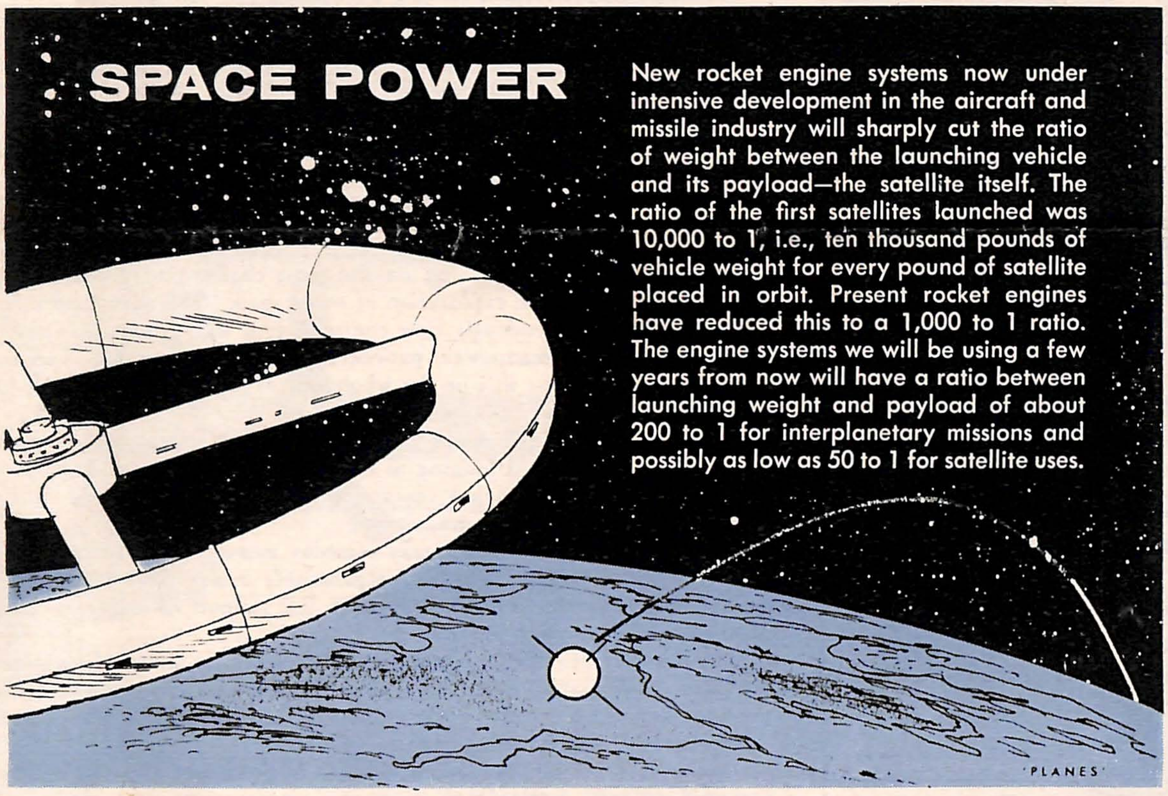
planes AIA aerospace

AIRPLANES • MISSILES • SPACECRAFT • HELICOPTERS • POWERPLANTS

OFFICIAL PUBLICATION OF THE AEROSPACE INDUSTRIES ASSOCIATION OF AMERICA, INC. VOL. 15 NO. 5 MAY, 1959

# AIA BECOMES AEROSPACE INDUSTRIES ASSN.




## Remote Control 'Mobot', Equipped with TV Eye, May Someday Be First 'Man' on Moon

A remote control mobile robot developed by an aircraft and missile company may someday be the first "man" on the moon.

Called a "Mobot," the machine can be applied to almost any situation which is too dangerous for man to undertake by himself, from working in radioactive rooms to handling materials in deep water.

Looking more like a fork-lift than a Frankenstein monster, the Mobot is equipped with flexible steel hands and television-camera eyes. It is part of the company's full-scale experimental program to measure effects of atomic radiation upon electronic components.

While the Mobot enters a "hot" (radioactive) area deadly to man, its human operator remains safely removed in another room equipped with a push button panel board and console of monitors. The operator sees the hot room through the Mobot's TV-camera eyes which send him a picture on a closed circuit. The operator electronically directs the machine to pick up and move radioactive materials.

Television cameras mounted on the walls of the hot room give the operator an overall picture of the environment, while cameras atop the machine itself afford forward and rear direction views. Additional cameras on the Mobot's "shoulders" offer closeups of the "fingers" at work. A microphone attached to the Mobot permits the operator to hear the metal fingers grasp an object.

The remote control handling machine can be equipped with auxiliary tools such as wrenches, screwdrivers, hammers, and shears for dismantling radioactive equipment. It can perform a variety of lifting, inverting, and placing operations.

It is simple, rugged, and inexpensive, operates electrically by cable or radio link, can lift extremely heavy objects, or handle delicate items with tweezer-like care. Its electropneumatic fists and fingers can be adjusted for a light touch or a 200-pound squeeze.

The Mobot is expected to be the forerunner of a long line of machines which will be designed to perform a wide variety of duties. One such possibility could be collecting specimens from the moon, as the operator remains safely in the spaceship's interior.

## New Brazing Process Repairs Steel Panels, Offers Huge Savings

A new brazing process which makes possible the repair of an aircraft's damaged stainless steel panels, saved taxpayers some $35,000 in the first four months of use.

Developed by research engineers of an aircraft plant, the process is performed with the aid of a special tool, and makes the panels as good as new.

Stainless steel panels consist of a "sandwich" of honeycomb core covered on each side by very thin stainless steel skins. The panels give a highly efficient structure that holds up under the high temperatures produced by the plane's powerplants and air friction at Mach 2 speeds.

The skins, however, are so thin that they are easily damaged. An inadvertent poke with a screwdriver can damage them beyond use.

With the new process, the damaged skin and honeycomb is carefully cut away from the panel. A new piece of honeycomb is spliced into the core, after which a new piece of stainless steel skin large enough to cover the opening is put into place.

The new tool is then brought into play. It fits over the spot getting the fix to apply heat which brazes the new stainless steel to the panel.

## New Name Reflects Industry Changes

By J. S. McDonnell

Vice President and Member of the Board of Governors
Aerospace Industries Association

The membership of the Aircraft Industries Association has overwhelmingly approved a proposal to change the Association's name to Aerospace Industries Association—a simple action on the surface but one that points up the sweeping changes that have occurred in the industry since World War II.

The change from "Aircraft" to "Aerospace" sums up the prime responsibilities the industry has in both air and space programs. The industry, years before the Russians launched Sputnik I, had propulsion, guidance and instrumentation projects under way primarily aimed at application in military missiles and aircraft, but which also had immediate utilization in space exploration vehicles.

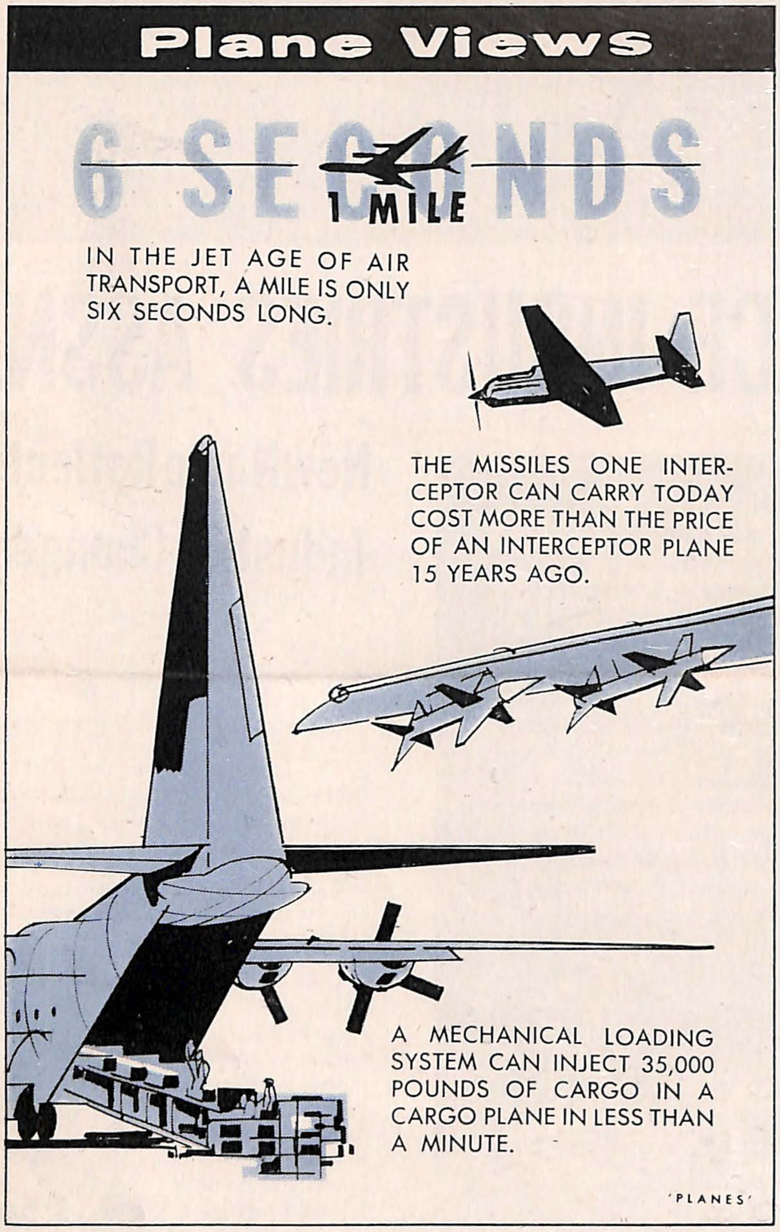

**Mr. McDonnell**

The nation, through Congress, reacted promptly and effectively to the Sputnik challenge. The National Aeronautics and Space Administration was created based on the personnel and facilities of the National Advisory Committee for Aeronautics. The infinity of space became another arena for international competition, and the managers, engineers and scientists, largely centered in what is historically known as the aircraft industry, were called upon to accelerate the development and production of hardware for the space programs—both military and civil.

The U.S. satellites now in orbit were placed there by slightly modified versions of intercontinental and intermediate range ballistic missiles.

Where do we stand today in industry? Expenditures by the Government account for approximately 80 per cent of the industry's total business, and are a reasonable barometer of the type of work being performed. Expenditures for military aircraft are declining from $8.5 billion in 1958 to an estimated $6.6 billion in 1960. Expenditures for guided missiles have increased

*(See AEROSPACE, Page 7)*




## Aerospace Quote

"Aviation, missiles and space have had a stupendous impact on our people, our security and the entire international picture. They will exert greater influence in the future.

"Millions of Americans in science, industry, the Armed Forces, and other pursuits earn their livelihood as a direct result of these programs. Most large American firms have heavy stakes in these areas. . . .

"Our most expensive and important defense efforts are in these fields and our nation's survival in the years ahead depends on our achievements in aviation, missiles, and space. More than 12 billions of our 18 billion FY '59 procurement and development budget will go directly or indirectly into aviation, missiles or space activities.

"The scientific progress during our lifetime, although only a small beginning, has probably had a greater impact on this world than all previous technological advancements in recorded history. Many of man's most dramatic achievements have been made in your fields of interests."
—*Hon. M. A. MacIntyre, Under Secretary of the Air Force.*

## Laboratory Produces Tailor-Made Weather

"Make it yourself" weather is the latest thing at an aircraft and missile company.

This is accomplished in a new $2½ million laboratory, which can control temperatures from minus 100 to plus 400 degrees Fahrenheit, and provides humidity from 20 per cent to 95 per cent at various temperatures.

Designed to simulate altitudes from sea level to 100,000 feet in a matter of a few minutes, the laboratory will be used to test performance of components of high speed, high altitude jet aircraft and the latest versions of our most sophisticated weapon systems.

The laboratory consists of three high-altitude test chambers of a size which makes it possible for large components or complete aircraft systems to be subjected to environmental testing.

Another flexible feature is that all three chambers can be operated simultaneously and at different conditions.

The auxiliary systems can be used to supply vacuum, refrigeration and high pressure, high temperature air to test setups in the area adjacent to the laboratory.


## PLANES-AEROSPACE

*Planes-Aerospace* is an official publication of the Aerospace Industries Association of America, Inc., the national trade association of the designers, developers and manufacturers of aircraft, missiles, spacecraft, their propulsion, navigation and guidance systems and other aeronautical systems and their components.

The purpose of *Planes-Aerospace* is to:

Foster public understanding of the role of the aerospace industry in insuring our national security through development and production of advanced weapon systems for our military services and allies;

Foster public understanding of commercial and general aviation as prime factors in domestic and international travel and trade.

Publication Office: 610 Shoreham Building, Washington 5, D. C.
New York Office: 150 East 42nd Street, New York 17, New York.
Los Angeles Office: 7660 Beverly Boulevard, Los Angeles 36, California.

ALL MATERIAL MAY BE REPRODUCED WITH OR WITHOUT CREDIT —MATS OF CHARTS—PRODUCED IN UNITS OF STANDARD NEWSPAPER COLUMN WIDTHS—ARE AVAILABLE FREE UPON REQUEST

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


## Supporting Progress

Our nation is now embarking on the most challenging adventure ever undertaken by man—the exploration of outer space. The adventure will be costly; it will be tremendously time consuming; it will demand the best we have in brainpower, manpower, patience, energy, and courage. And most important to its success will be the wholehearted support of an enlightened public.

Why a space program? Aside from its tremendous appeal to the imagination and to man's eternal longing to conquer the unknown, aside from the staggering potentials of such a venture, what tangible evidence do we have to support a project of such magnitude?

The potentials of what space may someday mean to our society can still hardly be realized. But even the comparatively meager knowledge now at hand should suffice to unite the nation in full support of a dynamic, well-planned, well-financed program.

Since January 31, 1958, this country has successfully launched eight earth satellites, a solar satellite and three space probes, all of which have already provided important new knowledge about the environment of nearby space.

Highlights of space findings are:

Discovery of two intense radiation zones in the upper atmosphere which surround the earth in bands.

Determination that the earth is slightly pear-shaped with the stem at the North Pole. Simultaneous measurements from islands and mainland have permitted more accurate mapping.

New and reliable data regarding the makeup of the atmosphere that surrounds the earth.

Even the presently foreseeable applications are enormous. Earth satellites may revolutionize meteorological research, resulting in improved weather forecasting and possibly some degree of weather control. More accurate forecasts have tremendous economic implications for agriculture, food processing industries, public utility companies and other industries.

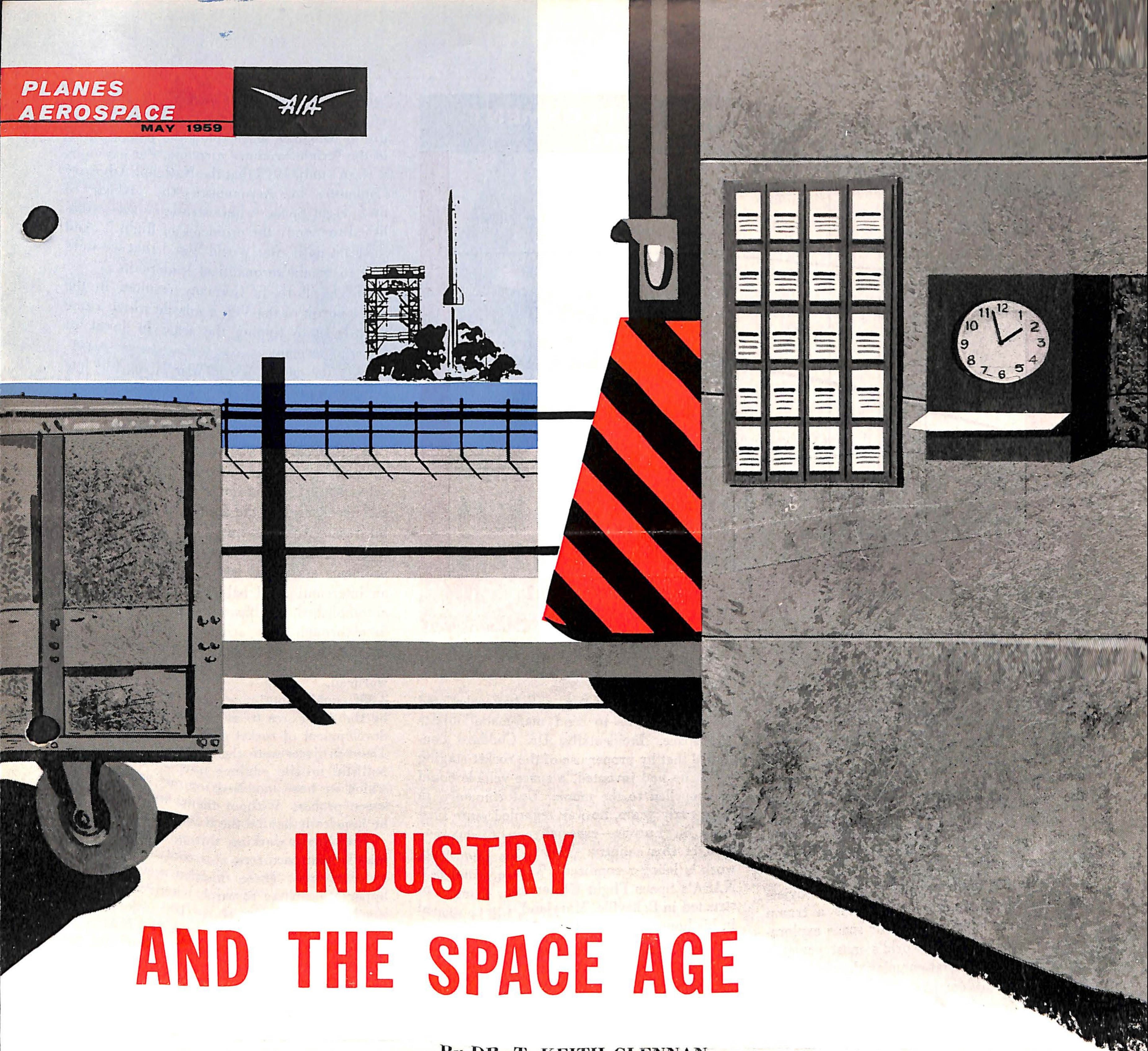
Satellites properly instrumented will permit world-wide observation of hurricanes, tornadoes, cloud heights and type, presence of precipitation, thunderstorms, measurement of temperatures at various levels.

Development of a world-wide communications system of great capacity including that required for television transmission is another foreseen application of earth satellites. A telephone call around the world for 20 cents was recently predicted by a communications executive.

The manned and unmanned exploration of space will have major influence on the development of nearly every branch of engineering and technology. The most profound impact will be on the basic sciences of astronomy and geophysics, for space vehicles make possible direct experimental measurements in space at the site of the phenomena under study.

To most Americans, the real and long-term importance of space exploration lies in beneficial uses to which we put the knowledge gained. Our goal is a peaceful one. But space is an environment which can be used to threaten and endanger the free world. We must make certain that we are able to meet this threat in space or in any other quarter. Russian Sputniks and Luniks testify to the scientific and engineering capabilities of the Soviet Union. The Russians exceed us in rocket propulsion and the capability of placing heavy payloads in orbit, due to the fact that they began serious work in the ballistic missile field six or eight years earlier than we did.

We must respond with a continuing, well-rounded program of research and engineering that includes an ample basic research effort. It is important that the American people believe in the inherent rightness of our purpose and our goals. If we don't accept the challenge, others will.



# INDUSTRY AND THE SPACE AGE

By DR. T. KEITH GLENNAN

DR. T. KEITH GLENNAN, first Administrator of the National Aeronautics and Space Administration, is president-on-leave of the Case Institute of Technology, Cleveland, Ohio. He was born in Enderlin, N. D., and is a graduate of the Sheffield Scientific School of Yale University. Dr. Glennan joined the Columbia University Division of War Research in 1942, serving throughout the war, first as Administrator and then Director of the U. S. Navy's Underwater Sound Laboratories at New London, Conn. From October, 1950, to November, 1952, concurrent with his Case presidency, he served as a member of the Atomic Energy Commission.

IN the eight months since the National Aeronautics and Space Administration put out its "Open For Business" sign, a vigorous program for initial space exploration has been evolved. NASA has already made contracts or arranged for other federal departments to make contracts for it, totaling approximately $185,000,000.

Our efforts today are aimed at three major fields:

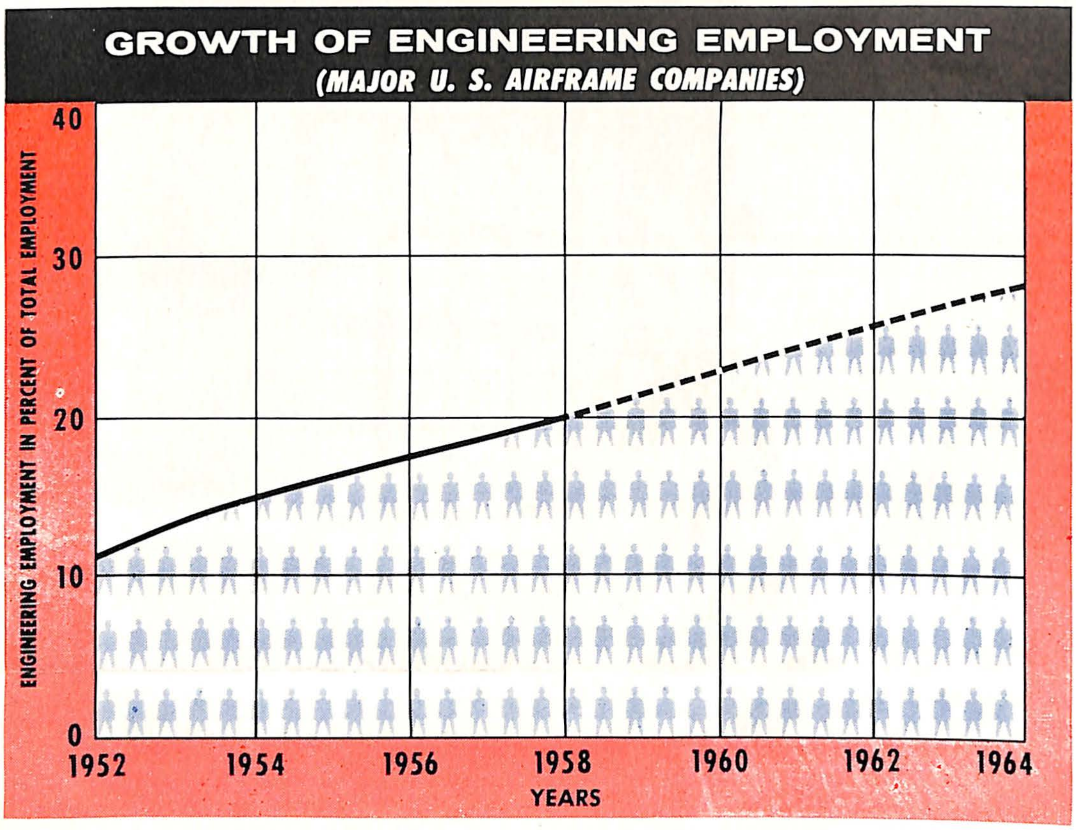
- Development of higher thrust rocket engines. Under intensive development by aerospace companies are several new power plants, including a 1 - 1½ million-pound-thrust single chamber rocket engine. This is the absolutely necessary first step—power to propel larger instrumented payloads and man into space.
- Development of greater reliability in all components, particularly in control, tracking and telemetry systems.
- Development of more knowledge about man himself and the physiological and psychological problems of space flight.

What about our objectives in space? First there is the enhancement of our national security with all this implies; second, the advancement of basic knowledge about the earth and the universe in which we live; and, finally, the economic benefits for this nation and, ultimately, for men everywhere.

The most frequent question I am asked regarding our space efforts is, "Which nation is leading—the United States or Russia?"

There is a tendency among Americans in competitive situations, whether it be baseball or space exploration, to let their attitudes oscillate between forlorn discouragement and heady optimism as the situation shifts from day to day.

Each time a Soviet accomplishment with satellites or deep space probes is reported, there is a vocal group that insists we have




fallen so far behind we may as well throw in the towel. By the same token, when we place a payload into space, I am suddenly deluged with the question: "Have we caught up with—or passed—the Russians?"

The answer, if there is an answer to such a sweeping question, lies someplace in between the two attitudes. We are not hopelessly behind the Russians, but neither have we yet caught up, and we certainly haven't passed the Russians.

Despite the unquestioned gains the Soviets have made, this nation still holds a trump card: We are supported in our space exploration programs by the world's most versatile and capable industrial complex that has as its basis the firms composing the aircraft and missile industry.

Fundamentally, space is an extension of the atmosphere directly overhead. The rockets which we are using to roll back the frontiers of space are lineal descendants of the Wright Flyer of 1903. Generally, aircraft of the most advanced types have been developed by industry for the military services, and later converted to civilian use. This has been true of rocket development too.

NASA has made use of these military developments, slightly modified, ever since it went into operation in October 1958, because they were the only rocket booster systems available with power enough to send a payload into orbit. For the next year or so we will continue to be dependent on military boosters for our basic power plants.

The prompt reaction to the Russian space challenge was made possible by the substantial competence we had in rocket and space technology, both in industry and government.

In 1926, the world's first successful flight of a liquid-fuel rocket was conducted by an American scientist, Dr. Robert H. Goddard. Earlier he had done much pioneering theoretical work in rocketry, and had calculated the requirements to send man-made objects into space. Incidentally, Dr. Goddard concluded that by proper use of the rocket staging which he had invented, a space vehicle could be propelled to the moon. Unfortunately, in those early years, he was regarded more seriously in Europe—especially in Germany—than in this country. Today, his pioneering work is being recognized. We are proud that NASA's Space Flight Center, now being constructed in Beltsville, Maryland, will be named in his honor.

There is a thoughtful parallel to be drawn between our neglect of rocketry for decades after Goddard and the earlier American failure to recognize and exploit the potentialities of the Wright brothers' airplane. For example, it wasn't until 1915 that the National Advisory Committee for Aeronautics—the forbear of the present Space Administration—was established to "study the problems of flight." And it wasn't until after World War I that we were able to regain aeronautical leadership.

Rocket efforts in Germany resulted in the development of the V-2, a missile which came very close to tipping the scale in favor of Hitler's Germany.

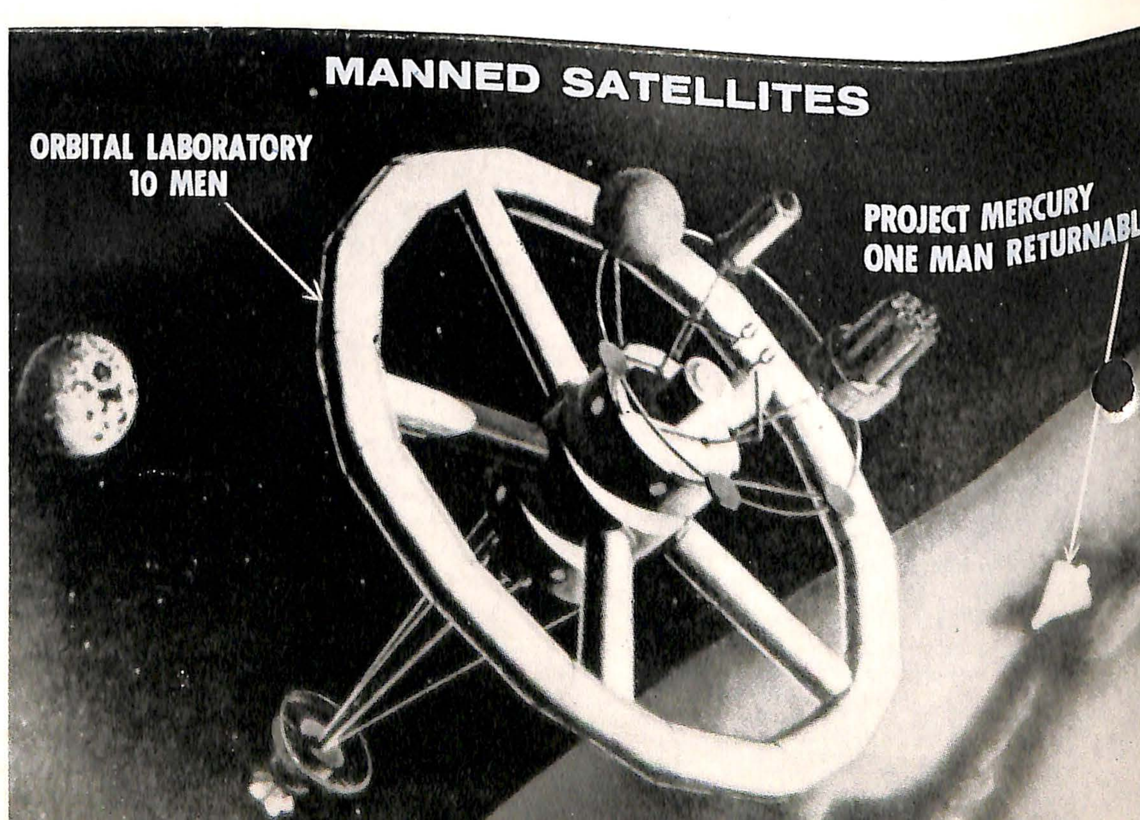
With the end of World War II, only a few companies in the U.S. and government laboratories, operating with limited funds, continued to work with rockets and missiles.

A vital contract was awarded to an aircraft company by the Air Force in 1946 for the development of a long-range missile. The project was cancelled the following year largely for reasons of economy. The company continued with its own funds to work on the problems associated with the development of an intercontinental ballistic missile, and had accomplished significant advances when the breakthrough was achieved that permitted packaging a nuclear payload with a relatively small, reasonably light-weight but high-yield warhead.

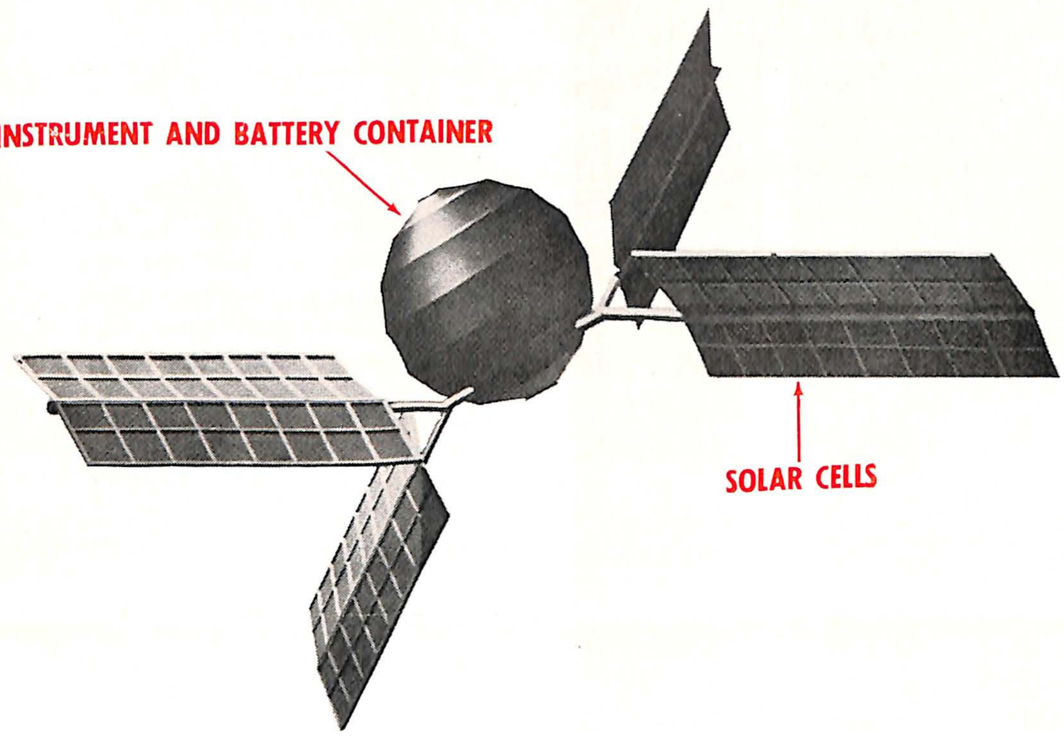
Of equal importance were the contracts let by the Air Force to an aircraft company for development of rocket engines of high thrust. These projects were the direct forbear of the ballistic missile engines now in production, which we have modified for our satellite and space probes. Without them, we might well be hopelessly behind the Russians.

The Navy, working through aircraft and missile manufacturers, also contributed to our space efforts. These missiles were used in upper atmosphere research where we learned much about altitudes above 100 miles.

At Wallops Island, Virginia, the NACA in 1945 began using rockets to propel its re-



## SPACE PROBE PAYLOAD CONFIGURATION




search vehicles to constantly higher speeds. Nearly 3,300 firings have been made since then.

Similarly, the Army's interest in ballistic missiles and rockets made major contributions. The Army employed effectively the talents of about 125 German scientists and engineers who had worked on the V-2. Using both reconstructed V-2's and other missiles, altitudes of 250 miles were reached.

This background of industrial and government experience has enabled us to make great strides since NASA became operative eight months ago. As for NASA itself, we had the great advantage of taking over the personnel and facilities of the National Advisory Committee for Aeronautics. These included some 8,000 scientists and engineers and supporting people, along with the great research centers at Langley Field, Virginia; at Moffett Field, California, and the Lewis Research Center, at Cleveland, Ohio. Other smaller activities, though highly important, which we inherited are the High-Speed Flight Station at Edwards Air Force Base, California, and the launching facility at Wallops Island.

Last November, more than 160 scientists from the Naval Research Laboratory were transferred to NASA. These included the group that had directed the Vanguard project and others conducting upper atmosphere research.

A month later, the Jet Propulsion Laboratory in Pasadena, California, was transferred from the Army to NASA. This famed laboratory employs some 2,300 people on a variety of projects. It is operated by the California Institute of Technology under contract to NASA.

Aside from the personnel at the Jet Propulsion Laboratory, NASA expects to have about 9,000 employees by the end of June. Our budget for the next fiscal year calls for an increase of slightly more than 1,000—mostly scientists and engineers—by the end of June 1960. Our present plan is to keep NASA as small as we can.

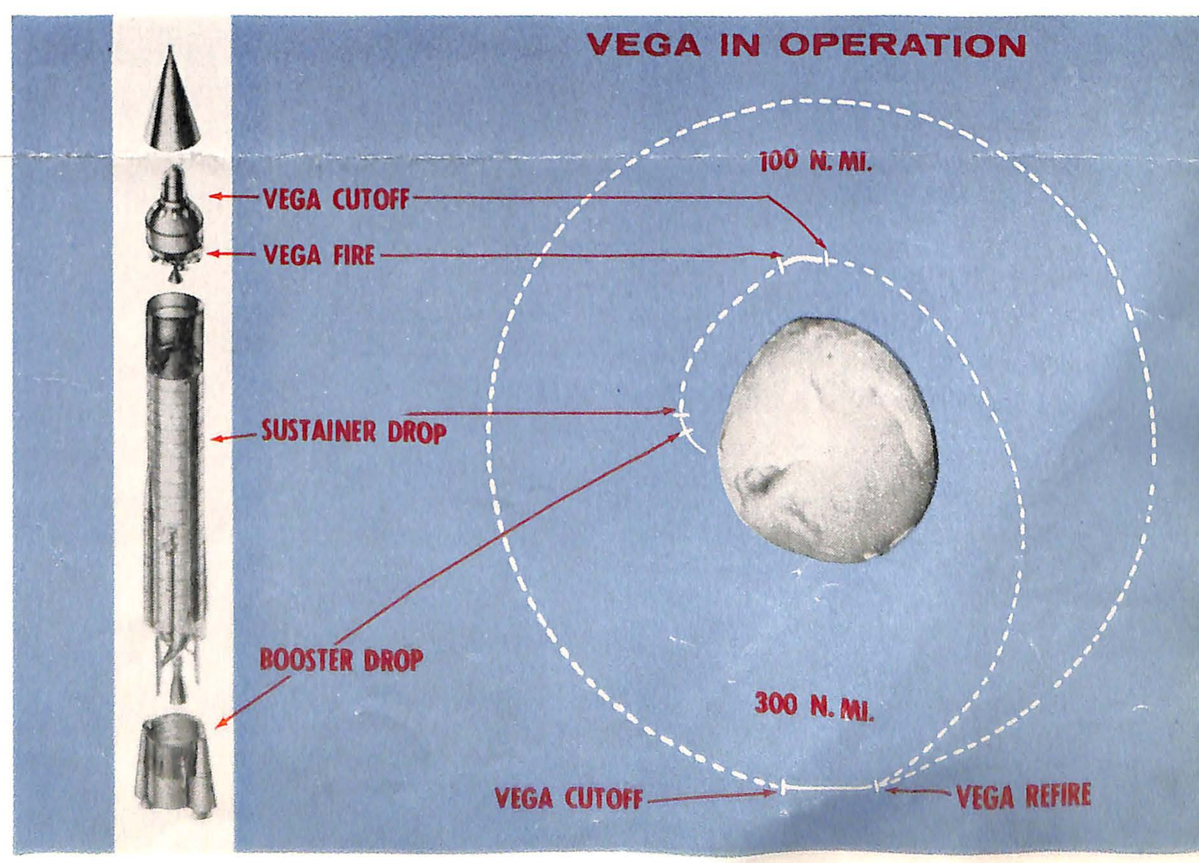
This means that a large part of our research and development, and prime contracts on such programs as Project Mercury, a manned capsule capable of orbital flight; Delta, a project aimed at developing upper stage rocketry capable of putting 250 pounds in a nominal 300-mile earth orbit or sending a 100-pound payload on a deep space mission; and Vega, a launching vehicle capable of putting a 5,000-pound satellite in an earth orbit or sending a 1,000-pound payload on a deep space investigation, will be handled by firms in the aerospace industrial complex.

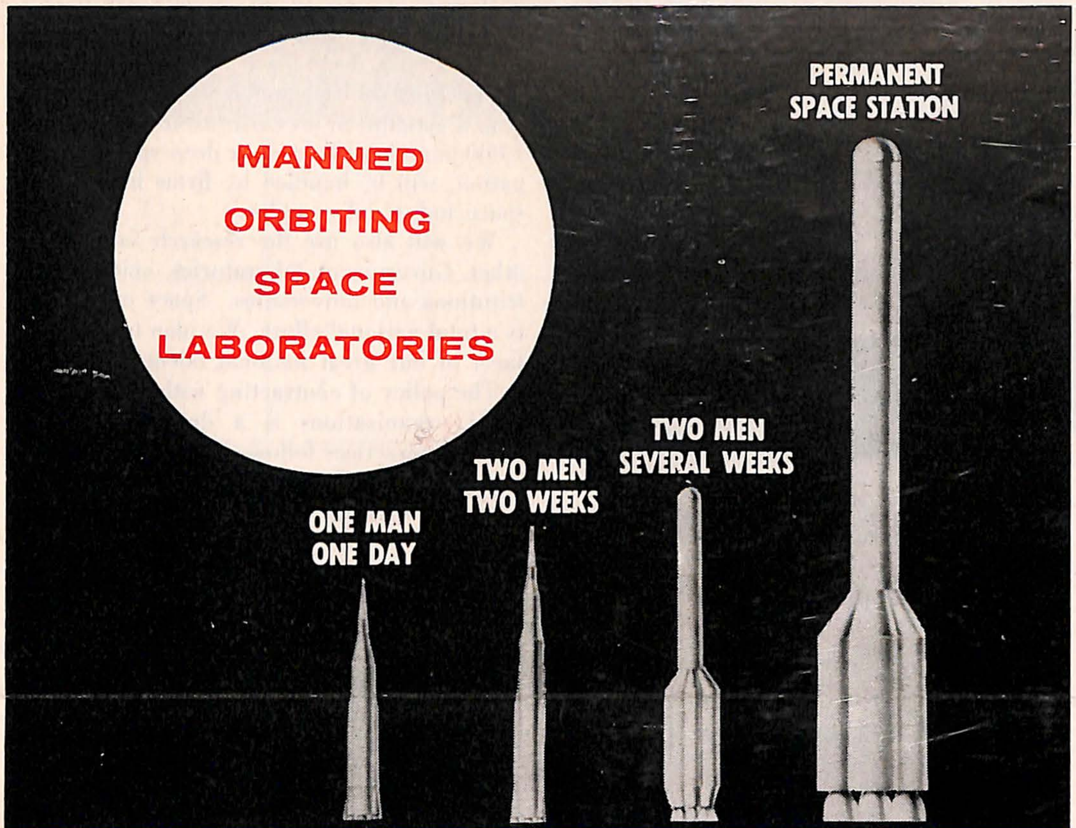
We will also use the research facilities of other Government laboratories, scientific institutions and universities. Space exploration is a total national effort. We plan to use every facet of our great national talents and skills.

The policy of contracting with industry and other organizations is a definite departure from the practices followed by our predecessor agency, NACA. Last year NACA had a budget for research and development programs of about $100,000,000. It had as its mission the development of an understanding of the problems of flight sufficient to satisfy the military and civil needs for new information required in the design of vehicles capable of faster, higher, safer flight. The NACA was not involved in production orders. Scarcely an aircraft or missile flying today doesn't utilize one and usually several of the research fruits of NACA.

The creation of NASA certainly does not mean that we are relegating aeronautics to a technological dumping ground. NASA is charged with these same research responsibilities in the new field of exploration in space as well as in aeronautics. The airplane is going to be with us for many, many years. We will continue to strive to meet our responsibility to assure America's leadership in the underlying technology of both areas—space and aeronautics.

In contrast with the $100,000,000 annual budget of the NACA, the new organization has a 1959 budget of $385,000,000 to carry out






| PHASE | 1 (MERCURY) | 2 | 3 | 4 |
|---|---|---|---|---|
| THRUST (LBS) | 365,000 | 390,000 | 1,200,000 | 6,000,000 |
| PAYLOAD (LBS) | 2,200 | 6,500 | 12,000 | 150,000 |

its new responsibilities in the search for new knowledge and the application of that knowledge in aeronautics and in the non-military exploitation of space. It is the space development and operating functions that account for the bulk of the increased budget. Approximately $250,000,000 of our Fiscal Year 1959 budget of $385,000,000 has been earmarked for contracts outside NASA.

The proposed budget for Fiscal Year 1960 asks that $485,300,000 be granted to NASA. Of this amount, about $350,000,000 is intended for work to be performed by others. Again this means principally industry.

This current budget now being considered by Congress will be the last which will be less than half a billion. As we move through our successive phases of the space exploration programs, costs are inevitably going to increase—substantially.

There is a pattern that is gradually taking form regarding industry and the space program of NASA. Industry will not be heavy industry in the sense that vast quantities of raw materials will be consumed or that a large quantity of individual end items will be required. Even the military requirements for ballistic missiles utilize but relatively little of the industrial production capacity. The indications are that the further industrial changes which will be required to support our space activities will be very much along the same line as the modifications to industry which have been already required by our modern weapons systems.

The work will pose fascinating and challenging engineering—and production—problems for many years to come.

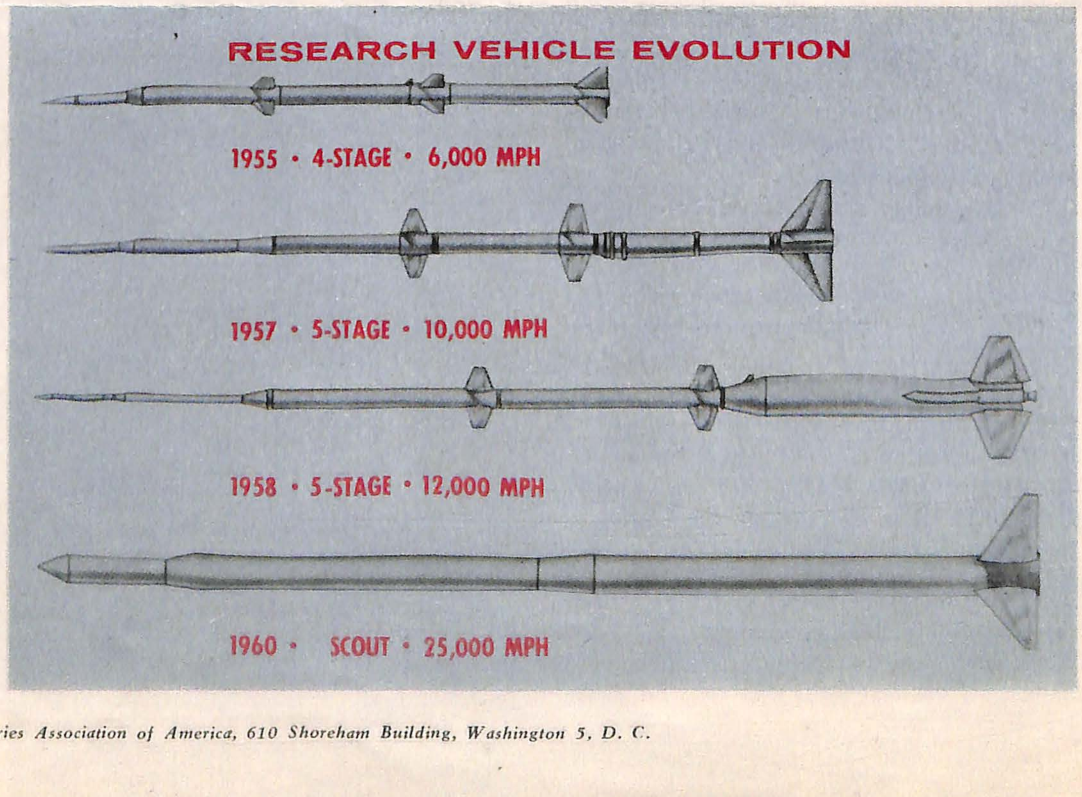
The aerospace industry, since World War II, has been constantly subjected to this process of industrial change. The days of large volume production of any weapon system may well be over. The aerospace industry has adjusted its management and its planning to this fact of industrial life. In addition, in their industrial assignments, these companies have shown a vigorous ability in translating the laboratory findings to working hardware in a very short time. Today, they work closer to the state-of-the-art than any other industry.

This experience is invaluable to our space programs where we must keep every one of our projects flexible and immediately adaptable to technological change. I note with interest that within the month the Aircraft Industries Association has changed its name to the Aerospace Industries Association. This is an entirely appropriate change, reflecting the major role that the companies forming the membership of AIA are playing and will play in our space projects. I expect that their responsibilities will continue to widen as we move from phase to phase of our programs.

Our program for the next few years is well founded, subject only to the provision of necessary funds by Congress. Beyond that our planning takes us into the preliminary stages of orbiting laboratories, lunar landings, (both unmanned and manned), the development of satellite systems components for weather forecasting, global communications and other equally exciting activities.

Beyond that planning we can see the day of interplanetary travel. But simply taking the advantages that are definitely available in just the weather and communications advances, experts estimate that the returns will be counted in the billions of dollars. Very great as such returns will be from our work in space, I have an inner conviction that in the years to come there will be other great gains from what we learn in space. They will be the ones we don't even dream of today. They will be the ones that will dwarf those we can only dimly see today.

A very great deal has been done in the brief eight months of NASA's existence. An inestimable future lies ahead. It is a future that will require from all of us our very best.



# 'Aerospace' Signifies Responsibilities in Both Air and Space Programs

*(Continued from page 1)*

rapidly from one-half billion dollars in 1954 to a planned expenditure of $4 billion in 1960. Dr. Hugh Dryden, Deputy Administrator of NASA, recently predicted that expenditures for space projects will pass the billion-dollar mark within the next few years.

These are the solid facts behind the decision to reflect more accurately the industry's responsibilities by changing the organizational name.

The new responsibilities require specialists in the industry literally ranging from "a" to "z"—astronomy to zoology—specialties once limited to the campus.

No other manufacturing industry in our history has been subjected to such far-reaching changes—a revolution in evolution. These changes stem basically from the yeasty technology of the industry, but more than the engineering and scientific functions have been affected. Management has been re-aligned, manufacturing techniques have advanced, new facilities have been designed and constructed, and industry's operations and products are increasingly diversified.

This transition, with its swift rate of change, also induced a number of financial problems in the industry. For instance, the new requirements for high-performance, very complex equipment demanded an almost totally new set of facilities, not only for production of the end item, but for the intricate research, development and test work which must precede its acceptance as a proven reliable weapon.

Thus, an industry whose earnings rate has been traditionally low was forced to divert large portions of its income to construction of facilities, and very expensive facilities because of the performance and complexity involved. The alternative was not merely losing competitive standing within the industry; without these facilities we could not hope to match the Soviet Union in the technological cold war.

General Orval R. Cook (USAF-Ret.), President of the Aerospace Industries Association, recently essayed a prediction on what will happen to the aerospace industry during the next decade which are pertinent to the name change. Here are his estimates.

1. The aerospace industry will continue to be one of the Nation's largest manufacturing employers.

2. The percentage of scientists, engineers and technicians, compared to overall employment, will increase, continuing an already established trend.

3. The industry's payroll, now some $5 billion annually, will continue to increase as the percentage of skilled and semi-skilled workers declines.

4. Large-scale production of major weapons systems will become a thing of the past as greater performance capabilities are built into new weapons.

5. On the average, the costs of these new weapons systems will continue to increase as more and more research, development and testing will be required to insure performance and reliability.

6. There will be an ever-increasing demand for new facilities in every category—from tools to buildings—with special emphasis on new research and test facilities.

7. The team approach—with several manufacturers pooling their engineering, management and production skills—will be required for almost every major new system.

8. Expenditures for space vehicles will continue to mount and development and production of equipment for space exploration will become a significant part of the industry's total sales.

9. There will be a continuing strong market for commercial aircraft of every category, especially in the vertical take-off and landing category; and manned-military vehicles will be the core of our major weapons systems.

10. Our technological progress will continue at an accelerating rate and ten years from now we will be building things we have not yet dreamed of.

## Electronics Tell Story of Missile Flight

A ground-based electronic system which gives position and velocity data of an airborne ballistic missile, is so accurate that aircraft have been able to position themselves down range to actually see the missile plunge into the ocean. The information, fed into a computer and monitored by a plotting board, gives continuous predictions as to where the missile would impact if power were shut off.

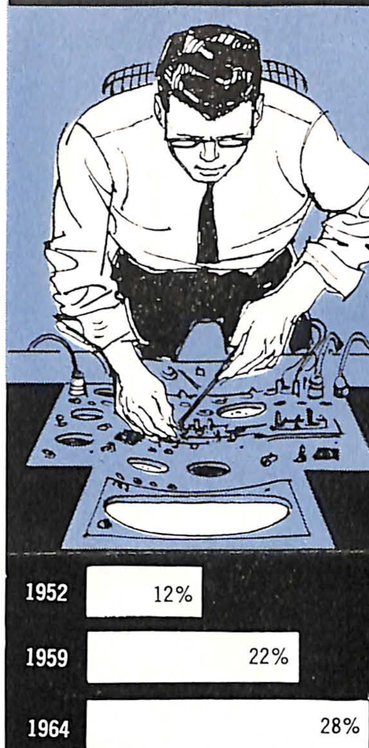
To insure this remarkable accuracy, the manufacturer has gathered together an unusual assortment of test tools for putting the advanced electronic system through its paces. Included are two-way "walkie-talkie" radio units, a special mobile unit and an airborne system carried aloft via a single-engine aircraft.

The mobile test unit consists of a transponder, antenna and special power plant which are hauled miles away via pick-up truck. There it exchanges signals with the ground station. Engineers can even detect small antenna movement caused by wind velocity and other factors.

Control and communication to the remote station is through two-way radio equipment, with the truck carrying a unit of the "walkie-talkie" class.

A recent addition to the test program is a light aircraft which has installed a transponder similar to those placed aboard missiles. Transmitting signals as it goes, the plane is flown to distant points to allow tracking by the ground station.

## ENGINEERING EMPLOYMENT GAINS




**The demands of a rapidly expanding technology have created increasing requirements for engineers in the aircraft and missile industry. In 1952, about 12 per cent of all employees in the major aircraft companies were engineers. Today, approximately 22 per cent are engineers, and it is estimated that this will increase to about 28 per cent in the next five years.**

'PLANES'

## NAEC Offers Free Booklet Listing Education Aids

In line with its program to aid educators in enriching the school curriculum, the National Aviation Education Council offers free of charge the second edition of the booklet *Pictures, Pamphlets, and Packets.*

The 24-page booklet lists more than 300 free and inexpensive air-space education teaching aids including booklets, films, pamphlets, pictures, maps, study units, bulletins, charts, etc., which are available from dozens of sources in industry and government. More than 80 percent of the items listed are free to teachers, school administrators, and librarians; none costs more than $1.00.

Teachers on every grade level will find *Pictures, Pamphlets, and Packets* a source of many supplementary classroom materials.

Copies may be obtained at no cost by writing to the National Aviation Education Council, 1025 Connecticut Ave., N. W., Washington 6, D. C.

Another booklet offered by NAEC is the 1959 edition of *Aircraft, Missiles and Spacecraft.* This is a profusely illustrated booklet that describes the various aircraft and missiles now in production. Price is $1.00.

## Unique Garb Used in Metal Test

Engineers of an aircraft and missile company are garbed like "men from Mars" while they test the industry's latest glamour metal—beryllium. Uniforms include air line respirators, coveralls, rubber gloves and shoe covers.

Beryllium is important for future use in missiles and supersonic aircraft because of its heat resistant characteristics and high strength-to-weight ratio.

The rigorous test series is to determine just how versatile the precious metal is and to see how it may best be handled in the factory.

Every safety precaution is taken by the company to protect employees working with the metal. Tests are conducted in a septically clean vacuumed room. Inside the 8 by 8-foot test laboratory is a vacuum-type machine which collects beryllium dust particles in the air for later analysis.

In present testing engineers are cutting into beryllium with regular band saws. An added safety feature on the band saw is a dust collector which gathers the metal particles at the point of the cut. Scraps and waste particles are carefully disposed of.

Before leaving the laboratory, the engineers vacuum each other to pick up beryllium dust, wash out the lab and change clothes. After leaving the lab, they change clothes once more.

Cost of beryllium sheet metal being tested is $300 per pound.

## Heat Exchanger Solves Fuel Icing Problem

An important technical advance was achieved recently by an aircraft manufacturer with the development of a fuel heater for jet aircraft to solve critical icing problems of engine fuel.

Rugged and highly reliable, the fuel heater weighs only 18 pounds. It utilizes hot engine compressor bleed air ducted through an air-to-liquid heat exchanger to raise fuel temperatures to a safe level. The new unit receives fuel at minus 60 degrees Fahrenheit and heats it to plus 35 to 45 degrees F. Compressor bleed air enters the heat exchanger at 450 degrees F., exiting at 90 degrees F.

Fuel system icing is caused by dissolved water found even in filtered fuels. Moisture is absorbed and retained by fuel much the same way water vapor is held in the atmosphere. As the fuel cools, water cools at an accelerated rate, and at minus 20 degrees F. becomes ice slush which obstructs fuel filters and screens. As a result, engine power is considerably weakened due to fuel starvation.

The heat exchanger consists of multiple parallel plates structurally bonded by vacuum furnace brazed fins.

When used in conjunction with ground water separation operations, the new unit offers complete protection against fuel icing.


## Space Travel Dress Under Intensive Study, Using Specially Designed Cockpit

What the well-dressed space traveler will wear may be strongly affected by a research program now under way at an aircraft and missile company.

The study involves the ability of man to tolerate extreme temperatures with and without special protective garments.

Volunteers are sealed into a cockpit in a special heat chamber for study of physical and psychological reactions to temperatures simulating reentry into the earth's atmosphere or a Mach 5 speed of a very high performance aircraft.

Air temperature in the cockpit is raised from 80 degrees Fahrenheit to 200 degrees in 19½ minutes; kept at 200 degrees for six minutes; then brought back to 80 degrees in another 19½ minutes.

As the cockpit heats up, cool air is used to ventilate the special type of pressure suit, now under study, to maintain a normal body temperature of 98.6 degrees F. The pilot has his own filtered and refrigerated air supply piped directly to him.

While the pilot is subjected to intense heat conditions, he must concentrate on a tracking problem—chasing a random dot on an oscilloscope and bringing it to center by manipulation of the controls, which are more sensitive than those of an actual plane. During tests, environmental temperatures, body temperatures, psychological reactions are recorded on instruments in a control room adjacent to the test chamber. Blood pressure, respiration, electrocardiogram, heart rate of the subject "pilot" is checked every three minutes by remote control.

Reactions of the subject are monitored by a closed circuit television with a physician in close attendance.

In another experiment humans are subjected to simulated "G" (gravity) stresses that must be endured by occupants of space vehicles while attaining speeds of up to 18,000 miles per hour—the speed necessary to put the space machine of the future into orbit.

Information obtained will serve as guides in the design of space vehicle environments.

### Traffic Gain

A substantial rise in scheduled airline traffic over the North Atlantic during the first quarter of this year as compared to the same three months of 1958, has been reported by the International Air Transport Association.

Passenger traffic increased 19.9 per cent to 190,894.

## Ceramic Magnets Prove Lighter, More Powerful than Iron Type

The magnet, an indispensable part of electronics, is being revamped by the aircraft and missile industry to equip it for space age application.

Iron, which was formerly the most frequently used mineral to hold a magnetic field, is considered too heavy by manufacturers of airplanes and missiles. In addition, iron loses its magnetic strength in high temperatures encountered in supersonic, high altitude flight.

One approach to reducing weight and combatting high-temperature effect is the ceramic magnet, made by mixing two carefully measured amounts of powdered metallic oxides, such as iron oxide and barium oxide. Heat and pressure turn the two powders into a ceramic capable of retaining an induced magnetic field.

One company is trying a refinement of this procedure. They are inducing the magnetic field at the same time they heat, squeeze and cool the ceramic.

The new process is expected to give the ceramic magnet longer life and stronger magnetic properties. The new ceramic magnets, known as ferrites, are half the weight of iron, or, if as heavy, have two to three times the magnetic strength.

These stronger magnetic properties are especially important at high frequencies. Also, the ceramic magnet retains this strength at high temperatures.

Laboratory technicians have made up a research stockpile of ceramic magnets. Some are in the shape of dominoes; some in the shape of tiddly-winks. So far these chalky black disks and blocks have shown no inclination to lose magnetism. Oppositely polarized surfaces refuse vigorously to be separated. But flip one of the disks over and the two can't be held together by human hand.

## 'Torture' Tests Prove Transport Durability

The durability of a U. S.-built jet transport was highlighted recently in a series of fuselage "torture tests."

The fuselage was deliberately damaged with six saw cuts, up to 22 inches in length, reaching through skin and major structural members, and submerged in a 170,000-gallon water tank. Water pressure inside the fuselage was increased to simulate conditions of high-altitude flight.

Although the difference in pressure between the inside and outside of the fuselage was 25 per cent greater than would ever be experienced in actual flight, the damage remained confined to its original section and the structure remained sound.

Tests also were run on the double-paned windows of the passenger compartments, to prove ability of the inner pane to stand up if the outer pane should fail. Even inner panes deeply scratched to induce failure held up through the testing.

### Manufacturer Airlifts 6,000 Dealers to Meeting

A recent showing of industrial and farm equipment at the Nassau plant of a U. S. manufacturer involved one of the largest civilian airlifts ever held by any company.

More than 6,000 dealers were flown to Nassau from all over the U. S. and Canada and many points in the world to preview the new line. Transportation was arranged by the manufacturer in a fleet of 133 chartered transport aircraft.

The showing resulted in more than $376 million in orders for the manufacturer, who has long been a proponent of the use of the airplane as a tool in business.

An executive of the company stated that he had no data on the time saving element of the airlift because "the entire meeting could not even have been put on without using the airplane, so there is no reference by which to compare time saving."

## Facts and Figures Now Off the Press

The 1959 edition of Aviation Facts and Figures, official publication of the Aerospace Industries Association, is now available for distribution.

A standard aviation reference work, the illustrated 148-page booklet contains the latest available statistical information on the aerospace industry.

The volume covers in 12 chapters of charts and text the principal segments of the industry, including Research and Development, Guided Missiles, Finance, Military Aviation, General Aviation, Airlines and Transportation, Helicopters, Production and Facilities.

This year, for the first time, a chapter on the U. S. space program is included.

The paperbound booklet, with four-color cover, is published by American Aviation Publications, 1000 Vermont Avenue, N.W., Washington 5, D. C. Cost is $2.00.

### Quick Cut

A cutting machine which can rough out a 2¾-inch aluminum ICBM bulkhead in an hour and a half has been installed in an aircraft and missile plant. Prior to installation, the process took a full eight-hour day. It had to be done by sawing and milling processes.

The new cutter, which evolved from a welding machine, can chew its way through a three-inch aluminum plate at about 15 inches per minute, and through five-eighths-inch metal as fast as 85 inches a minute.