

AIR PASSENGER TRAFFIC REACHES NEW HIGH

1,900 Executives Serve AIA

Today there are more than 1,900 top aerospace industry executives, in 42 highly specialized areas, who serve on councils and committees of the Aerospace Industries Association, devoting thousands of man-hours to improve the quality of the U. S. aircraft, missiles and spacecraft, their propulsion systems, accessories and equipment.

The vanguard of this array of scientific, engineering and production talent consists of forty presidents, or chief executive officers, appointed from among the 119 member companies of the Aerospace Industries Association. These men spearhead cooperative, industry-wide efforts in investigating, studying and solving mutual research, engineering and production problems. Their primary concern is increasing manufacturing efficiency—eliminating costly duplication of time and experience in weapons system development, thus improving the quality of aircraft and missiles at less cost to the taxpayer.

Requirement Forecast

The Technical Service of the AIA is comprised of eight main committees composed of engineering executives who deal with industry technical policy on aircraft, spacecraft, missiles, propulsion and equipment engineering problems. Nineteen subordinate working committees undertake specific projects in these fields such as:

The forecast of technical requirements for materials, systems and manufacturing methods which must be met in and during the next ten years. A similar forecast made last year was a primary reference used by the Defense Department in the establishment of a \$20 million materials research program.

The Manufacturing Equipment Committee is conducting an industry-wide program to refine a computer programming system of automatically positioned machine tools to insure the highest application of a \$30 million investment of numerically controlled machine tools.

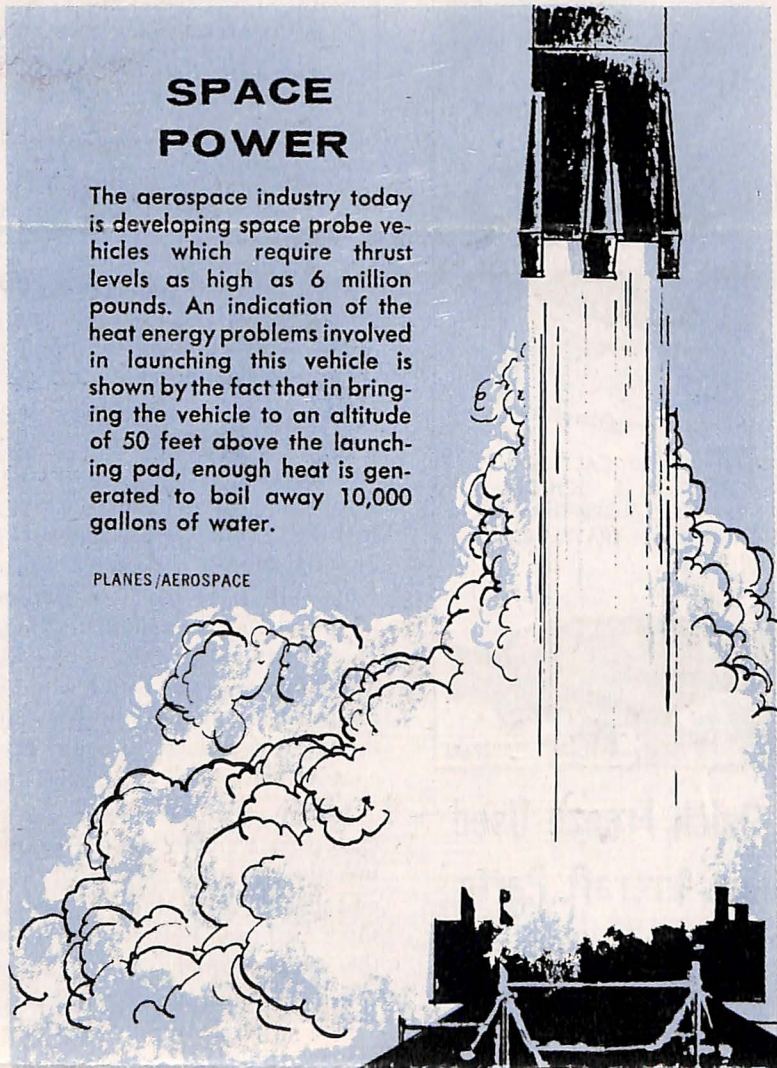
Government Liaison

Because more than \$1.5 billion is spent annually in the preparation of engineering drawings required by Government contracts, a committee of the AIA maintains a close liaison (See *WEAPON*, Page 8)

SPACE POWER

The aerospace industry today is developing space probe vehicles which require thrust levels as high as 6 million pounds. An indication of the heat energy problems involved in launching this vehicle is shown by the fact that in bringing the vehicle to an altitude of 50 feet above the launching pad, enough heat is generated to boil away 10,000 gallons of water.

PLANES/AEROSPACE



New Techniques Speed Jet Engine Changes

Important steps have been taken by two aerospace companies, to insure that engines of a jet transport can be quickly serviced or changed.

Purpose was to eliminate economic bugaboo of lost time of modern airline operations, much of which is due to engine repair and maintenance.

First, company engineers put quick-opening access doors around the engines; second, they set up quick-disconnects on the engines so that they could be removed from attaching points easily; and third, they provided engine build-up kits which will enable using airlines to build up engines to a point where a complete engine change can be made in a matter of minutes. In fact, an engine substitution can be made on the plane in little more

than a half-hour, compared with the three to six hours required for a piston engine.

These engine quick change kits contain all the parts necessary to turn a bare-bones jet engine into a full-rigged power plant. Each kit contains more than 500 detail parts and all accessories—fuel pump, generator, oil sumps, etc. The complete nose cowl is a separate component shipped in a separate crate. The small parts—clips, braces, angles, fuel, oil and air lines—are sealed in polyethylene bags and stapled to 4-foot square painted plywood boards. Each piece is fastened to the board in the exact sequence in which it is to be placed on the engine. This packaging system is an additional safety factor, as well as a time and money saver.

Turbine Airliners Spur Increase

Spurred by the new turbine-powered transports now in service, the U. S. scheduled airline industry during the first six months of 1959 set an all-time record in passengers carried.

Air transport experts predict the next six months will see even greater gains in air travel.

Here is the 6-month record of the domestic scheduled carriers:

- 14 billion revenue passenger miles flown.
- 22 billion seat miles available.

These basic statistics show that passenger traffic increased 11 per cent compared with the first six months of 1958 and 12 per cent compared with the same period in 1957. This record was achieved despite the fact that strikes shut down service by two major carriers in the early part of this year.

Jet Load Factor

The turbojet transports attained an unprecedented load factor of 90 per cent. The load factor, a sure barometer of public acceptance, is the ratio between seats available and seats filled. During the same period the load factor for piston-powered transports also was up, averaging about 60 per cent.

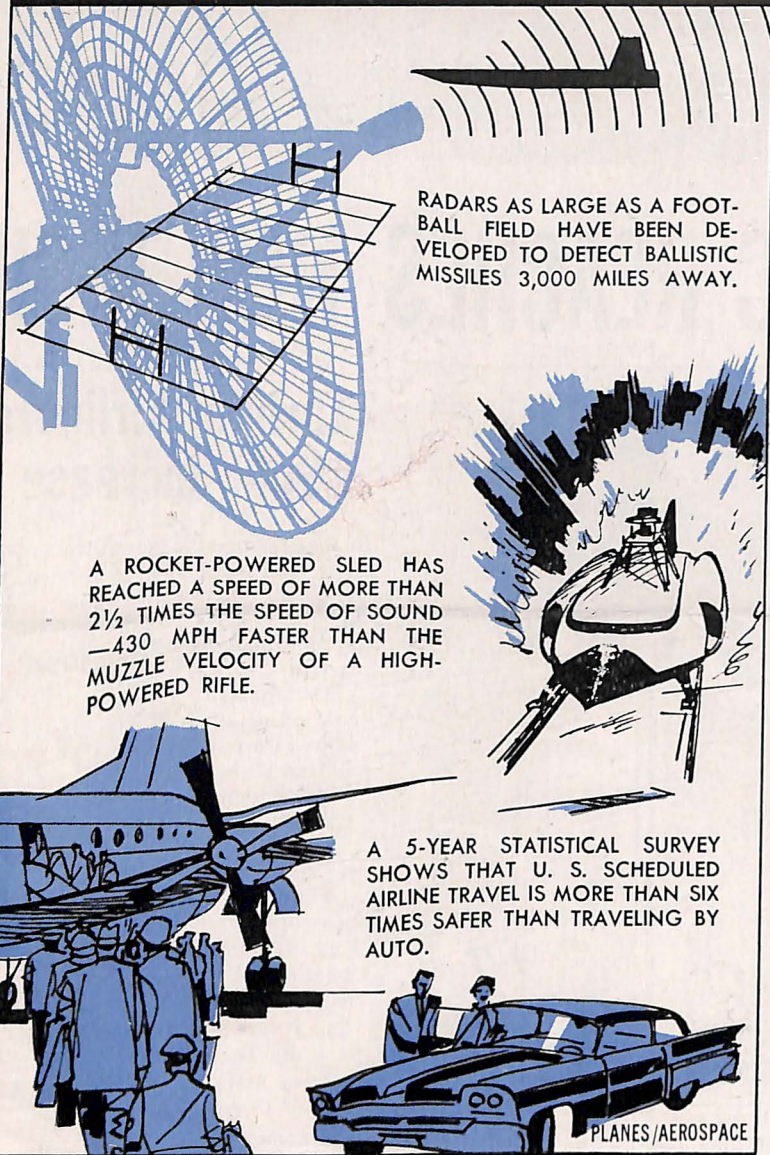
An air transport executive said the jet transports have been the prime stimulus of a new era in air travel. "There is no question that the availability of jet travel is largely responsible for this striking boom," he said. "It appears we are beginning to tap a new travel market of passengers who have never used air travel previously. The attraction of new air passengers is due to more realistic factors than simply public curiosity about jet flying. The bedrock reason is simply the service offered—the availability of a method of travel that can carry a passenger across the United States, a distance of 2,500 miles, in about 4 hours." This is half the time required by a piston airliner, and 16 times faster than the best rail service.

Deliveries Stepped Up

The prediction of further gains in air travel is based on the fact that more turbine-powered aircraft will be delivered in the last half of 1959. The first four-engine turbojet transport was delivered to a domestic car-

(See *VAST*, Page 7)

Plane Views



RADARS AS LARGE AS A FOOTBALL FIELD HAVE BEEN DEVELOPED TO DETECT BALLISTIC MISSILES 3,000 MILES AWAY.

A ROCKET-POWERED SLED HAS REACHED A SPEED OF MORE THAN $2\frac{1}{2}$ TIMES THE SPEED OF SOUND—430 MPH FASTER THAN THE MUZZLE VELOCITY OF A HIGH-POWERED RIFLE.

A 5-YEAR STATISTICAL SURVEY SHOWS THAT U. S. SCHEDULED AIRLINE TRAVEL IS MORE THAN SIX TIMES SAFER THAN TRAVELING BY AUTO.

PLANES/AEROSPACE

Aerospace Quote

"The major military threat which faces our nation today lies in Soviet aerospace power—even though, at the moment, this power is expressed in terms of aircraft and ballistic missiles. The primary military deterrent which has contained this threat and which has precluded it from developing into catastrophic reality, is United States aerospace power. This has been true for the past ten years with our conventional and early jet fighters and bombers. I am convinced that it will continue to be true as we operate with improved jet aircraft, missiles and eventually spacecraft and satellites.

"The decisive weapons of the future will be aerospace weapons. That nation—or group of nations—which maintains predominance in this area—not only in its military forces, but also in its laboratories, in its industries and in its technology—will possess the means for survival. . . . There is, at this point in time, little, if anything, in the area of basic space research which may not have some degree of military application."—Gen. Thomas D. White, Chief of Staff, USAF, Feb. 3, 1959.

Quick Freeze Used on Aircraft Parts

Improved protection against warping of airliner parts is being achieved with a new large quick-freezer which can produce a temperature of minus 130 degrees Fahrenheit.

Developed by an aircraft company to stabilize steel anti-icing ducts in a turboprop transport against warping or distortion, the 337-cubic-foot freezer is believed to be the largest minus-100-degrees F. box ever built. It is 15 feet long, 5 feet wide and $4\frac{1}{2}$ feet deep.

The new warp-proof process requires heat treatment, quick drench, return to room temperature, then the super-cold bath. The air ducts are submersed in methylene chloride, and in two minutes undergo a 200-degree temperature change—from plus 90 degrees to minus 110.

Previously the parts were sandwiched between layers of dry ice inside a plain, insulated box. Loading time was one hour and minimum temperature was minus 100 degrees.

Now it takes less than two minutes to load, and the lower temperature provides improved anti-warp protection.

Savings in labor time and dry ice will pay for the \$23,360 box in five months.

PLANES-AEROSPACE

Planes-Aerospace is an official publication of the Aerospace 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-Aerospace* is to:

Foster public understanding of the role of the aerospace 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.

Publication Office: 610 Shoreham Building, Washington 5, D. C.

New York Office: 150 East 42nd Street, New York 17, New York.

Los Angeles Office: 7660 Beverly Boulevard, Los Angeles 36, California.

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—MATS OF CHARTS—PRODUCED IN UNITS OF STANDARD NEWS-

PAPER COLUMN WIDTHS—ARE AVAILABLE FREE UPON REQUEST

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Valuable Studies

Congressional committees will perform a valuable and constructive service in making "full and complete" studies of various Defense Department procurement techniques, and the scope, objectives and procedures in administration of the Renegotiation Act.

The Aerospace Industries Association wholeheartedly approves the purposes of these studies since both procurement and renegotiation have been subjected to substantial misinterpretation and misinformation. Questions involving these highly complex problems cannot be resolved in brief debate. Only impartial and detailed studies can develop the essential facts.

Recently there has been a crescendo of criticism directed at procurement techniques used by the Department of Defense. For example, the incentive-type contract, under which a contractor shares in savings he is able to make below a target price, has been termed as wasteful and working against the best interests of the Government. However, the military services, in many procurement actions, praise the incentive contract as one of their most useful and effective procurement tools.

In any event, contractors do not determine the type of contracts its customers want to use. This is the buyer's prerogative. The buyer uses the type of contract that best meets his requirements whether it be cost-plus-fixed-fee, incentive-type, cost reimbursement or variations of these methods. But one fact remains: There is no one type of contract that will adequately cover the myriad defense procurement actions that range from shoes to orbital bombers.

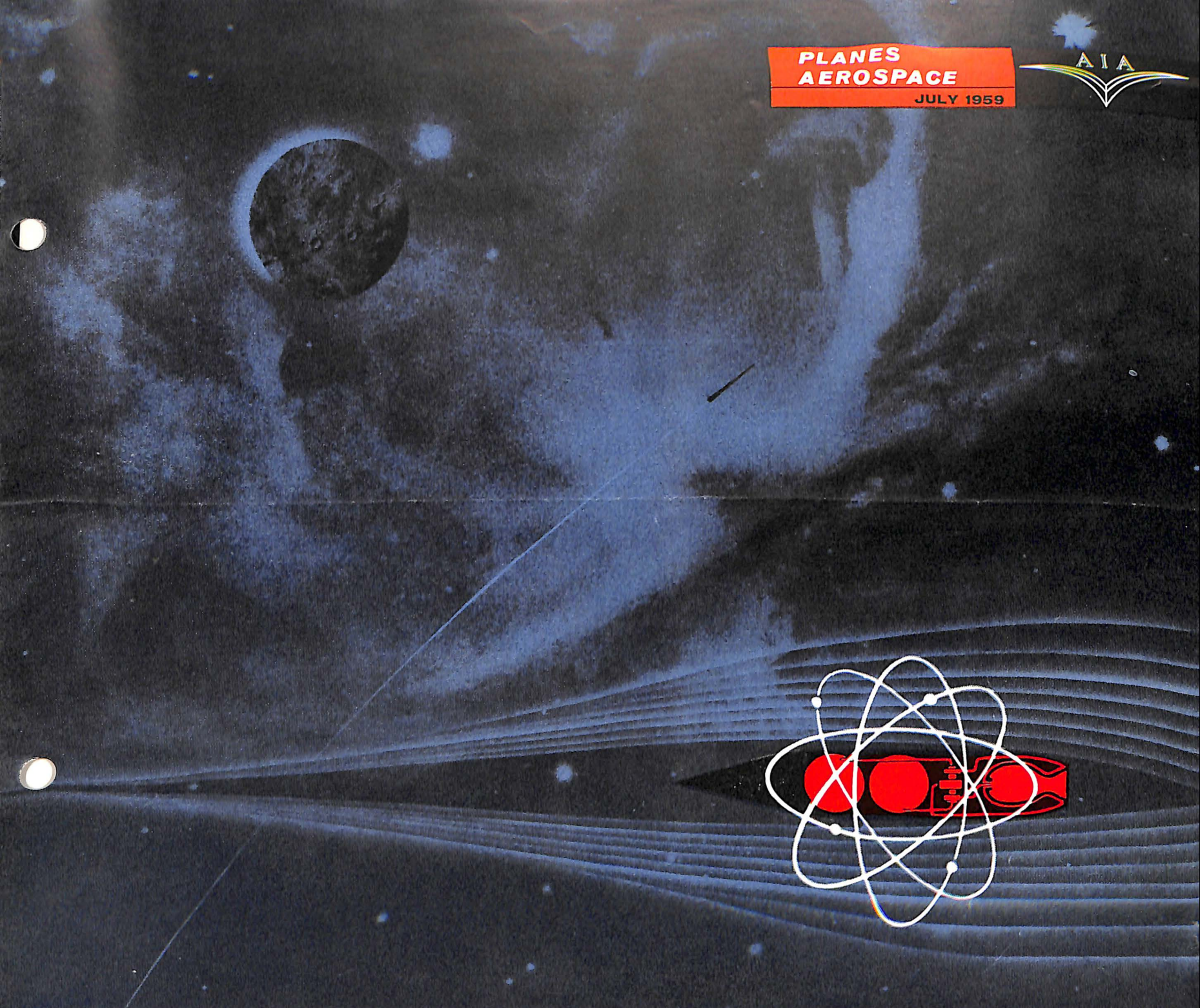
The General Accounting Office has maintained for many years permanent staffs at the plants of large defense contractors to review and audit all aspects of Government contracts. This extensive experience acquired by GAO should be utilized by the subcommittees of the House and Senate Committees in evolving recommendations.

Certainly the question of adequacy or inadequacy of contracting methods requires an answer. The Defense Department should be furnished new guidelines, if necessary, for future procurement policies or their present techniques deserve congressional endorsement.

Information acquired in the procurement study, which is due to be completed by September 30, 1960, will be made available to the Joint Committee on Internal Revenue Taxation in its study of renegotiation practices. This is most important since it will provide the necessary procurement background for the renegotiation study which will be completed March 31, 1961.

Originally, the Renegotiation Act was designed to be an integral part of procurement. But during the past 17 years renegotiation has drifted farther and farther away from procurement in both philosophy and administration. In fact, the drift has been so extensive that today renegotiation administration is, in many cases, in direct conflict with procurement policies of the Department of Defense.

Resolute studies by these committees will do much to clarify the murky and confusing relationship between two branches of the Government charged with responsibilities that affect every taxpayer.



THE NEXT TEN YEARS— AEROSPACE FORECAST

BY SAM D. DANIELS

Director of Technical Service

SAM D. DANIELS is the Director of Technical Service for the Aerospace Industries Association. This Service represents mutual interests of AIA member companies in various areas of engineering and manufacturing. Mr. Daniels was graduated from Purdue University in 1937 with



a degree in mechanical engineering. During World War II he served with the Aeronautical Board in Washington and was discharged as a lieutenant colonel. He later attended Harvard University where he received a master's degree in business administration.

THE fantastic achievements in flight research over the last few years have whetted the public appetite for more fantasy. Earth satellites, the first of which went into orbit less than two years ago, are now regarded as commonplace. The interested bystander is impatient for more dramatic news—probes to the planets, or word that man himself has entered space.

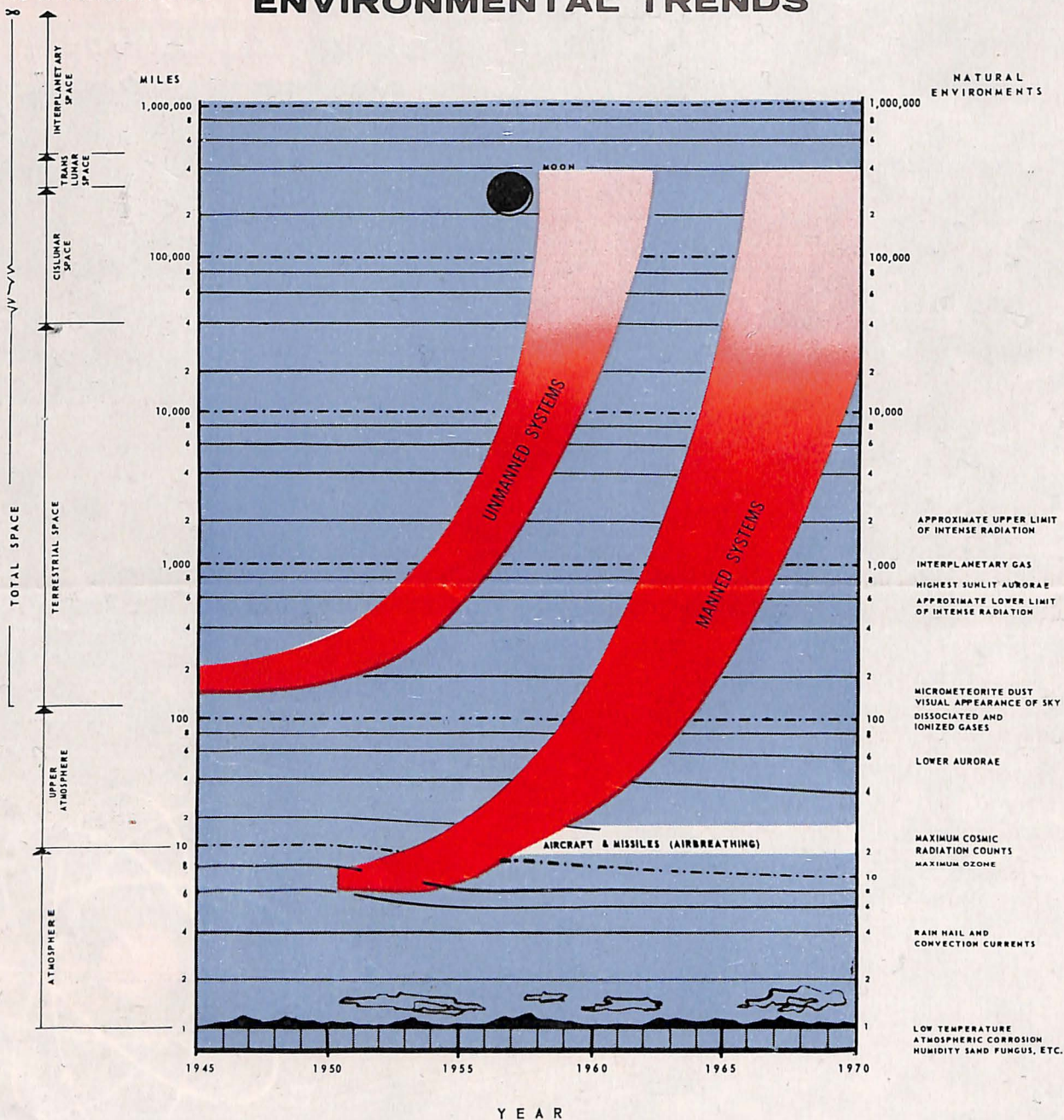
He no longer doubts that such feats can be accomplished. The marvels of recent aerospace history have instilled in him a sublime confidence in the abilities of the scientific community. It is a confidence entirely justified, but one which should be tempered with knowledge of the problems our scientists face.

When the layman is told that it will take five years to do this and 10 years to do that, the question most frequently asked is *why* will it take so long?

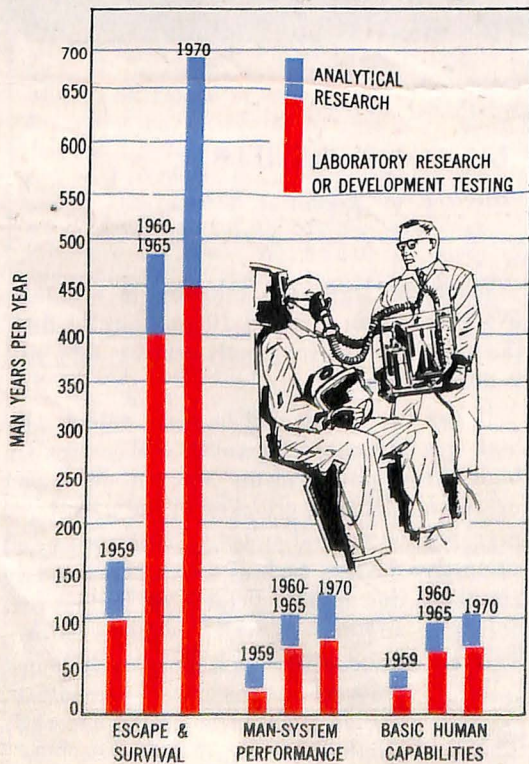
It has been explained to some extent why high performance structures and extremely high thrust power plants are not developed overnight. Often overlooked in the *why*, however, are the myriad systems, sub-systems and protective devices, each of which is constantly changing due to the dictates of higher performance and each of which requires its own separate period of research and development.

In a report of its technical committees, Aerospace Industries Association recently shed some light on "why it takes so long."

ENVIRONMENTAL TRENDS



HUMAN SYSTEMS



The report is the Sixth Annual Forecast of Trends and Requirements in the aerospace complex, intended for use by the Department of Defense and other Government agencies and industrial groups serving the aerospace industry.

This report, compiled by some 200 engineering and production experts, analyzes requirements of the next 10 years if the United States is to hold its position in the international race for aeronautic and astronautic supremacy. It is divided into two sections—engineering trends and requirements, and manufacturing trends and requirements. The report is, on the one hand, a series of predictions of things to come in the next decade of flight, and on the other a compendium of the problems to be surmounted if these things are to come about. It was compiled jointly by the members of AIA's Research and Testing, Manufacturing Equipment, Tooling, and Test Committees.

To understand the content of the report, it is best to consider first what United States aerospace scientists and engineers plan to accomplish within the coming decade.

In space exploration, it is planned to send unmanned probes to some of the planets within our solar system.

It is also planned to send man himself into space, at first into the "threshold" area with aerodynamic vehicles, later into orbit in nearby terrestrial space, and eventually, within the decade, to the vicinity of the moon.

During the same period, there will be continuing research on aircraft which fly within the atmosphere. Today, while military aircraft capable of speeds three times that of sound are in development status, designers are already researching faster atmospheric vehicles.

And while the first American passenger-carrying jet transports are entering service, aircraft engineers are looking beyond to the supersonic airliner.

In each of these areas, performance increases significantly beyond the current advanced limits will be required, and with each increment of performance increase comes a new set of problems. The AIA forecast outlines the problems and the trends toward their solutions, not only in the major areas such as

propulsion and structures, but across the board into such detailed areas as lubrication of gyro bearings under extreme temperature conditions.

Temperature is a factor which influences a wide area in the development and construction of the next generation of flying vehicles, whether they are designed for atmospheric or extra-terrestrial flight.

Consider, for instance, a vehicle designed to enter space and return to Earth. In space, it will be subjected to extremely low temperatures. As it returns to the atmosphere at high speed, it will encounter friction heating, caused by a speeding up of the air molecules over the surface of the vehicle. The same effect can be produced by rubbing a hand rapidly over a table top, except that the friction effect on a vehicle striking a progressively more dense atmosphere at very high speeds is magnified many thousands of times. The longer the friction is sustained, the higher the temperature.

For this reason, the AIA forecast divides its predictions of temperatures to be encountered over the next 10 years into two categories: those induced under "short time exposure" and those which will be experienced by continuous flight vehicles, or aircraft which must fly long periods within the atmosphere.

The forecast predicts that, by 1970, re-entry vehicles—gliders, missiles and returnable satellites—will encounter temperatures as high as 10,000 degrees Fahrenheit, a temperature at which a structure made of metals such as those in modern aircraft would completely disintegrate from heat friction. Currently, friction heating on missiles re-entering the atmosphere runs about 2,500 degrees Fahrenheit.

Similarly, today's atmospheric aircraft encounter temperatures ranging from 500 to 800 degrees Fahrenheit. The type of continuous flight aircraft projected for the next 10 years will build up friction heating to as much as 2,500 degrees.

Obviously, such temperatures demand considerable research into the types of materials to be used for structures. The annual forecast predicts increased use of alloy steels, stainless steels and "super-alloys," which can maintain structural integrity in heat of more than 2,000 degrees.

Because of this limitation, the forecast predicts that the speeds of continuous flight atmospheric vehicles, such as military aircraft, will level off during the next decade at Mach 4, four times the speed of sound or roughly 2,500 to 2,700 miles per hour. This is about twice the speed attainable with current advanced operational aircraft.

For resistance to higher temperatures, such as those to be encountered by space vehicles on re-entry, the forecast indicates that ceramics and cermets (metal-ceramic combinations) hold promise, but again there is a need for more research.

Temperature, of course, does not affect only the external structure of the flying vehicle. It has its impact on all components—hydraulic systems, electrical systems, pneumatic systems, cooling systems, delicate guidance systems. In this latter area, the forecast predicts increased use of inertial guidance sys-

tems and a proportionate decrease in non-inertial systems, which brings a corollary problem: the need for development of new methods of lubricating the bearings in the gyros and accelerometers which are the prime components of the inertial guidance system.

Even the portions of the vehicle which must be transparent—cockpit canopies in atmospheric craft or portholes in the space vehicle—present a problem. At the moderate temperatures encountered in today's aircraft, ordinary glass is no good; instead, such materials as laminated glass or laminated plastic are used.

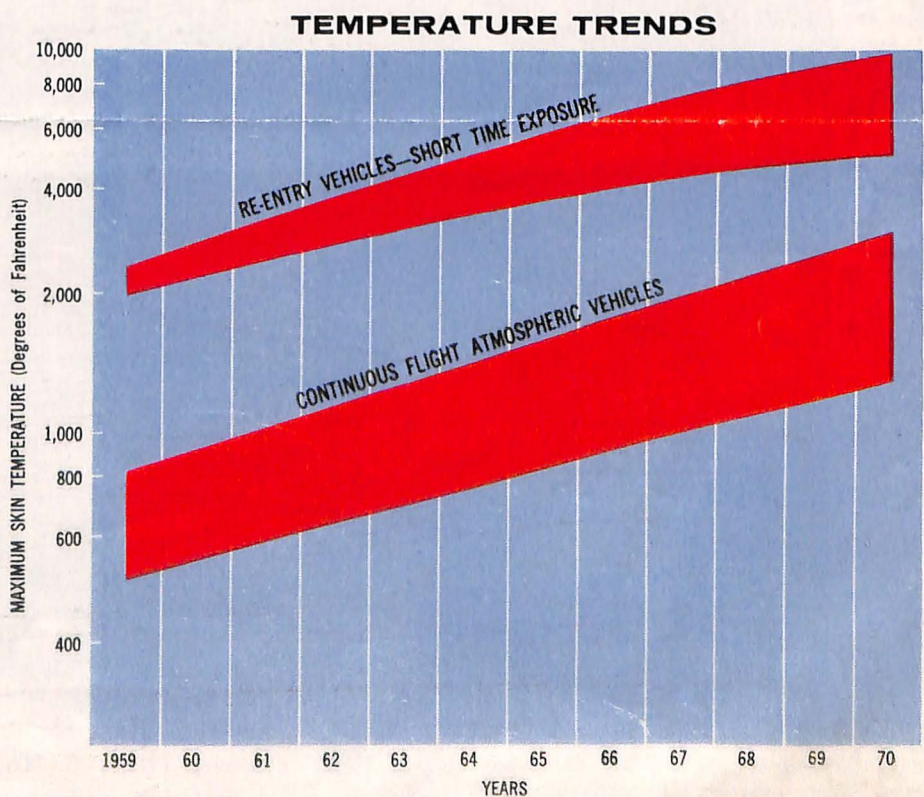
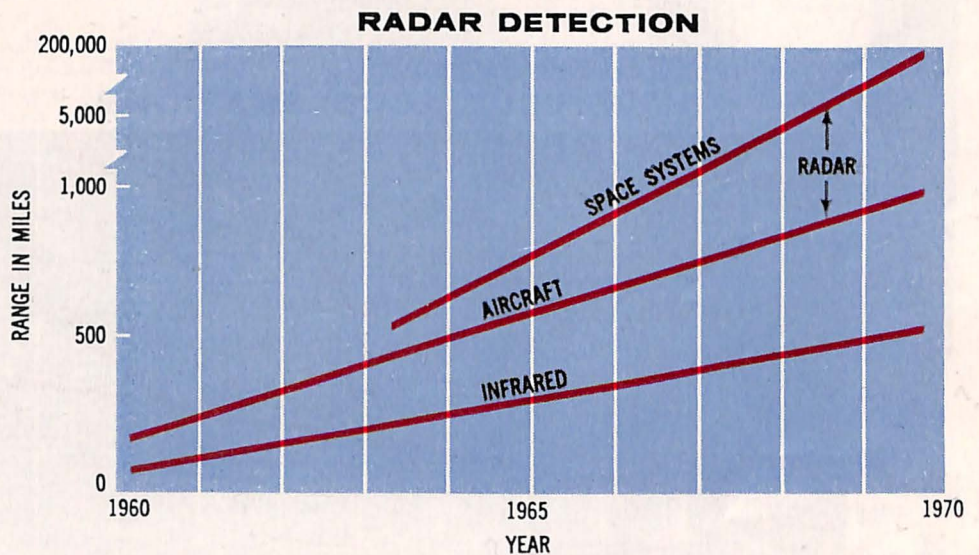
To provide protection against the predictable temperatures, completely new types of transparent materials will have to be developed. The forecast indicates that, in the 1965-1970 period, materials like quartz and synthetic corundum, with high degrees of temperature resistance, will come into use. The possible use of corundum provides interesting food for thought. Corundum is an extremely hard, crystalline mineral used for gem stones; a ruby is red corundum, a sapphire blue corundum and the oriental topaz a yellow corun-

dum. Synthetic corundum, made in an electric furnace and used as an abrasive, is purer, more uniform and harder than natural corundum. Thus, within the decade, high performance aircraft may have "windows" of gem consistency. The report indicates that improved compounds of inorganic glass may be developed.

Rubber, in wide use in aircraft for fuel cells, sealants, gaskets, etc., is also affected by temperature extremes. The forecast predicted that use of natural rubber will decrease during the next 10 years in favor of high-temperature and ozone-resistant synthetics.

In the manufacturing area, as opposed to the research and development field, the next decade will also bring marked changes. In recent years, the time cycle from drawing board to production of an end item has become shorter while manufacturing methods and equipment have become more complex. The report indicates a continuation of this trend.

This trend, according to the forecast, will have the following effects on manufacturing processes:



- Greater educational and technical specialization will be required to produce the next decade's advanced weapons systems.

- Use of new materials will require new facilities for handling, and more complex processes will require better and more expensive equipment. There will be increasing use of automation and numerical control (electronically directed automatic machining).

- New standards of quality control and data evaluation must be developed.

- Two of the principal manufacturing problems will be the necessity for achieving incredibly close tolerances, even beyond those of today measured in millionths of an inch, and brazing, welding and heat treating in carefully controlled atmospheres.

- Fabrication techniques must be developed to permit shaping of high-strength steels with yields in excess of 300,000 pounds per square inch and alloys with yields of more than 200,000 pounds per square inch.

- Some machining operations now performed at room temperature will have to be done with super-heated materials and tools or at sub-zero temperatures, since practically all of the ceramics cannot be machined with or-

dinary tools. Obviously, new tools will be required for the new materials; for example, some precise parts may be machined by a high impulse electrical discharge rather than by ordinary techniques.

The advancing technology will have a similar effect on testing equipment and techniques. The trend toward miniaturization and "integrated system packages" (testing of a complex system as a unit rather than by individual part) will require new test equipment with greater accuracy and higher reliability.

There will be a need for developing new standards and facilities for testing in controlled environments to measure the effects of atmospheric substances, radiation damage, heat conductivity and expansion and strength under varying temperatures.

Entire test sequences will be recorded on tape for automatic testing. The trend is toward memory drums and storage devices that will be able to compare and make decisions with regard to the accumulated test data.

Destructive testing, the application of force to a part until it breaks to determine its stress limits, will not be good enough for testing some of the new, extremely high-strength ma-

terials contemplated. Some new methods of determining structural integrity without destroying the part must be developed.

And, aside from all these requirements, the forecast cautions that "a breakthrough in the use of gravity or anti-gravity for propulsion will create a need for entirely new testing methods and techniques."

Among the other predictions included in the report were these:

- Air-breathing propulsion systems like turbojet engines will be limited to vehicles designed for the movement of large payloads from one point on the Earth's surface to another. Improvements in this type of engine will depend primarily upon development of new, high-energy fuels, and also on development of accessories and lubricants suitable for the more severe operating environments which will be encountered.

- Development of high-energy fuels can result in an increase of 50% in the specific impulses obtainable by current rocket power plants. Nuclear rocket power plants, still in the study stage, can provide increases in thrust efficiency of 400%. The report indicates that nuclear rocket engines should replace chemical rockets as the chief source of power for high-performance vehicles after 1970. Thrust control or manned vehicles requires further development, the report states, adding that a clear superiority for the application of solid or liquid propellant rockets for selected categories of vehicles has not yet been established.

Development of ion rockets and photon engines, which have been studied as possible power plants for use in outer space where low thrust for long periods of time is effective due to lack of atmospheric resistance, will be accelerated when space flight, by chemical and nuclear rockets, becomes more frequent.

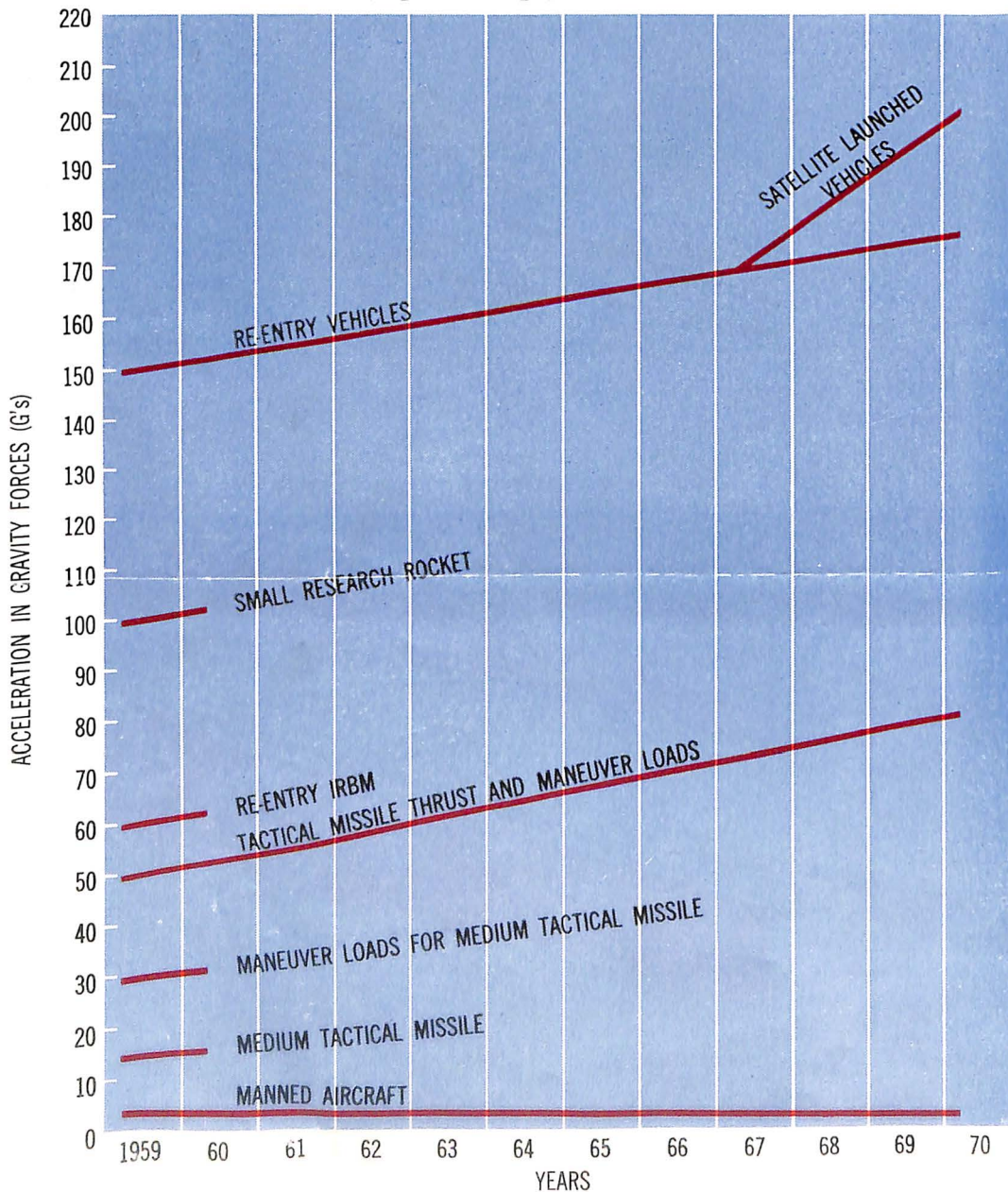
Considerable effort is required and will take place during the decade on "human systems." The major human factor effort during the decade will be applied to problems of escape and survival, with the development of space vehicle escape systems being the most critical problem area.

Other areas of research in this field include work on human performance as a component of specific vehicles and research in basic human capabilities and limitations, involving the more complex aspects of human behavior, such as ability to make decisions and process information in an alien environment.

During the coming decade, the useful range of airborne detection systems will be substantially increased, with research emphasis placed on high reliability and reduction of volume and weight. For space research, the effects of rare and ionized gases, aurorae and cosmic interference on detection systems will require considerable study.

The foregoing are but the highlights of the extensive report compiled by AIA's technical committees, but they serve to emphasize a point: advancing technology is not so much a matter of major "breakthroughs" as it is of painstaking work in an ever-widening research spectrum. The aerospace industry, and the companion industries which work closely with it, are devoting every effort to solve the problems and fulfill the predictions contained in this Sixth Annual Forecast.

VEHICLE ACCELERATIONS



Vast Increase in Speed Attracts New Passengers to Air Travel

(Continued from page 1)

rier in January 1959, the first U. S. built turboprop in 1958, and the production pace has been stepped up to a point where an average of 25 turbine transports will be delivered to U. S. carriers each month during the balance of 1959.

The aerospace industry, by mid-July, had delivered a total of 127 turbine-powered transports to U. S. airlines, including 38 of the four-engine turbojet transports. By the end of this year, the transport manufacturers will deliver another 160 turbine airliners to U. S. carriers, including 70 of the big turbojets. These shipments are being made by four companies. A fifth manufacturer of large turbojet transports will not start shipments until 1960. In addition, U. S.-built jet transports are in service with foreign airlines.

Decade of Planning

Behind these statistics of burgeoning air travel is nearly a decade of planning, design and development of jet transports. The five manufacturers invested \$1.6 billion in jet airliner development before a single plane carried a paying passenger.

In fact, the model of the first four-engine turbojet to enter airline service marked the fifth anniversary of its first flight this month. This plane, still active in demonstration testing, is a veteran of some 1,200 hours of test flights, and in its five years of

rigorous testing has had an airborne experience equivalent in some respects to the punishment an airline plane might take in 30 or 40 years.

An idea of the thorough program of testing and re-testing can be obtained from a study which shows that to record some of the experiences of the prototype transport required 500,000 feet of graph paper, 230,000 feet of film and 25,000 feet of magnetic tape.

Safety Features

These are the most thoroughly tested transports ever to enter airline use, and have built-in safety features to insure reliability.

For example, the turbojet transport has fewer cockpit engine controls and displays that require frequent attention from the crew than a piston-engine airliner that went into service more than 20 years ago.

Other safety features:

- Suspending jet engines from the wing, compared with the nacelle mounting of piston engines, indicates a reduction of about 60 per cent in fire rate hazard for the turbojets.

- Meticulous design has reduced substantially the probability of structural failure. Loads or stresses are distributed so that they are carried by several structural sections and no single failure could cause serious difficulty.

- Four-engine jet transports have much greater climb capability with only two engines than four-engine piston transports.

- Mountains present no problem: 90 per cent of all flights are above the world's highest terrain. Turbojets also operate above the weather during cruise.

- Speed brakes control the approach angle on landings, reducing the chances of overshooting the runway and requiring the plane to go around again.

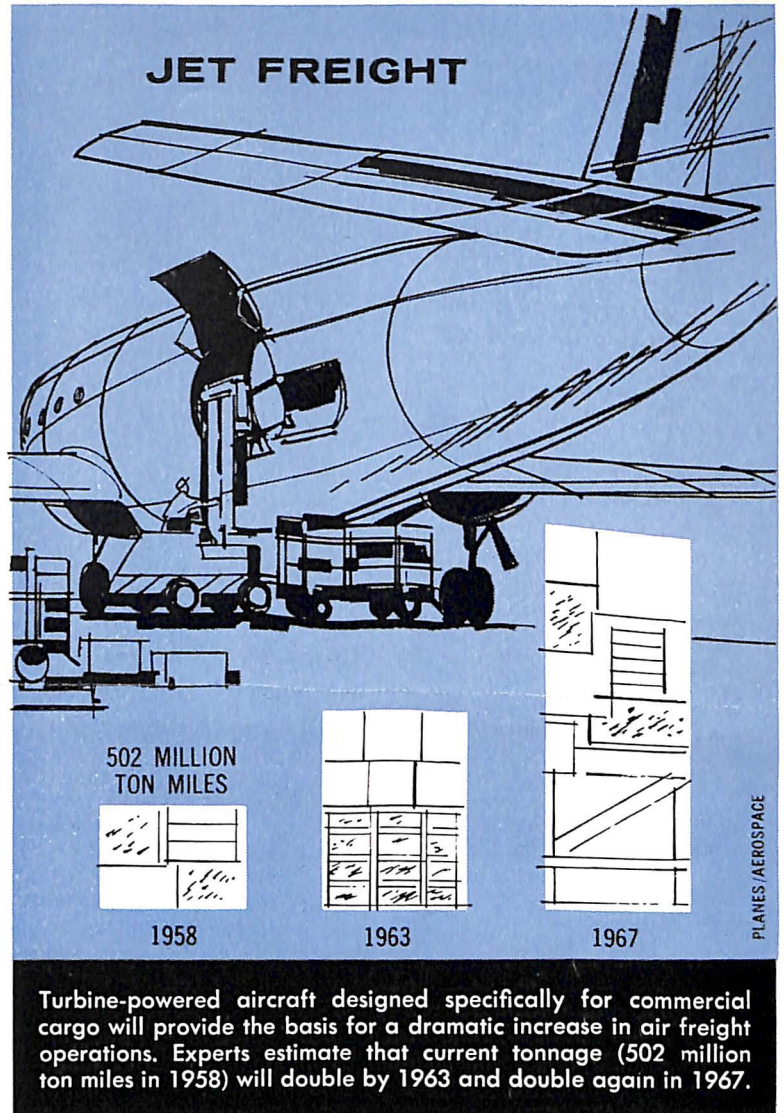
- The possibility of decompression (an explosive loss of cabin air at high altitudes) has been minimized by such techniques as the use of small, double windows and simple plug-like doors. The plug-type door eliminates the possibility of decompression due to hinge failure.

These safety factors are in addition to the large number of safety devices used in piston planes, and developed over the years by the U. S. transport aircraft manufacturers.

California Pilots Lead

California leads all other states in the number of registered and active pilots as of January 1, 1959, the Federal Aviation Agency recently announced. The "Bear" State has 102,709 registered pilots, of which 47,068 are "active." Active pilots are those who possess a current medical certificate.

Texas is second in the number of pilots with 25,614 in the active category out of a total 58,517. The new State of Alaska shows up with 2,877 active pilots out of a registered 4,564.



Device Stops Debris from Entering Jets

An aerospace company has devised an ingenious method of preventing airport runway debris and foreign material from entering the air that is sucked into a jet engine.

Company engineers learned that debris is not sucked up directly by the large volume of air entering the engines. Instead, the air being drawn into the engines frequently sets up a small vortex of air—a miniature tornado—which rotates at high velocity and lifts damaging particles to the level of the jet intake.

To prevent the formation of this vortex, the company installed a blow-away jet just below the engine intake. The blow-away jet consists of a small amount of engine high pressure bleed air directed forward and downward. The jet of air carries to the ground and is spread in all directions with sufficient velocity to overpower any inward velocity induced by the engine inlet. This forestalls the formation of a vortex below the inlet and prevents any material from being sucked into the engine from the runway.

Normal operation of the blow-away jet is automatic, being actuated by the landing gear. It operates only during ground operations and shuts off when the airplane is airborne.

In over 700 hours of engine operation, no damage to the engines caused by ingestion of debris has been found.

Rigorous Sandstorm Tests Insure Reliability of Jet Bomber Components

U. S.-built aircraft are designed to serve in any environment, from the heat and sand of the desert to the intense cold of the Arctic Circle.

Reliability of operation under all conditions is insured by the aerospace industry with a painstaking and comprehensive test program for each plane before and after it rolls off the assembly line.

Typical of environmental testing is a controlled sandstorm of special design being used in an aircraft plant to test components and subsystems of a long-range jet bomber under desert conditions and in dust environments.

An oblong test chamber contains the artificial sandstorm. Temperature and humidity are controlled while a special, sharp, off-white mixture of silica sand and dust fills the air in the chamber and seeks out any vulnerable areas in the test specimen. Sand density is indicated accurately by a new electronic measuring device.

Work area of the chamber is a space about 5 feet by 5, 10 feet long. Air pushed by two 12-inch squirrel-cage fans enters the chamber at the rear, where silica is fed into the air stream.

The device being tested is placed on an elevated floor, in the path of the sandstorm. Beneath this floor are heaters and air ducts, for the suction-return of sand and air to the rear. Floor jets releasing dry com-

pressed air keep the settling sand agitated.

Only about a half pound of silica is used at one time, since it is constantly re-circulated. Temperature is kept at 77 degrees for 6 hours, then hiked to 160 degrees for another 6. Humidity is kept below 30 per cent.

When a component comes out of the chamber after a specified time in the sand, its operation is tested again, to compare its performance with that recorded before it went through the simulated sandstorm.

Hydraulic Controls Boost Production

Production time of a gas turbine part has been cut from 24 hours to 30 minutes with development of new hydraulic controls by an aerospace company engineer.

The parts involved are complex multi-bladed inducer wheels, set in the front of the engines to guide air into the compressor.

Production formerly required a two-step process. The first step was to produce wheels with flat blades. Then the blades had to be shaped into curves.

By adding hydraulic controls to self-guided milling machines, the wheels are now completed in one shorter step. The controls permit changing the angle of the blades while they are being milled.

Weapon Quality Is Improved

(Continued from Page 1)

with Government agencies in an effort to promote standardization of specifications and unified drafting practices, with the objective of eliminating waste and duplication.

The National Aircraft Standards Committee of the AIA, working closely with all Government agencies, has assisted in the development of more than 1,200 aircraft manufacturing standards, which has resulted in saving thousands of man-hours and millions of dollars.

Costs Reduced

Development of programs involving the use of new adhesives and plastics has resulted in the savings of thousands of man-hours of effort, and has made modern planes lighter and tougher. Even methods of conservation, salvaging of waste materials and packaging units for shipment, have been coordinated among companies and have resulted in additional cost reduction formulas.

Efforts of the Traffic Service of the AIA have saved both the Government and the industry millions of dollars through effective representation of industry's traffic problems. In one case arguments presented by the Traffic Service of AIA resulted in annual savings to the Government of 15-20 per cent, on a freight bill approximating \$24 million annually. In another case, efforts of the Traffic Service have saved one West Coast aircraft plant more than \$100,000 annually in freight charges.

The Export Service of the AIA promotes and facilitates the conduct of the aerospace industry's export business. It appraises relative markets in foreign countries; and interprets industry viewpoints to the Departments of State, Commerce, Defense and Treasury, the Civil Aeronautics Board, Federal Aviation Agency, Export-Import Bank, World Bank, International Finance Corporation, and Foreign Embassies and Governments.

Administrative Problems

The Industry Planning Service deals with problems affecting the business and administrative aspects of the aerospace industry, and maintains liaison with Government agencies in connection with the many laws, regulations and specifications affecting the business activities of the industry.

The Utility Airplane Council, representing the manufacturers of light airplanes and engines, strives to promote utility aircraft for business, industry, agriculture, instructional and personal use. The Council, among other things, is engaged in a program to acquaint the Nation with the need for more and better airports; it is conducting a thorough study of the present methods of training and licensing private pilots.

The AIA's Helicopter Council deals with governmental policies, military developments and commercial utilization affecting the manufacture and public acceptance of rotary-winged aircraft on behalf of the helicopter industry.

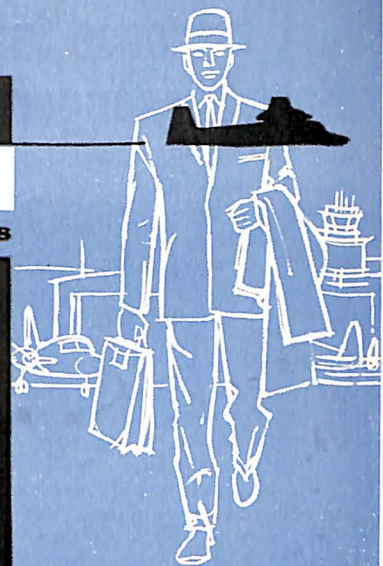
NEARLY ONE HALF

11.5 MILLION

FLYING HOURS

WINGS FOR BUSINESS

Business flying accounts for nearly half of the 11.5 million hours flown in 1958 by general aviation, which includes all civil flying except the scheduled airlines, *Aviation Facts and Figures*, official publication of the Aerospace Industries Association, reports. This segment of general aviation has grown rapidly since the end of World War II when it accounted for only 11 per cent of the total. Companies today consider business aircraft one of their most important—and profitable—business tools.



PLANES/AEROSPACE

Generator Taps Sun For Energy Supply On Space Missions

A solar-powered thermoelectric generator, under development by two aerospace companies will enable future long-mission satellites and manned space vehicles to tap a limitless supply of electric energy.

The thermoelectric generator weighs three pounds and measures 20 inches in length. It is capable of converting the energy of the sun into 2.5 watts of power—enough to operate a radio transmitter broadcasting a strong signal back to earth.

A sun-powered thermoelectric unit shows considerable merit as a source of auxiliary power for space missions that may take months or even years to complete, company engineers stated. For this kind of equipment, weight will be at a premium, reliability must be high, with little or no maintenance, and life expectancy must be long.

The direct conversion of heat to electricity through a static device involves a phenomenon in which electric current flows continuously in a closed circuit composed of two different metals so long as the junctions of the metals are kept at different temperatures.

Amplifier Weight Reduced Five Times

A major advance in the miniaturization of airborne electronics equipment has been achieved by an aerospace company with the development of a VHF (Very High Frequency) amplifier complete with power supply, which occupies a space of less than 3 cubic feet.

The amplifier is a two-stage design weighing less than 200 pounds. It has an output of 5 kilowatts. Engineers say a similar amplifier of conventional design would weigh more than 1,000 pounds and would require a standard 6-foot-high relay rack for installation.

The new unit can operate over a temperature range of minus 10 degrees Fahrenheit to 100 degrees F., and at an equivalent altitude of 10,000 feet.

Small Firms Make Unique, Valuable Contribution to Defense Projects

The contribution of small business to the nation's air/space arm is exemplified by three firms in a small town which supply one of this nation's major aerospace manufacturers.

One firm which is essentially a two-man operation, supplies the prime contractor with machined parts for long range jet bombers. The owner is a skilled machinist who generally operates his shop with one assistant. When orders pile up, however, he adds additional help to meet his schedules. Purchasing officials say his workmanship is excellent and he delivers on time, so naturally, he receives repeat business.

Another firm, established by a former airline maintenance engineer—originally to manufacture wire forms with a new flash welding process—is now a consistent supplier of tubular controls and many other items used in aircraft manufacture. Realizing that the success of

participating in a defense program depends on workmanship and delivering on time, the energetic and aggressive supplier has been known to ride to a nearby state to meet planes carrying material and then personally bring his products to the prime contractor in his home state to make certain they are on time.

Another small firm developed a special application of a unique honeycomb metal material that has been useful to the airframe manufacturer. The firm also does ceramic tooling and other work for the prime contractor. Among the items developed by this company is a product with unusual insulation properties. The President of the concern demonstrates with a one-fourth inch sheet of the material. While a blow torch is applied to one side, he holds his face to the other—unwarmed by the flame.

These three firms are among many small businesses throughout the nation which participate in defense work. An airframe company official recently stated: "In building aircraft it is necessary to buy thousands of parts from all over the nation. (We) always welcome any manufacturer to come and look over our list of needs." The official said that approximately 80 per cent of his company's vendors were classified as "small business."

Industry Finds New Cost-Cutting Methods

Cost cutting is a constant factor in aerospace industry thinking, where the expense of doing business increases steadily. Typical of the kind of savings effected by economy-minded manufacturers are the following:

A new polish and machine buffing technique to remove scratches from rejected transport window panes will reduce rejections by more than 80 per cent. Savings on planes still to be built will amount to about \$207,000.

By replacing the cushion-type tires on fork lift trucks with solid rubber tires of a new design, the company will save \$1,800 a year.

Holes in the spongy blankets used for insulation and padding in airplanes formerly were marked by template and cut by hand. Now they're cut out by punch press, with a time savings of 80 per cent. Estimated annual cost reduction—\$6,808.

'Copter Used To Build Puerto Rico Power Line

The Puerto Rico Water Resources Authority has purchased a helicopter for use in power line construction throughout the island. The agency will use the helicopter as a flying crane to carry huge power poles to construction sites and lower them into pre-dug holes.

Cost of setting a pole by conventional methods on a Puerto Rico transmission line is about \$450. With the helicopter, the poles can be erected for approximately \$150 apiece, including the expense of digging the hole.