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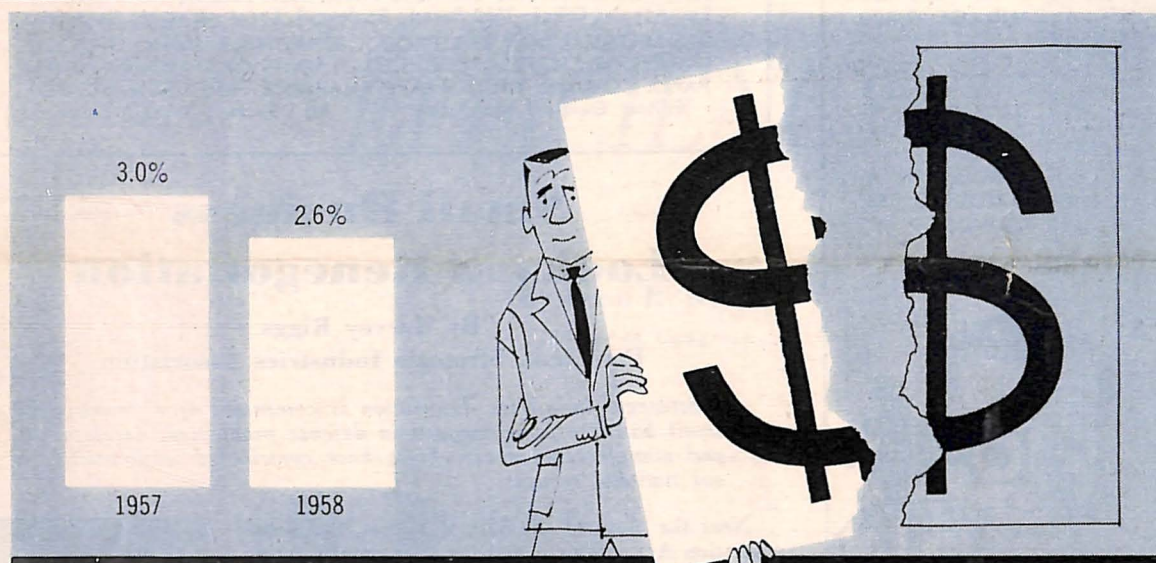
# planes

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## SURPLUS PISTON TRANSPORTS POSE PROBLEM



### EARNINGS DECLINE

The earning rate as a percentage of sales for 39 aircraft and parts companies declined to 2.6 per cent in 1958 compared with 3.0 in 1957, a recent survey by the First National City Bank of New York reveals. This is just half the average earning rate of 5.2 percent for all manufacturers. A major portion of the aircraft and parts industry earnings are subject to the renegotiation process and the final figure probably will be even lower than 2.6 per cent.

'PLANES'

## Air Cargo Gains Offer Solution

By Irving H. Taylor  
Director, Export Service  
Aircraft Industries Association

Turbine-powered transports now entering airline service in increasing numbers are leaving in their wake one of the knottiest problems ever faced by the U. S. air transport and manufacturing industries: Disposal of surplus piston-engine airliners.

A recent Government survey shows that the U. S. Air carriers, foreign air carriers and the U. S. military services plan to dispose of an estimated 7,093 transport aircraft by the end of 1961.



Mr. Taylor

U. S. air carriers account for approximately half this number with 843 transports—556 four-engined and 287 twin-engined—scheduled to be released during the next three years. The magnitude of the problem is emphasized by the \$827 million original cost of these airframes and components plus improvements through 1957.

The full impact of this situation has not been felt. But there is no question that it will become critical within the next six months unless immediate constructive action is taken through government-industry cooperation.

The survey shows that 600 similar transports will become surplus to the requirements of foreign air carriers in the next three years. There is a trend among foreign carriers to dispose of their surplus aircraft to other foreign carriers by accepting equity stock in the other airline as payment. This technique serves to pre-empt the normal market for outright sale or lease of used aircraft.

In addition, the market already is limited for disposal of four-engined aircraft to the smaller foreign carriers since they serve less-populated cities and lighter-density routes which cannot support this larger equipment economically or technically. These smaller lines, most of them operating in the less developed areas abroad, are further handicapped by the lack of airports capable of handling most of the surplus transports being released by U. S. carriers.

Both the air transport and manu-  
(See AIA EXPORT, Page 7)

## Missile Part Manufacture Requires Unique Facilities

The manufacture of intricate components used in missile guidance systems, such as floated gyroscopes, is accomplished in rooms that rival the cleanliness of a surgical theater.

The facility requirements and production methods are unique in manufacturing, and the floor space cost is more than three times the cost of conventional manufacturing areas.

A typical area for gyroscope assembly required new foundations for the rooms built within the main factory to still vibration effects from other plant operations and from street traffic.

### Other features:

Plumbing and wiring is arranged so that maintenance can be handled from spaces between the "clean" rooms.

Overhead lighting is designed flush to the ceiling. Since maintenance workers cannot be permitted in the clean rooms, they are provided a crawl space in the roof for bulb replacement.

Elimination of dust particles in the rooms calls for an atmospheric control system which utilizes charcoal filters. This system insures that 99.8 per cent of airborne particles larger than 12 millionths of an inch are excluded from air entering the rooms.

Temperature in the rooms is constant; not more than two degrees

variation is allowed.

To forestall dust collection, the interiors of these rooms could have no corners; they are rounded off. Walls and ceilings were covered with a special vinyl sheeting that is washed every other day. The work benches, built of stainless steel, are extended from the walls in a cantilever design to eliminate leg supports, another possible source of dust collection. The floors are cleaned daily by a special wet vacuuming process using liquid freon.

## Gyroscopes Feature Super Accuracy

The gyroscopes and accelerometers developed by an aircraft and missile company for inertial guidance systems are so accurate they can easily measure changes in angles and vibrations infinitesimal enough to shake an object weighing as little as a fly.

One fly weighs about 1/2500 of an ounce. It would take about .000000005 foot pounds of force to "tickle" the fly.

Super accuracy is required for these components which must guide missiles and hypersonic aircraft at speeds of thousands of miles per hour.

Clean room has air locks, through which parts to be assembled are passed. These parts are cleaned prior to their entry into the assembly room; they are also polished and examined under 45-power microscopes to permit detection of infinitesimal metal burrs. Dental drills are used to eliminate such burrs.

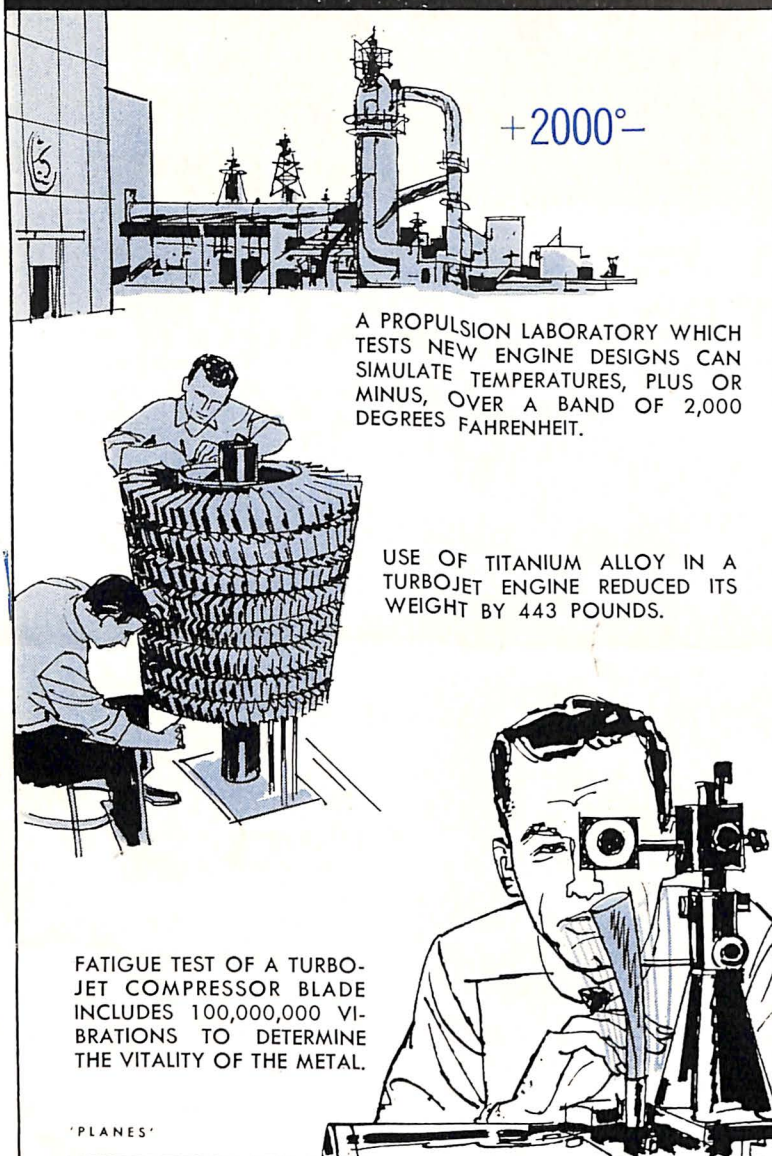
Along with these precautions, equal care is taken to insure that working personnel entering the assembly rooms do not introduce dust. Entry is made in two stages. The worker must first doff street clothing and scrub his face and hands. He then enters a final dressing room where he puts on a "flying suit," a hair covering and shoe boots, all made of lint-free nylon. Next, he passes through an "air shower," which removes loose particles of matter.

Such employees are carefully screened. A worker with dandruff, for instance, would be automatically eliminated.

Conventional blueprints and paper pads for noting data are not allowed in the clean rooms, because the paper might shred. Paper has been replaced by special plastic sheets. At the same time, the pencil has been eliminated in favor of the ball-point pen, because tiny pieces of graphite might find their way into a gyro assembly.



## Plane Views



A PROPULSION LABORATORY WHICH TESTS NEW ENGINE DESIGNS CAN SIMULATE TEMPERATURES, PLUS OR MINUS, OVER A BAND OF 2,000 DEGREES FAHRENHEIT.

USE OF TITANIUM ALLOY IN A TURBOJET ENGINE REDUCED ITS WEIGHT BY 443 POUNDS.

FATIGUE TEST OF A TURBOJET COMPRESSOR BLADE INCLUDES 100,000,000 VIBRATIONS TO DETERMINE THE VITALITY OF THE METAL.

## PLANES

*Planes* is an official publication of the Aircraft Industries Association of America, Inc., the national trade association of the designers, developers and manufacturers of aircraft, missiles, spacecraft, their propulsion, navigation and guidance systems and other aeronautical systems and their components.

The purpose of *Planes* is to:

Foster public understanding of the role of the aviation industry in insuring our national security through development and production of advanced weapon systems for our military services and allies;  
Foster public understanding of commercial and general aviation as prime factors in domestic and international travel and trade.

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## Small Business Looks at Renegotiation

By Harvey Riggs  
President, Strategic Industries Association

*Strategic Industries Association is comprised of 87 competent, small business firms engaged in defense production, development and manufacture, whose efforts have contributed substantially to our national security.*

Near the close of the 85th Congress, the Renegotiation Act was extended for a six-month period to June 30, 1959. The Ways and Means Committee of the House of Representatives had held a one-day hearing on July 29, 1958. The conclusion was that more extensive hearings were warranted and it was contemplated that these would be held in the Spring of 1959.

It is the unqualified belief of the majority of SIA members that Renegotiation is bad for the country—that it literally tends to balloon the costs of defense procurement.



Mr. Riggs

The costs of appealing decisions of the Renegotiation Board are prohibitive for small firms. The complicated and highly technical work involved in appealing the decisions involves various expenditures which could cost a company a sum equal to its net worth.

Because the extension—and/or amendment—of Renegotiation will shortly be explored, it seems timely to reproduce the beliefs and views of SIA members as set forth in the association's book on policy, *WHERE WE STAND*:

1. Extensive competition for defense contracts is such as to eliminate any possible justification for continuance of Renegotiation.
2. The Renegotiation Act embraces a basic error of economic principle. *It restricts incentives to earn profits and hence automatically eliminates incentives to reduce costs.*
3. Many costs have ballooned as the direct result of the reverse incentives imposed by the operation of the Act.
4. Costs of administering the Renegotiation Act, including both government and industry costs (which must ultimately be paid in the cost of end-items produced for government) far exceed theoretical recoveries.
5. The continued existence of Renegotiations tends further to increase net costs to government by discouraging potential competitors from taking risks of government contracting.
6. Renegotiation is the *most serious deterrent to economical subcontracting*, because major prime contractors are penalized in the form of lower profit allowances when they execute economical subcontracts in lieu of inplant work.
7. Renegotiation places *inequitable burdens on small business*. Lower overhead independent business sells products to government at the same price as large competitors. Where the smaller business—through its efficiency—operates at a lower cost, the resulting extra profit must be refunded to government. Thus, the smaller business is forced to sell at a net lower price and is indirectly subsidizing the inefficiency of its competitors.
8. Inequities exist in the processing of Renegotiation with smaller firms. The relative burden of paper work is greater on the smaller firm. Without technical experts, the presentation of a Renegotiation case is less effective.
9. Adequate restraints and protections against unreasonable defense profits exist in (a) presently available procedures of defense contracting including target-type and price-redetermination contracts, and in (b) the readily available competition which would be instantly attracted to any defense production opportunity that appeared to be profitable.

## USAF Book Program Lists New Titles

The U. S. Air Force Book Program, which was established to encourage publication of books on aviation, air power and space power, during the past three years has aided in the preparation of more than 200 hard and paper-back volumes.

The most recent listing includes the following books:

*Flying Tiger—Chennault of China*, Robert L. Scott, Jr. (Doubleday, \$3.95). A biography of the late Lt. Gen. Claire L. Chennault by an officer who commanded a fighter group under Gen. Chennault in China.

*As the Pro Flies*, John R. Hoyt (McGraw-Hill, \$4.95). A basic book on the techniques of flying light planes, and the advanced techniques of flying planes of all sizes. This highly readable book covers navigation, radio communication, instrument flying, etc.

*The Book of Missiles*, Clive Davis (Dodd, Mead, \$2.75). A guide to rockets and missiles of all services with information on space programs. Book contains a glossary of missile terminology.

*Jet Pilot*, Flint DuPre (Research Publishing, \$1.00—paperback). A guide telling how young men can become jet pilots in the Air Force.

## AIR QUOTE

"The national strategy of the United States is distinctly different than that of the USSR. In the judgment of the Defense Department the security of this country will be better served by placing reliance on a diversified system of retaliatory weapons rather than staking the Nation's very existence on one or two individual weapons systems.

"The Department of Defense plans to maintain a manned bomber force distinctly superior both in size and in quality to that of the USSR. In addition, the Department also intends to have a significant capability in ICBM's, in land based IRBM's, in submarine-based . . . missiles, and in carrier-based bombers. Other units having a strategic delivery capability include the tactical aircraft and guided missile units of the Air Force and Army which because they are deployed overseas can reach the Soviet homeland. That is why in judging the relative military strength of the United States and the USSR the entire spectrum of strategic weapons available to the United States and available to the USSR must be considered . . ."—Neil McElroy, Secretary of Defense, Jan. 26, 1959.



RENEGOTIATION -

# ROADBLOCK TO EFFICIENCY

By Cecil R. King  
Member of Congress

**R**  
86TH CONGRESS  
1ST SESSION  
**H. R. 5123**

IN THE HOUSE OF REPRESENTATIVES

MARCH 2, 1959

Mr. KING of California introduced the following bill; which was referred to the Committee on Ways and Means

## A BILL

To extend the Renegotiation Act of 1951 for two years, to provide additional factors to be considered in determining excessive profits, to permit appeals from decisions of the Tax Court in renegotiation cases, to provide for reports to Congress, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-*  
2 *tives of the United States of America in Congress assembled,*

### 3 SECTION 1. TWO-YEAR EXTENSION.

4 Section 102 (c) (1) of the Renegotiation Act of 1951,  
5 as amended (50 U.S.C., App., sec. 1212 (c) (1)), is  
6 amended by striking out "June 30, 1959" and inserting in  
7 lieu thereof "June 30, 1961".

I

**planes**  
APRIL 1959



CONGRESSMAN  
CECIL R. KING,  
represents the 17th  
District in California  
and resides in the  
City of Inglewood.  
He is now serving  
his tenth consecu-  
tive term in the House of Represen-  
tatives and is third ranking Member  
on the Committee on Ways and  
Means, as well as a Member of the  
Joint Committee on Internal Revenue  
Taxation. Prior to his election to the  
Congress, he served in the State  
Legislature for a ten year period.

IN the atmosphere of international tension which prevails today, any reasonable person will agree that the economic health of defense industries is of paramount importance to our national security and welfare.

The companies which comprise this industry have become as essential to the preservation of peace as the machines and weapons they supply to the armed services.

It is their task not only to turn out modern equipment for the effective arming of our forces in being, but to perfect and refine their products and to conduct large scale research and development programs on tomorrow's weaponry to insure that we are victorious over the Soviet Union in the cold war's great technological race.

To do so, these companies must invest large sums of corporate funds in new tools and equipment and research and production facilities without which we cannot hope to surpass our international competitor who is bound by no monetary restrictions.

It is obvious, then, that the financial health of this industry is of prime importance to the nation's defense. It is also a vital factor in our economy, because the companies engaged in defense work now number in the tens of thousands and employ millions of workers.

The Government is, of course, interested in the financial well-being of all the nation's industry. Paradoxically, in the area of defense production, there exist restrictions which threaten the stability of industry and hamper it in carrying out its assigned role as the bulwark of our defense in the technological war.

One such major restriction is the process of contract renegotiation. Public interest tends to shy away from such a typically Governmentese word as "renegotiation." It sounds like a tremendously complicated technical subject—which it is. In simplified terms, however, it is a process whereby one Government agency may review performance under defense contracts entered into by another governmental agency and, in effect, change the terms of the original agreement.



A close scrutiny of the administration of renegotiation, however, shows that the Government's Renegotiation Board has made arbitrary decisions taking away hundreds of millions of dollars that contractors feel they have rightfully earned. It conducts its deliberations in an aura of secrecy so that contractors rarely learn why in specific terms they are being stripped of earnings justly theirs according to the original contract.

Under the present Act, the Board is permitted to operate in a manner that is foreign to any other administrative agency of the Government having quasi-judicial powers. As I stated recently in Congress, it is morally wrong for the United States to contract in good faith with a person and years later, after performance of the contract has been satisfactorily completed, to change the terms of the contract and take away earnings that were openly and fairly negotiated in the first place.

But there is more involved than moral principle. The administration of contract renegotiation in recent years has seriously impaired the long-range capability of defense industry to handle the important role which we, as a nation, have assigned it.

As a representative of the State of California, which has hundreds of thousands of people who are dependent upon the soundness of defense industry for their livelihood, I have been interested in renegotiation for some time. A careful study of the ramifications of the current Renegotiation Act has led me to introduce, in the current session of the Congress, legislation which would tend to correct the inequities of the Act as it is now administered. The situation has become so important and so serious that I feel new legislation in this area is required if we are to maintain an adequate defense.

Renegotiation came into being in 1942, when virtually our entire national industrial effort was being devoted to the arming of ourselves for World War II. It was, at that time, a sound policy. We were ordering tens of billions of dollars worth of arms and materiel from a great many contractors.

The Renegotiation Act was originally designed as an integral part of the procurement process. Its primary purpose was to assure reasonable prices. It was not designed to

serve as a form of excess profits taxation nor as a means of recapturing past profits.

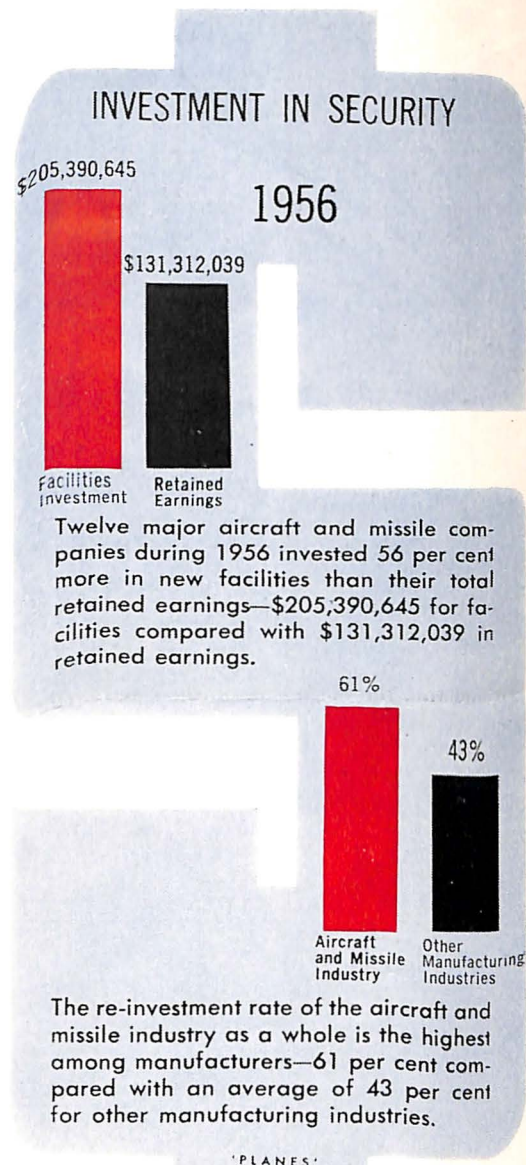
In the total war economy that existed in 1942 the quantities of weapons and other materiel required and the urgent need for early deliveries did not permit the military services to develop the techniques required to negotiate with any assurance of reasonable prices. In most instances the military services were not buying so many units at a specific price, but, rather, they were buying capacity—three shifts per day capacity. Under these conditions renegotiation did play an essential part in the pricing policy of the services. It was this contribution to the procurement function that was used to differentiate renegotiation of excessive profits from taxation of excess profits.

The Act as conceived was to be temporary legislation, to be in effect only during the helter-skelter war years when the urgency of the national peril engendered of necessity some hasty contract decisions and negotiations. Accordingly, renegotiation was dropped at the end of the war and was not a part of contractual procedure during 1946 and 1947.

In 1948, it again became apparent that a new defense build-up was required to meet the potential new threat of world Communism. As the re-arming programs got under way, renegotiation was dragged out of the limbo to which it had been consigned and reintroduced to defense contracting.

In 1951 my distinguished colleague, Congressman Carl Vinson, expressed in forthright and lucid terms an explanation of renegotiation which has been hailed by the Renegotiation Board, the Defense Department and contractors:

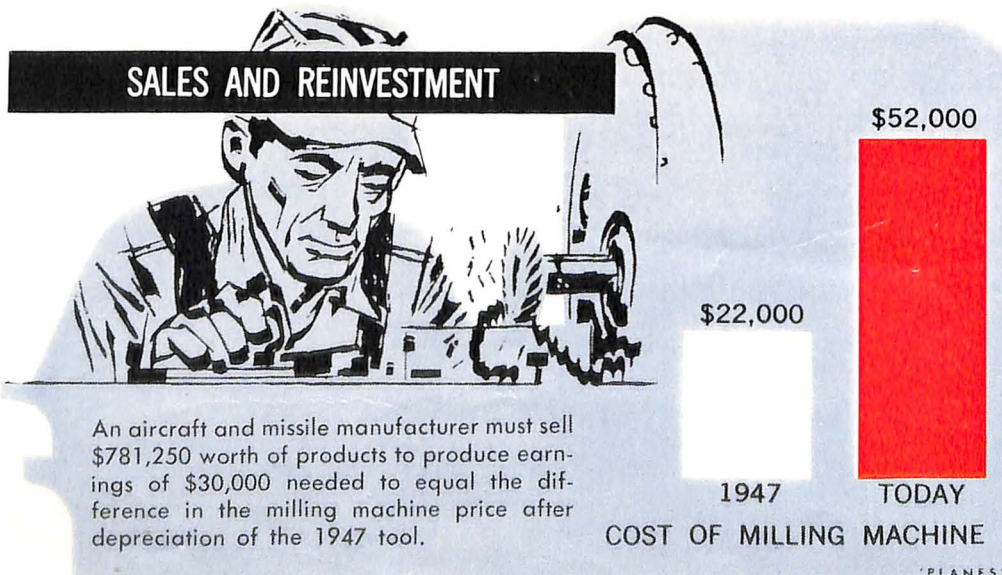
"Renegotiation does no more than eliminate profits that are *clearly excessive and unreasonable on an overall basis*—profits that it would be clearly unconscionable for a contractor to retain from his dealing with his Government in circumstances which preclude proper initial pricing. The *sole objective* as well as the net result of a renegotiation proceeding is to make certain that the Government has paid no more to a contractor, directly or indirectly, than he should in good conscience be entitled to receive in the circumstances—in a word, that from the efforts of the Government to main-



tain the common defense for the common good, he has not accumulated more than a fair return or overall price for what he has done."

Renegotiation, as conceived by the Congress at that time, was to be a watchdog function, guarding against windfalls. Responsible contractors, who fortunately outnumber the windfall seekers by many fold, found no fault with the concept; they neither sought nor expected excess profits.

Since that time, renegotiation has degenerated into something other than the watchdog





function originally envisioned. Despite the large amounts of money being spent on defense today, we are at peace, and normal contracting methods should apply. Instead, defense contractors argue the Renegotiation Act is being applied by one agency of the Government to recapture profits earned in prior years from contracts negotiated with another governmental agency.

Renegotiation has become a source of considerable controversy. Many manufacturers ask its outright elimination; others agree there should be some sort of Government control over "windfall" profits. What they want is a modified law which prevents unreasonable, indiscriminate axing of legitimate earnings, one which insures that the contract provisions of the Department of Defense which encourage efficiency and which reward outstanding contributions to the defense effort are not circumvented by the renegotiation process.

In specific, the criticisms leveled at renegotiation as currently administered are these:

- It is obsolete.
- It hinders cost reduction.
- It impedes technological progress.
- It is used not solely to recapture excess profit, but as a "broadsword" against industry as a whole.
- Its criteria are too vague.

As for the obsolescence factor, remember that renegotiation was first introduced in wartime when defense expenditures represented about 42% of the gross national product. Though high today, they have remained for several years at about 10% of the gross national product.

More importantly, military experience with private contractors has brought about a whole new set of contract types and provisions. Coupled with very effective negotiating techniques and administered by well-qualified Government procurement personnel, they assure the Government a fair price for defense products without eliminating the manufacturer's incentive to reduce costs.

These contractual procedures, which take into consideration a great many detailed technical factors, were evolved through a long period of military-contractor relationships. They correct, for the most part, the deficiencies of wartime procurement and they are generally fair and reasonable to both contracting parties. Renegotiation, on the other hand, remains relatively unchanged from the original 17-year-old law. Because of the overall effectiveness of the present procurement system, renegotiation should be employed only in those exceptional cases where excessive profits do occur. Unfortunately, it does not work that way.

While reduction of defense costs is a prime target of military contracting officers, renegotiation actually works against it.

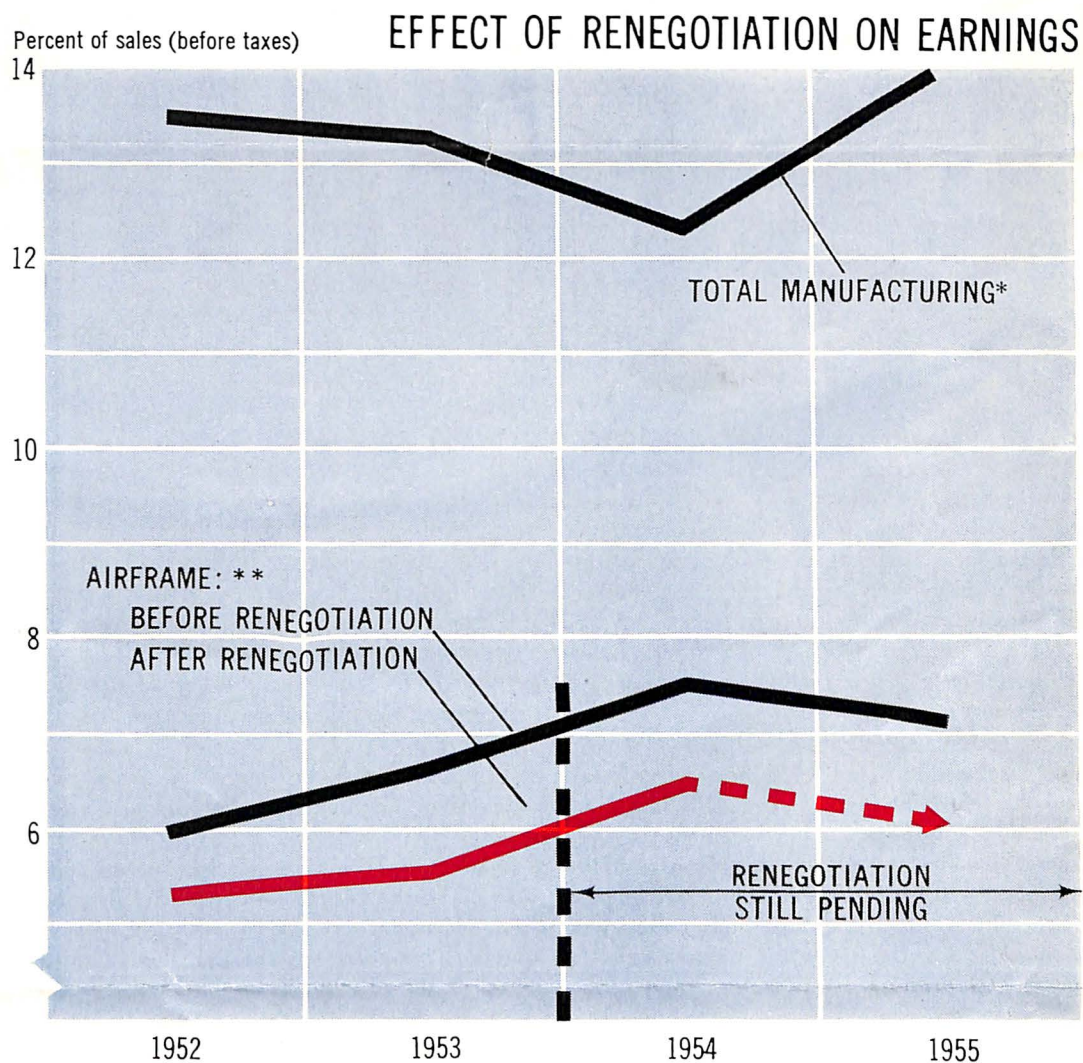
Certain types of contracts provide incentive bonuses to the contractor as a reward for cutting costs. In such cases, both parties benefit—the Government because the bonus paid is a small fraction of the saving. Under such contracts manufacturers have demonstrated extraordinary efficiency in cutting costs. What

has happened all too frequently, however, is that the manufacturer not only loses his incentive reward in the process of renegotiating the contract, he also loses some of his basic earnings because of arbitrary disallowances by a group which was not a party to the original contract, which comes around long after completion of the contract and says in effect that the original agreement was no good.

The aircraft industry has provided some concrete examples. One company earned some \$25,000,000 before taxes in incentive bonuses over a three-year period. When its contracts were renegotiated, it found it had lost all of its incentive earnings — *and more than \$2,000,000 besides.*

hinders incentive in that direction—and the Renegotiation Act unquestionably does—is a hindrance to the defense effort.

The Act also works against technological progress, in that it has brought confiscation of earnings which would have been available for privately-financed research and development and for research and production facilities which reduce the time and cost of bringing new weapons systems to operational status. Defense industry, and particularly the aircraft industry, has plowed back significant portions of its earnings for these purposes. Industry might understandably be reluctant to make additional long-term commitments for such facilities, with the shadow of a vague,



\* Computed by Adjusting First National City Bank of New York After Tax Data to Reflect Assumed Average Tax Rates of 60% in 1952 and 1953, and 52% in 1954 and 1955.

\*\* 12 Airframe Companies Having the Largest Sales in Each Year.

In nine selected cases in the aircraft industry during this three-year period, the aggregate incentive earnings were \$55,000,000. When the renegotiation process was completed, the companies were told not only to return the incentive earnings in renegotiation refunds, but were assessed an additional \$9,000,000.

I need not dwell on the obvious effect such proceedings can have on cost-cutting incentive but I might stress the importance of reducing costs. If we are to maintain an adequate defense without shattering the national economy, we must further reduce costs. Anything which

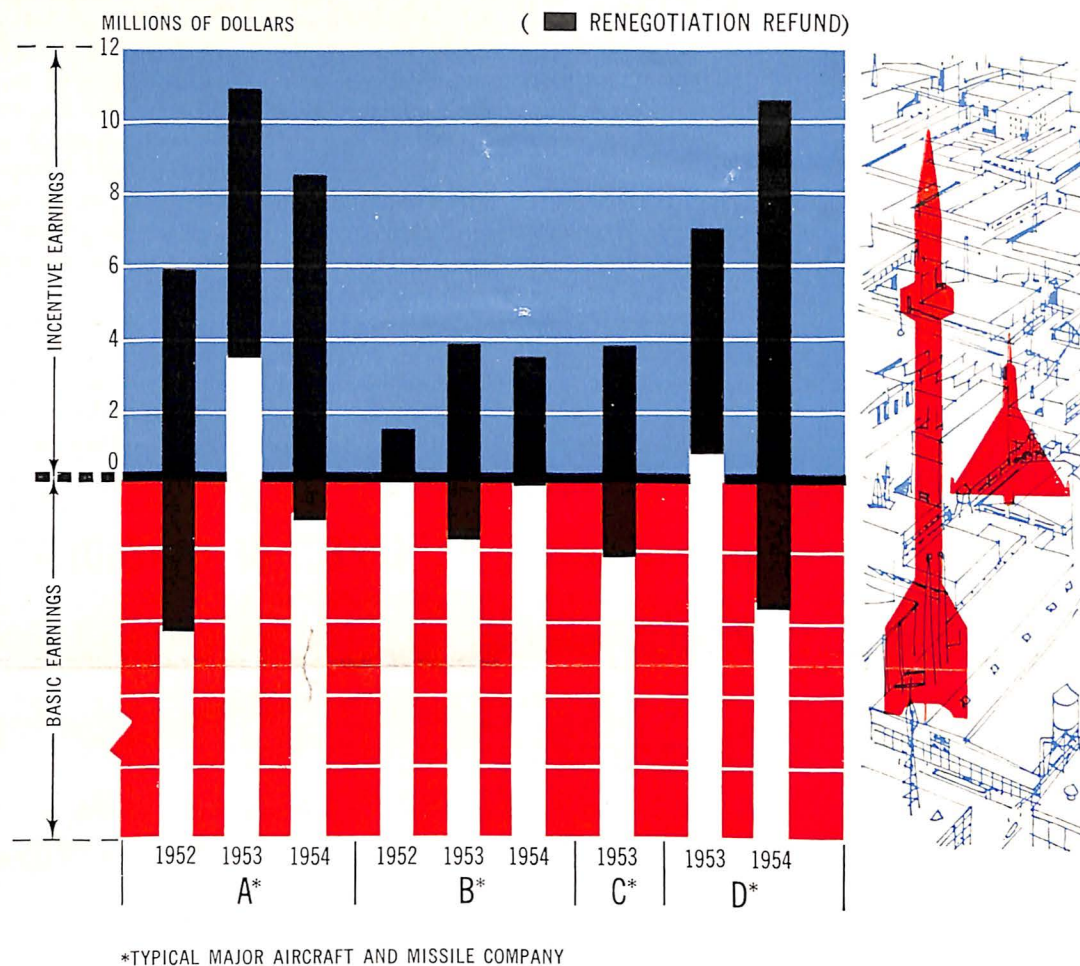
arbitrary renegotiating proceeding operating several years after earnings are made constantly looming over its shoulder.

The airframe manufacturing industry has charged that renegotiation is a "broadsword" attack on its companies. The earnings of this segment of defense industry have traditionally been low. For instance, in the period 1946-57, they averaged 5.2% of sales before taxes, while *all* major U. S. manufacturers averaged 13.1%.

A congressional committee conducted a comprehensive study of the airframe industry's earnings for the period 1952-55 and con-



## ELIMINATION OF INCENTIVE EARNINGS BASED ON EFFICIENCY



cluded that there was no evidence that the profits allowed were excessive.

Nonetheless, the airframe industry appears to be a prime target of the renegotiators. In the period 1951-54, ten member companies of this industry were requested to make renegotiation refunds amounting to \$101,500,000. With renegotiation for 1955 now in process, and the three succeeding years still to come, these companies are justifiably worried. They find it hard to believe that they could *all* be guilty of profiteering every year, particularly when they compare their earnings with other industries. The Renegotiation Board has said, in effect, that airframe industry earnings as a whole are excessive, although the earnings standards were carefully calculated by the Department of Defense and not questioned by Congress.

The final criticism leveled at the Act is that the criteria are too vague. The other criticisms involve the administration of the Act; this one involves a reason for the failures in administration.

The Act contains seven generalized factors to be considered by the Renegotiation Board:

- Efficiency of the contractor
- Reasonableness of costs and profits
- Net worth
- Extent of risk assumed
- Contribution to the defense effort
- Character of the business
- Other factors considered important by the Board.

The Act sets out no further explanation of these factors. Thus, it falls to the judgment of five men, who, unlike the officers who negotiated the original contracts, have little or no detailed, firsthand knowledge of the work performed years before they started their deliberations.

In some cases the Board has reversed decisions of Regional Boards. In one instance, there was a difference of \$10,000,000 in the amount of renegotiation refund requested by the Regional Board and the main Board, although both were applying the same set of facts. This points up the difficulty, if not the impossibility, of determining excessive profits without specific standards, which the Act does not provide.

As a result of the inequities described here, I feel that the Act as presently constituted works against the best interests of the nation's defense and its economy. Accordingly, I am sponsoring bill H.R. 5123 in the House of Representatives, which has four principal objectives:

- It would add to the factors the Board must consider the need for financial stability and incentives to efficiency and economy in defense industry, and the desirability of comparing costs and profits in the defense industry with those of other industries when determining the reasonableness of profits.
- It would tend to preserve the integrity of contracts fairly negotiated with the Government by providing a definition of profits that

are clearly not excessive under all the circumstances.

- It gives the Congress, the public and the company affected information on the reasons for the Board's decisions, eliminating the freedom from public scrutiny the Board enjoys in an age which demands that Government activities be carried on in the light of day.

- It provides for appeals from Tax Court renegotiation decisions to the same extent as in other Tax Court cases.

During the last session of Congress, renegotiation was extended for a six-month period until June 30, 1959. The new bill would extend it, as modified, for an additional two years, for neither I nor legitimate defense contractors question the need for the "watchdog." We just want to insure that it does not bite the innocent.

Recurring threats to world peace will continue to require large defense expenditures for some time. However, I believe that contracting procedures in the Government are now adequate to prevent windfall profits, the original statutory objective. We must not become so zealous in guarding against windfalls that we impose roadblocks to our technological progress. We must recognize that a healthy defense industry is as important a consideration to our continued safety as the military services which use its products. That industry has its full quota of real, technological obstacles; it needs no artificial ones.



# AIA Export Committee Working With Government on Problem

(Continued from Page 1)

facturing industries are well aware of their responsibilities. It is clearly up to them to ingeniously search out and promote markets for the sale of used transports both here and abroad. There is one unquestioned fact that assures a firm foundation for disposing of used transports: Air transportation will continue to grow. This growth, particularly in the air cargo field, should in the near future be able to absorb the most productive and useful of the equipment which will become surplus to the current main line requirements. The outlook for increased utilization of air cargo is optimistic. There have been phenomenal gains made in Central and South America where the air cargo carriers are, in many cases, the only link for commerce between areas. Even in the United States, with a highly developed system of surface transportation, air cargo has demonstrated its increasing shipper acceptance. Since 1949, air freight and express tonnage has increased 410 per cent on scheduled U. S. carriers.

An air transport authority recently stated: "The freight or cargo business is arriving on the horizon of the bright future which was predicted by most of us a decade ago. The great increase will be afforded by the economy of the turbo-prop freighter because cargo can be moved at a considerable profit at 8 to 12 cents per ton mile. This increase will carry with it added business in the more specialized fields and will require a great many piston type air freighters in both the four-engine and two-engine categories.

The Export Committee of the Aircraft Industries Association has been working closely with inter-governmental committees seeking orderly and equitable solutions to these surplus transport aircraft disposal problems. The Air Coordinating Committee has served the invaluable function of providing a central point for discussion of the ideas of both private industry and Federal agencies involved in this matter. The first accomplishment has been the assignment of a Special Assistant to the Administrator of the Business and Defense Services Administration, Department of Commerce, to work on the surplus aircraft problem.

There appears to be general agreement among the various government agencies that the first step in the program should be a major statement of U. S. policy encouraging disposal of used transports. One prime point in the policy statement would support the disposal of the used transports abroad on much the same terms as new transports. The use of U. S.-used equipment will eventually create an expanded market for new U. S. transports.

There is little doubt that a market exists or could be created for the absorption of surplus transport aircraft. The heart of the problem can be summed up in one word: Financing.

The Export-Import Bank has been a major participant in the financing of the sale of numerous new transport aircraft abroad, and appears willing to consider enlarging its lending program to include similar used aircraft. However, the Export-Import Bank loans dollars and generally must be repaid in dollars, and there is a dollar shortage in most of the less-developed countries which make up a substantial part of the anticipated foreign market.

There are other areas where government cooperation will speed the eventual solution. For example, since the start of Marshall Plan aid, the program for development of transportation has been concentrated primarily upon highways, ports and railroads. Air transportation projects should now be included in a much larger scale, in such development plans as Technical Cooperation or Special Assistance Programs. This would permit furnishing of surplus aircraft to under-developed areas of the world to provide the tremendous benefits of air transportation.

The coordinated plan between government and industry should include a careful scheduling of sales of surplus military transport aircraft if such sales would further depress the commercial used plane market. In fact, it is strongly recommended that surplus or excess military transport aircraft be sold with the stipulation that they shall not be used for other than military purposes. At the present time, the U. S. military services estimate they will have 248 twin-engined transports and 2 four-engined transports surplus to their needs through 1961. Conceivably this figure would be considerably increased should world tensions ease to the point where a numerically large scale reserve military airlift fleet no longer had to be maintained in being.

Progress is being made in solidifying the joint industry-government approaches to the business of surplus transports. It remains to translate forthcoming policies into action. The results may serve as an example of the benefits which can be derived through such cooperation in similar problems that may arise.

## Spray Etching Lowers Printed Circuit Costs

Improved quality and lower costs in the manufacture of printed circuit boards have resulted from recent installation of an automatic continuous spray etching machine in an aircraft and missile company.

A printed circuit board is used in lieu of conventional wiring in aircraft components.

With the new etching process, exposed printed circuit boards are loaded into the right side of the machine. A moving worm gear progresses the boards between two banks of 12 spray nozzles, which spray heated etchant over either or both sides of the boards.

## TURBINE TRAVEL

50,000 PASSENGERS

JET

5 MONTHS

PISTON

1 YEAR

A U. S. international air carrier operating three turbojet transports last month flew its 50,000th jet passenger across the Atlantic in its first five months of regular flights. Air transport experts estimate that it would require more than a year for three modern piston-powered transports to handle an equal number of passengers. Speed and passenger capacity of airliners have more than doubled in the past five years.

'PLANES'

## Canopy Ejection Tests on Ground Insure Safety in Supersonic Flight Operations

Canopy ejection tests conducted by an aircraft company are insuring safety of pilot and crew of supersonic jet fighters and bombers.

Purpose of the test is to make certain that the canopy is blown clear of the aircraft in such a fashion as not to endanger a pilot or other crew member who may be attempting to escape from the airplane.

## Ultrasonic Detector Insures Fuel Purity

An ultrasonic method of detecting the most minute contamination in fuels and other flowing fluids has been developed by an aircraft and missile company.

Considered a major scientific breakthrough, the system will automatically detect, count and size particles ranging in diameter from one micron (.00003937 inches) to 25 microns and larger as they might flow from a refueling truck to an airplane or missile, stop the flow of fuel, re-route the contaminated fuel through filters, and automatically resume the flow of pure fuel or other liquids into the vehicle.

The complexities of modern aircraft and missiles demand the most pure fuels and other liquids for both efficient and safe operation. The close tolerances necessary in some of today's components make it possible for minute particles in the fuel, or hydraulic or liquid oxygen systems to cause either malfunction or even complete failure.

The ultrasonic system was originally developed with hydraulic oil and jet fuel as the liquid media, but performs as successfully with other fluids ranging in temperature from minus 298 degrees Fahrenheit (liquid oxygen) to plus 1050 degrees Fahrenheit (molten bismuth).

The system can replace the currently used microscopic analysis method of evaluating hydraulic filter elements, performing an equal or better job in 1/40th of the time.

ion as not to endanger a pilot or other crew member who may be attempting to escape from the airplane.

To make the tests, engineers set up a nose section on a test rig and install instrumentation to gather data on the functioning of everything vital to proper ejection of the canopy.

Count-down begins over a loudspeaker which can be heard throughout the test area—and which warns everyone in the vicinity that the canopy is about to blast off.

The canopy blows off, sails through the air and lands in a rugged net made of interlaced one-inch rope.

As all this goes on, a high speed camera records exactly what happened. Film can race through the camera at speeds up to 140 miles per hour to give an ultra slow motion effect when projected.

Vital part in the canopy ejection process is the actuator-remover located in the cockpit. When the pilot trips the control, the actuator-remover provides the force required to remove the canopy under all conditions and at supersonic speeds.

Operation of the ejection system has been tested in temperatures ranging from minus 65 to plus 160 degrees. The actuator has gone through sand and dust tests at a number of temperatures. It has also been exposed to a terrific salt spray and has even gone through fungus tests.

## High Thrust

In a recent successful flight of a U. S.-built intercontinental ballistic missile, the first stage engine with its two thrust chambers lifted a total weight of 110 tons—the equivalent of 12 city busses.

The thrust of this engine equals the combined horsepower of 15,300 average-size American automobiles.



## New Techniques Aid Metal Strength

A new structural concept has been developed by an aircraft and missile company which provides the high strength-to-weight characteristics and high temperature properties needed for the Mach 3 airplane.

Metals and methods of fabrication adequate for Mach 1 planes cannot withstand air friction temperatures of above 600 degrees Fahrenheit encountered in a 2200 miles per hour flight.

The result of a four-year research program, the concept is essentially the ultimate refinement of standard aircraft structure design (skins attached to stringers). With the new method of fabrication, stringers are replaced by continuous miniature corrugations, which are then attached to foil-gage sheet metal skins. Attachment is made by spotwelding so that the structure is homogeneous.

Spotwelding adds no weight, is aerodynamically clean, can be done with machinery readily available, and may be inspected quickly and thoroughly.

Heat resistant metals, such as stainless steel, which would have been too heavy to employ for the Mach 3 plane using conventional fabrication methods, are highly suitable with the new system.

## Cockpit Illumination Efficiency Increased

Application of electroluminescence in the manufacture of a Navy jet attack plane will result in a high efficiency increase in cockpit instrument illumination.

Electroluminescence was discovered by a French scientist in 1936. It is the charging of panels of glass, ceramic or other material so that a suffusion of light results.

Burning time of some 200 1¼-watt bulbs in cockpits of modern aircraft ranges from 25 to 300 hours. Burning time for electroluminescence is 8,000 hours.

The product developed in the Navy jet attack plane application is neither glass nor ceramic, but a sheet of plastic only 50/1000ths of an inch thick.

Electric companies have been refining the system of electroluminescence through the years, but with the increase in importance of the elements of speed, heat, space and light intensity in modern aircraft, the aircraft and missile industry has been moved to further and faster development.

## No-Slip Storage

An economical storage box for delicate instruments and precision tools has been developed by packaging engineers of an aircraft plant.

The new box combines the no-slip design of a rubber bathroom mat and the amazing compressibility of foam plastic. It eliminates the costly custom "nests" that formerly had to be made for each different tool and instrument shape.



## INCENTIVES AND RESULTS

Incentive-type contracts—a technique where the contractor shares in savings if he reduces cost targets or surpasses delivery schedules or exceeds performance specifications—is one of the most efficient and economical methods of procuring weapon systems. But it is not new. The first military contract awarded to the Wright brothers for an aircraft featured the incentive principle: For every mile an hour exceeding 40 mph the Wrights would be given \$1,000 above the original price. The U. S. received a plane capable of flying an unprecedented 42½ mph, and the Wright brothers received an extra \$2,500.

PLANES

## New 'Aiming' Device Improves Accuracy of Guidance Systems for Missiles

A new device which lines up mechanisms in moving vehicles with a precision never before possible is solving a space age engineering problem.

Developed by an aircraft and missile manufacturer, the device can make the "aiming" of missiles and the guidance of space craft a great

deal more accurate, besides improving other systems and structures which depend on accurate directional heading.

The system uses a new principle of infra-red light beams to line up the guidance systems in missiles with the master compass.

In older alignment systems, a compass and a guidance system would both be mounted on a supposedly rigid steel frame. When the heading of the guidance system hit the "straight line" of the airframe at the same angle as the compass, the guidance system was assumed to be accurately aligned with the compass.

But the apparently rigid steel frame "bent" under the stresses of movement and became a curved line, not a straight one. When this happened the compass and guidance system "lines" were no longer parallel, and the guidance system's direction was not accurate.

The simple beam of infra-red light remains true, unaffected by stress and movement. With this new alignment system, guidance and compass are still mounted on the steel frame, but they don't depend on it for their needed straight "third line." A beam of light, which doesn't bend when the metal does, makes the "third line."

## Machine Speed

One of the most valuable tools to speed design and development of aircraft and missiles is the automatic data processing machine.

An idea of the speed and efficiency of these machines can be obtained from a study which shows that five of the machines can print 142,800 characters a minute or 68,544,000 characters per eight hour shift. It would require 62 typists each capable of 60 words per minute, working every minute of the day, to type an equivalent number of characters.

## Tunnel Tests Aid Air Purification

A happy by-product of wind tunnel testing conducted by an aircraft company is the purification of smog in the air around the West Coast plant.

More than three and one-half million cubic feet of pure air each day is sent into the ozone after "blow down" of supersonic bomber and fighter models in a trisonic wind tunnel.

The pure air, required in testing wind tunnel models of aircraft, is originally taken from the smog above. Following processing which includes cleaning and drying of the air, it is pumped from the compressor building to the wind tunnel storage system which holds 214,000 cubic feet of air.

It takes 30 minutes to pump the storage system full at a pumping rate of 2481 pounds of air per minute. It then takes only 30 seconds of a concentrated blow to release the complete amount.

All air taken in by compressor plant is dried prior to entering the storage system to simulate the air at higher atmospheric altitudes.

Once the storage system is filled, the air awaits the release which will send it streaming through the test section containing various aircraft models, at speeds up to 2500 miles per hour or as low as 250 miles per hour.

## Electronic Instruments Take Guesswork Out of Aircraft Designs

More than 6,000 pounds of instrumentation installed in two developmental models of a jet transport for flight test purposes take all the guesswork out of the aircraft's operational capabilities.

The most modern electronically-controlled equipment records every test factor pertaining to power plant performance and aircraft stability and control.

Data cameras, shooting into two-way mirrors, allowing visual monitoring of gauges; multi-channel temperature recorders; digital counters which measure fuel quantity and rate of consumption within a tenth of a gallon are but part of the instrumentation.

More than 20 transmitters are installed on the wings and tail. About 50,000 feet of wiring connects the 10,000-15,000 electrical points.

While in-flight data is being recorded in the plane itself on film, graphs, or tape, information is being telemetered to the engineering test center. It takes data handling personnel several days to reduce data gathered during a normal two-hour test flight.

On the ground a camera records takeoffs and landings. Rate of acceleration and climb, together with braking, is recorded with a complete image of the plane caught in every 1.7 degree of motion on an 8 x 10-inch glass plate. Digital counters on the camera are caught in the photographs to give exact elapsed time in seconds and micro seconds.

It is a far cry from the days of "knee-pad" recording when pilots jotted down flight test data on notebooks strapped to their knees. Not a pulse beat of the plane is a mystery.