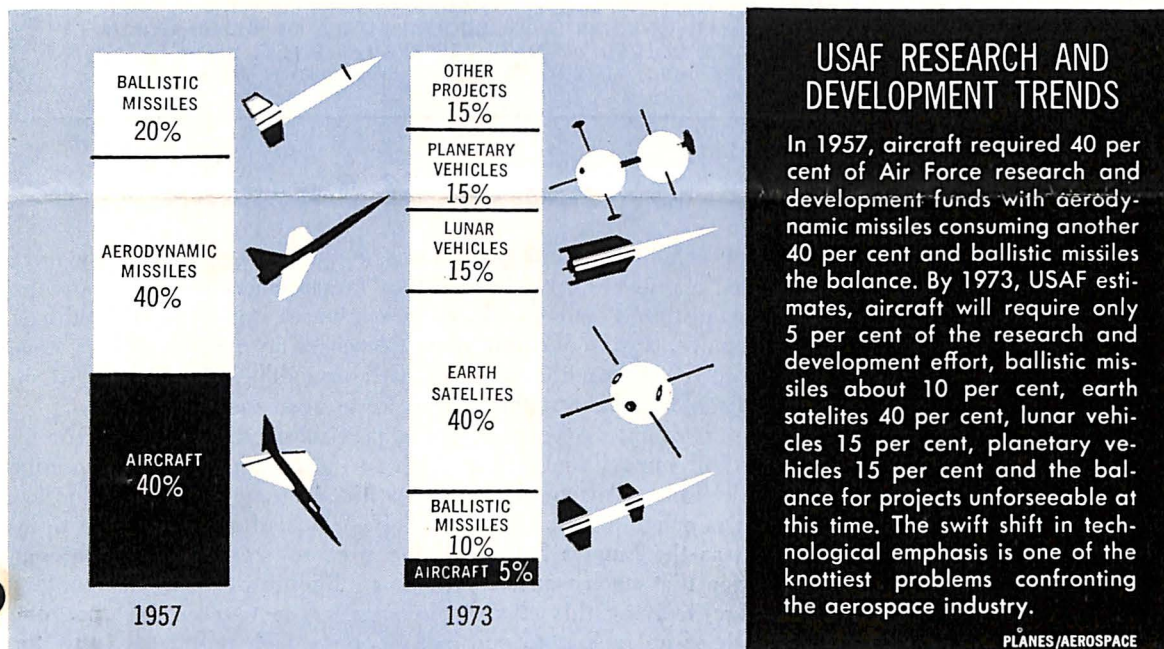


\$15 BILLION VOTED FOR AEROSPACE PROJECTS



USAF RESEARCH AND DEVELOPMENT TRENDS

In 1957, aircraft required 40 per cent of Air Force research and development funds with aerodynamic missiles consuming another 40 per cent and ballistic missiles the balance. By 1973, USAF estimates, aircraft will require only 5 per cent of the research and development effort, ballistic missiles about 10 per cent, earth satellites 40 per cent, lunar vehicles 15 per cent, planetary vehicles 15 per cent and the balance for projects unforeseeable at this time. The swift shift in technological emphasis is one of the knottiest problems confronting the aerospace industry.

PLANES/AEROSPACE

Military To Buy 1,500 Aircraft

The 86th Congress, during its first session, has appropriated nearly \$15 billion to pay for a wide variety of aerospace projects ranging from air traffic control towers to satellite probings of the radiation band around the earth.

This roundup includes procurement, research and development and related construction funds appropriated for the Department of Defense, National Aeronautics and Space Administration, Federal Aviation Agency and the Atomic Energy Commission. It does not include funds for maintenance, operations or salaries.

Largest single amount of money—\$6,057 million—was appropriated for aircraft for the Air Force, Navy and Army. This was \$140 million less than requested in the Federal Budget. Along with funds appropriated in previous years, this provides for the procurement of about 1,500 aircraft. This includes additional strategic bombers, jet tankers, fighter-bombers, turboprop transports, several moders, jet tankers, fighter-bombers,

Appropriation for Defense Department missile programs was \$3,624 million, which is \$76 million more than requested in the budget. These funds will provide for the accelerated development of anti-missile missiles. The high priority ICBM's and air-launched missiles will receive more funds in Fiscal Year 1960 than in the previous year. Present air defense missiles will be funded at just about half the amount of last year, a reduction of more than \$500 million.

Missile programs that are not technologically promising or have been superseded by more advanced developments have been cancelled.

Congress appropriated \$3,817 million for research, development test and evaluation which is \$44 million more than requested. The extra funds were provided for anti-submarine warfare.

It is not possible to make valid comparisons with this amount for (See FUNDS, Page 3)

Aerospace Industry Leads in Research Effort

Aerospace industry research and development accounted for more than one-third of the total amount expended for research and development by all U. S. industries during 1957.

A survey by the National Science Foundation shows that the companies making up the aerospace industry spent \$2,544 million on research and development projects, an increase of \$436 million over 1956. The total for all industries was \$7,155 million in 1957 compared with \$6,018 million in 1956.

Civil Aircraft Show Increase During 1958

Active civil aircraft in 1958 totalled 69,718, a four per cent increase over 1957, Federal Aviation Agency reported.

California holds first place in number, with 8,556. Four other states combined with California account for more than one-third of the total. They are Texas, Illinois, New York and Ohio.

Figures are contained in the booklet "U. S. Active Civil Aircraft by State and County," available from the U. S. Government Printing Office, Washington 25, D. C. Cost is 55 cents.

The survey notes: "The aircraft and parts (aerospace) and electrical equipment industries together accounted for slightly more than one-half of the total research and development by private firms in 1957. Both of these industries are closely associated with the country's heavy research and development program in the missile and space exploration fields. It can be anticipated that they will continue to play a dominant role in the research and development picture for some years to come."

Industrial research and development, sparked by the aerospace industry, has more than doubled since 1953 when about \$3.5 billion was expended. A feature article in this issue of *Planes-Aerospace* by Gen. Orval R. Cook, (USAF-Ret.), President of the Aerospace Industries Association, describes some of the outstanding civil applications of military research and development programs.

The National Science Foundation estimates that the total research and development effort of the U. S., which includes programs directly handled by the U. S. Government, colleges and universities and other non-profit institutions, was about \$10 billion.

The aerospace industry also led all other industries in the performance of basic research. The survey shows that \$241 million was spent by all industries with the aerospace industry expending \$52 million or 22 per cent of the total.

The importance of research is graphically stated in a recent report by the House Committee on Science and Astronautics: "National security today is as dependent upon research as Elizabethan England was dependent upon the fleet of Sir Francis Drake."

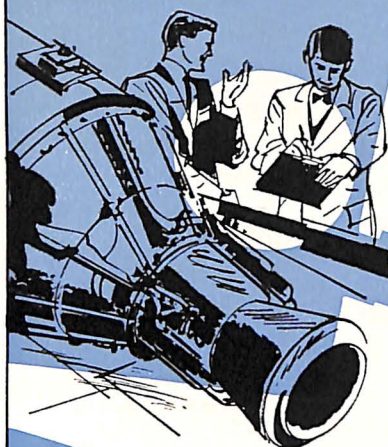
Water Cooling System Protects Delicate Radar

An evaporative cooling system that will keep delicate radar equipment from burning up as it moves through space in supersonic vehicles is a current research project at an aerospace company.

The water cooling system, now undergoing preliminary testing, will be checked in simulated altitudes of up to 75,000 feet and Mach 3.2 speeds for 15 minutes' duration.

The manufacturer's engineering department has been working on the cooling system under Navy research development contracts.

Plane Views

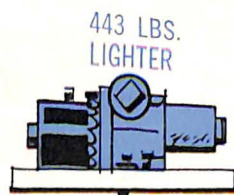
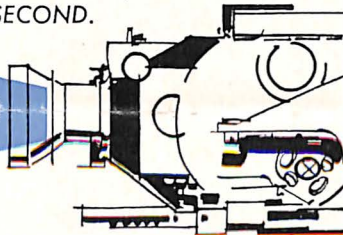


ABOUT SIXTY PER CENT OF THE COMPONENTS IN A ROCKET ENGINE ARE SUB-CONTRACTED BY THE PRIME MANUFACTURER.

CAMERA DEVELOPED FOR PHOTOGRAPHING HIGH SPEED FLIGHTS CAN TAKE AS MANY AS 8,000 PICTURES A SECOND.

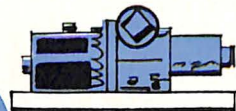


8000 pictures a second



443 LBS. LIGHTER

TURBOJET COMPRESSOR BUILT OF TITANIUM IS 443 POUNDS LIGHTER THAN A COMPRESSOR BUILT OF STEEL.



PLANES/AEROSPACE

Aerospace Quote

"Our principal goal in procuring a new weapon system must always be to get the best possible system within a time period dictated by the requirement for the weapon.

"This means that we must make optimum use of competitive ideas, established capabilities, and facilities. We do not consider these objectives to be in conflict but rather that they are mutually supporting. . .

"Again, let me say we reserve the right to approve or veto any proposals made to us that indicate an incompatibility with the fundamental goal I have just mentioned. We consider that this position encourages the aggressive use of initiative, maximum competitive opportunity, and the flow of co-operation which are characteristic of our industrial economy."—Donald R. Jackson, Deputy to Assistant Secretary of the Air Force, Materiel, Sept. 3, 1959.

Exhaustive Tests Mark Missile Production

Rigid performance tests for more than 40 thousand parts is the prelude to assembling an intercontinental ballistic missile.

Ranging in size from smaller than a postage stamp to complete rocket engines, the parts are funneled into the manufacturer's plant from more than 50 major suppliers across the country.

In the plant each must "perform" for an array of complicated "proofing tools." These include "silent" engine run test chambers, dust-free labs for electronic, hydraulic and pneumatic components, a variety of individual or console test panels and a special vat employing ultrasonic sound waves.

Before they move to assembly areas each part must bear a stamp of approval either by resident plant inspectors or by company inspectors who work in plants of suppliers across the nation.

The aerospace industry utilizes unique techniques unrivalled by any other manufacturing industry to insure the reliability of its products.

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.

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Editor: Gerald J. McAllister Art Director: James J. Fisher

Measure of Success

The tremendous technological gains in the aerospace industry have generated a problem aptly termed the "measurement pinch" — — — the need for advanced system of U. S. measurement standards and calibration methods. In the past few years tolerances on machined parts have shrunk from thousandths to tenths of thousandths to millionths of an inch. Tolerances have rapidly edged up to near absolute.

How important is the need for a precise standard? An error in accuracy of one-millionth of an inch in the bore-hole of a gyroscope can easily cause a space vehicle to miss the moon by thousands of miles.

What is one-millionth of an inch? If a stack of quarters three times as high as the Empire State Building were to represent an inch, one quarter in that stack would represent a millionth of an inch. Another way of conceiving this elusive measurement is to consider that one millionth of an inch is to one inch as a six inch post card is to the length of Long Island.

The measurement pinch involves more than just length. The measurement of temperature, voltages, microwave frequencies, vibrations, even humidity are among the areas requiring immediate attention.

The Aerospace Industries Association recently completed a survey of industry calibration practices and needs among 77 companies manufacturing such precision equipment as missiles, computers, bombing-navigation systems, rocket engines and inertial guidance systems.

The National Bureau of Standards, the Federal agency charged with the task of standards and calibration, worked closely with the AIA committee in preparing the survey questionnaire. After reviewing the report, R. D. Huntoon, Deputy Director of the Bureau of Standards, stated: "It gives us highly significant information about measurement problems as seen by the industries that are working on guided missiles; rocket engines, electronic control, sensing, and telemetering devices; and space vehicles. This segment of industry is still under wraps as far as the more technical phases are concerned; and it is tied directly to both the military security of the Nation and to its position of industrial leadership."

This is the crux of the burgeoning problem. There must be more basic research on the highly technical problems involved in providing better calibrations and standards. However, the problem strikes deeper than just more research. The pace of research is very important, too. The dramatic changes taking place in aerospace technology demands immediate action. Standards and calibration programs must be placed on a crash basis if we are to keep pace with the new accuracies and measurement ranges required for tomorrow's weapons.

The National Bureau of Standards, although it operates under the Department of Commerce, should be logically viewed as a partner in national security along with military services and the supporting industrial complex. This agency should not be shackled in its work through any ignorance of its importance.

Performance failures in tomorrow's sophisticated weapons could conceivably be catastrophic. We must have reliability of performance that has as its basis the continuous development of finer measurement standards.



DEFENSE DIVIDENDS

By ORVAL R. COOK

President, Aerospace Industries Association

GEN. ORVAL R. COOK, (USAF-RET.) has served as President of the Aerospace Industries Association since January, 1957. Immediately prior to his retirement from the Air Force in 1956 he was Deputy Commander-in-Chief of the United States European Command. He

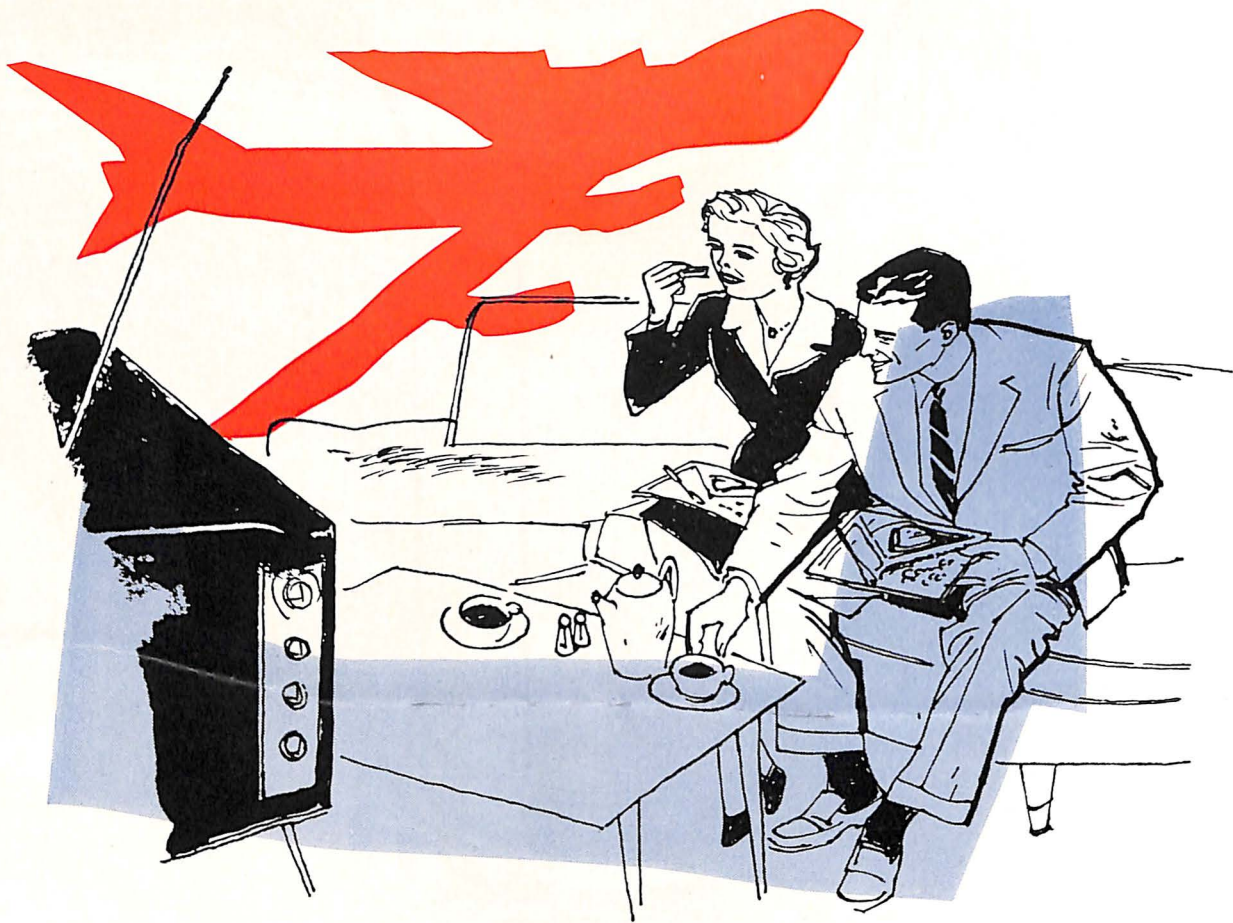


also served as the Air Force's Deputy Chief of Staff for Materiel with over-all responsibility for USAF industrial planning and procurement. During World War II, he served with the Far East Air Force in the Southwestern Pacific.

HAVE you ever sat down to one of those pre-cooked frozen meals known as "TV dinners"? Chances are you have, because this boon to the busy housewife has become tremendously popular in the last few years. The chances are equally good that you were not aware that this modern convenience is a direct product of the national defense effort. The TV dinner was originally developed by the Air Force as a solution to the problem of feeding aircrews aboard long range bombers on missions which sometimes covered two full days.

The pre-cooked frozen meal is but one of myriad items which have resulted from the defense program. Other by-products range across the board from commercial atomic power and new methods of cancer treatment to much less spectacular examples such as moisture-proof packaging of foods and improved hearing aids.

A comprehensive digest of the benefits accruing to the civilian economy from defense research expenditures is contained in a new report prepared by the Operations Research



Office of Johns Hopkins University. The report, entitled "Defense Spending and the U. S. Economy," outlines the results of a study contract with the Department of the Army.

It is by no means an attempt to justify heavy defense research and development expenditures because of their civilian applications. "Obviously," says the report, "it does not follow that the greater the military budget, the greater the civilian benefit, without limit. Nor is it argued that military budgets should be increased for any reason other than military necessity. In short, the object of the study has been to introduce an additional dimension of consideration in judging the utility of a dollar of military expenditure."

The report merits the widest possible circulation, because it is important to future defense programs that the American citizen understand that the defense dollar produces a considerable degree of "feed-back" to the civilian economy, aside from the basic problem of survival.

For the past decade, the taxpayer has been required to turn back to the Government a substantial portion of his income to support the military programs. He has accepted it, for the most part without enthusiasm, but with the acknowledgement that strong defense is a requisite to his continued existence, or at least to a continuance of his way of life. He has, for the most part, been unaware of the side benefits to the civilian economy produced by the heavy expenditures for defense.

The Johns Hopkins report makes these major points:

1. In fiscal year 1958, expenditures for military research and development amounted

to more than \$5 billion, or more than half of all research and development work carried on in the United States. Almost all of this military research and development has a "transference value," or benefit to the civilian economy. In fact, the investigators learned, a dollar spent on military research and development frequently produces just as much (or in some cases more) benefit to the civilian economy as a dollar spent for civilian research and development.

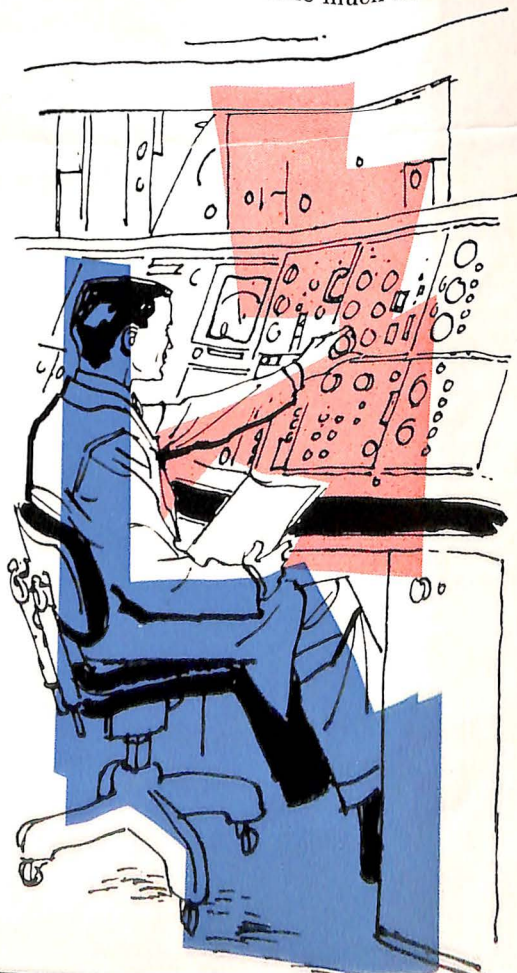
2. Most military occupations have civilian counterparts, with the result that the civilian economy benefits directly from the transfer of skilled personnel who have received their training in the military services. In the technological age, there is more and more need for skilled workers, and the military is providing industry with a pool of technically trained personnel.

3. The money invested in defense has important indirect, as well as direct, impacts on the national economy. For instance, the purchase of a tank affects not only the automotive company which builds it, but a great many other industries which produce component parts. Similarly, wage payments to military and civilian employees of the Department of Defense generate a considerable amount of economic activity and have impacts on levels of production and sales.

The most graphic examples of non-defense benefits to the civilian economy resulting from defense work lie in new end products which were developed as a result of military research. The voluminous Johns Hopkins report lists literally hundreds of them.

Some of the more notable examples come

readily to mind. For instance, there is commercial atomic power which offers great potential for tomorrow, a benefit which might have arrived decades later, had it not been for the military requirement for a greater means of destruction. The turbojet transports now plying the Nation's airways, daily attracting new passengers because of their superior performance and contributing to the national economy, might have come much later but for



the need for high-powered jet engines for military aircraft. All of the turbojet engines used in American commercial transports were developed originally as military projects.

The widespread use of electronic computers in all types of industries is now well known. The computer itself, and the manufacturing industry which grew from it, is a product of the military programs. It was in 1942 that the Army decided it needed a faster method of calculating trajectory and firing tables. The Ballistic Research Laboratories of the Ordnance Department explored the possibilities of developing electronic computing devices capable of extremely high rates of calculation and let a contract for the development of such a system. This contract, with the Moore School of Engineering of the University of Pennsylvania, produced ENIAC, the first modern electronic computer.

The productivity benefits to industry and the entire economy of electronic computation are enormous. Such computers are used for payrolls, inventories, research problems, scheduling, traffic problems and a great variety of other jobs. Some indication of the importance of this development is contained in the fact that, in 1957, latest year for which figures are available, the value of computers sold or rented was about \$350,000,000. It is obviously much higher today, due to the increased demand for electronic calculation in the space age.

In addition to these major items which stemmed from military research, the Johns Hopkins report lists a great number of other products and processes brought about initially by military requirements. Here are some examples:

Cold Weather Footwear. now used by meat packers, lumber workers, police, explorers, sportsmen and a number of other occupations, resulted from an Army problem: trench foot and frostbite among combat troops in cold weather areas. A Quartermaster Corps research and development project came up with a special shoe using a double vapor barrier in which a fleece and felt insulation is sealed between impermeable inner and outer casings. The shoe is now sold by practically all major footwear manufacturers.

Cancer Treatment. During a study of the effects of nitrogen mustard gases on tissues, in an effort to develop treatment and antidotes, the important discovery was made that intravenous injection of this mustard gas produced an action which aids treatment of such forms of cancer as leukemia, Hodgkin's disease and lymphosarcoma. Though these forms of cancer cannot be completely cured by the nitrogen mustards, life can be prolonged by retarding the spread of the disease.

Nuclear Vulcanizing, a process which can produce a marked effect on the rubber industry's vulcanizing techniques by eliminating the use of heat and pressure through exposure of the rubber to gamma radiation, was developed by the Air Force at Wright Air Development Center.

Plastic Hearing Aid. Research at the Army's Walter Reed Hospital, aimed at enabling personnel to be effective after a hearing loss, recently produced a soft, non-toxic plastic hearing aid capable of much higher per-



formance levels than other such devices. The new hearing aid is comfortable, capable of withstanding extremes of climate, remains in place even during strenuous exercise, and creates no allergy problems. The report states that hearing aid manufacturers in the U. S. and abroad, as well as hospitals, clinics and hearing aid centers are rapidly changing to this new soft ear-mold aid and predicts that the Army development will become universal within the next decade.

Treatment of Waste Water. A Navy project brought forth equipment and chemical processes for treating and re-using waste water in laundry operations. This system has obvious utility in areas facing water shortage problems, and is applicable to other areas for such uses as preserving streams from water pollution.

Weather Prediction. Air Force meteorological research and development has made substantial contributions in the art of weather forecasting and the information gained has been passed along to all interested agencies so that the public may benefit by better weather prognosis. Improved forecasting and the operations of Air Force weather reconnaissance aircraft have saved countless millions of dollars and many human lives, where storm and hurricane warnings permit measures lessening the impact and destruction of these phenomena.

Fire Extinguishing Agent. Research by the Army Corps of Engineers to solve the problem of rapidly extinguishing fires under varied climatic conditions yielded a new agent capable of extinguishing petroleum fires under normal and arctic conditions. The new agent is non-toxic and superior to the one it is replacing. It has particular benefit in the aviation field, because it is ideal as an extinguishing agent for fixed systems in aircraft. The new agent will also make it possible to perform safely many hitherto hazardous industrial operations.

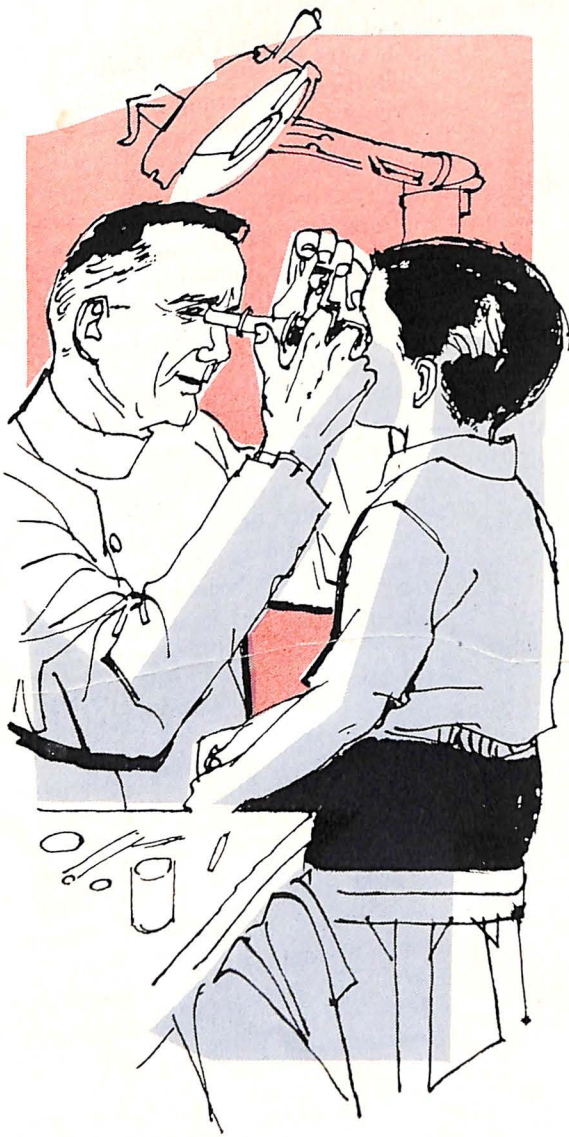
Printed Circuits. The Air Force, concerned by costs and reliability of electronic equipment, conducted an investigation designed to eliminate some of the many operations required to assemble component parts into circuits. The investigation proved that printed circuit boards helped eliminate mistakes in wiring, speeded up assembly and consequently reduced costs. The printed circuit technique has now been widely adopted by the electronics, electrical and automotive industries and has contributed materially to better and more easily maintained civilian products in these fields.

An Army Chemical Corps study on the effects of nerve gases on the human system produced a compound known as DFP, which has civilian application in the treatment of eye disease. It is used to relieve pressure in the eyeballs of people with glaucoma, a serious disease which often leads to blindness. It is also used to treat persons with bladder difficulties that often develop after surgery.

And then there is the flame thrower. It is at first hard to imagine a civilian application for a product so obviously dedicated to destruction, but the flame thrower is now in wide use commercially. A small, knapsack-type of flame thrower was developed for use in burning off thorns on cactus and other desert plants to make them suitable as feed for cattle. Tractor-drawn flame throwers, mounted on cultivators, are used in onion and cotton fields for controlling weeds. Aquatic weeds and deep-rooted weeds in the more arid Western states are controlled by flame throwers with excellent results.

These are but a few of the products and processes developed by military stimulus. The report lists more than 300 such examples, and there are a great many more of a classified nature not included in the report.

The Johns Hopkins report does not confine itself to product development, however. It points out that military expenditures also have direct effect on local employment, and while the study is devoted primarily to listing the beneficial aspects of military programs to the



civilian economy, it adds that shifts in defense expenditures can have a markedly detrimental effect, so closely have the military programs and the civilian economy become inter-related. As an example, the report lists the near-disastrous occurrences in the Los Angeles-Long Beach, California, area from May to November of 1957 when a series of defense contract cancellations and cutbacks played havoc with employment.

During that period, 29,000 aircraft workers were laid off, and these layoffs resulted in other layoffs in supplier industries located in the community. About 4,400 workers were dismissed in the electrical machinery industry, 1,300 were dropped in instrument-making establishments and about 2,500 were laid off by firms making non-electrical machinery for the aircraft manufacturers. The Bureau of Employment security of the Department of Labor recorded tremendous increases in relief payments, since there were almost no local opportunities for alternative employment for the laid-off workers. Local businesses of almost every type were adversely affected by declining sales to this large segment of the local labor force.

Conversely, defense activity can be instrumental in increasing local economic output or bringing about regional economic development. Many communities have received their initial growth stimulus from the activation of an Army camp or an Air Force or Navy base. In some cases, the communities dropped to a lower economic level after the military activity ceased, but in a great many others the community's development was maintained by reason of resources and industries developed during the period of military activity.

One more effect of military expenditures on the civilian economy lies in the field of real

estate. The military agencies are important landlords and renters throughout the Nation and military activities typically call for large land areas as well as storage and office facilities in high-rent districts. The military demand for such space produces an inevitable effect on the value of adjacent and surrounding property. Certain areas—Alaska, for instance—have developed to a great extent because of the existence of permanent military installations.

Completely aside from the question of survival, it is obvious from this brief summary of the Johns Hopkins report that money spent for defense buys more than security and cannot logically be described as all "money down the drain."

On a wistful note, the report makes this comment:

"One simple, traditional and generally held idea is that the military establishment represents economic waste. There is a kind of validity in this; in a world organized in a truly rational manner, there would be no military; there would also be no involuntary unemployment, and the whole product of human efforts would go directly to serve human welfare."

Unfortunately, we live in no such Utopian atmosphere. The threat of aggression has not diminished and there is little likelihood of an abrupt reduction in defense expenditures, for defense is not only a contributor to the national economy, it is essential to its continuance. Under these circumstances, it is encouraging to know that while we are spending billions to remain strong, we will continue to get the "feedback" bonus that will help make a better way of life while we maintain the peace.



Funds for Research and Development Show Steady Upward Trend

(Continued from Page 1)

previous years since it includes many development projects formerly included in procurement appropriations. But the trend, figured on either the new or old basis, is upward.

Indicative of the trend is the fact that 40 per cent of the total RDT&E fund, or almost \$1.5 billion, will go for missiles. Anti-submarine warfare projects include the perfection of anti-submarine guided missiles and other weapons such as a drone helicopter. Work will also continue on the development of nuclear propulsion for military aircraft.

102 Air Force Wings

The research and development fund includes the amount needed for the Advanced Research Projects Agency which is responsible for developing long-range projects in space with military applications.

Congress granted \$1,360 million for construction out of which more than 40 per cent will be used for missile facilities construction.

In air strength summary, the Air Force will have 102 combat wings at the end of FY 1960, three less than at the close of FY 1959. There will be two less air defense wings and one less tactical wing. The number of strategic wings remain unchanged at 43. Squadrons of the Military Air Transport Service will be reduced by three, but refueling squadrons will be increased by eight.

The Navy will continue to operate 16 carrier air groups, 22 carrier anti-submarine warfare squadrons and 42 patrol and warning squadrons. The Navy, including the Marine Corps, will have about 9,000 aircraft in active service. This is 600 less than the Navy had at the end of FY 1959.

5,700 Army Aircraft

The Army will have seven missile commands and missile groups. There is a small reduction in the number of air defense battalions, but the number of guided missile anti-aircraft battalions remains the same. The Army will continue to have an active inventory of nearly 5,700 aircraft. These are light fixed-wing aircraft and helicopters.

The National Aeronautics and Space Administration was granted \$318,675,000 for research and development projects in astronautical and aeronautical research. One major item is Project Mercury, the plan which will put man into orbital flight around the earth.

The Federal Aviation Agency for FY 1960 has a total appropriation of \$557,745,000 an increase of about \$8 million over the previous year. Out of this amount, \$118,200,000 will be used for air navigation facilities. This program includes eight long-range radars; equipment for tying the FAA system in with Air Defense Command radars; 18 very high frequency omniranges at terminals; 10 air route traffic control centers; 20 instrument landing systems; 16 traffic control towers and 50 sequence flashing approach lights at airports.

Airport Program

The Federal-Aid Airport Act provided for \$63 million for airport construction, and the FAA appropriation contained \$22,470,000 for Dulles International Airport near Washington, D. C.

FAA's research and development appropriation amounted to \$48,725,000. The projects involved are both short-range and long-range, all aimed at improving the air navigation, communications, data processing and display, airport layout and design, and the evaluation, development and testing of the National Weather System.

The Atomic Energy Commission has a total appropriation of about \$2.7 billion dollars. From this amount, the AEC will spend \$68,700,000 for aircraft reactors, \$27,900,000 for missile propulsion systems and \$12,100,000 for satellite power sources.

'Hurricane' Rains Used in Jet Windshield Test

Rain and wind are hurled with hurricane force against windshields of one of the jet transport planes now in production.

Purpose of the artificially produced stormy weather is to enable the transport manufacturer to find the best means of clearing jet aircraft cockpit glass so pilots can see despite any downpour.

Steady walls of water approximating rainfall of two inches an hour are shot out of pipe at the aircraft's windshield in air streams simulating jet speeds at takeoff and landing.

Engineers and test specialists point out that windshield wipers which cleared cockpit glass of conventional planes would be inefficient on the high-speed jets.

"Blades of the wipers would never touch the glass as they are lifted by the airstream at jet speed," an engineer said.



Self-Service Plan Utilized To Cut Production Time

A self-service super-market plan for supplying parts to workers on an aerospace assembly line is paying dividends in efficiency and lower costs.

Peg boards are placed along the walls or mounted on wheels and parts needed are hung from the board. In some areas, due to the special shape and odd curves of some of the parts, storage shelves required large amounts of floor space. With the peg board in place, parts are hung on the wall, at hand when needed, and safe from damage.

Conventional shelving costs more, too. Production experts say that one \$6.80 sheet of peg board will handle more parts than commercial shelving costing \$37.50.

Wide Temperature Ranges Simulated

Temperature extremes cold enough to freeze mercury and more than twice as hot as the sun's surface are being employed in the manufacture of modern aircraft, missiles and spacecraft.

One aerospace company is using a new technique for warp-proofing airliner parts by quick-freezing them at minus 130 degrees Fahrenheit.

Another is using a revolutionary type of test equipment which can create temperatures up to 25,000 degrees F.

The "cold" process, at temperatures low enough to cause a tennis ball to shatter like a light bulb when dropped on the floor, is used to stabilize steel anti-icing ducts used in jet transports, provides improved protection against warping or distortion.

The "hot" process is being used to test materials like graphites, used for missile nose cone application, and extremely high melting metals for leading edges in high speed flight equipment. The process subjects them to temperatures more than twice as hot as that on the sun's surface.

The heat test equipment, known as a plasmajet, is expected to make it possible in the near future to handle such metals as tungsten, which has a melting point of 6,100 degrees. Because of its hardness and resistance to heat, tungsten has several applications in missile manufacture.

Civil Defense Offers Aid in Buying 'Copters

The Office of Civil and Defense Mobilization will contribute on a matching funds basis to states and their political subdivisions for purchase of certain organizational equipment, including helicopters.

The contributions program is to assure more effective civil defense planning and training, and to better enable states to meet natural disasters or other emergencies, according to Joseph F. Napoli, who directs the financial assistance office at Civil and Defense Mobilization headquarters in Battle Creek, Mich.

Financial aid in purchasing helicopters, is "due to the versatility, special adaptability and superior effectiveness of helicopters in performing highly specialized types of civil defense emergency operations, particularly in the fields of evacuation, observation, traffic direction and control, damage assessment, radiological monitoring, attack warning, rescue and communications," ODCM states.

Digital Plotters Speed Tests

An electronic wonder which can translate satellite and missile performance data to a graph or plot at the fabulous rate of more than 4000 points a second has been developed by an aerospace manufacturer.

The high-speed digital plotter permits complete flight evaluations of the manufacturer's space programs 17 times faster and at least 12 times cheaper than was possible with the previously used system of converting electronic signals into a finished graph form for engineering analyses.

The new plotter takes the processed data spewed out with lightning-like rapidity by advanced computers and turns it into a finished plot complete with printed annotations in one completely automatic operation.

Engineers say that one typical data reduction job which used to take 106 eight-hour working days now can be done in six days. In addition to the man-hours saved, the cost savings in paper alone is conservatively estimated at 7 to 1.

"Putting it another way, where we used to produce 50,000 data points a day, we now have the capability of doing 282,000 a minute," said the engineer who spearheaded development of the plotter.

Development of the new system represents a year's intensified work by the company's research department. Two units have been delivered—one to the Navy and one to the Air Force—for missile and satellite development work.

Sonic Fatigue Tests Check Structure

Because high frequency sound waves created by jet engines tend, in time, to weaken the metal of the aircraft and could result in parts requiring maintenance, an aerospace manufacturer has taken steps to make certain parts don't "get too tired."

The manufacturer has begun sonic fatigue tests to find out which parts might be affected as a part of the structure certification program.

Tests are run behind a specially constructed barrier which deflects noise during engine runs. Here the two inboard engines are run up while engineers take readings to find out how much fatigue is induced at various points in the structure. Tests are run on the ground because vibrations are even more severe than when the aircraft is in flight.

PREFERRED PERFORMANCE



MADE IN AMERICA

About 85 per cent of the transport aircraft operated by world airlines belonging to the International Air Transport Association were manufactured in the U. S., according to the 1959 edition of *Aviation Facts and Figures*, official publication of the Aerospace Industries Association. The "Made In America" label on airliners stands for high performance and passenger comfort and safety.

PLANES/AEROSPACE

Meteoroid Effects on Space Vehicle Materials Tested with 'Fastest Gun in The West'

The "fastest gun in the West" is being used by an aerospace company to simulate the effects of meteoroids slamming against the hull of a space vehicle.

Astronautical experts estimate that 1,000 to 10,000 tons of these stony or metallic particles fall to earth each day from outer space. More than 95 per cent are microscopic in size and would not damage a space vehicle. But some of the rest could penetrate armor plate.

The "gun" is a special explosive charge into which is imbedded a cone-shaped steel "wave shaper." This cone shapes the explosive shock wave to impart extremely high velocity to whatever it is propelling. The tiny man-made meteoroids—aluminum pellets—are propelled into structural materials at speeds of about 16,000 miles per hour. This compares with the 550 mph speed of a .45-caliber bullet.

The object is to find what kind of materials and structures should be used to lessen the danger of meteoroid penetration.

Researchers do their firing in a metal tank 10 feet long and 4 feet in diameter. A near vacuum is created in the chamber to give a space-like environment. As the pellets, which weigh two-tenths of a gram or less than half as much as an aspirin tablet, blast toward their targets inside the tank, their velocities are measured down to a millionth of a second.

At these speeds the tiny pellets penetrate about a quarter of an inch into inch-thick solid metal samples.

Scientists can calculate the

metal thickness theoretically needed to protect man in space from meteoroids, but using the metal thicknesses necessary would be comparable to building a bomber out of battleship armor.

The research is being concentrated on double or multi-layered structures, and the use of lightweight honeycomb sandwich construction. The quest is for the best material and structure for vaporizing meteoroids on the outer surface and prevent their entering the inner shell of the space vehicle.

How hazardous are these meteoroids to space travelers? "No more dangerous than our own travel environment," says an aerospace scientist. "In fact, space travel probably has the edge."

Drill Sorter Saves Time, Money

A machine which can accurately sort 6,500 drills an hour has been developed by an aerospace company.

Use of the new machine speeds up the sorting process from the old hand method that could handle only 3,000 drills a day.

The machine can handle 52 different size drills, ranging in size from 3/32 to 17/64 of an inch.

Four banks of sorting racks are mounted on the portable table. Drills are fed by hand at the top of the sloping bank, and a semi-circular "flipper" moves them from one sizing station to another.

The design engineer estimates that the machine will pay for itself in a year through time saved in drill sorting.

NAEC Offers New Math Booklet

The Arithmetic of Flying, a booklet designed to acquaint junior high school students with the uses of mathematics in aviation, has been published by the National Aviation Education Council.

Jordan L. Larsen, Superintendent of Schools, Mount Vernon, N. Y., in an introduction to the booklet, states: "The materials . . . are intended to appeal to the present interests of pupils. The lively concern which junior high school students are known to have for all phases of aviation should be the source of strong motivation for studying the topics and problems which are included in the resource unit's twelve lessons."

For example, several common aircraft instruments are simply illustrated in the booklet to inspire interest in solving the problems built around them.

The booklet also contains a glossary of aeronautical terms, and lessons in such fields as Air and Ground Speeds, Time in Aviation, Knots and Nautical Miles, the Centigrade and Fahrenheit Thermometers, and other subjects.

The Arithmetic of Flying can be obtained from the National Aviation Education Council, 1025 Connecticut Avenue, N.W., Washington 6, D. C. Price is 50 cents.

Airlines Reach New Traffic High

The nation's domestic truck airlines ended the first seven months of 1959 with record revenues, traffic and service.

Profit margins and rate of return were up for the period, as compared to the same period in 1958, but rate of return still is lagging behind the 10.6% average annual rate recommended by Civil Aeronautics Board Examiner Ralph L. Wiser.

Earnings are still not enough to enable the carriers to continue providing improved air transportation, and to finance the largest re-equipment program ever attempted by the carriers.

Operating revenues for the period total \$1,017,766,000 as compared to \$870,614,000 for the similar seven months in 1958. Net income (before interest) was \$53,900,000 in the 1959 period and \$24,612,000 in 1958. Revenue passenger miles were 15.98 billion, compared to 14.30 billion for the first seven months of 1958. In terms of service, the airlines had available 25.86 billion seat miles, compared to 24.28 in the same 1958 period.