineers. Although the subjects are technical and complex, the language is such that it can be readily understood by technicians without professional degrees. Simplicity of writing and illustrating is a must.

## Jet Transport Doors Take Marathon Tests

Jet transport engineers are staying close to swinging doors these days.

But don't get the wrong idea. These doors will be used on the jet transports which are scheduled to enter airline service later this year. The doors are undergoing marathon tests for reliability and, so far, a test door has been opened and closed more than 15,000 times. It is inspected after every 200 cycles, dismantled and examined for wear after 5,000 cycles.

Other checks include water- and air-leakage tests and a performance check to determine the door's reaction to icing conditions.

Wider and higher than its own portal, the door is reduced in height when the handle is rotated and then is pushed edgewise through the doorway.

## New Aircraft Yearbook Completely Re-Styled

The 39th edition of *The Aircraft Year Book*, featuring a pictorial and written record of the top aviation events in 1957, has been completely re-styled.

Page size of this official publication of the Aircraft Industries Association has been increased to 8 x 11 inches, and photographs and art work have been used liberally in the new format designed for easy reading.

Included in this 432-page, fully indexed annual are reviews of individual company activities; photos, three-view drawings and specifications of all planes and engines in production; a comprehensive pictorial report on all missiles in development and production; aviation activities of the Department of Defense and other government agencies; research and development progress during the year in military and civil aviation; a summary of airline activities; the general aircraft and helicopter picture for the year; a complete bibliography of aviation books published in 1957; historic and current chronologies; and a listing of official records established during the year.

*The 1957-58 Aircraft Year Book* can be purchased for \$6.00 from American Aviation Publications, Inc., 1001 Vermont Ave., N.W., Washington 5, D. C.

## SAC Fuels 'em

A squadron of tanker planes in the Strategic Air Command transfers more fuel in air-to-air refueling operations in a 16-day period than the average auto service station would pump in three years.

1957 IN MILLIONS OF PASSENGER MILES



5,036	AMERICAN AIRLINES
4,581	UNITED AIR LINES
4,397	EASTERN AIR LINES
3,656	TRANS WORLD AIRLINES
3,010	PENNSYLVANIA RAILROAD
2,210	NEW YORK CENTRAL RAILROAD
1,775	ATCHISON, TOPEKA & SANTA FE RAILWAY
1,513	CAPITAL AIRLINES
1,314	DELTA AIR LINES
1,234	UNION PACIFIC RAILROAD

Six scheduled airlines are among the ten largest intercity rail and air carriers, based on passenger miles traveled, with four of the airlines ranking as the top carriers. Domestic and international carriers last year flew 31.2 billion passenger miles, an increase of 13 per cent over 1956.

'PLANES'

## Small Firms Take Big Missile Role

Small business firms are playing a major role in the ballistic missile program.

Recent studies show that of the \$1 billion paid to prime contractors engaged in ballistic missiles work, as of Jan. 1, 1958, more than \$267 million went to small business subcontractors. This is 21 per cent of the total payments, and the figure is more significant since the program to date has emphasized research and development and only now is gradually moving into the production phase.

A further breakdown shows that associated contractors in the ballistic missile program—manufacturers of power plants, guidance systems and nose cones—have paid out to small businesses nearly 50 per cent of the total funds involved in these items.

One missile engine manufacturer, in a detailed study of subcontracting, revealed that during 1957, \$40 million, or almost 18 per cent, went to small business firms on a first tier subcontracting basis. In addition, \$13 million was subcontracted to second, third and fourth tier small business firms by large businesses holding first tier subcontracts.

The engine manufacturer has a total of 4,084 small business concerns on his subcontracting list.

Another large company manufacturing auxiliary power supply for an ICBM reports that it has subcontracted 62 per cent of all its work to small business concerns, distributing these subcontracts to 709 different firms.

A major aircraft and missile manufacturer stated that 23 per cent of his over-all contract for a large ballistic missile went to small business concerns.

The aircraft and missile industry has established a comprehensive program of aiding small concerns, which has paid off in lower costs for national defense.

## It Takes A Little Longer To Pay It

Tax time took little time for an electronic computer developed by a major aircraft component manufacturer.

The average time for calculating individual federal income tax returns was 17 seconds, a demonstration of the speed of modern computers which are widely used in operating modern aircraft and missiles.

The individual's tax information—status as single or joint taxpayer, number of exemptions, total income, withholding tax, Social Security, interest, dividends, contributions and medical expenses—was fed into the computer.

The computer even "decided" for the taxpayer whether he should take the standard or itemized deductions and automatically prevented him from exceeding prescribed percentages.

## Engineers Duplicate Landings in Rain

Engineers at an aircraft company have devised a system to duplicate the conditions faced by a Navy pilot flying aboard an aircraft carrier on a rainswept night.

A shower, heavy rain and even a cloudburst can be produced by the flick of a switch. The secret of the storm-producing is in a vertical bar at the end of a 65-foot open circuit wind tunnel. The bar houses six "needles," each with a small opening through which water passes under pressure.

The flow of water from the needles is directed toward a windshield at the end of the tunnel. Behind the windshield a 200 horsepower fan "pulls" the water toward the windshield.

The system devised by the aircraft industry permits utilizing the best windshield designs and rain removal methods before an aircraft is delivered for fleet use.

## Aerodynamic Grooming Includes Close Shave

A close shave is part of the grooming that goes into the manufacture of today's aircraft and missiles.

Aerodynamic smoothness is a must if drag is to be reduced to a minimum. Rivet heads, for example, must be shaved to very close tolerances. The heads of driven rivets protrude .010 to .012 inches. This is too far for aerodynamic purposes which demand a protrusion of less than .002.

Aluminum rivets present no problem since they can be shaved with a standard tool. However, titanium and steel are being used in today's aircraft, and the industry has developed a tool to do the job of shaving rivets of these tougher materials. Tests show the new tool to be highly satisfactory and more than 1,000 titanium alloy fasteners were shaved before it required re-sharpening.

## X-ray Techniques Check Quality Of Vital Parts

The x-ray has moved onto the flight line, providing a new method of avoiding costly overhauls as well as an added safety factor.

Radiography machines have been used in the aircraft industry for several years in quality control checks of parts before they are assembled as part of the aircraft.

However, parts sometimes show signs of fatigue failure after exposure to flying stresses and strains such as the impact of constant landings.

The x-rays give certain warning of a possible failure long before it could occur, and replacements are made. Any part having a defect of one to two per cent of its total depth (roughly equivalent to a one-inch part showing a 1/100th of an inch fissure) is revealed by the x-ray.

Pictures are taken just as medical x-rays. Sensitized film is placed back of the part, and electromagnetic waves are shot through the part and recorded on film. Negative sizes range from dental plate size to more than a square foot. The film is specially cut to photograph oddly shaped parts or those in difficult positions.

Plans call for cataloging the results to show which parts to keep under surveillance and frequency of examination.

The new utilization of the x-ray technique is expected to yield rich dividends in lower overhaul and maintenance costs and a higher percentage of aircraft use.

## Painting Time Cut

A new painting technique, developed by aircraft workers in a Western aircraft plant, cuts painting time for small parts from one hour to three and a half minutes. The heart of the new device is a wire-cage drum which revolves, somewhat in the manner of a cement mixer. A paint spray gun is aimed at the drum which evenly coats the parts as the drum revolves.

## AIA Air Power Films Viewed by Millions

Three half-hour films produced by the Aircraft Industries Association, as a report to the American people on the progress and problems of U. S. air power have been shown as a public service by 388 television stations with audiences of millions of viewers.

The films have been telecast by stations in cities ranging in size from New York (4,500,000 sets) to Harrisburg, Ill. (30,000 sets). The first film, *Design for Survival*, is a general story of the growth of air power and its present leading role in national defense. This film has been telecast by 164 stations.

The second film, *The High Road*, describes the progress that has been made in the development and manufacture of commercial transport aircraft, and the great contribution these aircraft have made to speedy transportation within nations and internationally. The film has been shown by 113 television stations.

The most recent film released is *Men and Missiles*, a story of the tremendous gains made by the aircraft and missile industry in the development of this new aerial weapon. *Men and Missiles* recently was selected as one of the top 50 TV films by television stations in a poll conducted by *Variety*. It has been shown by 111 stations.

Another film, *Power in the Air*, is scheduled for release next month. This is the story of the progress made in powerplants for aircraft and missiles, ranging from the 12-horsepower engine of the Wright Brothers to the rocket engines producing thousands of pounds of thrust that powered our satellites into orbit around the Earth.

These films have been shown by hundreds of civic and military groups.