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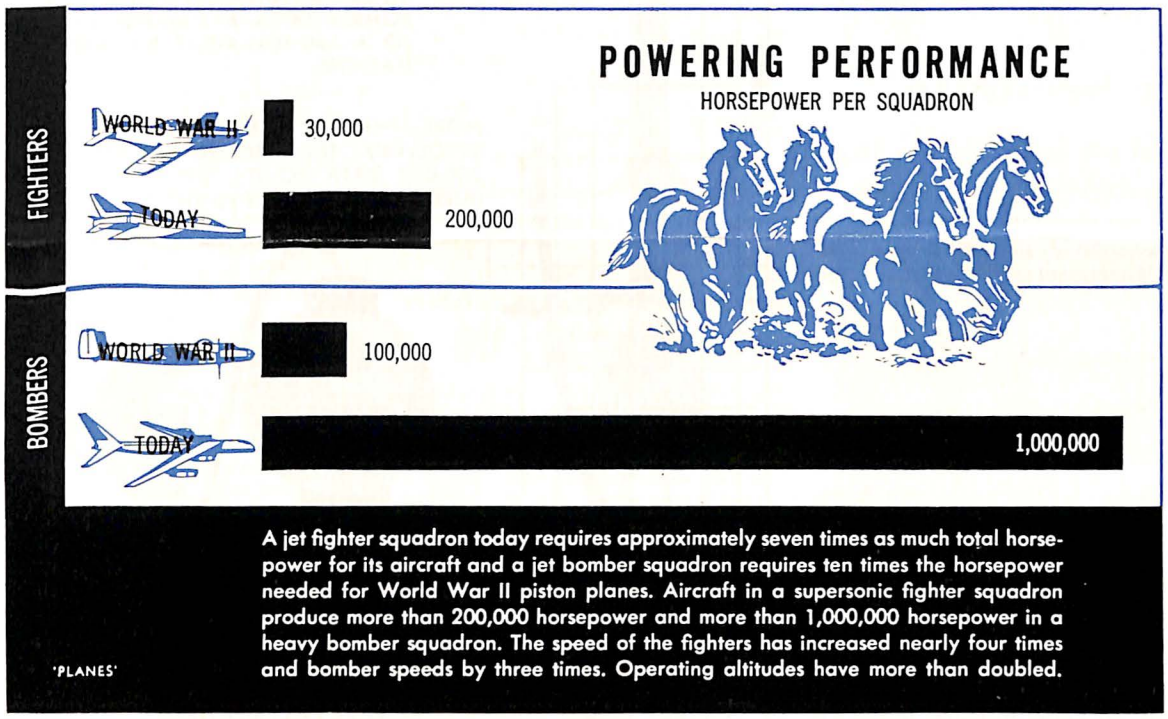
INDUSTRY MEETS SPACE AGE CHALLENGE



A jet fighter squadron today requires approximately seven times as much total horsepower for its aircraft and a jet bomber squadron requires ten times the horsepower needed for World War II piston planes. Aircraft in a supersonic fighter squadron produce more than 200,000 horsepower and more than 1,000,000 horsepower in a heavy bomber squadron. The speed of the fighters has increased nearly four times and bomber speeds by three times. Operating altitudes have more than doubled.

U.S. Civil Aviation Registers Amazing Gains During 20 Years of Civil Aeronautics Act

Civil aviation in the United States obtained its "legal wings" when Congress passed the Civil Aeronautics Act 20 years ago this month.

The Act created the Civil Aeronautics Authority, from which has evolved the present Civil Aeronautics Board and the Civil Aeronautics Administration. The five-man CAB is a quasi-judicial body responsible generally for the economic regulation of air carriers. The Civil Aeronautics Administration is the agency responsible for the interpretation and enforcement of rules. The CAA also operates the Federal Airways System.

At the end of 1957 the combined fleets of the nation's scheduled airlines totaled 1.829 aircraft, a 430 per cent increase over the 1938 fleet of 345 planes. Passenger volume swelled 3,678 per cent during the 20-year period—from 1,300,000 in 1938 to more than 49,000,000 in 1957—putting the air transport industry in first place among common carriers engaged in intercity passenger traffic. And, in assuming this leadership, the airlines achieved an almost unparalleled safety record to two-tenths of a passenger fatality per 1000 million passenger miles. In addition, airline cargo operations increased from 2,550,000 ton miles in 1938 to 714,437,000 ton miles last year, including 160,689 ton miles of U. S. mail.

Orval R. Cook, president, Aircraft Industries Association, stated: "The progress made by the scheduled airline industry in the 20 years since the passage of the Civil Aeronautics Act is the greatest in the history of all forms of transportation.

"A coast-to-coast scheduled flight in 1938 required about 16 hours, carrying 21 passengers. Today the flight is made non-stop in approximately eight hours with a load of 85 passengers. When the new turbojet transports enter service, the flight will be made in 4½ hours, carrying a load of 140 passengers. This astounding progress is due to the succession of superior transport developed and produced by the aircraft industry. The preference for American aircraft is global. About 85 per cent of the aircraft flown by the world's scheduled carriers are U. S. models.

"The next 20 years of commercial air transportation should produce even more dramatic developments. The aggressive research and development programs being pursued by airframe and engine companies will produce revolutionary developments that will carry air transportation to new peaks of service and convenience for the traveling public."

Jet Bomber Cabin Takes 2,000 'Punches' In Vibration Test

The cabin of a supersonic jet bomber now in production is taking more "punches" than most prize fighters absorb in championship bouts.

During one of the most rugged vibration tests ever attempted, the plane's cabin section takes 2,000 "rabbit punches" a second.

Tests are to check compatibility of integrated systems under varying conditions of vibration, and to determine how vibration is transmitted through the cabin structure.

A huge nine-ton vibration exciter delivers the "rabbit punches," which are tiny but powerful strokes to simulate actual in-flight vibration. The big machine delivers up to 2,000 cycles per second. The entire unit is portable.

The bomber cabin literally "dances on air" as it vibrates on unique air bags which completely support it above steel stanchions. The air cushions permit separation of cabin section from all supports and thereby permits greatest possible accuracy in vibration measurement.

Flat rubber bags support the cabin from each of three stanchions. The front bag is inflated to 18 pounds per square inch, and the two rear bags each get nine pounds per square inch.

Forward Planning Paying Off

By Maj. Gen. J. F. Phillips (USAF-Ret.)
Secretary, Guided Missile Committee
Aircraft Industries Association

Detailed planning for the Space Age of aviation was started by the industry responsible for aircraft and missiles about fifteen years ago—forward managerial and technical thinking that is paying big dividends in early availability of space exploration vehicles.

These management changes did not occur overnight nor only after Sputnik I brought space flight to the front pages of the world. As rapid changes were made in various phases of aeronautical technology, particularly over the past two decades, the aircraft and missile industry shifted its managerial organizations to give these new developments appropriately stronger voices. For example, staffs of specialists were augmented to include fields of science which are essential to space flight, including such areas as geophysics, astrophysics, aerophysics and chemistry. The innate flexibility of our companies has enabled management to exploit to the fullest advantage each successive breakthrough. Top planning groups are in constant consultation with scientists to find out which technological gains offer the greatest advantages in the competitive quest for more advanced flight systems.

One typical airframe manufacturer, among others, started serious engineering studies of space flight in 1943 when the potentials of rocket engines pointed unmistakably toward the eventual feasibility of orbital and escape velocities. Intensive satellite studies were continued by this company through 1946 when its scientists and engineers were satisfied that the major problem areas had been defined.

The experience gained through the production of tens of thousands of rocket missiles and advanced manned aircraft with the highly sophisticated fire control and bombing-navigation systems since that time has filled in many of the gaps in propulsion, stability and control, structures, materials and aerodynamics. Studies are continuing in celestial mechanics, interplanetary navigation and guidance techniques, effects of physical and geophysical

(See *TOTAL*, 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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Protecting Our Security

Prompt Congressional action on a vital bill now before the House Armed Services Committee is necessary if this nation's program of advanced weapon systems is to continue unimpeded. This legislation provides for indemnification by the government in connection with unusually hazardous risks arising from Department of Defense weapon programs.

The prime objectives are:

1. Public protection;
2. Contractor protection;
3. Simplify vital defense procurement.

Congress has already provided legislation for financial protection to the public against the hazards of nuclear materials used by licensees and contractors of the Atomic Energy Commission. The bill before the House committee would grant similar protection in Defense Department contracts.

A large number of companies today are engaged as prime and subcontractors and consultants in the development and manufacture of nuclear-armed weapon systems. Many of these systems utilize as fuel, mixtures of liquid oxygen and hydrocarbon fuels. A balanced mixture of these fuels is the explosive equivalent, pound for pound, to TNT.

The higher yield "exotic" fuels also pose additional risks because of their toxic properties.

There is no insurance available from commercial sources to take care of several areas of great risk in missile and other weapon programs. The bill provides for government indemnification up to $500,000,000 in the event a weapon system should malfunction and cause damage.

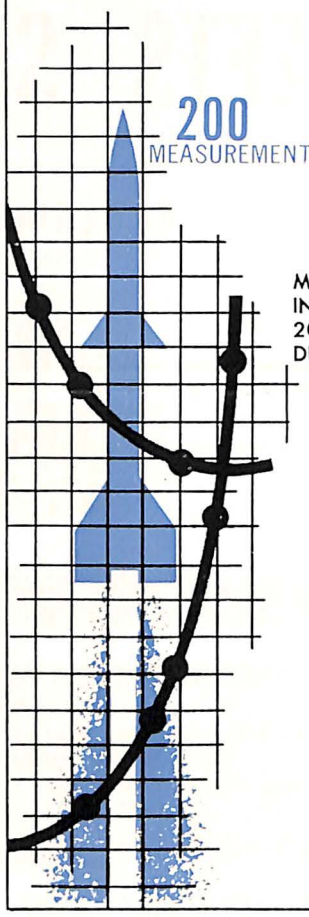
The safety record of the aircraft and missile industry in its development and production programs is superb. Every possible fool-proof and fail-safe device is used to keep opportunities for accidents to an absolute minimum. But any operation involving the human factor is subject to an error in judgment or calculation.

Today the air weapon industry puts its corporate neck on the block every time a weapon system is tested. Claims for damages in a major accident could far exceed the amount of assets of the largest manufacturer in this industry. This would result in the bankruptcy of the company, and still leave unsatisfied claims for damage far in excess of the assets.

In addition, the prime and subcontractors could be held responsible for damages caused by systems that malfunctioned after delivery to using services. Damages are also possible during their operation outside the U. S.

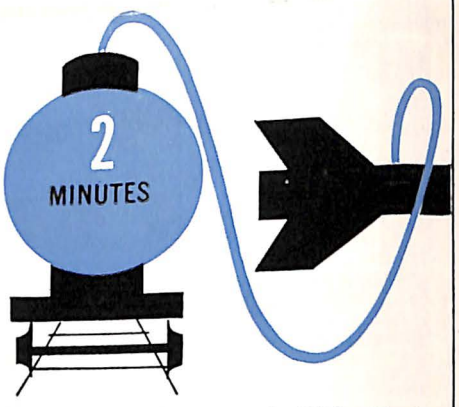
There are no serious objections to the bill; some changes in the language have been proposed to clarify certain points and to make the proposed legislation fully effective. Lack of public knowledge or awareness of the importance of this legislation does not diminish its importance. The principle problem is to obtain early hearings and approval by the House and Senate before the Congress adjourns. We cannot afford to gamble with our security by neglecting speedy action on this legislation.

Plane Views



COOLING SYSTEM ON A SUPERSONIC BOMBER DOES A JOB EQUIVALENT TO A 160-TON-A-DAY ICE MAKING MACHINE.

MORE THAN 200 MEASUREMENTS, INVOLVING THE RECORDING OF 200,000 DATA POINTS, ARE MADE DURING A MISSILE TEST FLIGHT.



A TURBOPUMP FEEDS FUEL TO A ROCKET ENGINE AT A RATE THAT WOULD EMPTY A RAILROAD TANK CAR IN TWO MINUTES.

'PLANES'

'Hi-Fi' System Tests Plane Components

Hi-fi has come to the aircraft industry—not Bach or "rock"—but carrying the sound of mechanical vibrations of a supersonic aircraft.

The equipment, known technically as a "complex motion vibration system," is, in effect, a huge hi-fi set. To test a component for the aircraft, an in-flight recording is made. The recording is played back on the hi-fi set, which excites the "shaker" or speaker with exactly the same motions the plane encounters in the air.

The new equipment insures that components will meet high performance standards. The vibration system converts recorded sound into exact mechanical vibrations.

Incidentally, as most hi-fi addicts know, home sets are rated below 50 watts. The power amplifier on this set is rated at 20,000 watts, and the shaker is rated at 3,500 pounds of force.

"The entire system is very similar to a giant hi-fi set," a test engineer stated. "In hi-fi people want an exact reproduction of the music put into it. This equipment does the same thing, except the output is geared to mechanical vibrations."

AIR QUOTE

". . . the industrial forces of the United States are doing their dead level best to maintain whatever degree of technological superiority now possessed, to catch up in those areas in which we appear to be behind, and to push forward even higher performing air and air/space vehicles.

"In face of the probability that if this country is attacked our production machinery may be severely crippled, industrial readiness has taken on a new perspective. Each finished item coming off the assembly line is theoretically considered the last one available to the operating forces.

"We cannot afford to rely on any degree of post D-Day build-up and accelerated production. Since the general philosophy of 'win or lose with what we have on hand at the outbreak of hostilities' is the only one that can be lived with, it is incumbent on the industrial complex to assure continuous availability of the most effective hardware."—*Lt. Gen. C. S. Irvine, Deputy Chief of Staff, Materiel, Headquarters, USAF.*

Total U. S. Industrial Effort Needed for Economical, Efficient Program

(*Continued from page* 1)

phenomena on space flight mechanics, orbital and trajectory problems, space communications and human factors.

The three U. S. satellites circling the Earth today owe much to the vision of the aircraft industry in starting formal planning for space flight in 1943. This was at a time when aircraft were being produced at top speed for World War II, and even supersonic flight remained only theoretically possible through utilization of the first crude turbojet engine.

The aircraft and missile industry has invested more than $1 billion in research and development programs and facilities since the end of World War II, and has programmed expenditures of another $1 billion by 1961. A large proportion of these funds are being used for missile and space flight research and development and production.

Organization and management philosophy has kept pace with the technical revolution. The approach has been two-fold. First, companies have established offices staffed with top managers and scientists to direct individual company efforts.

Need All U.S. Talents

Second, some of these space projects will require hundreds of millions of dollars, amounts unparalleled in our history of flight development. These infinitely complex efforts will need the talents and resources of nearly every facet of U. S. industry. We will require developments of new fuels, new metals, new tools and hundreds of other new products to support the program of the prime contractors in the aircraft and missile industry. The overall aspects of space flight are so great that aircraft companies have formed "pools" to marshall an unprecedented array of management and scientific talents so that our space programs can move ahead in an expeditious and economical manner.

The organization of one company exemplifies the pattern adopted by several firms. A systems management office has been established to exercise overall management responsibility for space weapon systems.

This includes mission definitions, design, procurement and manufacture, and test and delivery of operationally ready systems with the necessary ground and communications support. The office is fully organized to develop proposals and provide management for all assigned projects employing space age techniques.

The engineering departments in this company are organized to provide efficient design and project management. Specialists in a technical field are grouped together regardless of the project assigned. In this manner technical experts can rapidly exchange ideas so that when one project advances, all advance.

Members of the aircraft industry have combined their specialized ex-facilities to form development teams. Most recently two such teams composed of aircraft manufacturers were made up to develop the Dyna-Soar, a boost-glide vehicle that will utilize both centrifugal force and aerodynamic lift. The aircraft industry, along with the Air Force and the National Advisory Committee for Aeronautics, has been obtaining and assessing knowledge on the boost-glide concept since 1951. And this project will be preceded by another research vehicle, now in an advanced stage of construction by an aircraft company, which is scheduled to carry man to altitudes well in excess of 100 miles.

The aircraft industry complex has provided and will continue to provide the technological leadership, under the guidance of dynamic management, that will keep this nation predominant in the important areas of space flight.

Aviation Education Aid Offered by NAEC

Guidance Aids for a Stronger America, an aviation education project prepared as part of the Illinois Curriculum Program, has been reprinted by the National Aviation Education Council.

The book is the fifth in a series which provide junior and high school teachers aviation education materials for many areas of the school curricula. Previously published booklets are on science, mathematics, English and social studies. All are offered for 75 cents with the exception of the social studies booklet which is $1.00, by NAEC, 1025 Connecticut Ave., N.W., Washington 6, DC.

The aviation book contains a supplementary occupational monograph, "Careers in Aviation" by George D. Changaris, Administrative Assistant, American Personnel and Guidance Association.

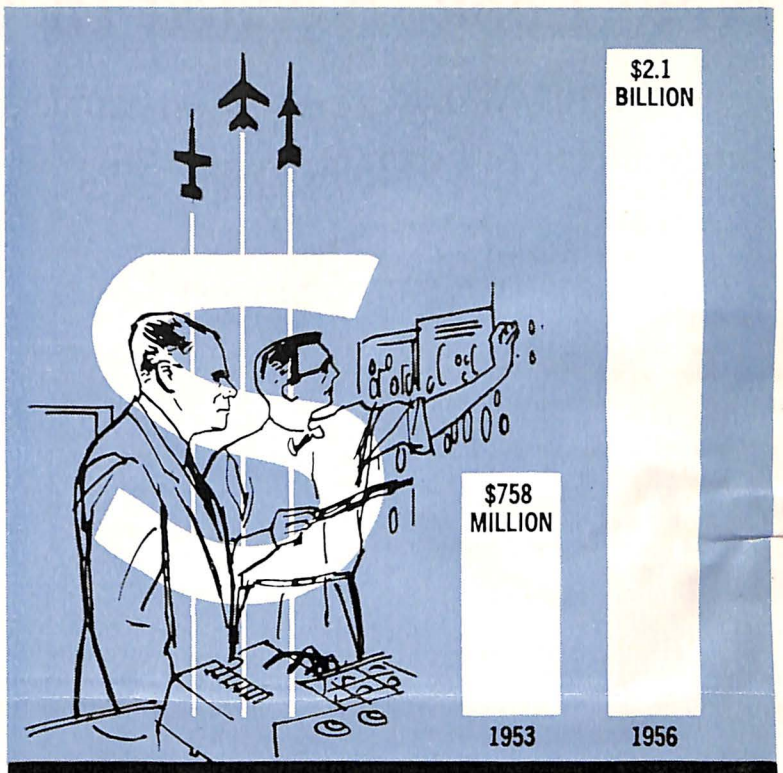
Dr. Frank L. Sievers, Chief, Guidance and Student Personnel Section, U. S. Office of Education, states in a foreword: "This monograph on aviation was written by a professionally prepared guidance specialist who examined the current literature and consulted with experts in the various phases of aviation. It should prove to be a valuable aid in helping individuals learn about and understand this important segment of our nation's working force."

The book also contains an up-to-date list of colleges, universities and technical schools offering aviation courses.

Space Cooling System

A radically new pressurization and cooling system developed by the U. S. aircraft industry will equip the first airplane to penetrate outer space.

The new system uses liquid nitrogen for pressurizing, rather than atmospheric air normally used. (At the extreme altitudes where the space plane will fly, the air lacks sufficient density to be efficiently compressed.)



RESEARCH INVESTMENT SOARS

The unparalleled technical requirements for aircraft, missiles and spacecraft have caused sharp increases in research and development investment. For example, R & D expenditures by both government and industry for these programs increased from $758 million in 1953 to $2.1 billion in 1956, a gain of 177 per cent. This compares with an average increase of 76 per cent for all industries for research and development financed by government and private sources. Research and development expenditures are expected to continue at a high level to meet the demands for the highly sophisticated aeronautic and astronautic systems the aircraft industry is now working on.

Source: National Science Foundation

'PLANES

Dynamite Used To Form Intricate Metal Parts Without Machining Process

A process of forming metal into intricate shapes by use of explosives has been developed by an aircraft and missile company.

The technique can shape materials in a way that cannot be duplicated by machine. The idea is based on knowledge gained from wartime explosions when ship designers studied underwater blasts to learn about damage from mines and torpedoes.

Engineers noted that these violent explosions produced improbable results. Some metals were deformed beyond recognizable elongation, and tough alloys sometimes were shaped around and over much softer metal.

The experimental blasts have been set under water with the metals to be formed placed over a basic work form at the bottom of a tank filled with water. The water gives a concentrated application of the shock waves produced by the explosion. Researchers evaluate the results of each test to determine the reaction of shock waves.

Putting dynamite to work, the test group has duplicated nearly every operation of the drop hammer, press, brake, and stretch press including shrinking, bending, shearing, stretching, piercing or a combination of these operations. The new metal-working method is also capable of embossing, inlaying or joining.

The team has run off hundreds of tests to determine the exact amount of dynamite needed to accomplish a given job on a specific metal.

Engineers believe the explosive forming process will be an important step in the evolution of a production ideal for aircraft and missiles which would be made in "two pieces and glued down the middle."

37-lb. Refrigeration System Developed

The smallest freon-type refrigeration system, weighing only 37 pounds, has been developed by a major component builders for airline galleys.

The unit will provide one-third ton cooling capacity for two, 11-cubic-foot galley refrigerators, and is smaller than the average home refrigerator compressor.

Freezing compartments will hold temperatures of 10 to 20 degrees Fahrenheit, and food compartments will be 32 to 40 degrees. The system overcomes the disadvantages of using dry ice which must be handled very carefully.

'New Look' Needed In CAB Local Airline Policy

New Aircraft Would Strengthen Carriers, But Inadequate Earnings Delay Program

By Stanley Gewirtz
Vice President and Assistant to the President
Air Transport Association of America

If the errors of the past provide the lessons for the future, local service airline libraries are chock-full of helpful primers for the Civil Aeronautics Board.

The financial squeeze, now being experienced by the major trunklines, has been chronic for the local service carriers since their inception at the close of World War II. Both groups of carriers have been frustrated in their prospective development by the inadequacy of their earnings. Unfortunately, both have suffered and continue to suffer from the snail-like pace with which the CAB moves to solve their problems.

Mr. Gewirtz

It is unfortunate and unnecessary that the local service industry is in such weak financial condition. It was created by the CAB after World War II. The Board is responsible, in large part, for the nature of local service route patterns. It has always had the opportunity to maintain this segment of the airline industry in good fiscal health.

Created to extend the advantages of regular air service to the small and intermediate cities, the nation's 13 local service airlines today serve all but four of the 48 states. Some 270 of the 460 cities they serve depend entirely upon local service airlines for their only scheduled passenger, mail and cargo service by air.

They now operate more than 200 transports, flying some 185,000 miles daily over 25,500 miles of routes.

They increased service five-fold in the past decade—to 1,650,000,000 seat-miles offered in 1957. Passenger traffic has increased 750 per cent—to 747,300,000 passenger-miles in 1957. The number of passengers enplaned per station has quadrupled, and load factor has risen from 27.2 per cent to 45.2 per cent for the year 1957.

Service Revenues Down

And despite spiraling costs in all categories, expenses per available seat mile have been kept down to a barely perceptible rise of only two per cent in 10 years. Percentage of public service revenues to total revenues has shrunk from 75 per cent in Fiscal 1948 to 34 per cent today.

Local airlines have been kept on starvation rations. Based upon an arbitrary seven or eight per cent return-on-investment formula, public service revenues have failed to provide a so-called "break-even need"—let alone provide profit. Delays—sometimes as long as four years—in settling rates of public service revenues impose continuing hardships on the local service airlines. And by the end of 1956, about $2.75 million in business expenditures had been retrospectively disallowed in rate proceedings: these expenses, rejected as much as three and four years later, had been incurred by reasonable managements on the basis of facts then before them. Accordingly, major decisions on equipment, operations and maintenance, administration, route development and promotion have been and are made under the constant threat of prospective disallowances for rate purposes so long as the rules of the game are developed after it is over.

It is impossible to reach any other conclusion when the nature of the Board's disallowances is assessed. In twenty mail rate cases, covering past periods with return predicated on a break-even need only, the Board has reduced earnings by 60 per cent through disallowances. Included among the categories of expense thrown out have been the following: excess mileage flown and the expenses incident thereto; costs of maintenance in excess of those based upon a universal rule-of-thumb; allegedly unnecessary advertising expenditures; legal fees above an annual limit of $15,000; executive salaries above a determined figure—most of which are lower than pilot wages.

$1 Million Loss in 1957

The financial results: the local airlines as an industry concluded 1957 with a million-dollar net loss; in the decade that ended with 1957, the industry reported a net loss of $5,624,000; local service carriers have never been able to pay dividends to common stockholders.

Now the local service airlines must re-equip. While public demand is a compelling factor, the urgent need is for operating economies and traffic promotion that modern aircraft would produce.

In view of the industry's negative earnings record, however, the local carriers are encountering extreme difficulty in raising funds for purchasing and introducing new equipment. Substantial earnings are necessary if local airline securities are to qualify as an investment. At least one airline reportedly has been greeted by a cool reception at the banks, asking seven per cent despite recent legislation affording government loan guarantees—legislation that would hardly have been required if the carriers had enjoyed adequate and equitable earnings.

The Civil Aeronautics Board—both members and staff—lately has indicated a wholesome awareness of the probable inequities of regulatory policy and procedures affecting local service airlines.

In a recent opinion, Member Louis Hector said:

"Looking to the future, it is clear, of course, that the Board will become enmeshed in a hopeless mass of detailed decision-making if it tries to pass in each case on all the details of the proper extent, character and quality of service to be offered by the local service carriers. *General rules must be devised.* And in my view, if they are to work properly, they must be based on giving the carrier a real incentive to do a good job.

'Strive for a Formula'

"I would like to see the Board construct a set of mail rate standards and procedures whereby the detailed decisions as to the kind and amount of service offered could in most cases be removed from the area of detailed government regulation and returned to the area of private business decision. The cold winds of the competitive market will in the long run be a far better determinate of the proper quality and quantity of service to be offered the public than detailed decisions of a government agency. In my view, we should strive for a formula whereby local service managements may judge for themselves, within the simple, clear standards of profit and loss, whether to expand service or improve its quality."

In a major address, the Board's Chairman James Durfee stated:

"What we can do—and what we *will* do—is to improve the regulatory framework in which it will be easier for (local carriers) to do (their) job. Experience is teaching us that some of the basic regulatory concepts require improvement. First and foremost, the Board has become increasingly convinced that our present rate-making methods cannot achieve both financial stability for the carriers and subsidy control for the government."

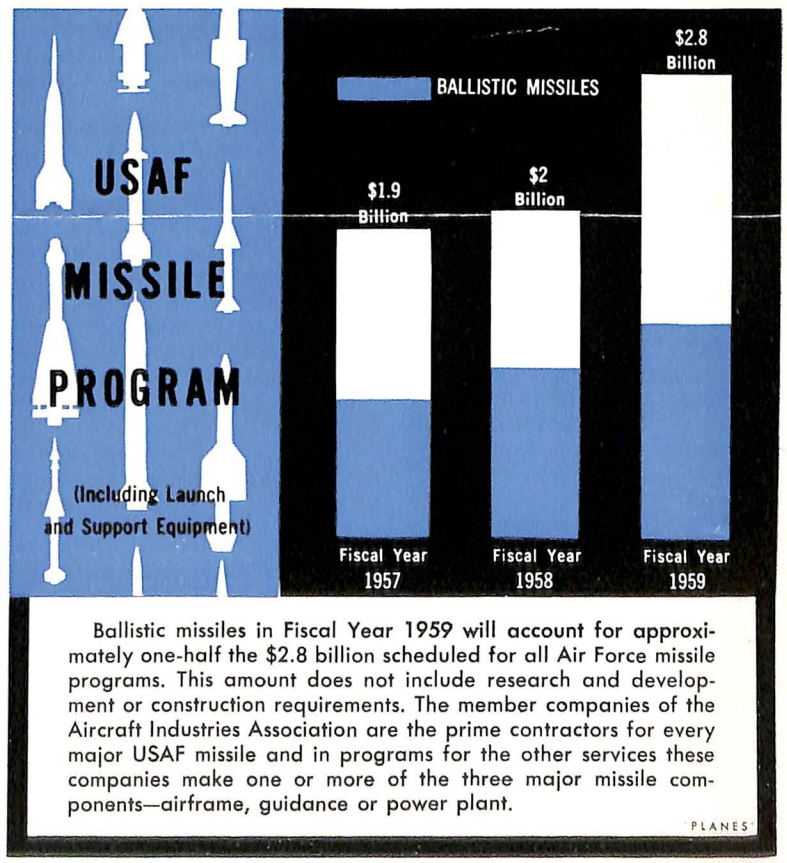
Something More Needed

The Board has an opportunity to act under its very broad powers despite the pendency of certain proceedings affecting local service earnings. This power of the Board's must be utilized affirmatively.

Although it has been and will continue to be the tendency of regulatory agencies to state a standard of earnings as a mathematical computation, something more is required. The more that is required is an understanding of what it takes to provide for profitable operations sufficient to attract capital, compensate existing stockholders, induce others to invest, maintain local service carriers' credit and enable them to raise funds on favorable terms in order to carry out their air transport responsibilities.

In order to provide the answer to the local service problems, a rate of return must be developed which would *actually*, not theoretically, provide for adequate earnings. Any percentage figure adopted, however, is worthless unless the CAB is willing to permit management to make reasonable mistakes. So long as government usurps the prerogatives of management, there will be little incentive to develop a local service industry in the public interest.

The Board has expressed the willingness to move forward. It should do so—and very quickly—before the local service industry is smothered by delay and indecision.



Ballistic missiles in Fiscal Year 1959 will account for approximately one-half the $2.8 billion scheduled for all Air Force missile programs. This amount does not include research and development or construction requirements. The member companies of the Aircraft Industries Association are the prime contractors for every major USAF missile and in programs for the other services these companies make one or more of the three major missile components—airframe, guidance or power plant.

PLANES