AIA

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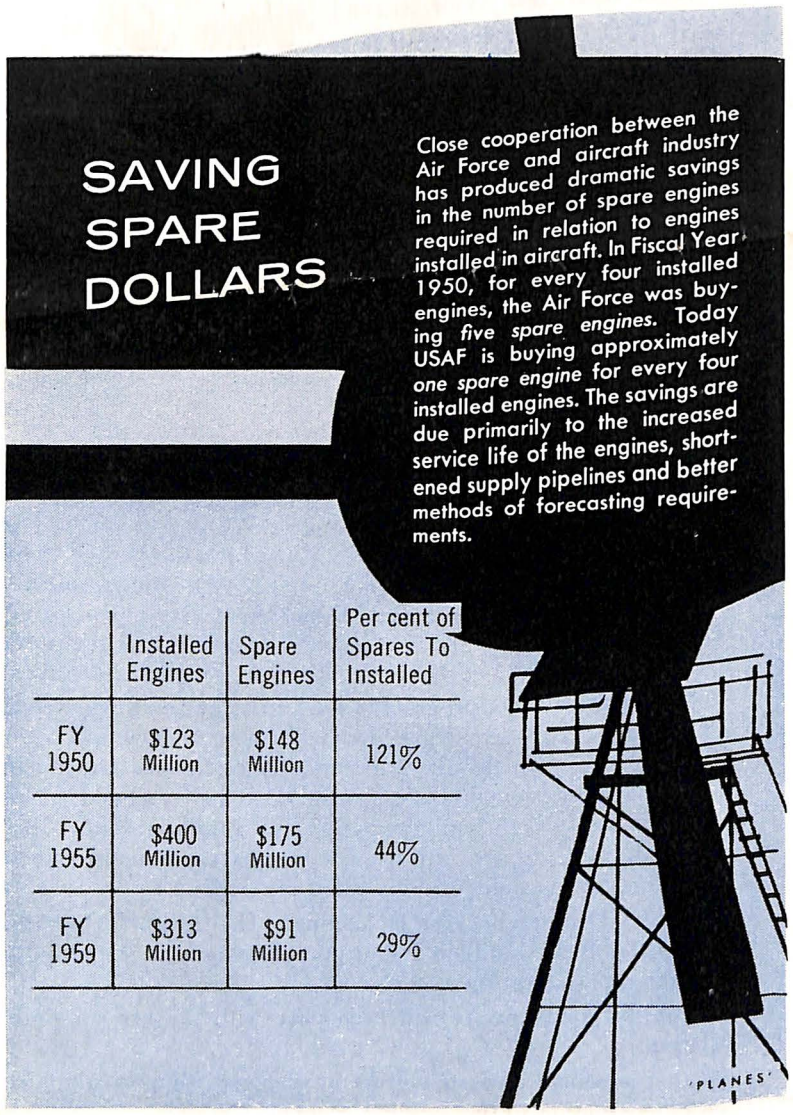
planes

Airplanes • Missiles • Helicopters • Aircraft Engines • Spacecraft

OFFICIAL PUBLICATION OF THE AIRCRAFT INDUSTRIES ASSOCIATION OF AMERICA

AF MEETS WEAPON PROCUREMENT CHALLENGE



	Installed Engines	Spare Engines	Per cent of Spares To Installed
FY 1950	$123 Million	$148 Million	121%
FY 1955	$400 Million	$175 Million	44%
FY 1959	$313 Million	$91 Million	29%

Punched Cards Simulate Missile 'War,' Save Millions in Operation Studies

A phantom aerial missile war is being conducted at an aircraft and missile company which is saving the company hundreds of missiles and the taxpayer millions of dollars.

The fuel for this phantom war is a stack of punched cards which represent all the operations in the air defense missile's ground guidance equipment and all the performance characteristics of the missile and the target aircraft. When the cards are fed into an electronic data processing machine, the flight of a missile can be duplicated to within 200 feet of an actual flight path.

The phantom missile, target and ground-guidance equipment (called a weapon system flight test simulator) utilize mathematical duplications of all items that can affect the path of a missile. The things simulated include a radar system, ground guidance systems, target action, weather conditions and the missile.

Primary job of the flight-test simulation program is to provide much of the "flight data" necessary for engineering study.

A phantom missile flight takes about five times as long as a real missile flight, but the accuracy of the re-creation has been proved. The simulation is so accurate and precise that it is considered the standard against which actual missile flights are compared.

Weapon System Concept Speeding Utilization of Technical Gains

By Brig. Gen. W. A. Davis
Deputy for Procurement
Air Materiel Command, USAF

A single modern weapons system complex today could cost as much as $10 billion—ten times as much money as the Air Force expended for all bombers, fighters and transports purchased just ten years ago.

However, the cost of today's system includes all support from recruiting and training of personnel, development and production of the weapon to operating air bases; and its destructive potential is many times greater. A schematic drawing of a modern weapon program would resemble an inverted pyramid with the on-the-line weapon itself at the bottom representing—in the case of an intercontinental ballistic missile—about 20 per cent of the total cost of the program.

The essence of a successful weapon program is contained in a delicate balance between management and technology.

We are all familiar with the astounding technological advances we have made in the past five years. These advances hold a rich promise for immediate military applications and later for commercial adaptation. Their timely application hinges on the ability of management to translate technical breakthroughs into inventory hardware.

Technological gains are increasing at a much more rapid rate than management skills; history has consistently demonstrated that man's scientific progress has challenged his ability to control these advances. In addition, management varies in complexity and difficulty in precise proportion to the size of an organization.

Problem Now Critical

The Air Force has faced this management problem for many years, but in the last few years its importance has become accentuated and critical. Modern weapons are so infinitely complex that there is no single company capable of producing a complete weapon system incorporating the fruits of productive research and development programs.

Over the last five years, the Air Force has developed and refined managerial tools to deal with these vast and complicated weapons. One of the most important advancements is the Weapon System Integration Concept. This plan establishes by Air Force contract a strong prime contractor with the basic responsibility to design, develop, produce and manage the total effort under the supervision of the Air Force.

The Air Force does not surrender any of its responsibilities. In fact, this plan leaves the Air Force managers free to devote more time to the essential elements of planning, scheduling and performance evaluation rather than becoming enmeshed

(See *WEAPON*, Page 7)

Jet 'Flies' Without Leaving Ground

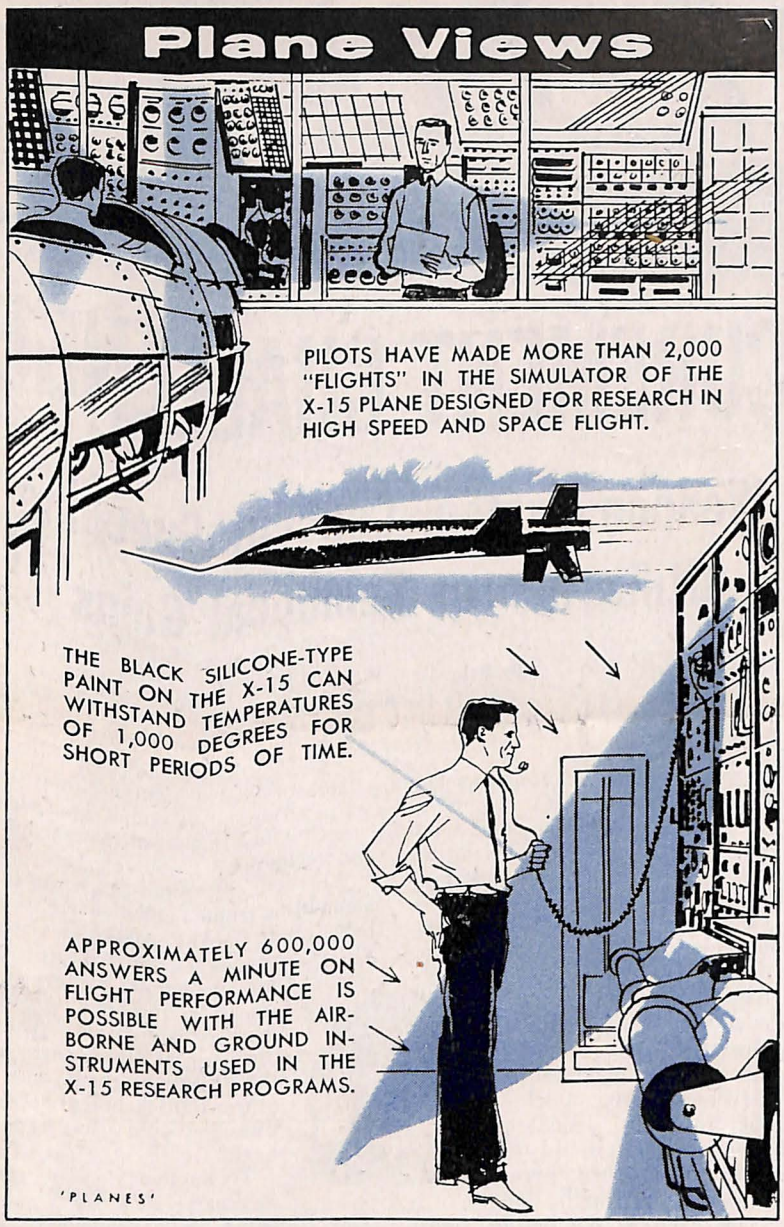
The jet engine of a supersonic bomber is "flying high" at an aircraft plant, before it ever leaves the ground. The engine is checked at various simulated altitudes and mach numbers while it actually remains at static sea level.

Objective of the test, which generally runs about two to four hours, is to find a way to measure absolute thrust.

All engine conditions are carefully monitored in the test control room during test run. Various pressures are reported through giant manometers located on both sides of the control room.

Because of the constant roar of the jet engine throughout the test period, personnel directly connected with the project wear special intercom head sets.

Other tests performed by the aircraft company are power plant system evaluations, starting characteristics and engine performance. Tests are also made to determine the effect of jet engine exhaust gas temperatures and noise on airplane structure and equipment.



'59 Aircraft Year Book Now Available

The 1959 Aircraft Year Book, which presents an authoritative record of aviation events during the past year, is now off the press.

An official publication of the Aircraft Industries Association, this 40th edition utilizes the same format as last year with a page size of 8 by 11 inches.

The book includes a review of individual company accomplishments; an illustrated listing with specification of aircraft and engines in production; a report on missile activities; historic and current chronologies; research and development by both civil and military agencies; listing of official records established during the year; a roundup of International Geophysical Year accomplishments; report on activities of individual airlines; and a review of operational activities of the military services and other Government agencies.

The 486-page book is edited by James J. Haggerty, Jr., noted aviation writer. It contains more than 1,000 illustrations, and is published by American Aviation Publications, Inc., 1001 Vermont Ave., N.W., Washington 5, D. C. Price is $6.00.

AIR QUOTE

"There is no compromise with or shortcut to the truth of the challenging tasks facing the Air Force and industry today. We cannot predict or envision our way to national survival. We can guarantee this survival only if we put forth the creative energy necessary to convert predictions and visions into defense hardware.

"I, for one, am convinced that we can meet the challenge. I believe that within the range of the unlimited mental and physical resources available to us, we have the wherewithal to meet and exceed the demands of national defense. The task is to convert the raw resources into high performing weapon systems and support equipment within the framework of a reasonable dollar outlay. I know we can accomplish this task. I know also that by cooperating fully, by using real Air Force industry we will accomplish it. If we want the free enterprise system to succeed in our present competitive world, we must, as free men, look to our laurels and our real accomplishments."—*Gen. C. S. Irvine, Deputy Chief of Staff, Materiel, USAF, Jan. 19, 1959.*

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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The Airport Lag

The phenomenal growth of air transportation since 1946 has overwhelmed our present national airport and airways systems, and the introduction of the new high speed turbojet transports is compounding an already critical problem.

Edward P. Curtis, in his recent report to President Eisenhower on aviation facilities planning, squarely outlines the reasons. "The crisis now in the making," he said, "is the result of not so much of too little foresight as it is perhaps, in the larger implications, of too much. It is a consequence of the phenomenon by means of which the United States is becoming more and more an air community. . . . . The industrial skills devoted to air technologies now comprise the largest single pool of employment in manufacturing. The airplane has become the prime mover of our population in its circulation over distances beyond 200 miles."

A comprehensive five-year program to modernize our airways systems is now under way. This year the Federal Aviation Agency will spend $175 million on new equipment such as surveillance radars. During the next four years, these amounts are scheduled to be expended: 1960, $231.5 million; 1961, $219.5 million; 1962, $215 million; and $185.9 million in 1963. This program will provide the electronic devices necessary to handle a large volume of high-speed air traffic.

However, the airport program is lagging. The Airport Operators Council estimates that $1 billion for airport development is needed in the next four years to meet these goals:

Assure that airport capacity will keep pace with the growth of air transportation.

Assure that adequate airports will be available to support air transportation's contribution to the national economy.

Assure that airports will be available for training and logistics of the military establishment and as standby bases in time of war.

The Federal Airport Act of 1946 authorized a grant-in-aid program to assist public agencies in the development of a nation-wide system of airports. Unfortunately, Federal appropriations have been made in varying amounts annually—no funds one year, very small appropriation in other years. This lack of stability has prevented communities from making reliable financial plans. For example, in many cases a municipal bond issue may be necessary for the community to meet its share of airport costs. Failure of the Federal government to meet its share, because of a reduced appropriation, causes the entire program to collapse.

The Senate last month passed a bill which would provide $100 million per year for each of four years, plus $65 million to be immediately available to assure adequate development of airports with especially urgent requirements. Action in the House has reduced this amount.

The lag in airport size and facilities can greatly reduce the benefits available to the traveling public in the civil turbine age. We cannot afford to dissipate these advantages by failure to provide proper facilities for their operation.

planes
MARCH 1959
AIA

SALUTE TO NATO

By Orval R. Cook

GEN. ORVAL R. COOK, (USAF-RET.) served as Deputy Commander-in-Chief of the United States European Command immediately prior to his retirement from the Air Force in May 1956. He also served as the Air Force's Deputy Chief of Staff for Materiel, with over-all responsibility for USAF industrial planning and procurement matters, from July 1951 to February 1954. He became President of the Aircraft Industries Association in January 1957. Prior service in the procurement and production field included the position of Director of Procurement and Industrial Mobilization Planning, Deputy Commanding General for Operations and Director of Procurement and Industrial Planning, all at the Air Materiel Command. During World War II he served with the Far East Air Forces in the Southwestern Pacific.

LAST November, the Soviet Union warmed up the cold war with a new ultimatum to the United States and its allies in the struggle against Communism.

Stripped of its diplomatic double-talk, it said this: The Western allies must get out of Berlin and abandon two million free people to Communist rule.

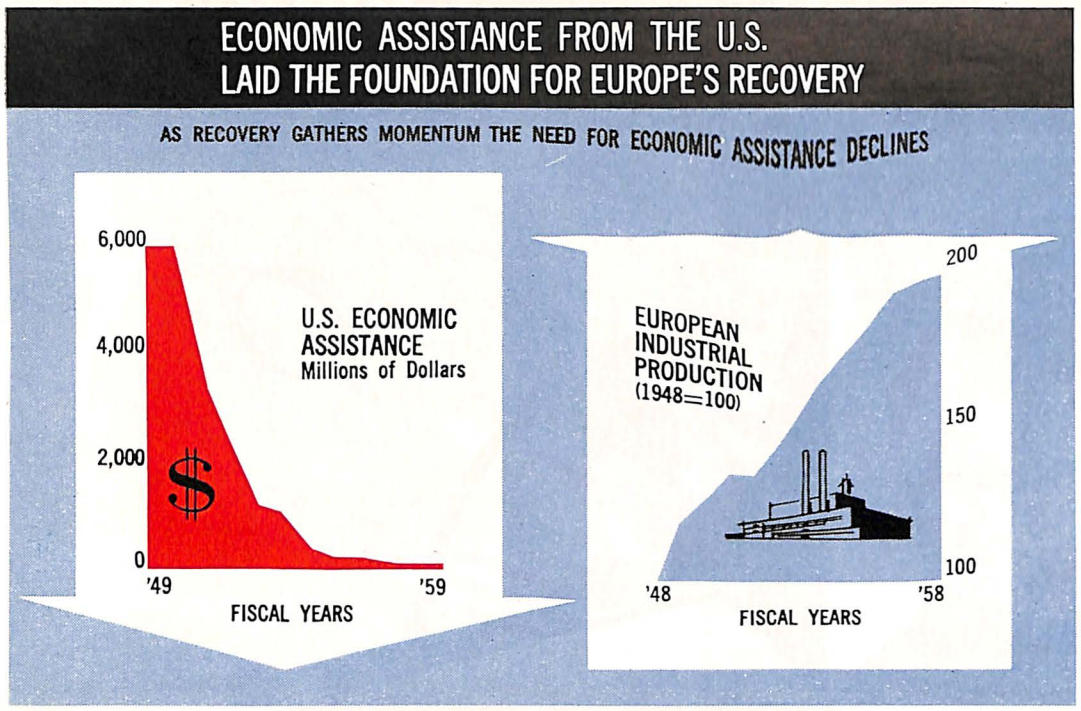
The attention of the entire world is focused on this latest crisis, for it could mean the start of another global war, a threat which has hung in precarious balance for more than a decade.

There is still hope that negotiation can bring about a settlement of this latest crisis, but the United States, as leader of the anti-Communist world, has taken a very firm position: There will be no accession to the Soviet demands, because it has been demonstrated all too frequently that to give the Soviets an inch is to invite their taking a yard.

In this atmosphere of international truculence, thoughtful citizens of the free world are asking this question: If Berlin generates the spark that turns the cold war into a hot one, how well are we prepared to resist Soviet use of force?

The debate as to our preparedness usually centers about our own American retaliatory capability, the strength of our land, sea and air forces. Surprisingly little attention is paid to another force of great importance in any conflict in Europe, one which includes elements of American military strength buttressed by the combined power of 14 other free nations. This is the North Atlantic Treaty Organization.

NATO, which has survived considerable controversy, misunderstanding and criticism to become the keystone of the global mutual security programs, celebrates the 10th anni-



versary of its founding on April 4. A potpourri of varying government interests, different opinions and international rivalries, it is remarkable that NATO ever saw its first birthday. It did, however, and it went on through the decade of its existence to become the powerful deterrent to Soviet aggression it is today. It is a monument to the solidarity of the Western world; its success is a tribute to the men of 15 nations who have worked tirelessly under difficult circumstances to forge a weapon of collective resistance to Soviet aims in Europe.

It was on April 4, 1949, that representatives of the member countries met in Washington and signed the North Atlantic Treaty. The Soviet Union, which in the years since the signing has several times indicated its extreme displeasure over the very existence of NATO, was primarily responsible for the signing.

In the years after World War II, the Soviets had shown clearly by a series of transgressions that it planned to pay only lip service to the aim of world peace. In the year before the treaty signing, the USSR had struck its coup d'etat at Czechoslovakia and imposed its infamous blockade of Berlin, later broken by the dramatic air lift.

These and other Soviet actions had indicated that the peace was an unstable one. In addition, two world wars had demonstrated that an attack on any one of the Western nations threatened the security of all of them. Twice in the first half of this century, the Atlantic Community countries had banded together to resist and finally overcome aggression. With the signing of the treaty, they pooled their resources for collective defense *before* the start of aggression.

The treaty required major policy changes on the part of some of the signatories, but these were compensated by the advantages to all concerned. The "have not" nations would be able to draw upon the resources of their more fortunate allies. To the United States, the chief "have" nation, the treaty offered a pool of manpower and real estate, an important plus, because it was evident even then that we could not hope to match the Soviet Union man for man and gun for gun without serious effect on our economic recovery.

A masterpiece of simplicity in comparison with other diplomatic documents of its type, the treaty consisted of a brief preamble and 14 concise articles. In only 100 words, the preamble set forth the aims of the treaty:

"The Parties to this Treaty reaffirm their faith in the purposes and principles of the Charter of the United Nations and their desire to live in peace with all peoples and all Governments.

"They are determined to safeguard the freedom, common heritage and civilization of their peoples, founded on the principles of democracy, individual liberty and the rule of law.

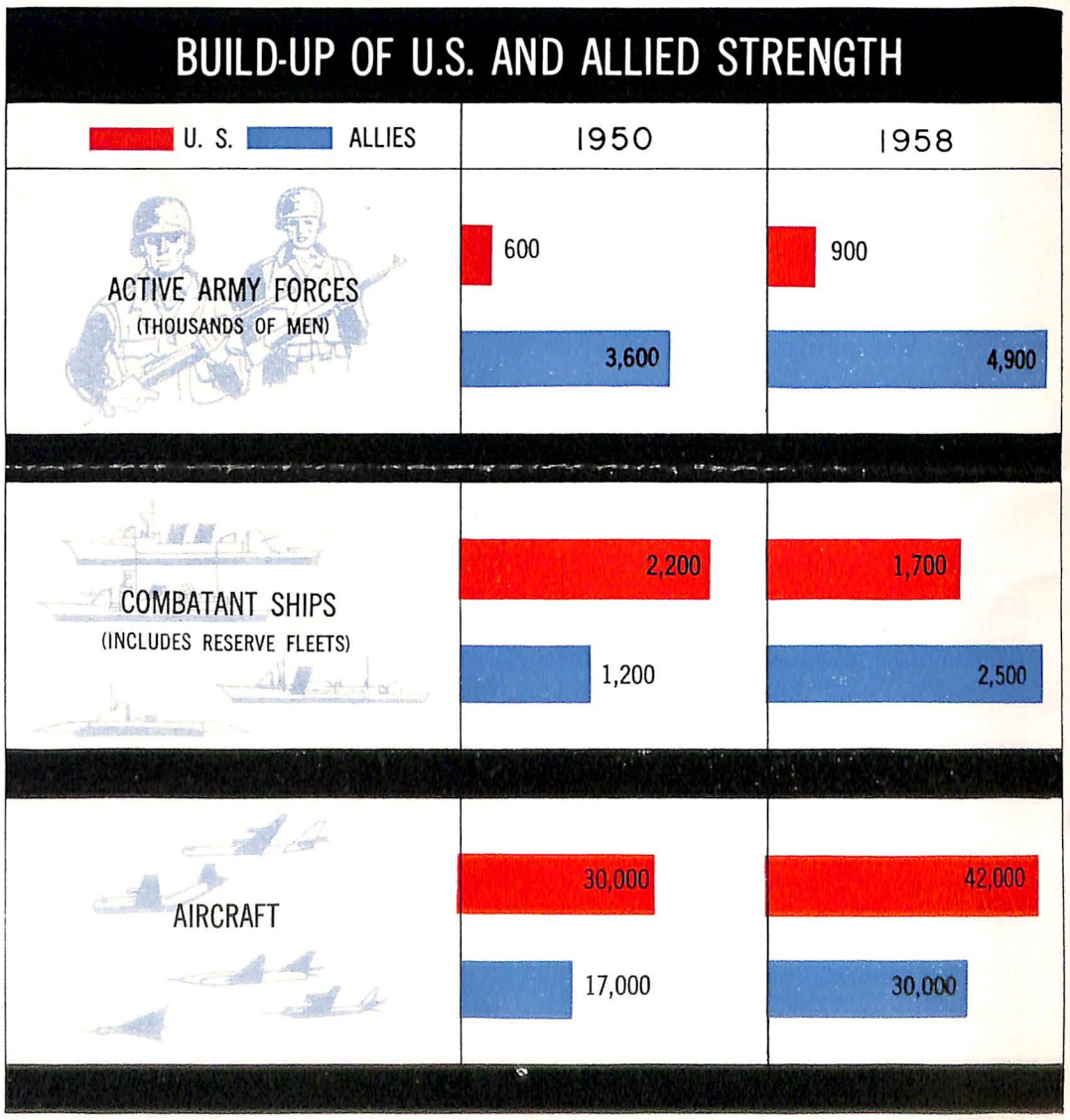
"They seek to promote stability and well-being in the North Atlantic area.

"They are resolved to unite their efforts for collective defense and for the preservation of peace and security.

"They therefore agree to this North Atlantic Treaty."

The major points covered in the Articles were these:

- The signatory countries would undertake to settle any international dispute by peaceful means and would refrain from the threat or use of force in any manner inconsistent with the purposes of the United Nations.
- They would seek to eliminate conflict in their international economic policies and encourage economic collaboration between any or all of them.
- By self-help and mutual aid, they would maintain and develop their capacity to resist armed attack.



• An armed attack on any one of the countries would be construed as an attack against all of them, and they would resist it in concert.

Six months after the signing of the treaty, President Truman signed into law the Mutual Defense Aid Program, under which the United States undertook to furnish military and financial aid to free countries requiring it. In the fiscal 1950 program, $1 billion was earmarked for NATO countries. Under this program, which later became the Military Assistance Program, the NATO countries were furnished with military equipment, such as aircraft and parts, which they were not in a position to build or procure.

From its humble beginnings, NATO has in 10 years built up into a solid, if not yet awesome, military force. In 1949, the combined force available in an emergency would hardly have struck terror into any potential aggressor. It consisted of 12 divisions of ground troops, in various stages of training and degrees of modernization, and a negligible naval force. They were backed by 400-odd aircraft and 15 airfields. Very few of the units could have been called combat-ready.

Gradually, over the decade, this force was solidified, strengthened and modernized, armed with newer weapons, the proficiency of its personnel brought to higher levels.

Today, the multi-national organization represents a very substantial deterrent to Soviet aggression.

It consists of 100 ground divisions, 6,000 aircraft and 160 strategically located air bases which increase the retaliatory potential of the combined force. The total NATO naval strength has increased eight-fold, and NATO is now in process of increasing the number of ground battalions equipped with missiles. It is most certainly a factor for serious consideration by the Soviets in any deliberations they may have about the use of force in Berlin or in subsequent crises.

Concurrently with the military build-up, the economic structure of NATO was considerably strengthened. During the last decade, the combined gross national product of the Organization for European Economic Cooperation rose 63% and in certain fields progress has been even more remarkable. In steel production, for instance, the combined output more than doubled.

This military and economic build-up is of prime importance to the world's freedom. The NATO nations hold a large share of the world's industrial resources; the lands they occupy are of vital strategic importance; they possess the world's largest pool of skilled manpower and a substantial portion of its scientific talent.

These resources cannot be permitted to fall under the control of Soviet communism, but there is no question that Europe remains a prime target of Soviet aggrandizement. Europe is more important to the United States and the rest of the free world today than it was in 1949. It follows logically that it is a greater prize in the eyes of the Red leaders, but 10 years of concerted effort have made it a much more difficult prize to win.

NATO today has two types of forces: the "sword" and the "shield." The "sword" includes ground, sea and air forces capable of inflicting retaliation in case of large-scale aggression. The "shield" forces are those stationed largely in forward areas, equipped to deal with limited actions against any one of the NATO countries. Both have nuclear capability.

The NATO organizational structure has both a civilian and a military side.

The topmost group is the North Atlantic Council, composed of representatives of the 15 countries. They are the ministers of foreign affairs, supported, when council meeting agenda dictates, by ministers of defense, economics and finance. Under the council are a number of committees, such as Political Affairs, Economics and Finance, Production and Logistics and Civil Emergency Planning.

The Military Committee is the top NATO defense group. It is composed of top military representatives of each country (usually a chief of staff) with the exception of Iceland, which, having no military establishment, is represented by a civilian, and Luxembourg, which is represented by Belgium. Chairmanship of this committee rotates annually in the alphabetical order of the countries.

Under this committee is the Military Representatives Committee, composed of representatives of each chief of staff, which handles the routine work.

There is also the NATO Standing Group, composed of representatives of the United Kingdom, France and the United States. It is the executive body and the working agency of the Military Committee.

The strategic area covered by the North Atlantic Treaty is divided, to take account of geographical as well as political factors, into three Supreme Commands.

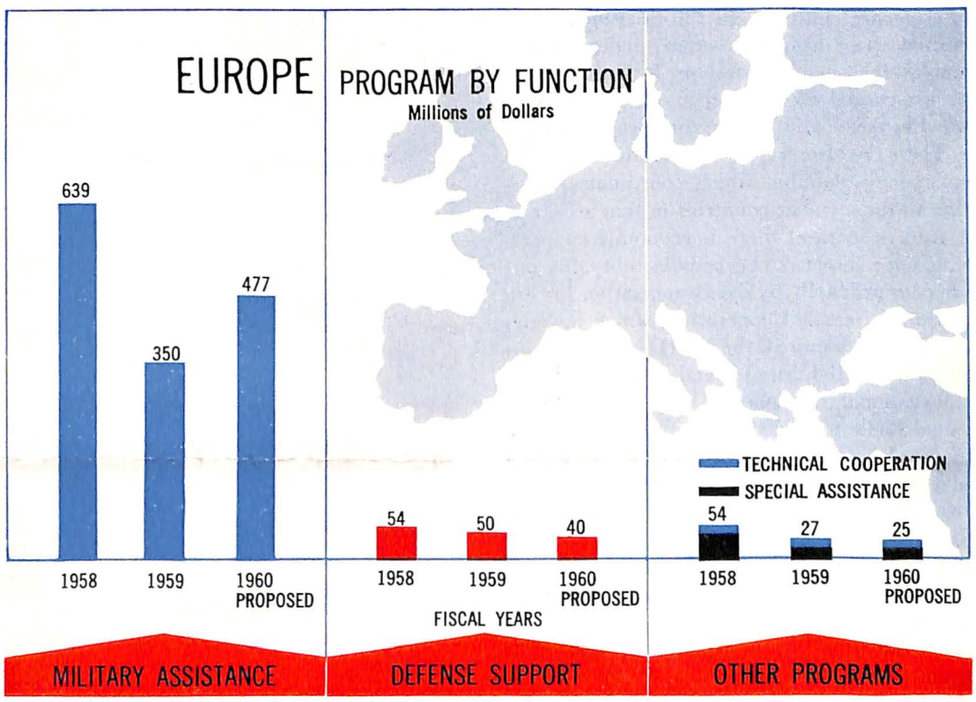
The European Command is under the Supreme Allied Commander Europe (SACEUR) with headquarters near Versailles. This command has from the start been headed by an American. President Eisenhower was its first commander. He was followed by Generals Matthew B. Ridgway (1952-53), Alfred M. Gruenther (1953-56) and Lauris Norstad, current SACEUR.

This command embraces the land area extending from the North Cape to North Africa and from the Atlantic to the eastern border of Turkey, excluding the United Kingdom and Portugal. It is broken down into four subordinate commands: Northern Europe, Central Europe, Southern Europe and the Mediterranean.

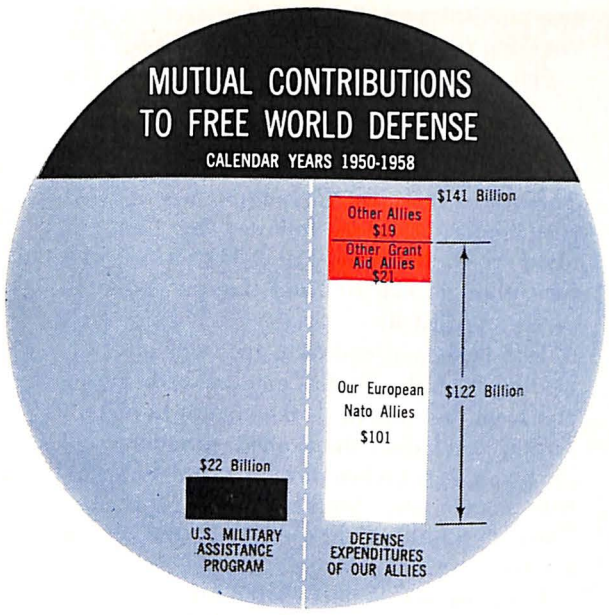
For naval action, there is the Atlantic Ocean Command, headquartered at Norfolk. The Supreme Commander, or SACLANT, has again been American since the command's organization. Current SACLANT is Admiral Jerauld Wright, who succeeded Admiral Lynde D. McCormick in 1954.

The Atlantic Ocean Command extends from the North Pole to the Tropic of Cancer and from the coastal waters of North America to those of Europe and Africa, except for the English Channel and the British Isles. It has three subordinate commands, two embracing the Eastern and Western Atlantic and the third the Striking Fleet Atlantic Command.

The third major command is the Channel Committee and Channel Command. The committee is composed of the naval chiefs of the United Kingdom, Belgium, France and the Netherlands. The Channel Command covers



Note: Excludes assistance from the Development Loan Fund



the English Channel and the southern North Sea.

In addition to these major subdivisions of NATO, there is the Canada-United States Regional Planning Group, which develops and recommends to the Military Committee plans for defense of the North American continent. It meets alternately in Washington and Ottawa.

NATO goes beyond the area of mutual security. There is, for instance, a group devoted to fostering cultural and informational cooperation, to promote better understanding among the member nations by information programs and by cultural exchanges between the European and North American partners.

There is also a joint committee for civil emergency planning which coordinates activities of the member countries in that area.

And, of course, there is economic cooperation, not a direct NATO responsibility, but one handled primarily by the Organization for European Economic Cooperation, which includes in its membership all the NATO countries plus Austria, Ireland, Sweden and Switzerland. The International Monetary Fund, the International Bank for Reconstruction and Development, the International Financial Company and other United Nations institutes all contribute to the economic structure of the Western allies.

To provide the member countries with complex, modern arms and equipment, there are the Mutual Weapons Development and Weapons Production Programs, under which NATO countries are bringing about closer cooperation in research, development and production.

The strengthening of the NATO group over a period of years has been expensive to the United States, but it is far from a one-way street. Despite frequent criticisms of the extent of our aid to Europe, the U.S. has by no means borne the burden of the cost.

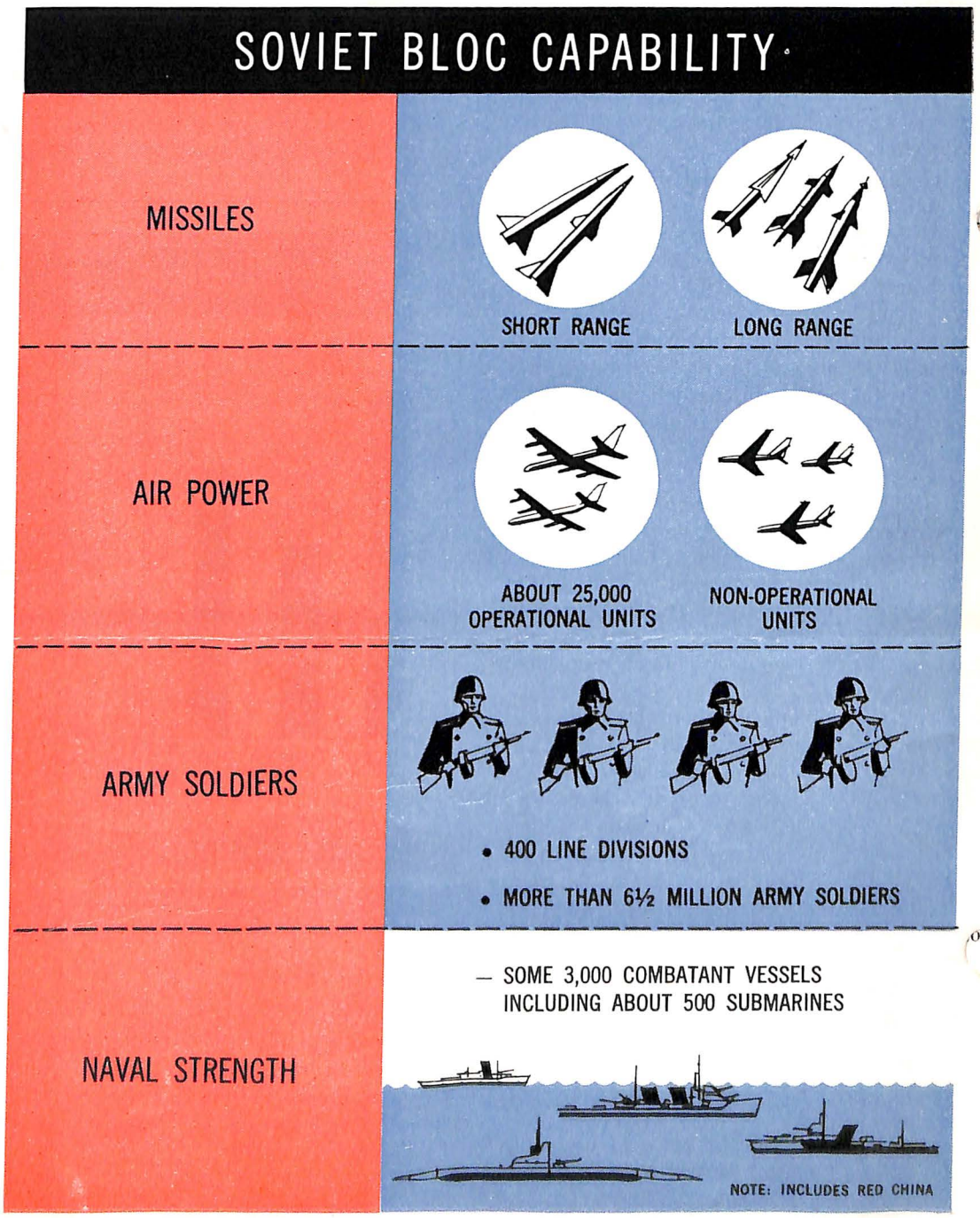
From the start of the NATO build-up through the end of the calendar year 1958, the United States contributed $14.6 billion in military assistance. During the same period, our NATO allies spent over $100 billion on defense. While the U.S. has furnished the bulk of the equipment needed and provided a good part of the training requirement, its European allies have contributed the vast majority of NATO manpower, including troop pay, clothing, food and housing; they have provided the land and facilities; and they have contributed substantial amounts of their own materiel. They also contribute shares of the costs of the weapons development and production programs.

This United States expenditure in NATO has been a good investment on our part. We have acquired a second deterrent force in the battle against creeping Communism and have increased the potential of our own American forces. For instance, the 160 air bases constructed under the NATO "intrastructure" cost sharing program represent a significant asset to our own retaliatory capability. In addition, there are the intangible benefits, such as better understanding and closer knitting of the Atlantic Community.

NATO today is not the end-all. There still exist, to some extent, disagreements and conflicts. The forces NATO has assembled are not 100% trained and equipped with the latest equipment, nor does their combined strength yet match the massive Soviet war machine in Europe.

NATO has nonetheless come a long way in its first decade. There exists a solid foundation of mutual respect and understanding among the members, a platform upon which to build further solidarity. The defense forces have grown many fold in number, their training status has improved in similar scale, and they are far better equipped than they were 10 years ago.

The Soviets do not like NATO, which is perhaps the greatest tribute to its existence. To what extent the collective program has deterred further aggression in Europe, we can only conjecture. But each degree of its growth reduces the chances of further Soviet thrusts. To quote President Eisenhower: "Together with our allies we stand firm wherever the probing finger of an aggressor may point. Thus we lessen the risk of aggression."



Aircraft Industries Association of America, 610 Shoreham Building, Washington 5, D. C.

Weapon Program Uses Skills Available in Broad Subcontracting Base

(*Continued from Page* 1)
in the myriad administrative details connected with weapon system design, development and production.

In addition, the Air Force has established strong internal management techniques, supplemented by the prime contractor's organization, to perform a surveillance-type control in integrating the development and production of a weapons system, with constant checks on program progress.

There are substantial technical advantages to this system. The project involves the efforts of many skilled industrial firms associated with the prime contractor, representing the best thinking and efforts of a large number of scientists and engineers. For example, over half the total force of more than 5,000 engineers directly associated with a supersonic bomber project were employed by subsystem contractors. In addition, several hundred other engineers were working in the plants of minor equipment manufacturers.

1,200 Vendors Used

On this particular project, more than 1,200 vendors furnished raw materials, off-the-shelf equipment and other items. Another 2,400 vendors provided operating supplies, special test equipment and facilities items. Work was spread out to contractors in 46 states of the Union.

Small firms, as well as large subcontractors, are given every opportunity to participate in weapons programs carried out under this system. Prime contractors have a requirement for small business participation, and representatives to facilitate their efforts to secure subcontracting work. The Air Force insures that small business capability is used.

Of the total dollars handled by the prime weapon system contractor, as much as 70 to 75 per cent is paid to other firms.

The Air Force carefully checks its prime and first-tier subcontractors to make sure that they do not expand into specialized fields where there are existing development and production talents and facilities. A strong subcontracting base is stressed throughout. This is particularly important in providing early availability of the weapon at a minimum cost.

Design Teams Formed

The Dyna-Soar program, aimed at providing a manned orbital bomber, is an example of the teamwork industry is evolving to meet unprecedented technical demands. Two teams of contractors, each headed by a prime airframe manufacturer, are working on design proposals now. They were formed voluntarily and their combined talents promise success in meeting the technological and managerial challenge posed by the project.

Ultimately one team will be selected for the development and production contract. Parallel development and production of weapon systems of similar performance and mission capabilities can no longer be afforded from a cost standpoint. This means that the prime contractor selected for development and production must meet his target dates or the Air Force faces a serious gap in its weapon inventory.

Causes Repercussions

This gap causes repercussions all along the line. It means a recasting of such allied programs as base construction, recruiting and training, research and development and funding. In fact, the Weapon System Management Concept is not only directed toward the design, development and production of a weapon, but also toward internal operations of the Air Force. While the term Weapon System Management Concept is appropriate for the development and production phase, a more accurate term for the over-all concept would be the Weapon System Integration.

The partnership between the Air Force and industry today is closer than before. Lt. General Clarence S. Irvine, Deputy Chief of Staff, Materiel, Headquarters USAF, sums it up this way:

"Every individual in our industrial complex, and every Air Force officer and civilian employee who is concerned with the materiel program has a share in this responsibility. Actually, this is as it should be. For we all share directly in the benefits of peace, prosperity, and the world's highest standard of living—the invaluable assets which this airpower must preserve."

NAEC Publishes New Pictorial Booklet

U. S. Aircraft, Missiles and Spacecraft, 1959, a comprehensive, pictorial account of aeronautic and astronautic achievements during 1958, is now available for distribution.

Published by the National Aviation Education Council and prepared in cooperation with the Aircraft Industries Association, the booklet, in previous editions known as *U. S. Aviation Today*, has been newly titled to more properly reflect the changing aspects of the industry.

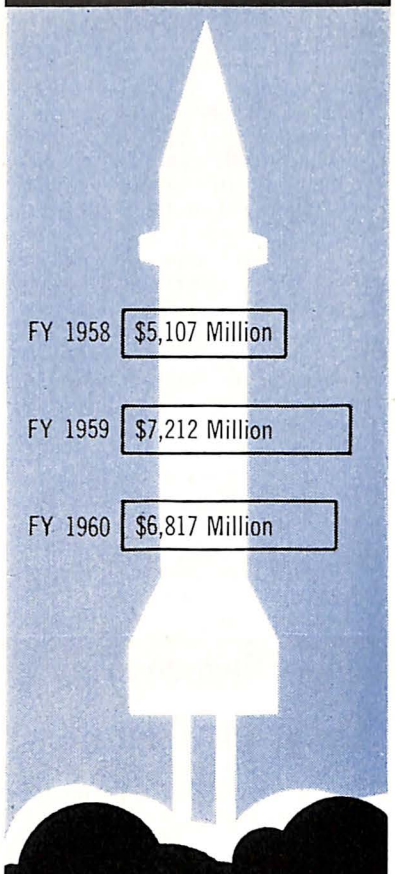
U. S. Aircraft, Missiles and Spacecraft contains photographs and three-view drawings of all aircraft and helicopters produced in the United States during the past year, together with specifications and performance data.

In addition, the booklet contains a special chapter on achievements in the field of space flight and records U. S. satellite progress during 1958.

An expanded missile section depicts all U. S. missiles in development, production, or operation, with specifications and performance data.

The 152-page booklet with three-color cover, may be obtained by writing to the National Aviation Education Council, 1025 Connecticut Avenue, N. W., Washington 6, D. C. Price is $1.00 per copy.

MISSILE PROGRAM



Defense Department reports that the obligational program (new orders) for all missile systems will decline $395 million in Fiscal Year 1960 compared with Fiscal Year 1959. The total in FY 1960 is estimated at $6,817 million with $7,212 million scheduled to be obligated in FY 1959. These amounts include all procurement, construction and research and development programs directly associated with missile programs. They also include aircraft and shipbuilding costs directly associated with providing missile capability such as submarines designed to launch missiles.

'PLANES'

New Jargon Developed For Scientific Terms

Advanced research by the aircraft and missile industry in such fields as nuclear energy is developing new concepts of measurement complete with new jargon.

For example, the estimated weight of an electron is one-thirtieth billion, billion, billion billionths of an ounce.

A "jiffy" is the time required for light (going at the speed of 186,000 miles a second) to travel one centimeter.

A "barn," which is an area used to measure atom action, is the part of a square centimeter that would be expressed by the fraction 1 over 1 followed by 24 zeros.

A "shed" is one-millionth of a "barn."

Flame Method Cuts Machining Time

A new flame cutting process developed by an aircraft company reduces machining time for jet plane windshield fittings from nine hours to 44 minutes per unit.

A windshield fitting starts out as a solid block of metal. Half-way mark in the production of a fitting is reached when the solid block is shaped to a rough approximation of the part. Formerly, a number of time-consuming steps were necessary to reach this rough contour stage.

With the new process, the solid block of metal is preheated to about 700 degrees to avoid edge cracking. It then is subjected to a jet of oxygen-acetylene flame, which carves the metal cleanly and rapidly. Unwanted metal simply drops away.

Once a cutting operation is completed, the metal is given further heat treatment to prevent surface hardening or cracking during cooling at room temperature. Tests show the entire process is some 20 times faster than the former method.

Preliminary analysis indicates that more than 3,000 man-hours will be saved in the costs of the windshield fittings currently programmed.

Future application of the flame cutting process could include multiple cutting heads, which means more complex parts could be processed at higher speeds.

Tiny Strain Gage Plays Key Testing Role

A tiny sensitive device known as a strain gage is playing an increasingly important role in the production of structurally sound aircraft and missiles. The instrument measures the strain which structural areas of an aircraft or missile are subjected to during testing.

With the advent of high-speed aircraft and missile ventures into outer space, strain gages are being relied on more and more for measuring strain in complex structures at high temperatures.

Simple in construction, a strain gage basically consists of several wires. Heart of the device is a tiny wire, one-half the thickness of a human hair.

The gages are attached to the material or structural area to be tested and connected to electrical instrumentation. Under pressure, or load, the structure in question lengthens or shortens, causing a duplicate, but minute, reaction in the wire.

Resistance of the wire to the electricity varies with the change in the dimensions of the wire. Measurements of the resistance changes indicate the extent of the load on the test structure and provide information as to its structural integrity.

One aircraft and missile company has thus far used 12,000 of the gages in proof and flight testing of its new jet airliners.

New Laboratory Groups Are Formed To Handle Space Age Research

Space Age research has been intensified by an aircraft and missile company which recently formed four specific laboratory groups to investigate problems that will affect satellites and missiles of the future.

The solid state physics group is investigating electrohydrodynamic shocks which would affect motion of satellites in outer space.

The nuclear physics group is engaged in basic research work using an atomic linear accelerator. Medium energy neutrons are generated to verify calculations of what makes stars burn.

Shock physics research and air ballistic studies are being set up in a third group.

In shock tube experiments, ionized gas is driven through the shock tube at extreme pressure to simulate shock waves up to Mach 20 (over 15,000 mph) with resulting high temperatures (in the 20,000-degree F. range). Spectographs are used to record density of shocks through optical windows set at intervals along the tube.

Work has begun on an aero ballistic range and .30-cal. gun to launch projectiles at Mach 15 in a controlled atmosphere to determine wake and shock patterns of hypersonic objects.

Work is also under way on molecular beam experiments. Shock front conditions which would form at re-entry of satellites into the earth's atmosphere may possibly be simulated in the molecular beam by means of intersecting beams of atoms and electrons.

All equipment has been designed by company scientists and built to their specifications. Of particular value is an electron microscope recently acquired by the physics section which magnifies objects by more than one million times.

Industry Facing Stiff Precision Requirements

Measurement accuracy of a tenth of a millionth of an inch within the next 10 years was predicted recently by an aircraft and missile industry executive.

The official pointed out that some plants today are manufacturing grinding, honing and other machine tools and measuring equipment for volume production of precision parts to an accuracy of plus or minus five millionths of an inch (six decimal places), and the aircraft and missile industry has requirements for seventh-decimal-place accuracy now.

Projected piloted plane speeds of more than 4500 miles an hour and missile altitudes of up to 240,000 miles with speeds of more than 24,000 miles an hour present incredible precision requirements in making such parts as gyros, control systems, power linkages and various sensing devices, he said.

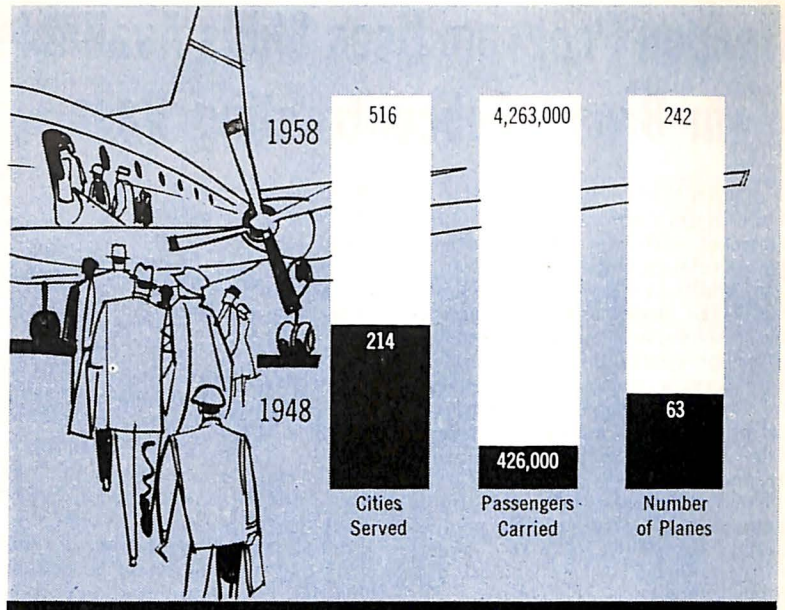
Gadget Reduces Time in Computor Operation

Two energetic aircraft industry technicians have come up with a timesaving gadget which eliminates much of the manual operation in the company's analog computer laboratory.

Known as an automatic run sequence unit, it is attached to the computer's recorder. The new device eases the task of engineers operating the two separate computers linked into one giant "brain."

Through automatic timer controls, an operator can station himself by the recorder visually checking test results produced by the machine in graph form. He can also ignore a problem inserted during the up to 15 minute problem run to busy himself with other work.

Formerly the job was a manual one requiring an operator to move between two button filled panels halfway across the room, manually punching the right one at the right time. Now the new control unit does this at dictation of the pre-set timers.



LOCAL SERVICE

America's 13 local service airlines have progressed swiftly in the last ten years, more than doubling the number of cities served while the number of passengers carried has increased 10 times. Number of planes in service has increased about four times. Local carriers today provide the only scheduled airline service available to 283 U. S. cities, and link smaller cities with main air traffic centers. New transport aircraft now available will further increase the service these carriers provide the traveling public.

'PLANES'

Electro-Hydraulic System Speeds Production of Precision Parts

An electro-hydraulic control system, built by an aircraft and missile company, makes possible for the first time the application of automation techniques in producing such precision items as missile nose cones, jet and rocket engine parts.

The system, a 360-degree automatic electro-hydraulic tracer, is used on a 425,000-pound roll-forming machine which can produce components from a one-inch thick piece of stainless steel as large as five feet in diameter by five feet long.

The machine, known as the "Spinforge," can automatically produce such mechanically-spun sections as conical, tubular, venturi and parabolic configurations with thin, heavy or tapered sectional thicknesses.

The "Spinforge" machine can produce in minutes precision parts components which previously required as much as a full day to assemble manually.

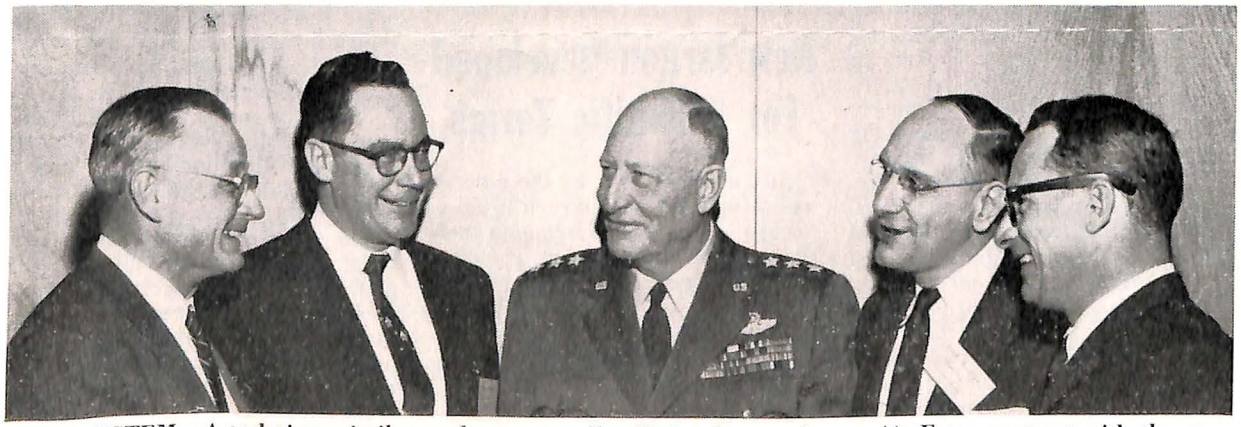
In the roll-forming of engine, aircraft and missile components, the "Spinforge" machine is able to apply 225,000 pounds of force on each of two rolls, which is considered sufficient for all metals presently used. The control system is designed to produce parts to within plus or minus .003 inch of specifications.

This is accomplished through the highly sophisticated automatic tracing control system. The part is duplicated through a process of tracing the outer surface contour of a perfect working model (a cross section) known as a template.

The piece of metal to be roll-formed on the machine is placed on a rotating table which supports a mandrel (a steel casting weighing as much as 40,000 pounds that is used as a core around which the metal is molded).

The operator then pushes a button on the control console to bring the tracing stylus into position on the template. At this point, the automatic control system takes over to produce the part at a rate of six inches per minute or less.

Heart of the control system is an electronic "brain" that has a built-in "intelligence" enabling it to interpret signals from the electro-magnetic stylus head to continuously adjust roller speed and angle.



APT SYSTEM—A technique similar to the paper roll in a player piano has been adapted, greatly refined, and a "language" added, for the machining of complex aircraft and missile parts which offers savings in skilled manhours of 80 to 95 percent. The new system, called APT (Automatically Programmed Tool), uses a high speed digital computer to calculate the numerical data necessary to program the motions a numerically controlled machine tool makes in cutting metal components for aircraft and missiles. APT was developed by the Massachusetts Institute of Technology under an Air Force contract with the cooperation of member companies of the Aircraft Industries Association. Five of the officials responsible for the development of the APT SYSTEM are, from left to right; Dr. G. E. Brown, Head, Electrical Engineering Department, MIT; Mr. C. B. Perry, Douglas Aircraft Company (Long Beach, California); Lt. Gen. Clarence S. Irvine, Deputy Chief of Staff, Materiel, USAF; Dr. Frank Rentjes, Director, Servo-mechanisms Laboratory, MIT; and Mr. J. A. Maurice, coordinator of the APT System for AIA.