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SPACE PROGRAM REQUIRES SINGLE AGENCY

Ground Equipment Spending Soars

Behind the spectacular, flame-spewing launching of missiles lies some of the most intricate testing, checking and handling processes ever devised by man.

The ground-handling equipment required in missile operations now make up a major share of the total cost of the missile program. In Fiscal Year 1959, this share will amount to $899 million for USAF missiles alone. This amount has grown steadily since Fiscal 1956 when $170 million was programmed. In Fiscal Year 1957, the amount was $324 million; Fiscal Year 1958, $603 million.

Lt. Gen. Clarence S. Irvine, USAF Deputy Chief of Staff for Materiel, recently stated: ". . . 10 Atlas (ICBM) missiles at a launching site represent less than 20 per cent of the site's total cost. All kinds of spares are valued at less than 10 per cent. Almost 40 per cent of the invested dollars will be ground support equipment. The remainder, a little more than 30 per cent, will represent the cost of the technical facilities."

However, it is important to remember that the ground support equipment is used over and over again and the missile is used just once.

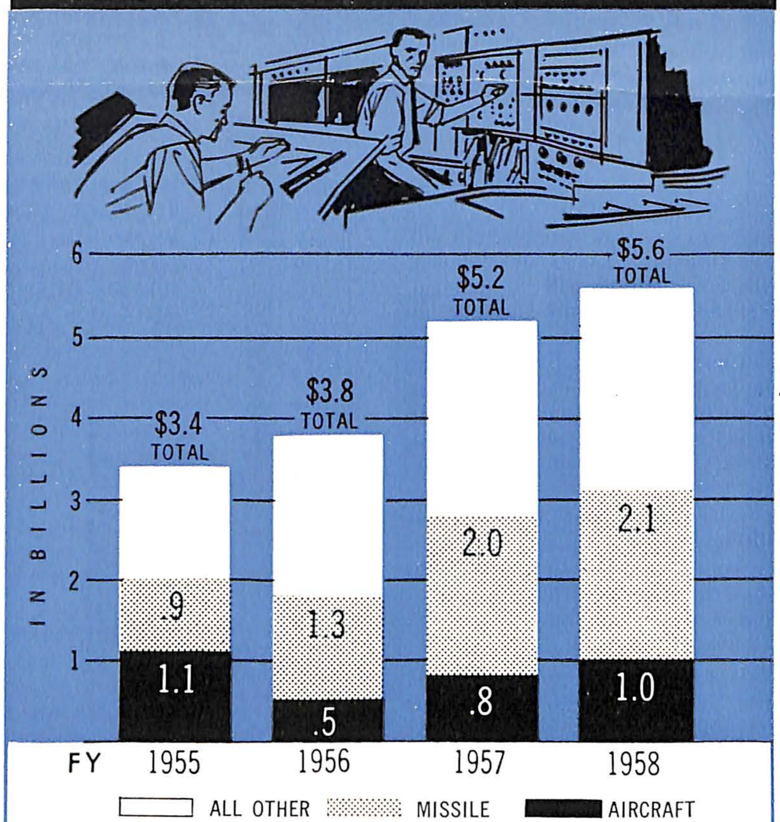
Typical ground support items include remote control systems; pre-launch checkout indicators; launcher carts; specially-designed trucks and trailers for transporting missiles; special tanks for transporting liquid oxygen fuel; slings, hoists and jacks for positioning the missile for firing.

The job of ground support equipment by no means is over once the missile is fired. Complex electronic gear tell technicians on the ground the missile's flight behavior.

AIA missiles manufacturers are devoting a substantial portion of their engineering research to simplify missile operations and reduce costs.

"The second generation of missiles should cost less to develop and produce," Air Force Secretary James Douglas said. "and should require less handling equipment, less manpower, and smaller expenditures for launching sites than is the case with our missiles that will soon become operational."

DEFENSE RESEARCH AND DEVELOPMENT PROGRAMS



The total defense research and development effort has increased from $3.4 billion in Fiscal Year 1955 to $5.6 billion in Fiscal Year 1958, a gain of about 40 per cent in three years. The aircraft and missile portion accounts for more than half of the total research and development program financed from all appropriations of the military services. In addition, the aircraft industry in ten years since World War II has invested $1 billion of its earnings in research and development programs and facilities and will have expended another $1 billion by 1961.

'PLANES'

Test-to-Destruction Proves Aircraft Design

Destruction is one of the most important factors in the development of new aircraft.

A "test-to-destruction"—on the ground—recently proved that a new jet aircraft will take the most severe punishment normally expected.

The static testing covered every part of the aircraft and required 15 months to carry out.

In the final destruction test, an airframe, complete except for engines and electronic equipment, was placed in the huge test rack.

Loads were applied by hydraulic jacks connected to the aircraft by cables. About 2,000 strain gauges and 60 miles of wiring were used.

Before reaching the inevitable point of failure from the tremendous loads imposed by the jacks, the wings of the aircraft were bent upward 12½ feet while on a previous test the wings had been deflected downward about 4 feet—a total movement of more than 16 feet. The aircraft, designed to withstand loads 50 per cent greater than expected, exceeded the design expectations by 10 per cent before failure.

Industry Is Ready To Move Ahead

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

The exciting possibilities of major space explorations, triggered by the recent satellite launchings, have seized the imagination of the world such as few other events in modern times.

There are no longer great technological doubts regarding our eventual capabilities to go just about wherever we want to in this solar system. Even planetary colonization is being given some consideration. Some fundamental know-how is already evident in our present hardware such as the intercontinental ballistic missiles, and the fact that a manned aircraft, capable of flying well beyond our heavy atmosphere, is nearing completion.

Our astronautical capabilities are firmly based on broad and successful research and development, production and managerial experience in aeronautics acquired by the missile and aircraft industry, particularly in the past eight years, which period has seen the maturity of large and experienced engineering staffs in our companies.

Every company engaged in the development or production of missiles, aircraft, or their components today is making a contribution to our spatial capabilities.

There are certain fundamental decisions and actions that must be taken with careful speed if we are to realize the optimum from the possibilities of space and our capabilities.

There are several proposals regarding which government agency should direct our national efforts in space. They all have the virtue of some logic since their current functions deal with certain facts we wish to know about space.

For example, the Department of Agriculture might push a claim as the agency to direct space programs since it is important to find out if plant life exists or could exist on the planets or their satellites. Or the Department of Interior conceivably could claim that minerals on the

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PLANES

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Foster a better public understanding of Air Power and the requirements essential to preservation of American leadership in the air:
Illustrate and explain the special problems of the aircraft industry and its vital role in our national security.

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Jets and Jeopardy

By I. C. Peterson
Director, Technical Service, Aircraft Industries Association

Within the next few months, America-bound passengers in Europe will board an American-built turbojet transport of a U.S. international airline, and a few minutes later the huge aircraft will lift smoothly from the runway and set course for its destination 3,600 miles away, covering the route in phase with the clock, that is, arriving at the hour of departure.

Behind this speedy, safe, luxurious air transport service are years of planning, millions of dollars expended for research and development of the transport, and millions of engineering hours.

Where does the engineering planning for a transport start?

The heart of any aircraft is the engine. Power sets the pace in the evolution of aircraft, and no transport manufacturer starts development without knowing that the completion of his new airframe will be matched, timewise, with the availability of an advanced-type, economical and tested engine.

Usually overlooked and of overriding importance is the length of time and the amount of money required for the design, development and testing of new gas turbine engines. A high thrust turbojet engine requires as long as ten years from start of design until production is under way and operational time on the engine has been acquired. The costs range as high as $100 to $150 million.

The design and development time for a large transport is about four years and the cost is about $15 to $20 million.

Most of the money required for turbine engine design and development has come from the military services. They have been the principal sources of development funds and the biggest customers for virtually every engine—piston or jet—now used on commercial airliners.

The reason commercial turbine transports are available now is directly due to the development of their powerplants for military use. The engines that will power two of the new turbojet transports will have acquired 4,500,000 operational hours in a variety of military aircraft. The time between overhauls has been increased, since it first went into production seven years ago, from 50 hours to 1,000 hours. These accomplishments are basic to safe, economical operation of new transports.

However, the military necessarily is devoting more and more of its research and development funds to newer power forms—rockets, ramjets, nuclear engines and ion propulsion methods.

Without the substantial participation of the military services it is likely that future generations of turbine transports may not be readily developed in time to meet our growing transportation demands. The huge costs of developing a new turbine engine cannot be economically absorbed in a limited civil market. And even the most optimistic transport designers predict it will be many years before rocket power becomes adaptable to commercial transportation.

There are three approaches to the problem of financing the development of new gas turbine engines for commercial use and a combination of all three is important to achieve:

1. Improve the research and development capabilities of engine companies by making it possible for them to make larger investments in facilities and programs.

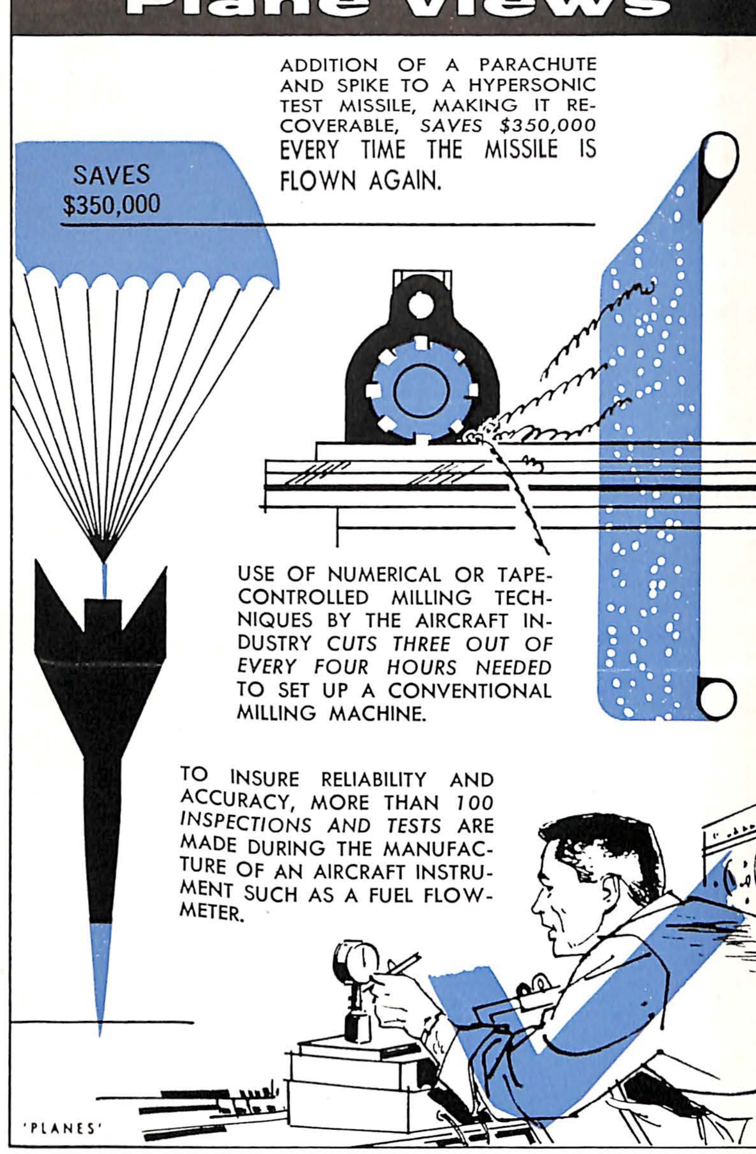
2. Improve the overall financial strength of the airlines through every possible means, such as an adequate fare increase, so that they can bear part of the development costs.

3. Continued military interest in improved transportation systems, such as shown by the Civil Reserve Air Fleet plan.

Other countries are engaged in aggressive programs of developing transport aircraft—programs that have already produced advanced turbojet and turboprop transports. There is no reason to doubt that they will continue to develop and produce greatly improved models of such aircraft.

The danger is not immediate. Our present turbine transports have a clear-cut lead in the world markets. But the time to plan for our position 10 to 15 years from now is *now*. Failure to move decisively could mean forfeiting our position as the leader in commercial air transports.

Plane Views



AIR QUOTE

"Air power is the total of the elements needed to apply force in the appropriate degree. It is offense, defense, reconnaissance, transport. It is general thermonuclear offensive, limited nuclear and conventional war, police action, and show of force.

"The characteristics of air power that give us these capabilities are mobility, flexibility, and the range and speed for instant reaction. Just as missiles and unmanned space vehicles give us phenomenal increases in reaction time with their ranges and speeds and, in turn, increased strategic mobility, they are limited in both flexibility and tactical mobility, within the foreseeable state of the art.

"Two characteristics—flexibility, mobility—and a third, *discretion*, are prime attributes of our manned aircraft system. Of these three, the attribute of wide discretion is one we cannot yet build into a machine. It becomes apparent, then, that we must preserve and refine our manned systems, if for no other reason, for this discretionary capability alone."—*Maj. Gen. James Ferguson, Director of Requirements, Deputy Chief of Staff, Development, February 26, 1958.*

'Value Analysis' Saves $400,000 in Year

A "value analysis" system has been devolped by an aircraft manufacturer that in one year has produced savings in air power costs of $400,000.

Value analysis insures a dollar's worth of utility for every dollar spent.

The savings gained from relatively low-cost items produce savings just as important as the high-value parts of a modern aircraft.

For example, a special high-temperature lockwasher was urgently needed, and sixteen would be used on each aircraft. The best quoted price was $5.10 each. The material required was not normally made in sheets, and a minimum quantity ordered from the mill made the cost prohibitive.

The lockwasher was similar to a standard lockwasher made of material that could not withstand the required high temperature. Value analysts conferred with engineers and were able to come up with a lockwasher made of stainless steel which would do the job.

The cost of the substitute lockwasher: *five and a half cents* compared with $5.10 for the special material.

Space Capabilities Need Direction

(*Continued from page* 1)

planets are of prime importance, and promote its candidacy as the space agency on that basis.

One fact is certain: We cannot afford a wide variety of government organizations trying to obtain responsibility for our space program. One of the prime drags on our present defense program is the failure to obtain prompt decisions on weapon projects, decisions backed with necessary funds over the lengthy time periods required to bring these projects to operational status.

Delays Proposals

Committees are piled upon committees, evaluation groups upon evaluation groups, and study groups upon study groups, producing a state of bureaucratic stagnation that delays even the most carefully prepared technical proposals. There are differences among government agencies on such common items as engineering drawings. Here is an example: The drawings in a contract were made by the manufacturer according to the standards of one agency. When this was discovered by another agency contracting for the same item, orders were issued to redraw every print to the second contracting agency's system even though not a single piece of hardware was changed in the process.

This situation can only be compounded by diffusing our space efforts among several agencies. And it is certainly no time to create a new agency, and attempt to staff it.

There is one thoughtful conclusion about space research: The exploration will cost billions. We cannot afford with limited technical and financial resources to rush helter-skelter into this space project or that space project. In addition to the requirement for an objective assessment of space projects, they in turn must be weighted against defense projects which do not involve outer space. There is no "crystal ball" now available that guarantees the money we spend in space will buy more national security than money spent on more conventional scientific research. This means that the decisions on space projects must not become the exclusive function of space experts. The space expert should provide the facts concerning a specific project, noting the limitations as well as the advantages, but the go-ahead decision must remain with an organization that has the facts concerning all projects.

At this point in history we cannot afford a scattered approach to our programs in space. Administrative wisdom must accompany technical imagination in these efforts or we will impede, perhaps lose, the opportunities space now offers.

AIRCRAFT EXPORT FINANCING MEETING. Recent meeting of the Export Committee of the Aircraft Industries Association featured discussions among private financiers, officials of government financial agencies and aircraft industry representatives to provide adequate financing for the aircraft industry's growing volume of exports. Shown above are (left to right): James P .Mitchell, Vice President, Chase Manhattan Bank, F. E. Hines, Vice President-Finance, Douglas Aircraft Co., and Chairman of AIA's Export Finance Committee, Orval R. Cook, President, Aircraft Industries Association, and Samuel C. Waugh, President, Export-Import Bank. The committee also heard talks on the European Common Market and the cooperation of U. S. agencies in assisting the flow of exports. The meeting closed with the 7th annual reception and banquet given by the Export Committee for foreign air and military attaches.

'Physician's 'Scopes Are Adapted To View Wing Interior Of Supersonic 'Patient'

The aircraft and missile industry, seeking new methods of checking and improving their product, have taken tips from the medical profession.

For example, hypodermic needles, similar to those used for penicillin shots, are used to inject additional sealant into bonded panels used in aircraft construction.

Latest principle adapted to aircraft use is the gastroscope (an instrument inserted down the throat to view the stomach) and the bronchoscope (for viewing tissue inside the lungs).

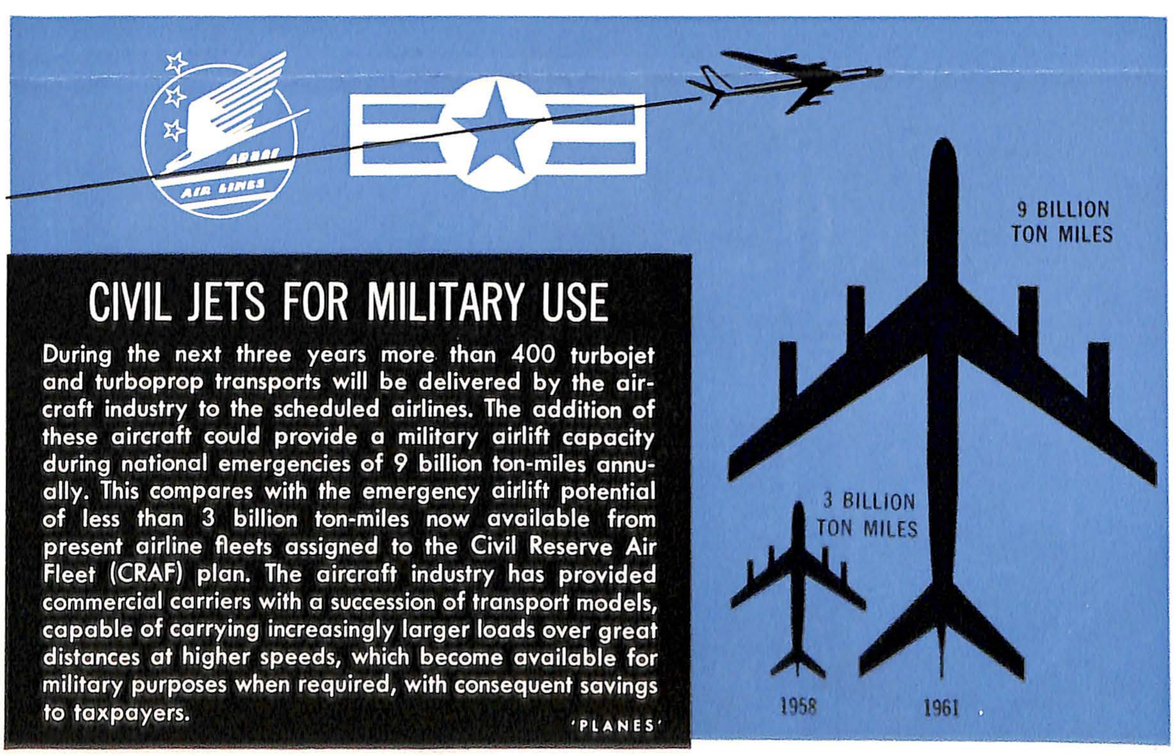
An aircraft manufacturer needed a way to inspect the sealed wings of a supersonic bomber. The chief engineer, visiting a doctor's office, got the idea of utilizing the gastroscope principle. He checked with clinics and laboratories but existing equipment couldn't do the job. He then contacted a medical instrument manufacturer, explaining his need for a viewer and a means of introducing a light powerful enough to see by and even to take photographs.

The instrument manufacturer developed the boroscope, which is about the size of a soda straw and can be inserted in the wing through a bolt hole. The precision-built viewers contain an internal lens system and the eye-piece gives a greatly magnified view. The lens can be covered by the lead in a blunt-pointed pencil.

Next big problem was to get enough light inside the wing to be able to see with the viewers. The medical scopes require very little light since only small areas are viewed. In addition, the light would have to be piped into the wing because of the danger of a bulb exploding inside the wing.

A system of condensing lenses, reflectors, prisms and a light conducting quartz rod was put together to reflect light from a 50-watt bulb. The light is strong enough to make photographs.

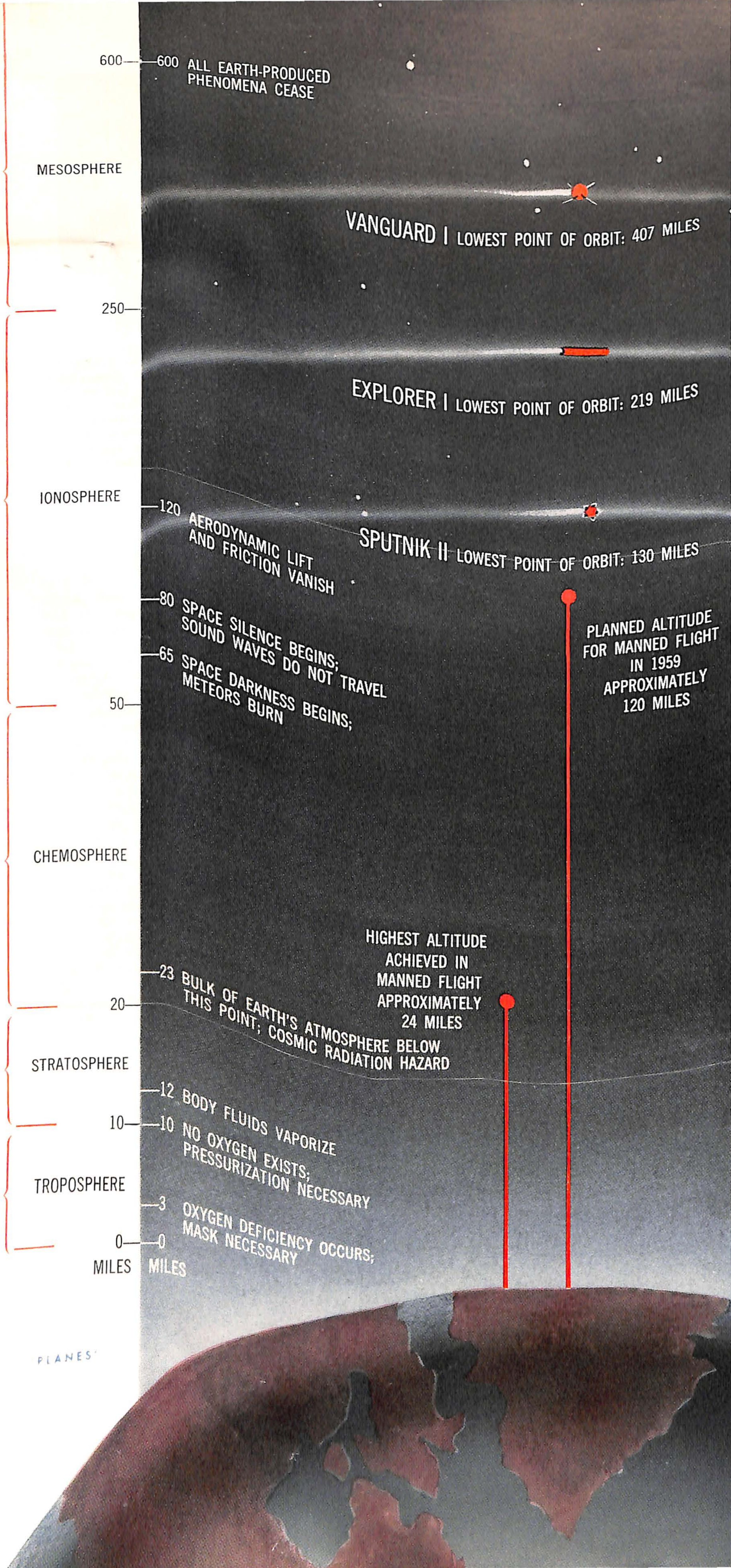
Now engineers checking the wing interior simply remove a few bolts, lower the lights and viewers and start looking around.



20% of Firm's Employees Have Science Degrees

The technological requirements the aircraft and missle industry are unique in U. S. manufacturing operations.

A survey made by a manufacturer of major components reveals that out of a total employment of 11,500 persons, 2,400 have science degrees or better. Very few of the largest colleges and universities have as many Ph.D's and Masters available on a full-time basis.



SPACE AND MAN

Space is so large that no one today knows where it ends or even if it does end. For example, our solar system with its nine planets revolving around the sun is only a small portion of the vast galaxy called the Milky Way. And this is only one of the more than 100 million star systems astronomers can view from Earth. One astronomer, seeking to reduce this immensity to something that can be conceived without recourse to the ghostlier realms of mathematics, said there may be as many stars in the universe as there are grains of sand on all the Earth's beaches.

There is even honest disagreement on where space begins. Biologists say it begins at 12 miles above the Earth's surface where, without special protective equipment, body fluids vaporize, blood literally boils; aerodynamicists claim space starts at 120 miles up where aerodynamic "lift" and friction vanishes; astronomers say space starts at 600 miles above Earth where all physical phenomena produced by our planet cease to exist.

The first probings of space have started. Vanguard I is orbiting at a maximum altitude of 2,513 miles. The Explorer I satellite circles the Earth at a top altitude of 1,587 miles, and Sputnik II orbits at a maximum altitude of 1,056 miles. An American rocket launched at 100,000-foot altitude from a balloon achieved an altitude estimated at between 2,400 to 4,000 miles.

The next step is to put man into space. The aircraft industry has experimental rocket-powered aircraft (or spacecraft) in advanced stages of construction which will be tested in 1959. The plan is to drop the spacecraft from a bomber, cut in the rocket engines which will power the vehicle to a top speed of some 4,000 miles per hour and altitudes of more than 100 miles. The aircraft will then re-enter the atmosphere in a calculated series of maneuvers to avoid destructive thermal heating, and finally land. This is not true space by astronomical calculations, but it does involve many of the toughest problems posed by outer space travel.

Manned flight to the Moon and back to Earth, manned satellites, unmanned reconnaissance of the inner planets, Venus and Mars, today are well within the technological grasp of the aircraft and missile industry.

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