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planes

Airplanes • Missiles • Helicopters • Aircraft Engines • Spacecraft

OFFICIAL PUBLICATION OF THE AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA

U. S. FORMS SOLID BASIS FOR SPACE AGE

Satellites Tell Space Story

Today there are four man-made satellites orbiting around the Earth —three launched by the U. S. and one by Russia—furnishing the first positive, continuous reports of conditions beyond the rind of atmosphere surrounding our planet.

The value of this information cannot be completely assessed. But initial evaluations show that the first fruits of the satellite program are well worth the tremendous scientific and engineering effort to bring them about.

One major discovery was a band of intense radiation beginning at about 600 miles from the Earth's surface and extending to the maximum heights of Explorer III's orbit (about 1,700 miles). This significant phenomenon was first noted by scientists when the Geiger tube in Explorers I and III, at times, registered zero. Laboratory tests confirmed that this was due, not to lack of radiation, but to such intensive radiation that the registering equipment was saturated.

New equipment was designed and launched in the Explorer IV satellite. The first data readings confirmed the existence of the heavy radiation field, and indicated that the instruments registered direct hits by charged particles, rather than secondary X-rays.

It also appeared to scientists that a substantial number of the particles penetrated the lead shielding placed around the Geiger tube.

The lesson learned is obvious: Radiation protection for the first humans venturing into space must be substantially greater than first calculated.

The Vanguard I satellite has furnished information on the temperature of the object as it hurtles around the Earth at a speed reaching 18,400 miles per hour. Another disclosure made by the satellites concerns atmospheric density at high altitudes. Information from the satellites shows the density to be at least 14 times greater than previously calculated.

The satellite program is far from completed. New satellites will be launched in the near future aimed at measuring the Earth's magnetic field and its radiation balance.

An ambitious part of the program,

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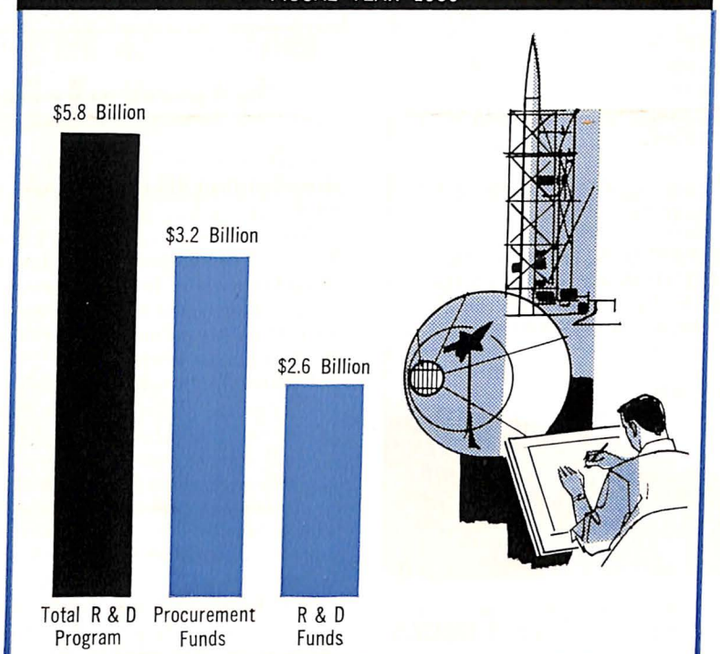
RESEARCH AND DEVELOPMENT PROGRAM
FISCAL YEAR 1959



Defense Department estimates that $5.8 billion will be obligated in Fiscal Year 1959 for research and development programs. Approximately 55 per cent of this amount will come from procurement funds, and the balance from purely research and development funds. The Defense Department breakdown of funds shows that out of the $2.6 billion planned for guided missile research and development, $1.9 billion, or 73 per cent of the total will come from procurement funds. The $5.8 billion excludes funds for military personnel, construction and industrial facilities in connection with the programs.

'PLANES'

Commercial Jet Airliners Prove Worth in Tests Equal to 100 Years of Flight Service

A commercial jet transport scheduled for service soon has already proved itself in underwater tests equal to 100 years of service.

The exhaustive pre-flight program to determine the fatigue resistance of the plane's fuselage was accomplished by immersing a 50-foot section of the fuselage and cockpit in a 21,000 cubic foot tank of water.

The fuselage section was subjected to all the situations a transport would encounter in service—including the boarding and disembarking of passengers.

Each underwater "flight" or cycle consisted of:

1. Pressurizing the cabin beyond its design maximum to include the aerodynamic suction met in flight.

2. Applying a severe 2 "G" (twice the force of gravity) gust load, along with additional loads to simulate external aerodynamic forces.

3. Depressurizing the fuselage.

4. Applying a landing load of 1.67 "Gs"—so hard they occur only once in 50,000 landings.

During the testing, a skin diving team of stress engineers and laboratory technicians inspected the structure frequently and kept an accurate running account of the test results.

Since the hydrostatic tests were started long before production had reached an advanced stage, engineers were able to apply the knowledge gained into improved design.

New Organizations Ready for Tasks

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

In a few weeks we will mark the first anniversary of the official dawn of the Space Age, the date when the Soviet Union made the first penetration of space with an object called *Sputnik*.

The early days following the satellite launching were bitter ones for the United States as the Soviets made propaganda capital by creating the impression that space was their exclusive domain.

A review of the calendar of events since October 4, 1957, however, shows that the United States has regained a lot of ground in the international prestige competition. Not since Pearl Harbor has the nation demonstrated so dramatically its capacity for rebounding from near-disaster. The fact that it was able to rebound is a tribute to the Administration, the Congress, the military services and the industry.

Today, we have the organizations —both civilian and military—to explore possible solutions to the mysteries of outer space, and there is more than a billion dollars available for acquiring necessary new knowledge and hardware.

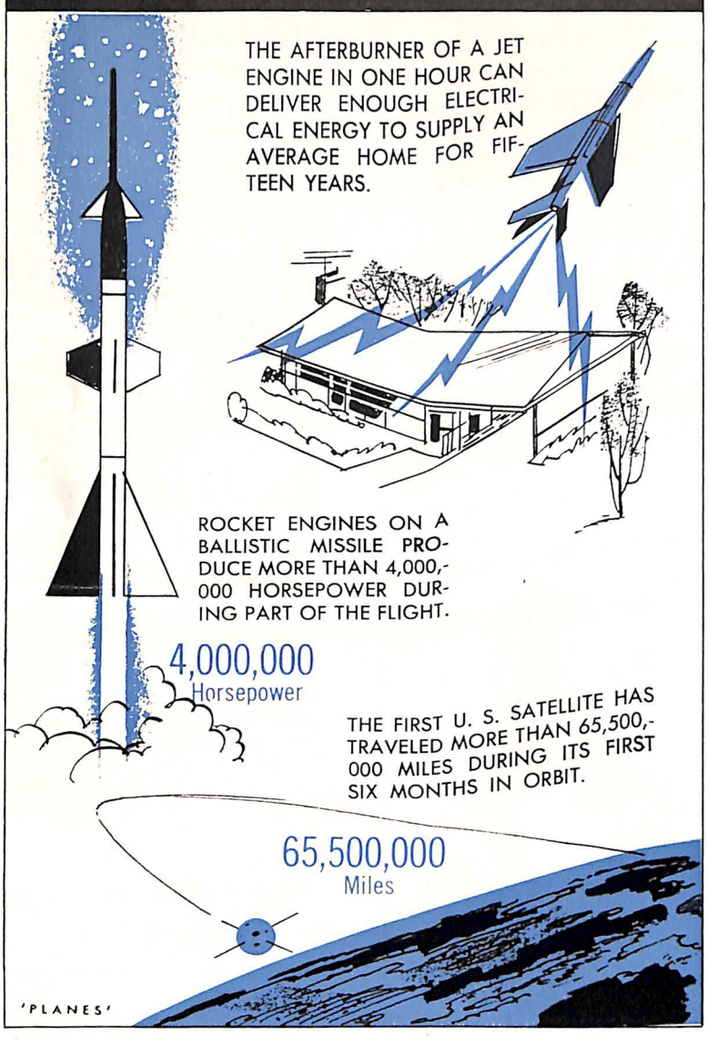
The initial step on the "road back" was the launching of America's first satellite, Explorer I, put into orbit on January 31 by the Army Ballistic Missile Agency. This, in itself, was a tremendous achievement, in view of the fact that the Explorer project had not even been in existence four months earlier when Sputnik I was fired into space.

Since that time, the U. S. has successfully launched three more satellites—two additional Explorers and one Vanguard. This put the international satellite box score at four to three in favor of the United States. The Soviets, of course, maintained an advantage in payload size. Considered as a matter of international prestige in the continuing struggle for the mind of man, however, success in numbers is likely to make more of an impression on the layman than the technical argument about relative payload weights.

Another important step toward furthering the American space effort was the creation, on February

(See *SPACE*, Page 3)

Plane Views



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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Stretching Dollars

Everyone these days is interested in cutting costs, but no group is more interested than the manufacturers engaged in production of defense equipment.

Weapons costs rise sharply every year—and they will continue to do so. There are two basic reasons. One, of course, is inflation, which reflects itself in higher costs of both manpower and materials.

The other is the continued necessity for more and more performance, a *must* if we are to maintain a competitive position with the armed forces of the Communist world.

Greater performance inevitably entails greater complexity, and complexity means higher costs. At the same time, there is a limit to the amount of defense appropriations the national economy can stand. It is imperative that all defense suppliers keep a sharp eye on costs to insure that the country gets maximium defense for its tax dollar.

The aircraft and missile industry has been actively pursuing cost reduction programs for some time—and they have been paying off most of the time in areas which escape public notice.

For instance, builders of guided weapons have been shipping parts in large quantities to missile sites by truck. The shipping costs normally involve considerable sums, but recently an industry traffic "watchdog" group decided that the trucking costs for the missile shipments were disproportionately high. At a conference with trucking officials, a protest backed by strong arguments was made. The truckers conceded that a lower rate was in order.

Due to the size of such shipments, even a small reduction in the truckload rate brings large savings. One company estimated that the rate drop in this case brought savings of $100,000 for parts shipments to seven missile sites over a six-month period. Future shipments will increase the savings figure, and, of course, there are a great number of other missiles and many other sites, compounding the cost reduction.

New manufacturing methods are continually providing lower cost benefits. A new technique called numerical control, which automatically feeds instructions to machine tools, is making possible substantial savings. One analysis showed a reduction of more than 50 per cent in the cost of milling aircraft wing skins through use of this method. Manufacturers are continuing their efforts to make greater use of this technique to speed production and reduce costs.

Another example involves a very small item, a tool insert which costs about a dollar but which is used up by the thousands. Formerly, used inserts were thrown away. Now, however, one company has developed a new grinding process by which the bits can be sharpened and used again. About 60 per cent of the bits can be re-used through this process, and 30 of them can be resharpened for less than the cost of a single new one. Dollar savings for a single company will run into five figures annually.

The savings in cases like these do not sound spectacular when compared with the billions going into defense production. But remember that there are thousands of similar cost reductions going on throughout all the companies in the industry. The aggregate represents a very solid contribution to the defense effort.

Cost consciousness in the aircraft and missile industry extends from top management to the man in the shop and through every area of the manufacturing process. The industry's continuous cost shaving efforts are more intense today than they ever have been and they will become even more intense, for the industry recognizes therein a responsibility almost as important as building the weapons.

AIR QUOTE

"In the current Fiscal Year 1958, expenditures for missiles and related ground equipment will be about ten times as great as in Fiscal Year 1953, and will require 20.9 per cent of our major procurement expenditures.

"Furthermore, the funds we are spending for aircraft and ships are buying far more efficient and complex weapons than those of a few years ago. There is little similarity between the century series of fighters . . . and those we used in Korea. Nuclear power and missile capability are also changing the nature of ship construction. All of these changes have great importance to American firms which participate in the military production program, either through prime contracts or subcontracts. They mean development of new materials, new production techniques, closer and closer tolerances, and higher and higher performance reliability.

"The small plant—and the large one as well—must rise to the challenge of intricate and complex equipment entailing in some cases industrial processes as yet undreamed of."—*Perkins McGuire, Assistant Secretary of Defense (Supply and Logistics), May 21, 1958.*

New Device Checks 1,600 Jet Circuits

A time-saving electronic device which can check from 200 to 1,600 circuits at one time is now tracing miles of complex circuits on jet aircraft.

The new circuit detector can check any electrical system, regardless of its complexity. It not only checks the continuity of each circuit, but it also locates and isolates short circuits caused by wire breaks and crossed connections. Circuit resistance sensitivity is measured by the touch of a finger and readings obtained from built-in meters.

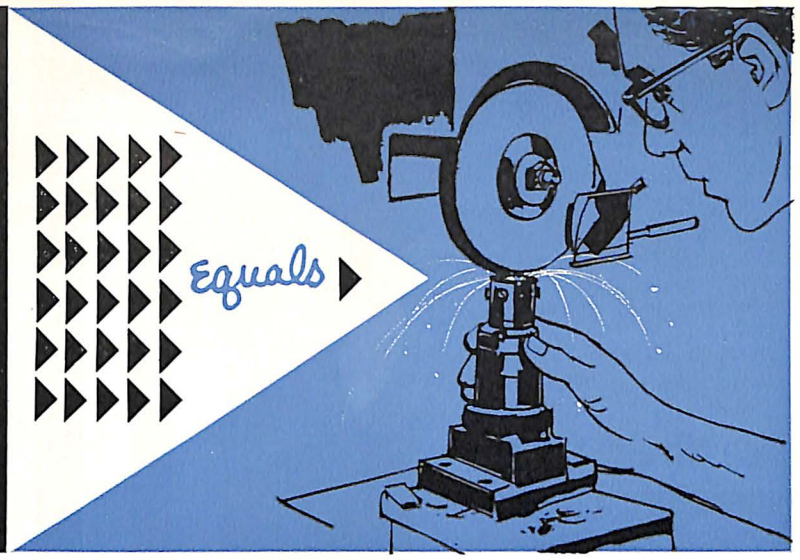
The new system enables one operator to do a dual job of continuity checking and recording of malfunctions. A circuit diagram which is placed on top of the detector carries information of the circuit being checked. As the operator checks the continuity, resistance and high potential of each plug, he marks them accordingly. This method detects and locates squawks immediately, permitting fast corrective action.

Key to the versatility of the operation lies in a plug board system which allows rapid changeover between circuits or types of aircraft. Every system takes at least one board which will accommodate 800 circuits enabling as many as six systems to be checked simultaneously.

COST CONSCIOUSNESS PAYOFF

One aircraft manufacturer has developed a grinding process whereby old tool bits (original cost, $1 each) can be re-sharpened. Formerly they were thrown away after brief use. Now the company reclaims 30 used bits for less than the cost of one new one. Savings: five figures annually.

'PLANES'



Space Exploration Program Has Available More Than $1 Billion for Projects

(*Continued from page* 1)

7, of the Advanced Projects Research Agency within the Department of Defense. ARPA immediately started planning with the vigor which has characterized the whole U. S. space effort. Working in cooperation with the military services, ARPA has already, in the seven months of its existence, awarded a great many contracts. In widely separated areas, they include such items as housing of humans in space capsules for long periods, a super radio antenna for maintaining communications with space vehicles, studies on nuclear rocket propulsion, a rocket powerplant of 1,000,000 pounds thrust and instrumental probes of the area around the Moon.

The first attempt in the latter area was unsuccessful, but there will be four more "lunar probes" in the near future. Even the initial failure, however, was a tribute to the speed with which the United States has marshalled its scientific and industrial talent for the "cold space war." It was an important attempt in two directions: operationally, because every failure brings success one step closer, and prestige-wise, because even a failure is better than no attempt at all.

For projects such as these, ARPA will spend some $471,000,000 in the current fiscal year.

Perhaps the most important step in the American space effort was the creation by the Administration and by Congress, of the National Aeronautics and Space Administration. Basically, this is an extension of the National Advisory Committee for Aeronautics, which has been at work on space research for several years, but the legislation provides for a considerably stepped-up space program in non-military areas.

NASA has already prepared a very sound space program for approval. As outlined to the House Space Committee, it includes:

- Unmanned space flights for the accumulation of scientific data, including vertical probes, satellites to study space environment, weather reconnaissance vehicles, vehicles for astronomical observations, lunar probes, and interplanetary probes.
- Investigations of manned space flight, including biological studies, a small scale recoverable orbiter and manned orbital and re-entry flights.
- Research and development on advanced components and techniques, including high energy propulsion systems, subsystems, such as controls and guidance systems, and vehicles, such as a stabilized space platform.

The military services, meanwhile, have accelerated work in other areas of space research, aiming toward development of space weapons systems. A number of new projects have been started and new emphasis has been placed on some projects which existed either in study or hardware form before Sputnik I.

Among the more important of these are reconnaissance satellites which can maintain "open skies" over the entire world and report back their findings; a boost-glide bomber capable of coasting around the earth several times after being rocket-blasted to space altitudes; and the X-15, a manned missile which will explore "inner space" at altitudes from 20 to 100 miles.

This collective effort has effectively demonstrated America's ability to rise to a challenge. It is too early to state which side holds an edge in the "space race," but certainly Russian claims to space dominance today carry a great deal less conviction to the international spectator than they did only 11 months ago.

Except for the satellites already in orbit, the United States space program has produced little in the way of "hardware." It is, however, providing a sound base for future advances. Within the next few years, some of the projects already initiated will begin to bear fruit. The more advanced projects will come later, for they involve degrees of complexity which tax to the utmost the ingenuity of the scientific and industrial community.

The race to space is not a sprint, but a marathon, and the United States has the scientific, industrial and material resources to match anything the competition might offer. To quote a top aircraft industry executive: "Past experience shows that to be first is not always to be most successful."

Electronic Equipment Cooled by 11½-lb. Unit Using Heat Exchange

An extremely versatile liquid cooling unit has been developed by a U. S. aircraft manufacturer which is especially adapted to cooling electronic equipment. The entire unit is 11.8 inches long by 5.35 inches high and weighs only 11.5 pounds.

It works this way: After absorbing heat, the liquid makes a double pass through a heat exchanger where it is cooled by air drawn through by a fan which is especially matched with the heat exchanger according to the cooling requirement.

The heat exchanger is a plate-and-fin type, constructed of brazed and welded aluminum alloy. It has a heat rejection capacity of 1.5 kilowatts.

Satellite To Check Cloud Cover

(*Continued from Page 1*)

with potential long range benefits, is a satellite experiment to observe the cloud cover of the Earth. This satellite would provide a television picture of the cloud cover as contrasted with the land masses and sea areas. A world-wide picture of the Earth's cloud cover will be extremely valuable for studying weather phenomena.

Another interesting portion of the U. S. satellite program will be a "sub-satellite" that will be placed into orbit concurrently with a conventional satellite. This will be an inflatable ball with a reflective cover of aluminum. Drag effects at very high altitudes will be observed on the ground since no instruments will be carried by the "sub-satellite."

The U. S. satellite program is sponsored by the Committee for the National Academy of Sciences. The U. S. aircraft and missile industry has a key role in furnishing the vehicles that place the satellites in orbit. The rocket engines developed and produced by a prime aircraft manufacturer have been the principal power source in the Explorer satellites. These are the same engines used to power the intermediate and intercontinental ballistic missiles.

Forging Technique Saves Time, Funds

A new forging technique developed by a major aircraft company is saving material, weight and money in the high speed production of intricately shaped pieces with close tolerances.

Currently producing truck axles and stepped shafts for aviation use, the new technique utilizes four die-faced hammers to forge a vertical, rotating billet of steel or other premium alloy into a final shape. The forge will work hot or cold, using round, square, solid or hollow billets.

In addition to speed and accuracy, the rotary forging process provides considerable savings in the cost of the finished pieces. For example, on axles, shafts and machine tool components, previously made by the removal of metal chips, this new technique achieves the final shape by moving the metal, with a substantially reduced loss in material. Rotary forging also gives greater strength because of the continuity of metal flow which is unaffected by subsequent machining, and parts are as much as 36 per cent lighter than conventional rough forgings.

Defense Opens Drive for Service Voters

The Department of Defense has launched a special campaign to encourage members of the armed forces to exercise their voting rights in this election year.

Secretary of Defense Neil McElroy has requested the state and territorial governors to proclaim September 15-22 as "Armed Forces Voters' Week." Secretary McElroy told the state officials that the Defense Department needs assistance "in reminding parents and wives to write to their sons and husbands overseas, telling them of local issues and candidates, and urging them to take part according to their political convictions, in the coming elections."

The federal voting assistance program covers 2,610,000 persons. This includes members of the armed forces, wives, dependents and employees of other federal departments.

Since 1955, all states have made legislative or administrative changes in election procedures to facilitate the program. The American serviceman fills out a post card requesting an absentee ballot and mails it to the election official in his county or township. The ballot is then mailed to the serviceman, who marks the candidates of his choice, and returns it to the election official.

In 1956, members of the armed forces from 50 states and territories stationed in more than 50 countries throughout the world voted in more than 3,000 precincts throughout the country.

Human Brain Retains Considerable Edge over Electronic Units

In the air-space age of automation, it's comforting to know that the human brain still has the edge over its electronic counterpart.

Automation experts admit that it would take 60,500 computers crowded into something the size of a skull to make human decisions. In supersonic jet combat planes, however, the robot brains are making strides.

A new electronically packed, computer-stuffed supersonic fighter-bomber built by an aircraft company for the USAF's Tactical Air Command, has seven electronic brain systems which handle everything from bombing to breathing. It has an electronic co-pilot, an automatic lead computing sight for air-to-air gunnery; a "brain" to make toss-bombing, with atomic or conventional bombs; a radar system to "see through" fog and darkness, and other brain-like units to handle navigation and identification.

A special "brain" regulates the jet's breathing by sensitively adjusting the rush of air (a million cubic feet a minute) through the inlet air ducts.

The man-made "brains" represents about 35 per cent of the total cost of the jet and took the aircraft company as many engineering man-hours to develop as the plane itself. But it still can't substitute for the one human brain on the aircraft—at the last moment of judgment.

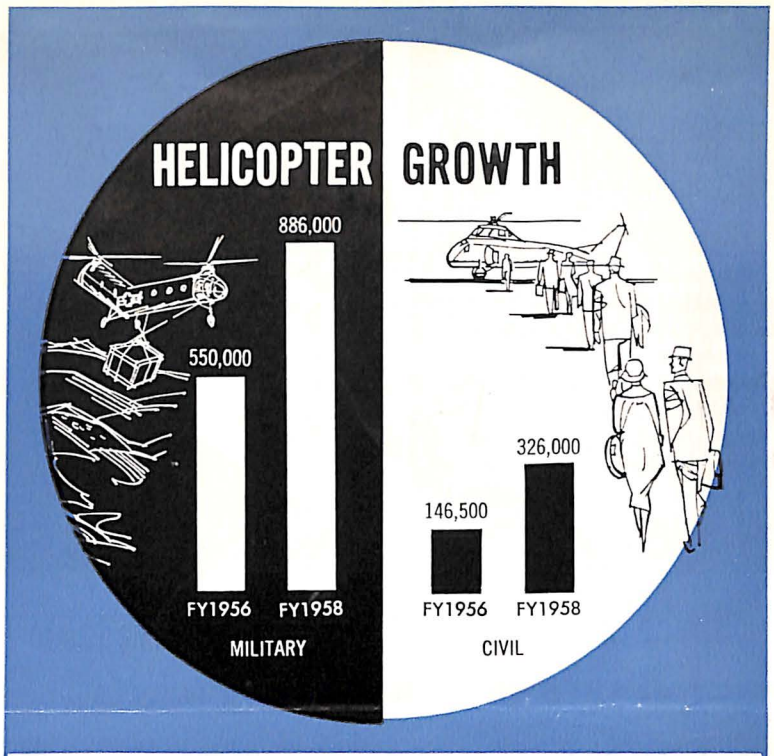
Furnace 'Brain' Checks Temperature Effects

There's a furnace with a brain in a West Coast aircraft plant that can evaluate immediately the effects of gas atmospheres and temperatures on new superalloys, and the effectiveness of brazing alloys presently available.

Heart of the new brazing installation is a completely automatic control system governing all functions required for high-temperature furnace brazing. This system—comparable to an automatic computing mechanism—is designed to (1) meter three types of gases—hydrogen, nitrogen and argon; (2) control every stage of furnace processing; (3) ensure safe operation throughout the critical loading, purging, brazing and cooling cycles. It indicates automatically the level of oxygen concentration in retort and furnace atmospheres, measures furnace gases by specific gravity, measures their pressure and flow rates.

Material in the furnace may be brazed directly in one operation or put through a number of different heating and cooling stages required by certain kinds of alloys. The operation of the furnace along with the maintenance of atmospheres of extreme purity and temperatures ranging from 900 to 2300F are programmed beforehand and fed into the installation's multiple-control system.

Once set and started, the installation is on its own—the operator need only make adjustments as signalled by the system's lights and buzzers—and consistent high quality of all parts is a foregone conclusion.



One of the fastest growing segments of aviation is helicopter operations—both military and civil. In two years, military helicopter flight hours increased 61 per cent from 550,000 in Fiscal Year 1956 to 886,000 hours in Fiscal Year 1958. Commercial operations showed a much larger growth of 122 per cent from 146,500 hours in Fiscal 1956 to 326,000 hours in 1957. Civil operations include three sheduled helicopter services and 105 commercial operators. The future growth of helicopter operations will probably be even more dramatic with the introduction of gas turbine engines and designs providing larger passenger and cargo capacity.

'PLANES'

Guided Missile Book Now Off Press

GUIDED MISSILES, 575 pages, illustrated. Published by McGraw-Hill Book Company and sponsored by the Department of the Air Force, with foreword by Lt. Gen. Charles T. Myers, USAF (Ret.). Price, $8.00.

The most comprehensive tome yet attempted in the field of missilery, *Guided Missiles* embraces almost every area of automatic weaponry—aerodynamics, propulsion, instrumentation, control and guidance, operation, maintenance and inspection.

It reaches its high points in an excellent short history of guided weapons, two chapters on guidance systems, and a simply-written but thorough discussion of missile warheads.

The volume falls short of its basic purpose of serving as a missile "primer." In some chapters it is too technical for the novitiate, yet rather basic for the expert. There are also omissions: the very important areas of missile reliability and ground support equipment are not covered at all.

In spite of the shortcomings, the book is probably the most complete unclassified work on the subject available and its profusion of well-thought-out illustrations helps simplify a difficult topic. It is a bookshelf must for those in non-technical jobs allied with the missile industry who would like to know more of the technical characteristics of guided weapons.

Supermarket Provides Jet Test Equipment

Engineers engaged in the early test flight program of a supersonic bomber utilized a nearby supermarket to provide necessary testing devices.

A "temperature reference ice vat" was required, but not available at the moment. A hurried trip to the supermarket produced a "plain old thermos bottle that worked real fine," according to an engineer.

To check the deck angle of the plane during flight a carpenter's level was used.

More accurate devices have since been designed, but the ingenuity of the test engineers served to keep the test program on schedule when they were not available.

Search for Heat-Resistant Materials Turns Up New Uses for Ceramics, Glass Compounds

Aircraft industry efforts to find materials that will withstand the tremendous heat-friction encountered by future aircraft, spacecraft and missiles have already produced some remarkable results.

One company has developed a ceramic that will maintain its properties in 5,000-degree heat. Called Galceram, its strength persists through both rapid and gradual temperature changes.

Another development is a glass material called Galglass, for possible use on nuclear-powered aircraft. Galglass would be useful wherever transparent shielding is needed. It reduces the effect of radiation and has the normal strength, appearance and usefulness of standard glass.

One aircraft company has evolved a high-temperature system of forming parts from glass cloth and resin. Parts formed by the new method have exceptionally high physical strength which endures exposure to high temperatures.

A fiberglass laminate made by the system underwent a heat test of more than 500 hours at 500 degrees Fahrenheit and emerged with a flexural strength of 45,000 psi (pounds per square inch). In comparison, a fiberglass laminate made by methods in common use was given the same heat test and ended with a flexural strength of 25,000 psi.

Glass cloth made of glass fibers woven to about the same weight as a linen tablecloth, is soaked with the resin and laid over a form to harden. As many layers of cloth and resin as desired may be placed one on top of the other.

The engineers experimented with various curing temperatures while the resin was hardening in an oven until the plastic was made to perform in the desired manner.

The plastic may be used to make radomes and nose cones for aircraft and missiles, and would be useful for any application where radar installation or electromagnetic radiation are concerned. The plastic allows radiation to pass through without distortion and retains this quality through a wide range of temperatures, including very high temperatures.

Bomber Parts Take Sandpaper Bath

Spar caps for a supersonic bomber now get a "sandpaper tub bath" to remove burrs left after machine operations. The new "bath" machine saves the aircraft company some 800 per cent of the time required by the old method of filing the burrs by hand.

The parts are submerged in aluminum oxide—an abrasive substance—and vibrated at 1,425 strokes per minute. Each stroke is only three-eighths inch long. The action removes all metal burrs.

The machine does in one day what it formerly took three men three days to do and gives a much better finish, according to an aircraft company engineer.