AIRCRAFT, MISSILES HEART OF NAVY POWER

Naval Aviation Force Third Largest
Military Air Power in World

By Vice Admiral William V. Davis, Jr.
Deputy Chief of Naval Operations (Air)

The U. S. Navy's air force, with nearly 10,000 operating aircraft, today is the world's third largest military air force, exceeded only by the U. S. Air Force and Russian air forces.

This powerful force has been strengthened even further by the addition of guided missiles to the fleet. Other potent missiles and manned aircraft of very high performance, still in the development stage, will be used with atomic-powered carriers and submarines now being built which will increase the speed, range and impact of our future Navy.

Naval aviation is a basic source of sea power which has three primary objectives:

1. Exploit the sea to defeat the enemy.
2. Deny the use of sea lanes to the enemy.
3. Insure the unhampered utilization of sea lanes by our own and allied shipping.

Naval aircraft and guided missiles are the heart of our striking capability as well as our defensive capability. The integration of aviation with our surface and underwater fleets is a tribute to the men of the Navy who have developed their employment to its present peak of versatility and to the aircraft industry which has conceived and produced a succession of high performance aircraft and missiles. This partnership is paying a continuous dividend in national security.

Where does the Navy stand in an era where a crisis is always present and varies only in degree of severity? Our fleets are in position in every critical world area. The Navy striking strength, built around the air power of our carriers and air power in our anti-submarine warfare squadrons, is ready today for immediate use in any type of emergency. Navy fleets are at sea now, able to deliver an offensive blow or simply to prevent trouble by their presence. Versatility and mobility are the keystones of today's Navy.

The attack carrier striking force is the Navy's Sunday punch which is available for action every day of the week. The U. S. Navy pioneered many of the great advances in the carrier aviation system, and its development as an instrument of national defense has been pushed forward to a degree of effectiveness far beyond that of any other nation.

The force is built around the carriers, but the supporting cruisers and destroyers play important parts in making this a balanced striking force.

The Navy is putting ever-increasing reliance on guided missiles and aircraft to take over the job formerly done by its guns. Missiles have added another dimension to sea-air power. Today, seven cruisers are being converted for guided missiles, and ten frigates are under construction.

(See NAVY, Page 7)
Tapes Telling Tales About Performance

Magnetic tapes are telling stories to engineers—up to 2,200 of them—about the performance of supersonic aircraft, speeding their development.

Tape recording systems are mounted in the aircraft and during test flights, virtually every phase of the aircraft’s performance can be recorded on tape. Perfection in the aircraft is speeded up, quickly reporting data that once required weeks to obtain. The data on tape can be quickly translated into usable information by automation.

Data recorded by the tape includes pressure, altitudes, structural forces, temperatures and the pilot’s comments on the flight. Values recorded include air speed, angles of attack, sideslip, positions of the rudder, stabilator, flaps and aileron, engine revolutions per minute and fuel flow rate.

Before magnetic tape became available, the most common methods of obtaining data were actual photography of the instrument panel and recording oscillographs. The magnetic tape system is more compact and ultimately less expensive.

Engineers and scientists in the aircraft industry work constantly to reduce the cost of air power and to build superior aircraft.

\[\text{AIR QUOTE}\]

“If we had to fight a war today, it would still be fought, primarily, with manned air vehicles. The differences are that now they are jet powered, they are much faster and they pack far more punch per aircraft. Additionally, they are much more automatic, unlimited by weather, with advanced guidance systems, tracking devices, fire control equipment, and superior communications.”

“Ten years from now, this pattern should be drastically altered. If we have to fight an all-out war in 1967, we should now have adequate quantities of ballistic and air-breathing missiles which will effectively complement our manned bomber force and our manned fighter-interceptors.

“Further, these will be faster, higher-flying, and more lethal than anything we have now: manned aircraft in standard categories, with speeds exceeding Mach 3, and development aircraft reaching toward Mach 10. Our missiles, flying at over 300 miles at supersonic speeds, will be generally simplified and reduced in size, cost, and ground support requirements.”


\[\text{PLANE VIEWS}\]

Scientists are developing a furnace to test plane and airframe components at temperatures as high as 12,632 degrees Fahrenheit.

\[\text{EVERY 18 MINUTES A SCHEDULED AIRLINER COMPLETES A CROSSING OF THE NORTH ATLANTIC OR PACIFIC OCEAN.}\]

\[\text{WING AND TAIL ANTI-icing EQUIPMENT OF A GIANT NEW AIR TRANSPORT USE 2,800,000 BTUS OF HEAT PER HOUR—ENOUGH TO HEAT 56 FIVE ROOM HOUSES.}\]
By ORVAL R. COOK

PRESIDENT, AIRCRAFT INDUSTRIES ASSOCIATION

GEN. ORVAL R. COOK, (USAF-RET.) became president of the Aircraft Industries Association of America, January 2, 1957. Immediately prior to his retirement from the United States Air Force in May 1956, General Cook served as Deputy Commander in Chief of the United States European Command. Between July 1951 and February 1954, he was the Air Force's Deputy Chief of Staff for Materiel with over-all responsibility for all USAF industrial planning and procurement matters. Prior service in the same 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 Material Command. During World War II he served with the Far East Air Forces in the Southwestern Pacific.

FOR many years, the Aircraft Industries Association has made it a major point to keep the public informed of its progress and problems. Because the aircraft industry has become a cornerstone of the national defense structure, it must always depend on public understanding, and more especially on the support of serious-minded and purposeful Americans.

During the last year, much has happened to revise military aviation requirements. Comparative values in weaponry have altered greatly with the march of science and invention. Priorities have shifted. The old targets of force levels have been revised downward, and probably will go even lower. The things the defense establishment was in a big hurry for a few months ago don't seem so important now. In the aircraft industry, there have been contract cancellations, cutbacks.
stretch-outs, reduction in employment and facilities.

NO one can understand better than this industry the need for change in weapon requirements. As a matter of fact, it is contributing to that need by the very acceleration and momentum of research, development and invention. It has always been true that we invent new weapons and methods of offense, and then promptly invent the defenses against them. That is the history of the military arts—the teeter-totter of offense and defense. The big difference today is that science is moving at such a tremendous pace, and with such momentum of research, development and invention. It has always been true that we require more and more facilities. As a matter of fact, it is logical capability of matching us or surpassing us if we waver.

The aircraft industry has known all along that it would not keep up forever the pace of production which peaked in 1953 at 11,000 military aircraft. As a matter of fact, aircraft production has been coming down, year-by-year, ever since—9,000 in 1954, 8,000 in 1955 and 6,800 last year. Or, to put it in more accurate terms, 141 million airframe pounds in 1953, 130 million in 1954, 114 million in 1955, and 95.5 million in 1956. The industry knew that when target strength goals would have been reached, it would operate on a considerably lower plateau of production, aimed at maintaining those strength levels with the latest and best equipment. Actually, it was expected that 1961 would be the real turning point for the industry.

BUT in May, the Air Force announced plans for an even more drastic change extending over the next several years. The great potency of nuclear weapons, with their capacity for broad-scale annihilation, together with the high performance built into our aircraft and missile systems, reduced the numerical requirements for these items. Furthermore, the advancing state of perfection of guided missiles indicated that these aeronautical weapons would be able to perform a number of functions of manned aircraft, both offensively and defensively. All of this called for a gradual reduction in manned aircraft and an increase in missiles. The final effect—a diminishing over-all production requirement by the Air Force, requiring only half of the present plant space of Air Force contractors by 1959-60. Meanwhile, no re-programming had been announced by the other two services. This program would have permitted a gradual reduction, but not until after it had peaked in early 1958.

But it turned out that this orderly readjustment was not to be. The Government ran into money troubles and this resulted in, not a gradual decline, but a sharp drop that could hardly be called orderly adjustment. In June, the industry was told by the defense establishment that the rate of expenditure by the services was exceeding industry’s supply of money. In other words, the original estimate of defense expenditures for fiscal 1958 was $38 billion, but it was found that the spending rate was around $40 billion. It is not difficult to understand why: 1. industry, through a successful Government-industry cooperation in cutting lead time, was delivering equipment ahead of schedule in many cases; 2. inflation was having marked effect; 3. weapon systems had become so enormously complex that costs had risen sharply; 4. the necessity of keeping ahead of the Russians has placed top priorities on advanced weapons development, such as the ICBM and the IRBM—weapons rivalling the Manhattan Project (the atom bomb) in complexity and ultimate cost; 5. building and operating our distant early warning systems and our far-flung air bases is enormously expensive.

SOMETHING had to give—or else the national debt limit, now standing at $275 billion, would have to be raised. So the Defense Department ordered all of the military services to stay within the $38 billion expenditure limit. No longer can there be pre-production purchasing on long-lead-time items; each contract must be fully funded before any commitments can be made. The
services have had to pick and choose between promising parallel developmental and research projects in both manned aircraft and missiles. It was necessary to slow down production because of the services' inability to pay for it. For the industry, it was necessary to cut overhead. The work force had to be reduced. The most rigid economy had to be practiced.

We have known for a long time that guided missiles would assume a growing importance in our air arsenal, even though it is generally recognized that manned aircraft will be the backbone of our combat forces for the foreseeable future. This trend was only partially, and indirectly, responsible for our peculiar fiscal situation. It would have come in any case. But it has been speeded up as a result. Partially as a consequence, development and production on some important fighter types have been cut back or stretched out. Earlier, our heavy bomber, the B-52, which enjoys a high priority, had been stretched out.

It always has been considered sound military procurement practice to bring along more than one weapon system for the same mission. The theories back of this are well known. The instinctive American spirit of competition stimulates any manufacturer and his team to turn out a better product than the other fellow. It's the will to win. Also, if combat experience shows an unsuspected weakness in one aircraft, chances are it does not exist in the other, which can carry on until a fix is made. The B-25 and B-26 bombers in World War II were designed for the same types of missions; the B-17's and B-24's worked in parallel. So did the fighters—the P-47's, P-38's, P-51's and the F-4-U and F-6-F—and so on through the troop-carrying and cargo planes.

While there has been similar development in more recent operations, especially in the fighter and missile fields, it is obvious that this practice is going to be more restricted in the future. There is a disposition now to choose between parallel developments at an earlier stage than formerly—even before production. Recently, for example, the Air Force had to cancel one intercontinental air-breathing missile project that had already cost the Government $690 million (although the Government did get good return in missile advancement, including valuable data on guidance and ramjet and rocket power) in the development stage in favor of a rival weapon. Ultimately, this practice of earlier selection may be followed in other parallel developments, in the intercontinental and intermediate-range ballistic missiles.

What are some of the effects of all these recent moves on the aircraft industry? Well, reductions amounting to around a billion dollars have been ordered. Development of one fighter type has been cancelled outright. Six others, involving both Navy and Air Force, have been cut back or stretched out. A major contract for a large turboprop troop and cargo carrier, in an advanced stage of development, has been cancelled. The long-range missile mentioned a moment ago has been cancelled. Production on a major long-range bomber has been stretched out. One Navy bomber contract has been stretched out. Other weapon systems may be dropped through applications of priorities.

In the industry, a five per cent reduction in work force will be made by October 31. Overtime has been reduced to a bare minimum. The Defense Department has cut progress payments (in other words, incremental payments for work done) by five per cent, which will force contractors to make up the deficit in bank borrowings, even though interest on such loans is not admitted as cost of contract and must be taken out of earnings.

The industry has been told quite frankly that the services will not require facilities which cannot be used to best advantage in the reduced program. For example, there will be a sharply diminishing use for the high-bay factories the industry has employed in large-plane manufacture, since there will be few large military planes in the future.

There is no question that the effects of these changes will be selective to a large degree. Some companies and some of the nation's communities are going to feel them more than others, although austerity will be the watchword throughout the entire airframe, engine, and components industry.

It is likely that there will be somewhat less subcontracting than heretofore. When production was running high, the aircraft industry made a practice of subcontracting the work to a large extent. In the past year, subcontracts of the larger airframe companies have run from 30 per cent to as high as 60 per cent. But it is to be expected that, as the work load decreases for airframe and engine companies, there will be pull-backs, even though the armed services have said that economy and efficiency will be the determining factors. It makes little sense that a manufacturer whose facilities and work force are not fully occupied would continue to farm out work, if he can do the job better and at lower cost. Chances are he can. As Major General David Baker, until recently Director of Pro-

### U. S. AIRFRAME WEIGHT PRODUCTION, 1939 TO DATE

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<th>Year</th>
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curement and Production for the Air Material Command, said: “Since the products involved in this subcontracting are of the primes’ own engineering and design, their manufacture is generally compatible with the primes’ production capacity.”

SIMILARLY, with less hardware being produced, there is likely to be some impact on the normal sources of supply items. With the change in “mix” of our armaments, guided missile business is going to be of increasing importance to the aircraft industry to take up the slack left by airplane cancellations and cutbacks. The pilotless aircraft was developed chiefly by the aircraft industry. It has the same three vital elements as the manned aircraft—airframe, propulsion and guidance—so it is quite natural that this industry is best equipped to develop and produce it.

The techniques and know-how of aircraft production, acquired over the years, have been applied to guided missiles. Aircraft materials, electronics, systems and components also have wide application in guided missiles. It is quite natural that the industry which brought the airplane to its present advanced state should develop and produce missiles most efficiently and at lowest over-all cost.

There has been some disposition to place missile development in Government arsenals and with universities and other tax-free institutions. The aircraft industry does not believe in that. The business of missile systems is a natural function of the aircraft industry and should replace lost business in the manned aircraft field if this industry is to maintain

the state of health which has always been considered of vital importance to this nation. Also, there is an expensive loss of time and efficiency in translating the project from development by an arsenal or a university to production by industry. There are great advantages in flexibility and improvement if the design, experimental, tooling and manufacturing teams work together from the start. So there will be no misunderstanding, the aircraft industry does not advocate elimination of the arsenals and universities from either the aircraft or missiles field. They have a most important part to play in testing and in basic research.

There is one segment of the aircraft industry’s operations which, of course, is not affected by military re-programming. This is the commercial business. The first of the turbine-engine transports will be delivered to the airlines next year, and thereafter the great increase in speed and comfort of air travel will have a tremendous impact on our habits and on our economy. Meanwhile, there is a growing market in business and private flying, and new aircraft, designed especially for these markets, are coming along rapidly.

But, despite the fact that five companies have a backlog of over two billion dollars in jet and proyect transports, it is still true that commercial business is only a small fraction of the total business of this industry—something on the order of 15 per cent.

Now, let’s look at all of these developments through the eyes of the aircraft industry.

In the first place, nothing cataclysmic has happened. It will suffer shortly a hard and sudden drop in business, but it still will have a big job to do. Because of these reductions, and because of shifting emphasis on certain air weapons, the entire aircraft industry must make some important readjustments.

In the second place, this industry has never concerned itself with military requirements. That rests in the judgment and experience of the military services. Its job is to design, develop and produce those aircraft, missiles and systems for which the military specifies a need.

In the third place, the industry recognizes fully the need to maintain an economic balance in building our defenses. It has always applauded the national policy of building our civilian economy at the same time we were building military superiority, feeling it would be as disastrous for our country to be ruined economically as it would be militarily.

In the fourth place, the industry recognizes entirely with the military services that their job is to defend America, and not to support any segment of the aircraft industrial complex. These companies have never felt that the nation owes them existence. With a change in requirements and a reduction in the production of air armaments, competition will be severe. The industry has always been competitive, and it will continue to be.

In the fifth place, this industry will in no manner slacken its efforts to devise, develop and produce the best air weapons in the world to help assure a qualitative superiority. It will try to produce them at the lowest possible cost, consistent with the complexity and degree of urgency of the military task. The aircraft industry has reason to be proud of its achievements and contributions since the nation went on full alert with the Korean outbreak seven years ago.

The urgency of national defense is no less now than it was a few months ago. Indeed, there is ample evidence that Russia is making great progress in development of advanced armaments. We must not let our guard down. We must not instill in the public mind any sense of security that is not warranted.

No matter what expediencies may be dictated by our fiscal situation, we should not lose sight of the fact that we are faced by a most formidable and implacable enemy. He has surrendered nothing at the council tables. He boasts of his advanced air armaments, and we have very little reason to doubt that he has them. He speaks as from a position of strength.

You may be sure that our military planners are weighing these considerations very carefully and that they will do everything possible to maintain the balance of power in our favor. Whatever is required of the aircraft industry will be supplied in the shortest possible time and at the lowest feasible cost. There is only one important point to remember. Once the brakes have been applied to this complex industry, acceleration is not a simple matter.

**FEDERAL EXPENDITURES AND EXPENDITURES FOR MILITARY AIRCRAFT AND RELATED PROCUREMENT 1917 TO DATE (Dollar Figures in Millions)**

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F—Estimate
Navy's Versatility
Prime Deterrent
(Continued from page 1)

The United States Navy has moved rapidly in modernizing its naval air units. In 1947, less than one per cent of its air-
craft were jet powered. By 1952, about 19 per cent of its planes were jet powered. And today, more than 52 per-
cent of Navy's planes are powered by either turbojet or turbofan engines. The U.S. aircraft industry has produced a
series of high-performance aircraft that have greatly in-
creased the Navy's striking power.

Need Varied Forces

But there remains the danger of piece-meal conquest that in the ag-
gressive period of years could spell defeat. We cannot rely on one
type of retaliation; we need forces of a varied nature. The carrier
carrier can handle the task of nuclear deterrence or apply pre-
cisely the small force that could help snother lesser aggression. Some carrier forces can move their launching sites with
willing speed. A modern aircraft carrier can cover 24 hours in a
period. The enemy can never be sure where or when a carrier
striking force will be at any given moment. There are three principal types of combat aircraft used by the carrier force:
fighter, attack, and helicopter aircraft. The aircraft industry has provided the Navy su-
personic fighters with performance characteristics unparalleled by any
other nation. One of these fighters today holds the transcontinental speed record from Los Angeles to
New York. The mission of the fighter is to destroy enemy aircraft, and to
attack shore targets.

Formidable Weapon

The heavy attack bomber is the primary means of nuclear nu-
clear weapons over long distances. This plane can reach a target well
over a thousand miles away at great speed, in all kinds of weather.
This range, coupled with the mobility of its carrier, makes the heavy attack
plane a formidable weapon.
The light attack bomber features close-in, accurate delivery of nu-
clear and conventional weapons. These aircraft specialize in the selec-
tive destruction of small targets, bridges, rail and truck convoys, troop
concentration, will be of use.

The principal Russian naval threat is its force of well over 450
submarines. Armed with missiles capable of firing from surface or
even underwater positions, this fleet could ring the vital coastline areas
of the United States, including its coastal waters, with nuclear war.

The submarine is one of our most heavily populated areas. There is certainly no reason
to doubt that while it swims, billions of dollars will be spent on the latest in
classic weapons of war—fear, surprise and power—will be
soon available to the Russians. The United States, however, has
submarines service today and others
under construction. The virtually
limitless range, the ability to remain
submerged for long periods gives
the U.S. a technical lead in under-
water fleets.

Submarine Combat

Combat of submarines has many aspects. Nearly every type of aerial
vehicle used by the Navy comes into play.
The detection and sinking of sub-
marines at sea is a difficult task, and
specialized planes and equipment are required. The hunter-killer force is one example. This force consists of an air-
craft carrier with fixed wing and rotary aircraft, accompanied by destroyers. Propeller-driven aircraft are
used in this force, which is able to search for submarines in a wide pattern around the ships. Propeller aircraft are used, since
speed and high altitude are not re-
quired. In fact, low speed is
sirable in this type of plane. The
principal function of the helicopter
in the hunter-killer force is to de-
termine the precise location of sub-
merged submarines. The helicopter
can lower and lower its submarine
detection instruments into the water.

Aircraft of large size and range, are another weapon used against
submarines. They can carry all of the anti-submarine elec-
tronic equipment, plus the ordnance to destroy the target. The
plane can fly to a distant target, stay in the area in its search for
a target and then attack.

Electronic Detectors

The lighter-than-air patrol anti-
submarine aircraft, the blimp, has
ever been overlooked by the Navy.
Low speed and endurance are its
principal virtues. The blimp can
tow submarine-detecting instruments at slow speeds. A Navy blimp
recently covered, without refueling, a distance of 9,400 miles, creating the
Atlantic both ways.
The detection equipment used by the Navy represents some of the greatest advances made in elec-
tronics. This equipment, such as
the soundhounds, uses the earth's mag-
etic fields to detect the diesel-powered
submarine and water surface phenomena in its searching tech-
niques.
The jet seaplane will be the new-
est aircraft to enter Navy service.
This aircraft can carry up to 15 tons of
mines or bombs at very high speeds and altitudes. The seaplane
combination with its mobile base, the
fighter, offers another means of in-
creasing the mobility of Naval air
power.

Missile Program

The Navy has a comprehensive program of guided missiles in round-
out its air power. This program was established more than ten years
ago; there are more than a
dozen guided missile projects under way, and the progress shown by the
aircraft industry in meeting the
Navy's unique requirements in mis-
S cH E D U L E

S t a t e s a nd h u rl its

Prime Deterrent

1947 1% 1952 19% 1957 55%

A U T H O R I Z E D

A R M A D O E D

1957 55%
Quiet, Please! Men at Work in Echoless Room

Building Silence into New Transport

A science-fiction-like "quiet room," technically an anechoic chamber or room without echoes, has been constructed at one aircraft manufacturing facility to guarantee that a new turboprop airplane will be materially quieter than the best of today's luxury airliners.

The "quiet room" is lined with pie-shaped wedges of Fiberglas to absorb all resonance, and suspended by taut wires within an outer room in order to be free of vibration from outside. Instruments in this super-quiet laboratory measure sounds as low as 50 cycles per second, studying the noise output of such equipment as electric motors and pumps.

As part of its half-million-dollar "Operation Hush," the aircraft company has installed a $100,000 acoustic mock-up of a 25-foot fuselage section inside the anechoic chamber. Ends of the fuselage section are tightly sealed with massively insulating double plugs so that noise can enter only through the fuselage skin.

The mockup is bombarded with recorded flight noises through a loudspeaker while delicate recording instruments pick up and analyze the sound transmitted into the passenger compartment.

Tape Recorder Solves Seagull Menace

Because seagulls—like eagles—are protected by law, they possess a boldness seldom found among other birds, and have consequently become a hazard at airports near the seacoasts. Occasionally, they have been snatched into jet engines, or smashed into windshields. Since it is illegal to shoot the gulls, another means had to be found to keep them away from the airports. The problem was solved at Floyd Bennett Field, Long Island, in a novel way: a jeep is driven down the runway, playing a tape-recorded recording of frightened seagulls! It works every time, officials say.

The intensive noise abatement program for the new turboprop airplane began shortly after the airplane's design was completed, and every effort was being made to engineer quietness into the basic design. This is a vast improvement over earlier practices within the industry, when sound abatement was largely a hit-and-miss corrective operation after the airplane had taken shape.

"Engineers have yet to design a completely silent airplane," the noise abatement project chief says, "but the new luxuryliner "will come as close as money, research, imagination and hard work can make it.''

Private Pilot Does Well in Business

A fascinating insight into the makeup of the private pilot comes from the Aircraft Owners and Pilots Association, which, learned, after surveying its 65,000 members, that the composite (or average, or median) private pilot is:

- A college man, married, and the father of children under 21 years of age. earns $10,906 a year, owns his own home, participates in community affairs, owns more than one and a half automobiles, owns an airplane or has a financial interest in one. He also prefers summer vacations to winter vacations, and he may be one of the 22 per cent of private pilots who also own a boat of some sort.

The private flier seems to do all right in the business world, too, according to the AOPA's survey. Executive titles are held by almost half of those studied in the survey. Twelve per cent are presidents of business organizations, and 202 of them are board chairmen of corporations. Age wise, 66 per cent of the private pilots fall in the 31 to 50-year age bracket, 15.2 per cent are between 21 and 30, and 10.7 per cent are 51 to 60 years old.

Science Courses Gain in High Schools

For the first time in almost 50 years, high school students are showing an increased interest in mathematics and science courses.

A study by the U.S. Office of Education reveals that the percentage of students enrolled in these courses is up for the first time since 1910. Last fall, the percentages had been on the decline. However, despite the previous percentage declines, the total number of students enrolled in these courses increased steadily and is now the highest in the nation's history.

Increasingly complex military need, particularly in the design, development and production of aircraft and missiles, has created a demand for more scientific and engineering manpower. The aircraft industry has been very active in programs to enrich junior and high school curriculums and has furnished substantial aids to assist in teaching these vital courses. Liberal federal agency pointed out that the noise in the classroom or the noise of pupils taking courses in science and mathematics was due in part to the fact that more and more schools are offering such courses.

Many schools have introduced science and mathematics courses as a direct result of student interest in these subjects.

Percentage of public high schools offering courses in chemistry or physics in 1963 increased from 77 per cent in 1954 to 82 per cent last year. Schools offering plane geometry courses to 10th grade pupils rose from 28 per cent to 81 per cent.

An electronic flight simulator, which duplicates flying conditions aboard an Air Force cargo plane, is computed to cost about $35 an hour to operate, as compared with the 20 hours or more that pilots trained on the simulator, saving untold amounts of time, effort and money when he flies the aircraft.

The simulator reacts to the control exactly like its flying counterpart, except for the fact that it never leaves the ground. A technician at the simulator's base where the simulator performs its training chores, said the machine can "simulate fire in either engine, runway propellers, a 'hot nose,' when the engines are not in synchronization, backfire, cargo loading and unloading, fire in the heater compartment, ignition trouble of many types, false indication on any instrument, electrical failures, gear malfunctions and icing."

The simulator weighs 32,000 pounds, is 23 feet wide, 26 feet long and 12 feet tall. It puts out enough heat in its 250-volt vacuum tank to heat an average family home in the winter, uses 25,000 volt amps of power and has 450 miles of wire.

The simulator familiarizes pilots with emergency procedures under conditions which would be too dangerous to perform in the air. Occasionally, a pilot "crashes" while flying the simulator, but he can always walk away from such "crashes," resolving to do better next time. Eventually, emergency procedures will become second nature to pilots trained on the simulator, saving untold amounts of time, effort and money when he flies the aircraft.

Many such simulators—built by the deficit industry—are in use today, training both civilian and military pilots to keep safety uppermost when they graduate into the air.

Flight Simulator Cuts Training Costs from $350 to only $35 per Hour

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Booklet Tells Story of Jet Test Pilot

If, like most people, you are intrigued with one of the really courageous and imaginative figures of the air age, we recommend the booklet A Day In The Life Of A Jet Test Pilot. This is one of several publications put out by the National Aviation Education Council, a nonprofit organization devoted to broadening the educational horizons of American youth.

This is an authentic account of one day in the life of Pat, a "scientist of the sky," who works in an ever-changing mobile laboratory—the super-plus jet plane he tests. He is an engineer of the air who must be equipped, not only with steady courage, but many skills, much real knowledge and experience as well. For, from the time the jet was in the planning stages, and through each step in its development, Pat has had to sharpen his vast knowledge of flying many ideas which were included in its design.

The story moves swiftly and excitingly as it describes Pat's activities. He checks the morning flight schedule assigning him to test hop two jets. He attends briefing sessions—that are not so brief. He dons elaborate protective garb, including head gear with more gadgets, than Mr. John Smith devised for Madame's Easter chapeau. And finally, after hangar checks, flight checks, cockpit checks, and last minute confidences, the reader shares his exciting takeoff. The jet engine roars, whines, then screams as the plane streaks down the runway for a flight 40,000 feet above the earth.

A worthy addition to the library of the Air Force book A Day In The Life Of A Jet Test Pilot may be obtained by sending 50 cents to the National Aviation Education Council, 2350 Constitution Ave., N.W., Washington 6, D.C.