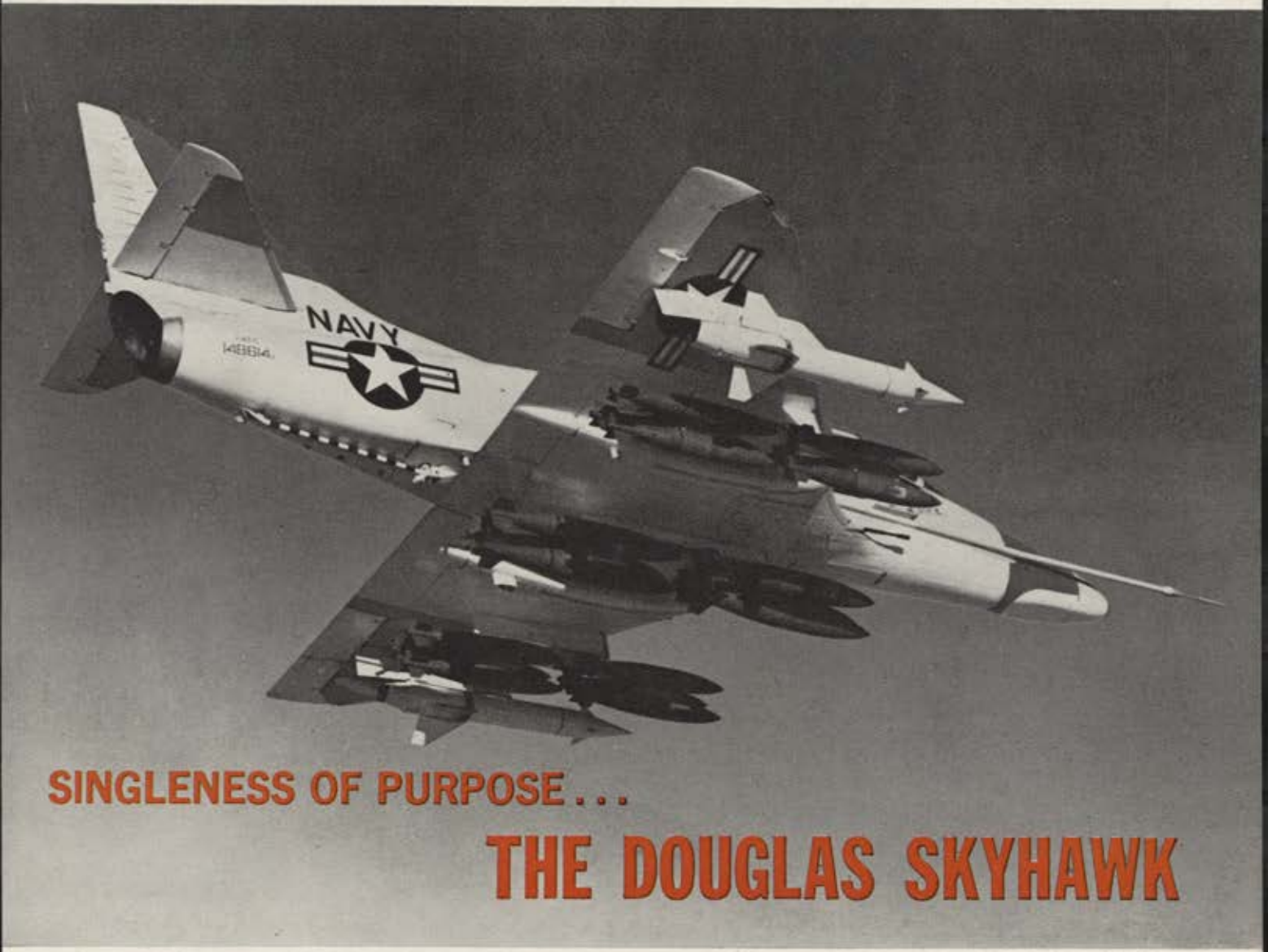
NOVEMBER 1965 / 50c

AIR FORCE

and **SPACE DIGEST**

The Magazine of Aerospace Power / *Published by the Air Force Association*



SINGLENESS OF PURPOSE . . .

THE DOUGLAS SKYHAWK

With a good record in Vietnam, the low-cost, ground-attack A-4 has a history of growth and performance that promises to keep it in the US and free world military inventory for another ten years . . .

Instant Loran for tactical precision. Sperry's new "fly-in" Loran-D network can be on the air *where the action is* in under 12 hours. This precision tactical navigation system will "lay down a grid" to turn trackless geography into precise, controlled pathways — in any weather, day or night — for pinpoint air support. □ Microcircuited for extreme reliability, the airborne receiver provides maximum navigation information with minimum pilot workload. Solid state transmitters are readily transportable and field maintainable. Loran-D, with ranges up to 500 miles, will serve aircraft — from helicopters to Mach 3 fighters — ground vehicles or troops. Under Air Force Systems Command contract Sperry Loran-D will soon undergo joint tests by USAF, Army and USCG. Sperry Loran-D is the answer to precise tactical support.
INFORMATION & COMMUNICATIONS DIV., Sperry Gyroscope Co., Great Neck, N.Y.

SPERRY
DIVISION OF
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CORPORATION

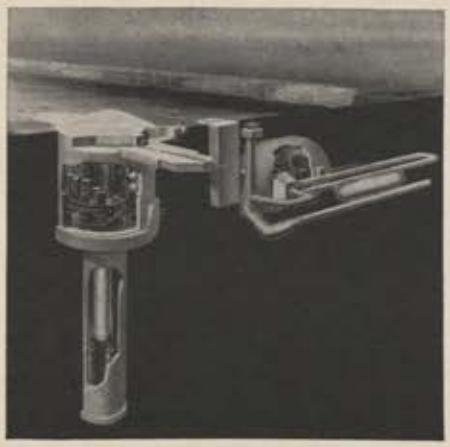
FIRST Minuteman II firing from an underground silo at Vandenberg AFB was a complete success. Minuteman II's nose cone splashed on target, some 5000 miles down the Western Test Range. U.S. Air Force's most advanced ICBM, Minuteman II has increased range, improved guidance, more flexible targeting and larger payload.

As Minuteman weapon system integrator, Boeing continues its responsibilities for assembly, installation, test, launch control and ground support equipment for Minuteman II. The first Minuteman II wing is now under construction at Grand Forks Air Force Base.

Minuteman is the nation's most cost-effective ICBM system. In going from drawing board to operational status in four years Minuteman set a new record in the design-development-production-delivery cycle of a major weapon system. Designed for simplicity, high reliability and ability to survive attack, Minuteman can remain on alert for long periods with minimum maintenance. Operation is from underground launch capsules, each manned by two Strategic Air Command officers. **Boeing Missile Division.**

Minuteman II

Underground, blast-resistant launcher. Contains missile and launch and targeting equipment. Connected to launch control center by multiple-channel communication system.



Launcher Equipment Building. Contains missile environmental control equipment.

This is a moving picture in 6 colors. It shows a commander what's happening all over the map. While it's happening.

Imagine.

A clear, detailed picture of a defense exercise. Events happening rapidly over thousands of square miles.*

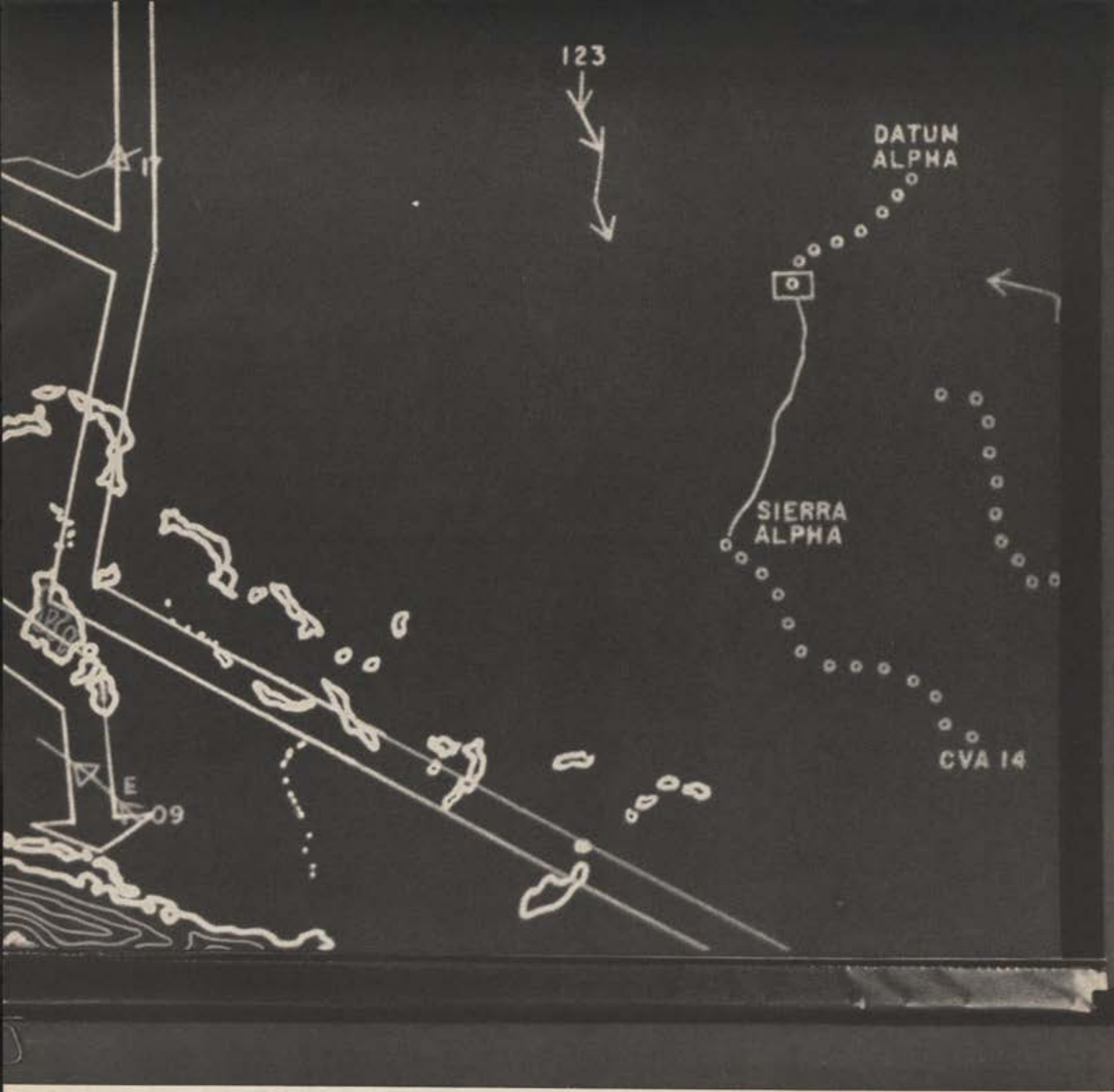
All the information the command-and-control center needs, graphically displayed in any desired size at any number of locations.

In real time, continuously updated by high-speed computers.

In enough colors to clearly identify all elements of the situation.

An unlimited range of numbers, symbols and words. Any kind of line, straight, curved, irregular.

Only the information that's essential for a decision. Superfluous data removed or restored at will, any portion of the display blown up for concentration. The big picture or a



detailed closeup.

Small screen, large screen, multiple screens. Any number of remote monitors showing all or portions of the information on the main display.

A permanent record, recallable at any time for review and analysis, or for problem simulation.

Extreme accuracy. Extreme reliability. Very moderate cost.

The name of this remarkable system is Vigicon. It's made up of modules that come off the shelf (our shelf). You can have a small system or a huge one. The only difference is the number of modules you need to do your job.

Right now Vigicon is at work in military and space applications. But lots of other people will use it someday.

Vigicon's picture of its own future is exceedingly bright.

NORTHROP

Within the next two years, an American astronaut will leave his orbiting Gemini spacecraft and perform unprecedented maneuvers in space completely free and untethered.

That an astronaut will be able to accomplish such a feat is the direct result of space maneuvering programs launched by the Air Force and the Astronautics Division of LTV Aerospace Corporation in 1959.

The results of studies and experimentation has produced an AMU (Astronaut Maneuvering Unit) which literally converts an astronaut in a pressure suit into a one-man spacecraft for performing useful tasks in space. The first space-type AMU already has been delivered — 20 days ahead of schedule. At least six others will follow soon.

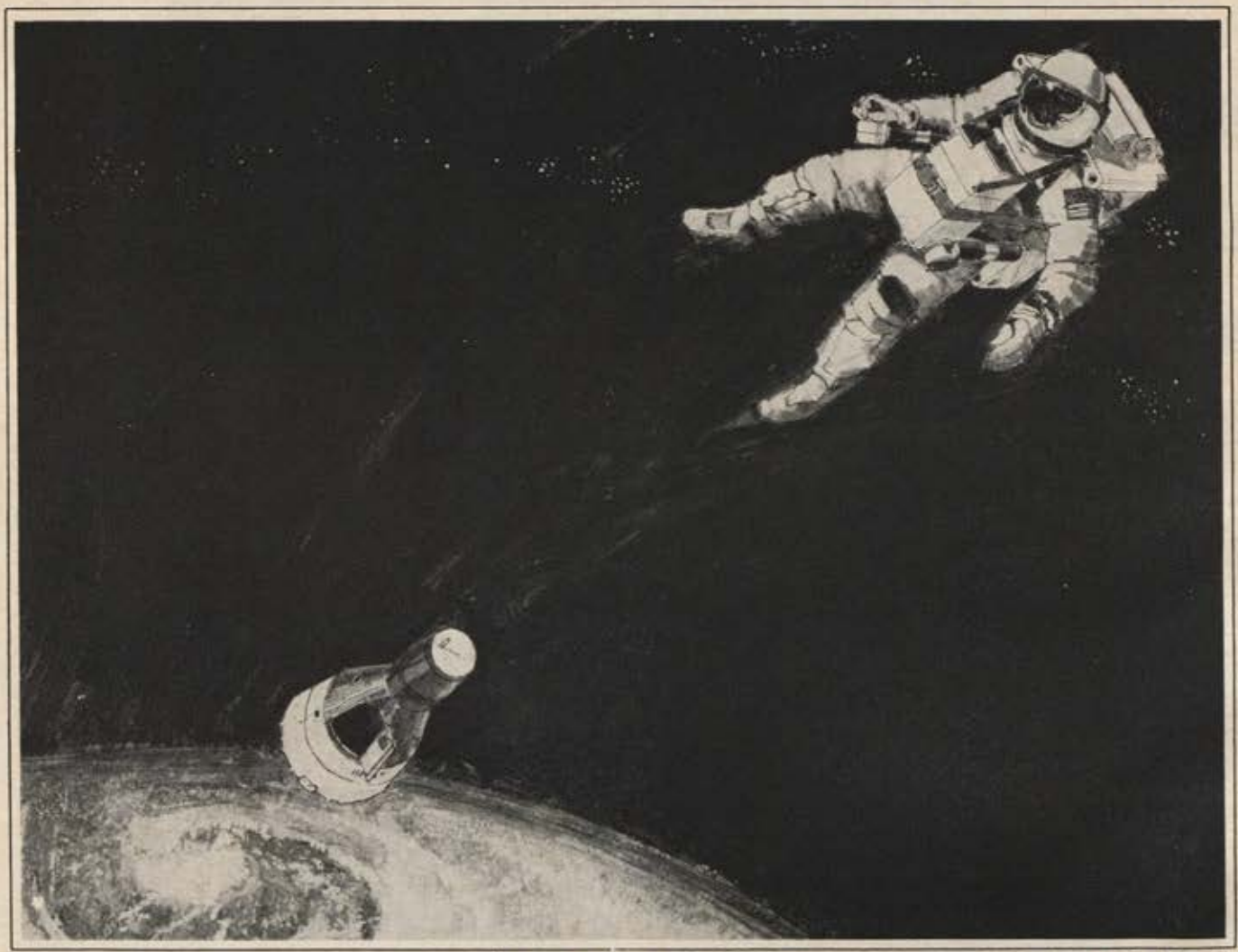
To be used initially as Air Force Gemini Experiment D-12, this AMU provides the Air Force with space maneuvering capabilities not only for Gemini, but also for future space programs.

At present, at least two flights are planned with the AMU during the Air Force's Experiment D-12. On the first mission, the astronaut will use a short tether. On the second, he will detach his tether and become the first astronaut in the nation — perhaps the world — to maneuver completely free and untethered.

These initial AMU flight excursions will be experiments in extra-vehicular maneuvering operations. The Air Force and LTV are now looking well beyond these initial research flights toward important space assignments for both manned and unmanned space maneuvering systems.

Experiment D-12 mission profile includes astronaut egressing from capsule on short tether, proceeding to adapter section, donning AMU and moving to nose of capsule where he performs checkout maneuvers, releases tether and begins flight sequence. Later returning to spacecraft, he fastens his back pack to adapter surface, re-enters Gemini. Mission complete.

untethered and free



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AIR FORCE and SPACE DIGEST

The Magazine of Aerospace Power
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SPACE DIGEST

DEPARTMENTS

An Editorial

Educating the Educators

By John F. Loosbrock

EDITOR, AIR FORCE/SPACE DIGEST

"EDUCATION is too important to be left solely to the educators."

This apt paraphrase of Clemenceau's dictum on war and generals was attributed recently by *Time* magazine to Francis Keppel, Assistant Secretary of Health, Education, and Welfare, and US Commissioner of Education.

Mr. Keppel sums up neatly the philosophy that underlies AFA's Aerospace Education Foundation, whose latest achievement was the Ninth Annual International Aerospace Education Conference, held September 15-17 in Washington in conjunction with AFA's Aerospace Development Briefings and Displays (*see pages 30 and 68*).

Heretofore the Foundation's international meetings have been held together with AFA's National Convention. For this reason, neither the Foundation nor its many contributions to American education have received the recognition they deserve, either from the public at large or, to be candid, within the Air Force Association itself. Hence, this admittedly condensed history and description.

From the inception of the Air Force Association, and in line with AFA's concept that a nation's airpower comprises more than military air might, a great deal of attention and support was expended on aviation education, as it was then called. As the years went on, it became apparent that this interest deserved more formal recognition and a deeper and wider channel of communication with the national education community. To this end, the Air Force Association Foundation was incorporated in May 1956, the lineal ancestor of today's Aerospace Education Foundation. Gill Robb Wilson was the first Chairman of the Foundation Board of Trustees, a group comprised of both AFA Board Members and non-AFA members from the fields of education, business, science, and industry. Currently, the President of the Foundation is Dr. Lindley Stiles, Dean of the School of Education, University of Wisconsin. Gen. Laurence S. Kuter, USAF (Ret.), a vice president of Pan American Airways, is Chairman of the Board. An Aerospace Education Advisory Council of professional educators serves both the Foundation and the Association.

As an indication of growth, the Foundation's first Aerospace Education Seminar in Dallas in 1958 attracted some 150 educators. At the September meeting in Washington, the Seminar—subject, "Scientific Literacy"—drew more than 600 educators, representing sixty-one foreign countries and thirty-six states of the US.

Dozens of similar seminars, briefings, and symposia, held in communities from coast to coast, have formed the backbone of the Foundation's activities. And these have universally been characterized by a yeasty effect that has gone far beyond mere impact on the participants. In Pennsylvania, for example, the nation's first earth and space science course was inaugurated at the junior high school level in 1959, followed by a similar course in elementary schools in 1960, together with a broad program for improving the general science background for elementary school teachers, furnishing planetariums as a part of new school construction, and other far-reaching effects. Dr. Charles Boehm, Superintendent of Public Instruction at the time these innovations were introduced, freely attributed them "as a result of the inspiration and support of the Aerospace Education Foundation and the Air Force Association."

To the same inspirational source, Dr. James G. Allen, Professor of History at the University of Colorado, attributes the establishment at Colorado of courses in the history of flight and space exploration leading to a new linkage between the physical and social sciences in a multidisciplinal approach to space-age education.

Similar word has come from leading educators in Missouri, Texas, Idaho, Utah, Nebraska, Iowa, and Wisconsin. Each symposium, seminar, and briefing session plants new seeds in fresh ground. And the Foundation's impact on education continues to expand.

In addition, there are more tangible specific projects. For example, the Foundation last year established at the Air Force Academy Library the Dr. Theodore von Kármán Memorial Collection, providing a bronze bust of Dr. von Kármán, a display case of memorabilia, and $6,500 worth of new scientific books and periodicals per year for five years—an expenditure of some $35,000.

At the University of Wisconsin, the Foundation cosponsors—with the University and the US Office of Education—the Center for Scientific Literacy Research, which is examining the twofold problem of how well-versed in science the average citizen should be and how well our schools are providing students with these minimum scientific literacy requirements.

The Foundation also sponsors the Arnold Air Society, professional society of the Air Force ROTC program, and provides financial support to the Society's annual conclave. And there is a sizable program of awards and scholarships under the Foundation's cognizance.

Staff support and administrative assistance is furnished without charge by the Air Force Association. Thus far, the bulk of the Foundation's financial support has come from funds transferred from the Air Force Association, but there is an imposing and growing list of individual and corporate donors. Much more is needed, of course, to continue the programs now in existence, to expand them, and to explore new areas.

The current ferment in education makes the Aerospace Education Foundation more important than ever. If "education is too important to be left solely to the educators," the Foundation's work is cut out for it.—END

FAIRCHILD HILLER
REPUBLIC AVIATION DIVISION

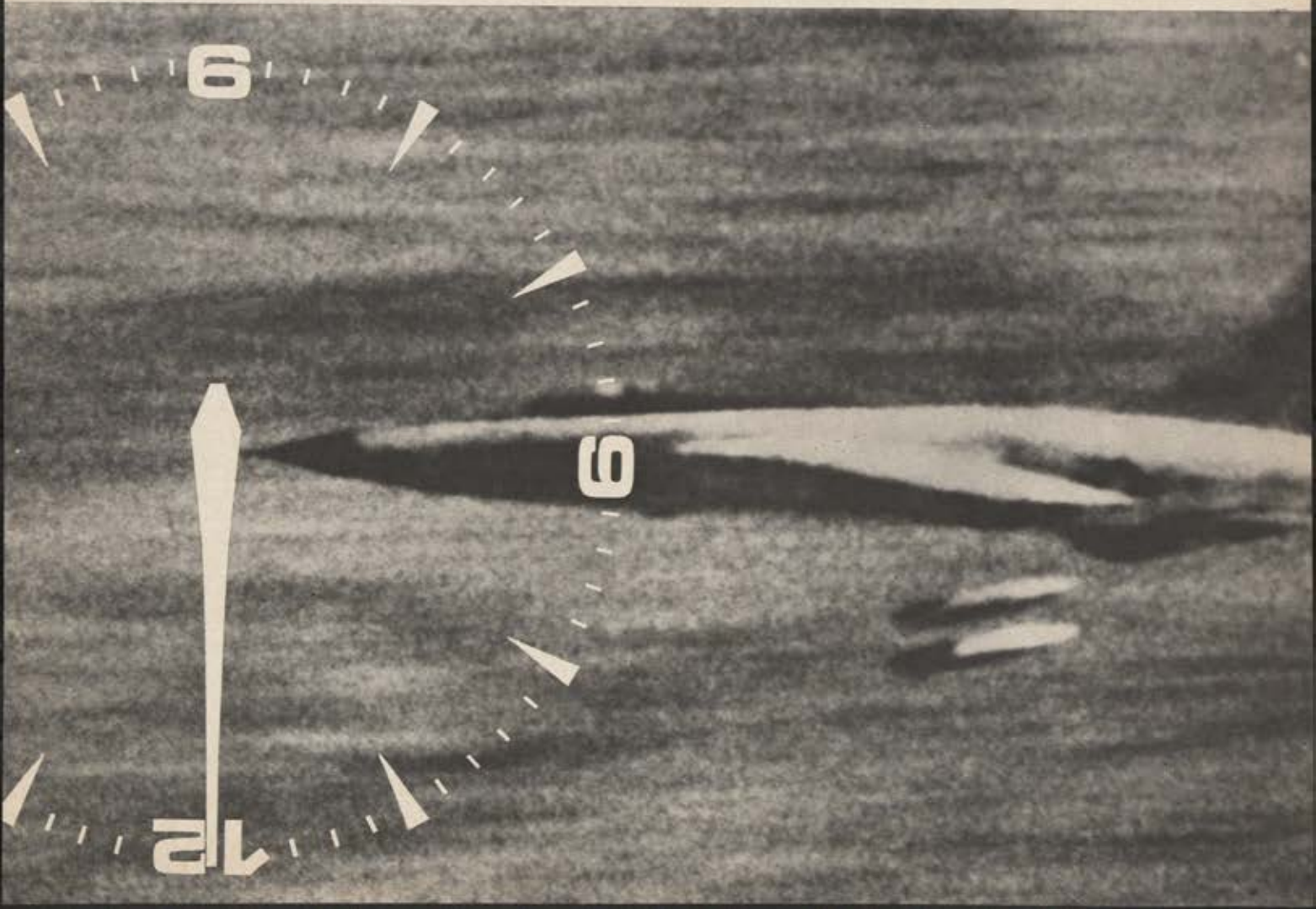
On the deck, below the enemy radar screen, down where the war is fought, that's where the Republic F-105 Thunderchief fighter-bomber excels . . . at 12 o'clock low.

The F-105 . . . faster than sound, with a full armament of iron bombs, rockets, and nose gun . . . with automated navigation, terrain avoidance, and fire control systems for close-strike precision . . . is helping nail down Vietnamese and U.S. policy in a war we must win for the peace of the future.

Today, the F-105 is our most versatile air weapons system for fighting this kind of "limited" war of aggression.

And it is a vital link to tomorrow's fighter-bomber—the Air Force concept of an all-mission weapon for instant retaliation. At Republic we are already at work on this requirement.

12 O'CLOCK LOW



"History Lesson"

Gentlemen: Just finished reading "History Lesson" [in "Airpower in the News" in the September issue]. [Claude Witze has] written lots of good stuff, but this is one of the best ones yet. I found myself nodding in agreement as I read, and—somehow—much of the confusion and fog generated by the day-to-day headlines gets cleared away when you can turn back to simple, yet valid, analogous situations in history.

It is a pity that the vociferous opponents of our actions in Vietnam can't see the light when the thesis is developed the way you have done.

JACK SHEA
Director of Public Relations
ARO, Inc.
Tullahoma, Tenn.

Gentlemen: Claude Witze's article, "History Lesson," is a bit frightening, but has comfort, too, in that its publication may open some eyes and ears. I wish it would be widely reprinted and quoted. AIR FORCE is still my favorite magazine. . . .

HERBERT O. JOHANSEN
Popular Science Monthly
New York, N. Y.

"A Great Piece"

Gentlemen: I read [William Leavitt's] piece, "Survival and Advance in the Space Age" [September issue]. I just want to say, I think it was a great piece.

THOMAS TURNER
Director of Marketing
Republic Aviation Div.
Fairchild Hiller Corp.
Farmingdale, L. I., N. Y.

For the Record

Gentlemen: I think you have done a fine job in explaining the significance of the activities of the industry and the Air Force from World War II to the present in the fifteenth annual Air Force Almanac, September issue of the AIR FORCE/SPACE DIGEST. The material in this issue deserves a thoughtful reading by all.

The material on page 62, "An Honor Roll of Industry . . . ," gives a good rundown of the industry efforts during WW II. In addition to the number of pounds of airframes produced, another method of reporting on the effort is the number of units produced. It might be of interest to your readers to learn how the leaders stood in this category. Here are some figures from "Fifty Years of Aviation Progress" issued by James H. Doolittle, Chairman of the National Committee to Observe the 50th Anniversary of Powered Flight, published in 1953. The material is from Table 20—Aircraft Manufacturers and Planes Produced—World War II:

Manufacturer	Total Plane Production (All Types)
North American	40,768
Convair	30,708
Douglas	30,516
Boeing	17,958
Lockheed	17,875

We here at North American are especially proud of this record as it discloses that thirteen percent of the 303,218 units were produced by NAA, compared to slightly over ten percent each for Convair and Douglas.

Another point not mentioned is that it is generally conceded that the best airplane to come out of WW II was the North American Mustang, the airplane that was initially designed and built for the British and only after some reluctance adopted enthusiastically by the USAF.

RALPH B. OAKLEY
Division Historian
Space & Information Systems Div.
North American Aviation, Inc.
Downey, Calif.

On Taking Criticism

Gentlemen: May I refer to the last sentence of your excellent article, "Managing the Explosion: Technology in World War II and After," by J. S. Butz, Jr. [Sept. '65, AF/SD, p. 65]: "The electorate can only hope that all men who are qualified to make such criticism will give the nation the benefit of their opinions."

This equals the remark made by our late President J. F. Kennedy: "Ask not what your country can do for you—ask what you can do for your country."

No truer words have ever been spoken. But is it possible for a "qualified opinion" to find a receptive ear?

It is the accepted rule that those in command are loathe to listen to anybody else's suggestion. The exception merely proves the rule. Higher echelons consider nonconformity to be a form of disloyalty and, occasionally, reward the offender by sidetracking him, even though his criticism had been solicited.

It takes moral courage to offer a practical solution to some given problem. It really means to "stick out one's neck." And, who wants to flirt with a halted, if not ruined, career? A married man with small children cannot afford the luxury of having "moral courage."

Our "boss" system should be changed.

The first step in the right direction would be to eliminate the word "boss" from government vocabulary.

ALBERT JASON
Oakland, Calif.

"Sooner" or Later

Gentlemen: I wish to correct a statement made in "Aerospace World" in the September 1965 issue.

You indicated the 937th Troop Carrier Group, Tinker AFB, Okla., was now flying C-119s and was scheduled to get C-124s. The 937th "Sooner" Group has had C-124s since January 1961. This unit served eleven months on active duty with the C-124 during the Berlin Crisis and has continuously operated this aircraft since that time.

LT. COL. HARRY J. HUFF, II, AFRES
Commander
Headquarters
937th Troop Carrier Group, Heavy (Reserve)
Tinker AFB, Okla.

Man Bites Dog

Gentlemen: I am certain that over the years you have received considerable conversation and correspondence from unhappy advertisers about position of their ad in your magazine.

I wish to take a "man bites dog" position and say All American Engi-

neering could not be happier about our ad in your fifteenth annual Almanac Issue. Not only did you honor our request that our ad be placed in the section devoted to TAC, but it appeared on the same page with [the] editorial [material] discussing the "forward fighter operating base"—the subject of our advertisement.

HARRY E. MATYCH
Director, Advertising and Public Relations
All American Engineering Company
Development Division
Wilmington, Del.

Armed Forces Staff College

Gentlemen: The Armed Forces Staff College is again indebted to the Air Force Association for its cooperation and generosity in supplying copies of the annual Almanac Issue of AIR FORCE/SPACE DIGEST Magazine... for each of our students. Your publication, containing as it does the most current information on the Air Staff and each of the Air Force major air commands, is always of valuable assistance to us in covering the Air Force story during our uniservice orientation weeks.

With the publication date of your September issue so closely approximating the date on which we begin Air Force Week, your special efforts to assure timely delivery are known and are genuinely appreciated. To you and the members of your staff, I wish to express sincere thanks for continuing support to the Staff College.

COL. J. C. JENNISON, USAF
Deputy Commandant, AF
Armed Forces Staff College
Norfolk, Va.

Space Navigation

Gentlemen: Maj. [William A.] Cohen's article ["Finding Your Way in Space"] in your August issue has just been read with the greatest interest. As a matter of fact, I am very much impressed by the work Major Cohen has been able to do in the short time he has put his mind on this particular field of endeavor. I find it to be very seldom we have young officers who get steamed up enough to attempt to break new ground, and I think this is what Major Cohen is doing.

I think the Air Force would be justified in assigning Major Cohen to some kind of special work on research, and turning him loose for a few months with full backing. I think he would return big dividends for the investment.

This type of article is a natural follow-on for the high-altitude flying program at Edwards AFB. A second article by Major Cohen, directed to cislunar navigation, should be equally helpful in showing that the high-flying project is already operating in space for practical purposes. Also the booster is retrieved.

Since the planned soft landing on the moon by 1970 indicates that fifteen or twenty years will be required for possible planetary operations, we should stress our unique space station, the moon.

Incidentally, an astronaut stranded on the moon could accomplish accurate navigation with two simple items—a timepiece and a space almanac.

P. V. H. WEEMS, USN (Ret.)
Randall House
Annapolis, Md.

• *Captain Weems is the author of several books on navigation and a past president of The Institute of Navigation.*—THE EDITORS

Chrysler's Contribution

Gentlemen: Karl G. Harr is to be complimented on his excellent article, "Industry and World War II—Embryo to Vigorous Maturity," which appeared in the September Almanac Issue. However, after reviewing the article and the extensive aircraft industry honor role listing on pages 62-63, I was somewhat surprised not to see Chrysler Corporation mentioned, particularly since the company operated the Dodge-Chicago Plant, the nation's largest aircraft manufacturing facility used during the war.

The huge facility, situated twenty miles outside Chicago, actually consisted of nineteen buildings, which covered twenty-two acres and over 6,300,000 square feet of floor space. Between 1943 and 1945, Dodge-Chicago produced 10,413 engines for the B-29 Superfortress. At peak production, more than 30,000 employees worked at the plant on a multishift basis in turning out eighteen-cylinder Cyclone engines.

The B-29 engine project was only one of the many Chrysler wartime aircraft programs. The company also built the pressurized nose section, the leading edges, and the cowlings of the B-29; the nose and center sections and wing flaps of the B-26 medium bomber; the center wings of the Curtiss Helldiver; the landing gear and arrester mechanisms of the Corsair fighter; cockpits for the B-17 Flying Fortress; ski pedestals for Army gliders; stabilizers for the P-40F; barrage rockets used in several fighter aircraft; and over 12,000,000 pounds of forged parts used in building a wide assortment of military aircraft. These projects were carried out in seven Chrysler plants in Michigan, Ohio, and California.

In my opinion, this activity qualifies for mention in any World War II summary of US aircraft industry accomplishments.

ROBERT B. HEATH
Manager, Public Relations
Defense-Space Group
Chrysler Corporation
Detroit, Mich.

A Dissenter

Gentlemen: While I am flattered that your Mr. Leavitt chose to conclude his article "MOL: Evolution of a Decision" in your October issue by quoting verbatim from my recent story on the same subject in *The New Republic* (September 11), I am distressed that his attempt to paraphrase another part of the same story does an injustice to my original writing.

Mr. Leavitt writes that I "posed the possibility of a mad airman in orbit setting off a war by turning in false alarms from the void."

My *New Republic* article said: "Granting this potential superiority of manned observers for such [surveillance] operations, we don't yet know how long man can live in orbit without deleterious effects on body or mind. There has been reason to fear that the isolation of space might produce hallucinations which could be disastrous for a mission intended to warn of enemy attack. Until the very recent Gemini space shots, no US astronaut had remained in orbit for more than a couple of days and Soviet cosmonauts who had stayed longer often experienced difficulties."

Even Mr. Leavitt himself points out earlier in his article that one of the purposes of the MOL program is to gather data on "human physiological and psychological response to month-long space missions."

May I ask that you set this record straight in your "Airmail" column in an upcoming issue?

RAYMOND D. SENTER
Washington, D. C.

• *Mr. Leavitt's reply: "We are making an exception to our usual policy in publishing this letter. Raymond D. Senter is the pseudonym of a writer for* The New Republic *magazine. We do not ordinarily publish letters from persons who will not identify themselves publicly (or if there are personal reasons precluding public identification, then privately, to us, in confidence). However, since many people read Mr. Senter's articles in a well-known national magazine, I will point out that it is hard to imagine what inference could be drawn from his sentence about 'hallucinations which could be disastrous*

(Continued on page 11)

WILCOX

Wilcox has a solid record of experience in the engineering of complete communications systems—airport systems, navigation systems.

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for a mission intended to warn of enemy attack' other than that space-borne observers might 'see' something that was really not happening and set off a false alarm. One other possible inference, of course, is that they might not *see something that* was *happening, which seems even more unlikely. I quite agree with Mr. Senter that the MOL program is designed to explore the human psycho-physiological response to long-term space missions. That is, indeed, one of the prime purposes of the program. Obviously, before MOL-type vehicles are fully committed as operational peace-patrollers, with American or international crews—the latter an idea that does appeal to Mr. Senter—the psycho-physiological safety of long-term exposure to the space environment will have been proved out to the satisfaction of the experts. The only way to find out the answers to such questions is through a program designed to find the answers, which is what MOL, on the military side, is—just as Mercury and Gemini, on the NASA side, have been."*

—W. LEAVITT

German Jets

Gentlemen: I am seeking assistance from readers who served during World War II in the ETO with the 8th, 9th, and 15th Army Air Forces.

I am completing research connected with a book dealing with the development, life, and combat history of the German rocket and jet fighters that were encountered by Allied aircrews during the period July 1944 to May 1945. These aircraft—the ME-163 and ME-262—were mainly directed against USAAF bombers and their fighter escorts, many fierce battles taking place over Germany during the closing stages of the war. Both types were also employed against American photographic-reconnaissance aircraft flying from Italy, and the ME-262 flew ground-attack missions during the Battle of the Bulge.

I am anxious to get first-hand accounts from former Air Force personnel and other WW II veterans who met these German jets in combat; especially those able to quote from diaries, flight logs, and other contemporary records. All documentation and photographs loaned will be copied and returned in good order.

RICHARD P. BATESON
8 Lawford Road
Chiswick
London, W.4, England

SAC Tail Markings

Gentlemen: I would like to hear from anyone who has information about group-wing formation tail markings used by SAC bombers in the latter part of World War II to the 1950s.

These are the squares, circles, triangles, and diamonds outlined in black, representing the numbered Air Force, and the letter inside representing the group-wing identification.

I would like to know the group-wing number that corresponds to the letter inside the outlined shape.

ED LAMBOLEY
R.R. #1
Marion, Ind. 46952

$324 Billion Question

Gentlemen: The $324 billion question: What happens to a nation of people kept *"free"* to the extent they are *"slaves"* to a socio-military society?

I enjoy and learn from AIR FORCE Magazine and am for a strong coordinated military machine. But somehow I get the impression that no new weapon, rocket, or military equipment device is ever turned down. Seems as if we buy them all, install them, and declare them obsolete at the same time.

How about some articles pertaining to wise decisions and curtailing of use of useless products or those which become obsolete in two years?

LT. CMDR. BILL STRUPP, USNR-R
Greenville, Fla.

Photos Needed

Gentlemen: The Air Force Museum is in dire need of photos taken in the Southwest Pacific during the first six months of World War II while the Japanese were advancing through the Philippines, Netherlands East Indies, and New Guinea areas.

Because of the speed with which the Allies had to withdraw from these areas, few official photographs of AAF flying activities exist. Any person having personal photos of AAF scenes taken during that period and is willing to loan them to the Air Force Museum for copying purposes is requested to contact us.

RESEARCH SECTION
Air Force Museum
Wright-Patterson AFB, Ohio

UNIT REUNIONS

Flying Class 40-G

The Air Force Flying School Class of 40-G will hold its twenty-fifth anniversary reunion at the Gunter Hotel, San Antonio, Tex., on the weekend of November 11-14. Further information and reservations may be obtained by contacting

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370 Quentin Dr.
San Antonio, Tex.
or
Albert Criz
20502 Oxnard St.
Woodland Hills, Calif.

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F. Office use, left-over, unaccounted, spoiled after printing	2,755	2,384
G. Total *(Sum of E & F—should equal net press run shown in A)*	102,170	115,056

I certify that the statements made by me above are correct. *(Signature of editor, publisher, or business manager, or owner)*

s/ JOHN F. LOOSBROCK
JOHN F. LOOSBROCK
Editor

AIRPOWER in the news

By Claude Witze
SENIOR EDITOR, AIR FORCE/SPACE DIGEST

Airpower Comes Through

WASHINGTON, D. C., OCTOBER 13

There are signs, at last, that the press and the public are beginning to get the airpower message from Vietnam. This reporter, back from a few weeks in Europe, came home with the impression that utility of air strikes in the Vietnamese theater is something more fully appreciated outside the United States. In both London and Paris, there was talk about the change in the American approach to its problem in Southeast Asia and the fact that the anticipated Viet Cong offensive did not materialize in the monsoon season. The credit is given to airpower.

Behold, by Labor Day this was recognized in the United States. The "turning point" in the war, wrote Jack Langguth in the New York *Times*, was last February 19, when US jet pilots, land- and carrier-based, were sent out to strike targets in South Vietnam.

Another reporter said that "although the daily air raids against North Vietnam have received most of the public attention, the ever-increasing ferocity of aerial bombardment in South Vietnam may have a much greater ultimate effect on the outcome of the guerrilla war. . . .

"Few Americans appreciate what their nation is doing in South Vietnam with airpower."

Then, there is Bernard Fall, a recognized expert on Vietnam, who has returned from a visit and reported in the *New Republic*.

Fall says that before last February, the date Langguth picks as a turning point, only two percent of the Viet Cong deserters cited air action as a reason for defection. Since February the rate has climbed to seventeen percent.

"Indeed," writes Fall, "as many an informed observer in Saigon will concede, what changed the character of the Vietnam war was *not* the decision to bomb North Vietnam; *not* the decision to use American ground troops in South Vietnam; but the decision to wage unlimited aerial warfare inside the country at the price of literally pounding the place to bits."

In Paris, in mid-September, this reporter spent an afternoon in company with Gen. Paul Stehlin, retired Chief of Staff of the French Air Force. General Stehlin is an author in his own right, with a volume of World War II recollections on the current best-seller list in his own country. He was an active Air Force commander more than a decade ago, when France was overwhelmed in its match with Vietnamese rebels.

It is General Stehlin's opinion that airpower could have prevented the defeat at Dienbienphu.

The French had more than thirty battalions fighting in the mud and filth on the ground, while General Stehlin and his colleagues were ill-equipped to help. They had some old B-25s and a few fighters left over from World War II. The United States, General Stehlin told me, had the *real* airpower at that time but refused to lend this strength to a cause that would have prevented the situation prevailing in 1965.

As for our own airpower effort, General Stehlin said we have restrained our use of it too long. He feels that a full application of air strength could shorten the war by many, many months and that we are foolish to hold it in check. He points out that the longer this conflict goes on, while we fight it with less than finality, the longer we give Hanoi and Peking to capitalize on its propaganda value.

At this writing, there is a new interest in the use of airpower in Vietnam that has stirred action in Congress. Investigating committees from both the House and Senate have members and staff workers in Saigon.

The House Armed Services Committee has a Special Subcommittee on Tactical Air Support, headed by Otis G. Pike, a New York Democrat, which is holding closed hearings on the subject. The chairman says he has been asked to find out "why our airpower is unable to find and destroy the Viet Cong in South Vietnam."

It has been true for well over a year that airpower kills more Viet Cong than any other form of weaponry. And, since February, the VC who are not killed find life in the bombed jungle intolerable.

How destructive does airpower have to be to satisfy Mr. Pike? If he wants to investigate a dilemma, he should study the policy governing the application of airpower, not the results of a restrained application.

What Can a Man Believe?

It was last June that the House Committee on Appropriations reported out the Defense Department's bill for Fiscal 1966. There is no doubt about it, the report said the requests "contained no funds specifically programmed to support what are now the current rates, or any increased future rates of operations in Vietnam, or in fact in any other specific area of the world."

By late September, the bill had ground its way through both Houses of Congress and a conference agreement, winding up with provision for $46,887,163,000. That includes what is frankly described as a "stopgap" fund of $1.7 billion for the war in Vietnam. If there is anyone, in the Pentagon or on Capitol Hill, who thinks this is enough, or anywhere near enough, he has not spoken out.

Debate on the conference report was held in the House on September 17 and in the Senate on September 21. The record, cursorily covered by the press, is worth some attention. To it should be added the October 7 attack of Senator John Stennis of Mississippi on Defense Secretary McNamara's proposed shakeup of the Army Reserve, which provides for the disbanding of 750 units.

While there is small evidence that the critics, and particularly Mr. Stennis, are directing their barbs at Mr. McNamara's most vulnerable points, it is apparent that Defense spokesmen continue to lack credibility. It may be that this is an inherent failing and one to be expected. A veteran Washington newsman said recently, when the subject was raised, that he was lied to when he covered City Hall at Little Rock and he hasn't expected anything else since—at least from those in power.

Senator Stennis professes to be aroused by the Pen-

(*Continued on page 15*)

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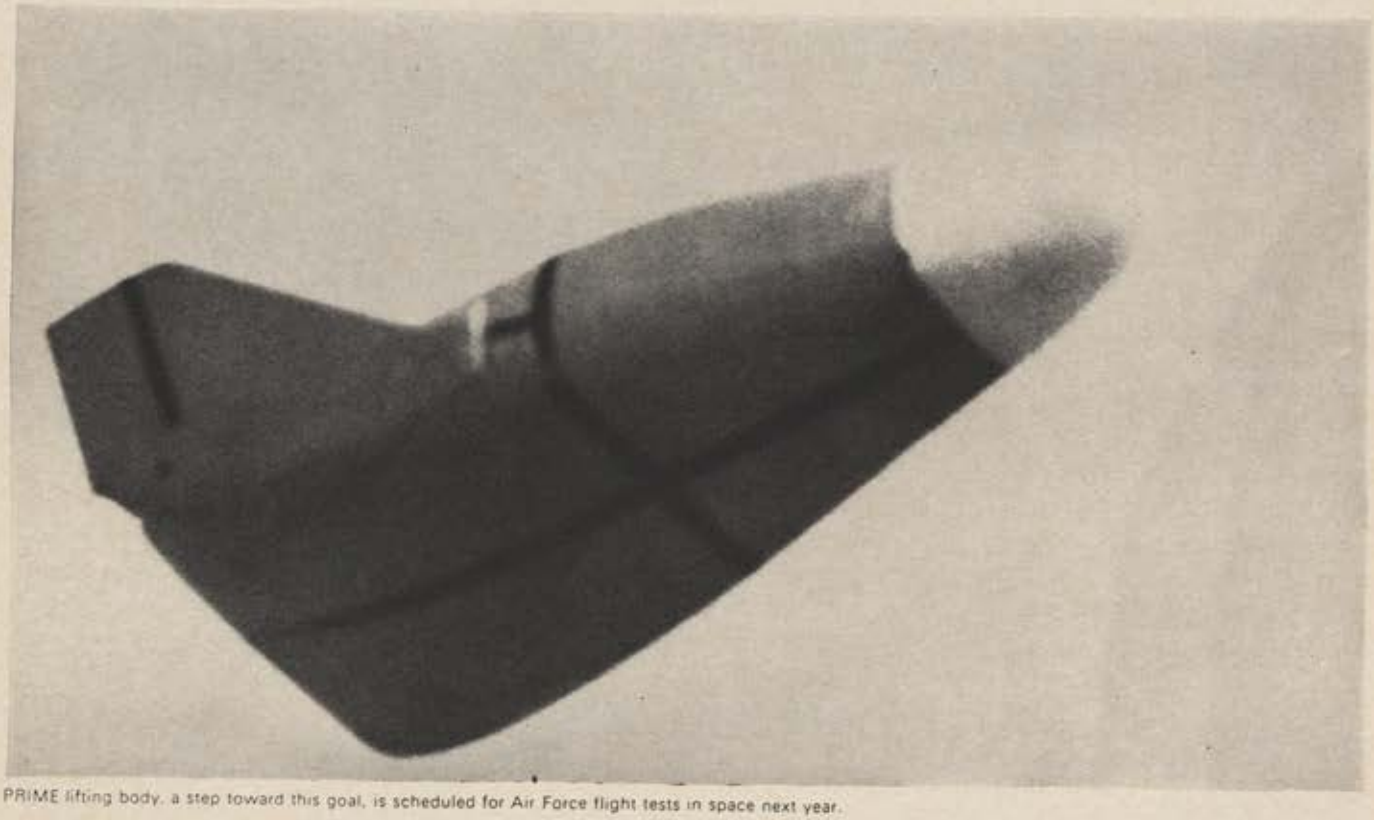

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tagon's determined effort to begin what he calls "a major scuttling of the Army Reserve." But that is not the burden of his complaint in his October 7 speech to the Senate. His real case is that Secretary McNamara told the press on September 30 that "we" had discussed the Reserve shakeup with members of the Senate. And that these men and "leaders" in the Armed Services and Appropriations Committees "have received the plan favorably."

Now, it appears that a Stennis survey shows that some of these Senators never heard of the new Reserve shakeup until it was announced by the Secretary. The men who say they never heard of it or approved it are Senators Hayden, Hill, Ellender, McClellan, Young of North Dakota, Smith, Byrd of Virginia, Symington, Jackson, and Thurmond.

Senator Russell, Chairman of the Committee on Armed Services, was quoted as saying he did not receive the plan favorably when it was presented to him by Cyrus Vance, the Deputy Defense Secretary. Senator Saltonstall also had a call from Mr. Vance and told the emissary that Mr. McNamara should submit legislation if he wanted to bring about the change. As for Mr. Stennis himself, he received Mr. Vance, but it was not made clear to him that the Defense Department intended to go ahead. If this had been made clear, the Senator reported, "I would have vigorously challenged him instantly and on the spot as proposing something far out of line from what is permitted in good faith by the language of the appropriations bill and far beyond what the conference understood."

To this, Mr. Vance replied that he had "the clear impression that Senator Stennis fully understood and supported our proposed course of action." The usual way to end this kind of a dispute is for both sides to profess there has been a misunderstanding. If it happens this time, it will further tax the public's sense of what is credible. There are many observers, regardless of their opinions, prejudices, and convictions on the Reserve question, who will not accept this as an unintentional misunderstanding.

The House and Senate debates of September 17 and 21, on the subject of the Defense budget, add to the dossier. A Republican Congressman, Glenard P. Lipscomb, a member of the Defense Appropriations Committee, urged the House to adopt the report. But he also begged the Administration to "come before Congress with a complete estimate of what is needed and a request for funds while we are in session and give us an opportunity to act in a timely, responsible way."

Mr. Lipscomb, who is from California, went on to say that the public has a right to know the size and nature of our commitment to the Vietnamese war. And, "It should not be fought and funded on a piecemeal basis."

Back of this comment lies the past optimism about the war—the kind that led Secretary McNamara to say early last year that the boys would start coming home in 1965—and the reluctant request for a $700 million supplemental appropriation for Fiscal 1965. The supplemental request was followed by a plea for an amendment to the Fiscal 1966 budget bill, the one just now approved, that will provide $1.7 billion more earmarked for Vietnam. There have been estimates that the effort in Vietnam will ultimately demand something in the neighborhood of $10 to $14 billion over and above what is inaccurately called our normal peacetime budget. Congress already expects there will be an additional request early next year, probably for something in excess of $5 billion.

The complaint of Mr. Lipscomb, in which he was noisily supported by Congressman Melvin R. Laird of Wisconsin, is that the Administration is trying to gloss over the facts about the cost of this war. He made his accusation about President Johnson as well as Secretary McNamara, saying both of them recognize the inadequacy of the budget. Mr. Laird is given to strong language, and he says the budget sent up in January is a "fraud."

At this point Chairman George H. Mahon, the tall and experienced Texas Democrat who heads the Defense Subcommittee and must defend the budget on the floor, took exception to the words being thrown about. He considered them "intemperate and unjustifiable," which may be at least partially right. His rebuttal was that the budget was made up late last year, too early to anticipate what would develop in Southeast Asia, India, Pakistan, and other parts of "a very large and fluid world."

Later, Congressman Robert L. F. Sikes of Florida pointed to the prospect that we may run short of equipment and supplies. This is a matter under investigation by committees on Capitol Hill, and Mr. Sikes said that "no one in the Department of Defense has appeared willing to face up to this." He said blanket denials have been issued and they may be right, but the work of Senator Stennis and his committee indicates otherwise.

This subject was discussed by Mr. Stennis in the Senate debate a few days later. He said his Preparedness Investigating Subcommittee, studying Army readiness, "found significant equipment shortages and large stocks of overage equipment that should be replaced." Details on these studies are classified, for sufficient reason, but the tone of the discussion was that Pentagon denials, like Mr. Vance's report of Senate approbation, are suspect.

At the outset, Senator Stennis said that, despite inclusion of the $1.7 billion extra for Vietnam and for some procurement and construction for that theater, there are other things missing. Among these are the additional expenses incurred for military personnel, operation, and maintenance. He urged support of the budget measure but emphasized the shortcomings:

"Although the Department of Defense has assured the Congress that the funds and flexibility provided are adequate at the present time, it is certain that a supplemental request of substantial proportions must be submitted early in the next session in order to fully fund the war in Vietnam and for other purposes.

"With that understanding, and barring unforeseen contingencies, it is my belief that the conference action you are being asked to approve today will provide for our defense needs until the Congress reconvenes."

Senator Saltonstall, a Massachusetts Republican, agreed with Mr. Stennis, but warned of the bills still to be paid.

"In my opinion the defense needs of this country have been adequately provided for temporarily," he said.

"However, I expect that in January the Administration will request from $7 to $10 billion in additional funds, in connection with the Southeast Asia operation and in connection with procurement for all our armed forces."

Under the guidance of Mr. Stennis, most of the remaining Senate discussion was centered on his favorite subject, the McNamara determination to shake down the Army Reserves. He said, "There can be no doubt in anyone's mind that the Congress forbids any realignment or reorganization of the Army Reserve components unless substantive legislation is enacted."

It may be that this issue is the one that will bring a climactic confrontation of the legislative branch with the Pentagon. It has merit only in the purely political arena.

Dr. Foster Testifies

John S. Foster, Jr., professionally a direct descendant of Herbert York and Harold Brown, has been named

(Continued on following page)

Director of Defense Research and Engineering. From the standpoint of our long-range national security, it may be the most important government job in America. And Dr. Foster's selection, like that of Harold Brown as Secretary of the Air Force, came as a surprise to almost all observers.

First, the lineage must be explained. The source is the University of California; specifically, the office of Director at the Lawrence Radiation Laboratory at Livermore. Dr. York had that job and moved to the Pentagon. Now he is back in California as a professor at the University of California in San Diego. He was succeeded at Livermore and later at the Pentagon DDR&E desk by Harold Brown, who moved on October 1 to replace Eugene Zuckert as USAF Secretary. Dr. Brown had been replaced in Livermore by Dr. Foster, who now comes along, in turn, to the top Pentagon research position. This appointment should bring a halt to all innuendos about Cambridge, Mass., and the Harvard-M.I.T. complex.

It must be pointed out that Dr. Foster, who has held his doctorate in physics since 1952, is no stranger to the Air Force. Here is the record:

- He has been a member of the Air Force Scientific Advisory Board since 1956.
- His scientific specialty has been the development of improved atomic weaponry.
- He pioneered work on electronic countermeasures to German radar in World War II and worked as a civilian adviser to the Fifteenth Air Force in Italy.

Like the Air Force Association, Dr. Foster opposed the nuclear test-ban treaty in 1963, and for much the same reasons that AFA did.

In case you have forgotten, it was in August of 1963 that the Senate Committee on Foreign Relations held hearings to sound out the most authoritative opinions on the proposed treaty. Dr. Foster was a witness, on August 21, 1963.

He was asked, at one point, whether "we are taking a great chance with the security of this country if we approve a treaty which prohibits our further testing in the atmosphere, and, consequently, learning by such testing important facts dealing with effects upon sites and systems?"

His answer:

"You are taking a risk, and you cannot calculate it."

"Regardless of these safeguards?"

"Regardless of these safeguards."

"Even though they are implemented to the fullest?"

"That is correct."

Earlier, in his prepared statement to the Senate Committee, Dr. Foster listed some of his apprehensions about the nuclear test-ban treaty. The first one he mentioned was the way the treaty would affect the American ability to solve future problems, not possible to anticipate. He was in favor of the 1963 practices of the Atomic Energy Commission on underground testing and "would be very worried if a more restrictive criterion were employed."

His second major concern, before the treaty was accepted in 1963, was with the American ability to "maintain the necessary capability of our laboratories, conduct an intensive underground program, and sustain a state of readiness to resume atmospheric testing in the event of abrogation."

He said that if the treaty were abrogated—and this was after the Russians had ended a previous moratorium with their own series of carefully prepared tests in 1961—we should be prepared to carry out a six-month program of our own. He said, "It may be necessary to maintain this state of readiness and keep the program current for many years."

Dr. Foster had other reservations about the test ban. He pointed out that missile systems are complex and that they must be proof-tested. He argued, simply, that if our weapons are to work reliably in new and strange environments, there must be no limit on the freedom to experiment. In this connection, he cited the problems of both missile penetration—in offensive war—and the defense against enemy missiles.

"The disadvantages resulting from the treaty in restricting our knowledge of site vulnerability, penetration, and defense, I believe, are very serious," Dr. Foster testified in 1963.

"Our current judgments are based on relatively new atmospheric tests. Wide margins of error are possible in weapon effects which we do not fully understand. Other effects, heretofore neglected as unimportant, could become dominant."

And then he made what probably was the most cogent observation about the proposed treaty. He said that current ignorance is ineradicable under its terms.

Dr. Foster concluded: "The proposed treaty would limit not only our knowledge of the actual state of Soviet military development, but would also restrict our knowledge of what may even be technically possible. Specifically, this requires that the United States explore vigorously all areas of technology critical to our security. Failure to do this would add to the uncertainties concerning our relative strength, and force us to choose between either an increase in risk to our security or a further increase in our level of armament.

"Thus, from purely technical-military considerations, the proposed treaty appears to me disadvantageous."

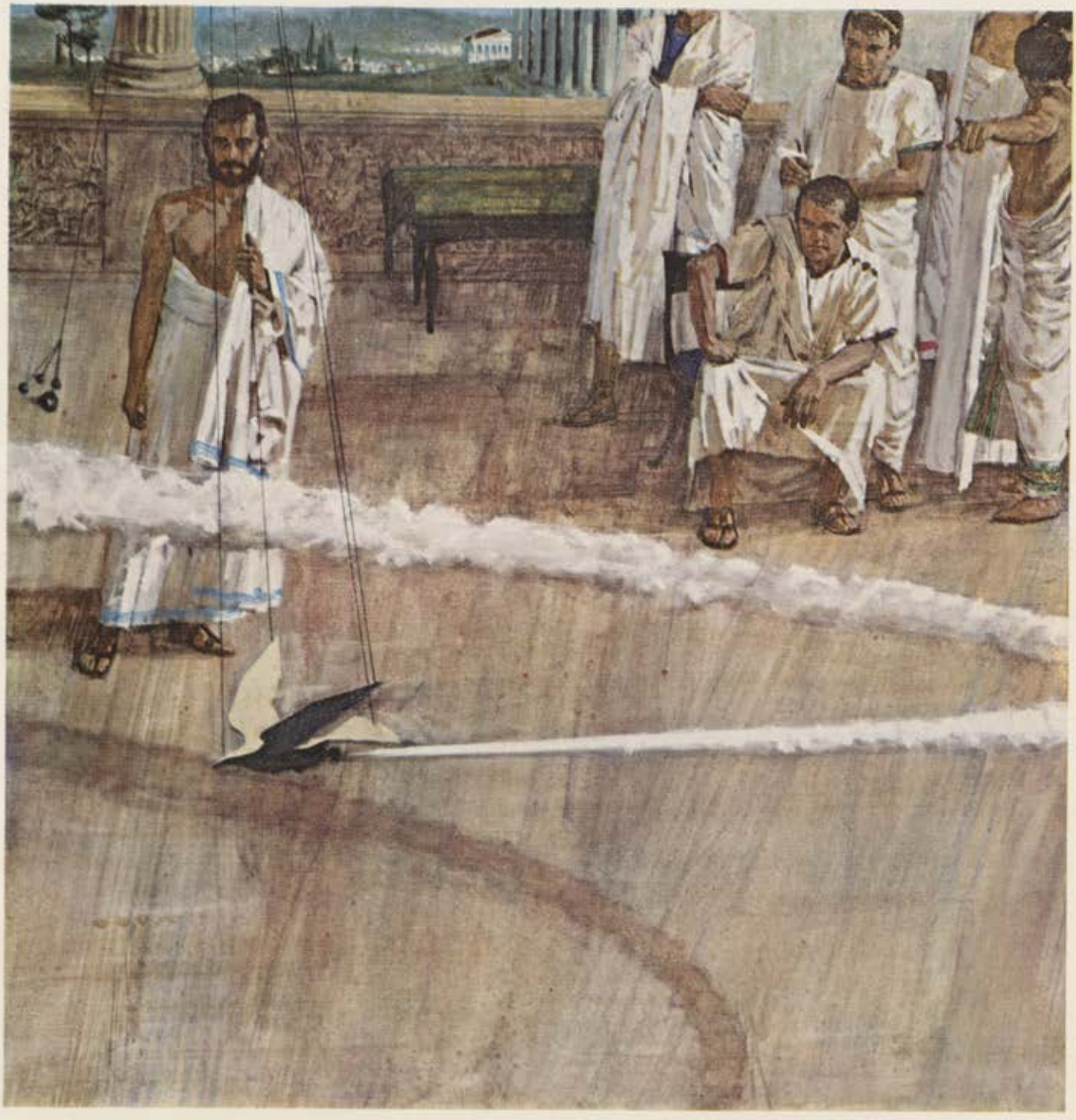
It is of further interest that in 1962 Dr. Foster was a participant in the Air Force Systems Command Management Conference at Monterey, Calif. His paper delivered at that session put the stress on his conviction that research is not something that can be allowed to run free in the field. It has to be organized.

Dr. Foster also made the statement at Monterey that "this country is in a race—a race for survival."

And he implied, at least, that this race requires an extension of research, both pure and applied, to fill yet another gap. It is the gap between research and production.

In 1965 we have another way of putting it. It is the gap between building blocks and operative systems.—END

John Stewart Foster, Jr., forty-three, a native of New Haven, Conn., has been named Director of Defense Research and Engineering. Educated at McGill University in Montreal and the University of California, he has been honored for his work on improved nuclear weapons.



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News,
Views
& Comments

AEROSPACE WORLD

By Allan R. Scholin

ASSOCIATE EDITOR, AIR FORCE/SPACE DIGEST

WASHINGTON, D. C., OCT. 15

By the time the huge Lockheed C-5A transport goes into operation for the Military Airlift Command in 1969, the US will have five times the military airlift it could muster in 1961. And when the complete C-5A fleet is flying in 1972, it will double the 1969 airlift capability.

These figures were presented by Secretary of Defense Robert S. McNamara when he announced award of the $2 billion C-5A contract to Lockheed on September 30.

The C-5A, with gross takeoff weight of nearly 700,000 pounds, will be able to carry 125 tons of cargo 3,200 miles, or fifty tons nonstop across the Pacific. This makes its cargo capacity equivalent to about six C-130E Hercules or three C-141A StarLifters. Expressed another way, it took 234 flights over a sixty-three-hour period to airlift 15,000 troops to Europe in Exercise Big Lift in the fall of 1963. Forty-two C-5As could have done the same job in only thirteen hours.

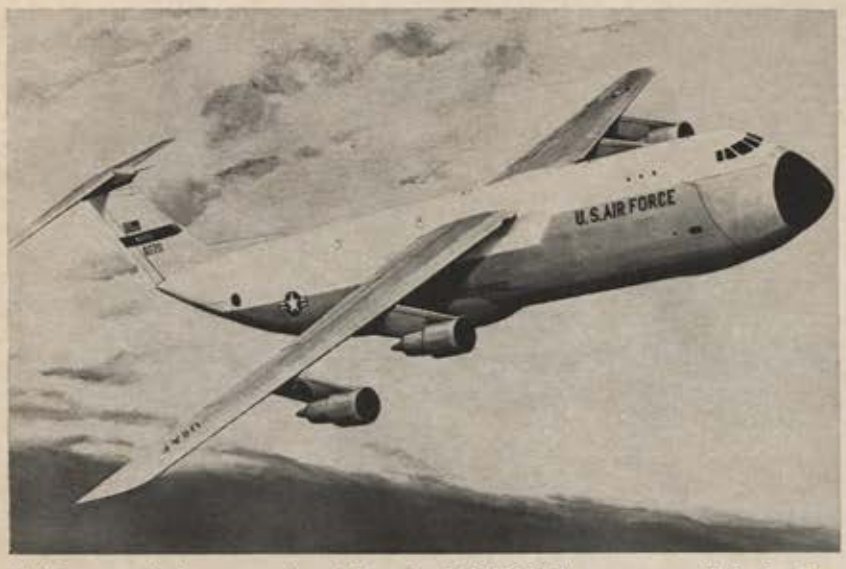
Powered by four General Electric fanjet engines of 40,000 pounds thrust each, the C-5A will cruise at more than 500 miles per hour. It measures 230 feet long, with a wingspan of 220 feet, and its tail, similar in design to that on the C-141, is sixty-three feet high. In comparison, the C-141 is 145 feet long with a wingspan of 161 feet.

More important, however, is the C-5A's cubic capacity. The fuselage will have two decks. The upper deck will carry seats for about 100 passengers. The cargo compartment below will be nineteen feet wide, 13.5 feet high, and 145 feet long—large enough to accommodate the biggest equipment items of an Army division. One limitation of both the C-130 and C-141 is that, except in carrying high-density cargo, they often "bulk out" before they reach their weight limit.

Lockheed was one of three competitors for the C-5A contract, along with Douglas and Boeing. Secretary McNamara said the Lockheed bid, in a new total-package contract covering development and production of fifty-eight planes and lifetime spares, was $250 million lower than the nearest competitor. The award to Lockheed followed an announcement by DoD that production of the C-141 will be cut back as C-5A production begins. The C-5A will be built in the same Lockheed plant located at Marietta, Ga., which is presently producing the StarLifter.

The Air Force has assigned Col. Guy M. Townsend as Director of the C-5A System Program Office (SPO) in AFSC's Aeronautical Systems Division at Wright-Patterson AFB, Ohio. Colo-

(Continued on page 22)



This is an artist's conception of how the USAF C-5A transport will look when it goes into service in 1969. Lockheed has been chosen to build the 700,000-pound aircraft and General Electric will furnish the four 40,000-pound thrust fanjet engines. C-5A's cubic capacity is one of its most important advantages. It is designed to carry bulk as well as tremendous weight.

Col. Guy M. Townsend has been named Director of the C-5A System Program Office. The XB-46 model in his hands and planes on shelf are some of the aircraft he has flown in his twenty-four years of service.

THE PATTERN OF GROWTH AT FAIRCHILD HILLER

With the announcement, September 30, of the acquisition of the operating assets of Republic Aviation Corporation—now the Republic Aviation Division of Fairchild Hiller—Fairchild Hiller has accelerated sharply a planned management program of growth as a fully integrated corporation in spacecraft and data systems, V/STOL (vertical/short take-off and landing) and conventional aircraft, and electronic and mechanical systems.

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3. Existing Republic programs under contract will be executed efficiently and profitably under combined management, and will add substantially to our contract flexibility.

During and since World War II, Republic has been a major producer of fighter-bomber aircraft, culminating in the famed F-105 Thunderchief fighter-bomber, a mainstay of our Air Force striking power in Vietnam.

Republic Aviation Division is also engaged in advanced designs for future fighter-bomber type aircraft, including V/STOL systems, has recently been awarded a contract for the design and production of an Advanced Orbiting Solar Observatory (AOSO), and is actively engaged in other related research and development programs in the space field.

With six Divisions (Transport, Republic Aviation, Space Systems, Electronic Systems, Stratos and Aircraft Service) at 14 facilities in 5 states, Fairchild Hiller continues to grow.

F-105 Thunderchief Fighter-Bomber

FAIRCHILD HILLER
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AEROSPACE AIRCRAFT V/STOL SYSTEMS ELECTRONICS

AEROSPACE WORLD

nel Townsend previously headed the XB-70 test force at Edwards AFB, Calif., while serving as Deputy for Systems at the Flight Test Center there.

Meanwhile, the AF Logistics Command announced that the San Antonio Air Materiel Area at Kelly AFB, Tex., has been designated as logistics manager for the C-5A system, with the Oklahoma City AMA, Tinker AFB, Okla., assigned responsibility for its GE engines.

That USAF may order more than the initial fifty-eight planes was indicated by Robert H. Charles, USAF's Assistant Secretary for Installations and Logistics, in a press conference a few days after the contract award. He noted that the contract includes an option to buy up to 115 planes, together with a pricing formula for additional numbers.

☆

The 32d Fighter Interceptor Squadron from Soesterberg, The Netherlands, emerged the over-all winner in the 1965 William Tell interceptor weapons meet at Tyndall AFB, Fla., early in October.

Competing in the F-102 Delta Dagger category, one of four in the meet, the 32d scored 8,782 of a possible 11,000 points, for a mark of just under eighty percent. The team was led by Capt. Erwin P. Wallaker.

USAF pilots on the Soesterberg team were aided by aircraft controllers of the Royal Netherlands Air Force, marking the first time in William Tell competition that foreign controllers had directed a team to victory. The unit also logged two other firsts—first USAFE team to win in its category and first to compete in its own aircraft. In previous years, overseas entries have borrowed aircraft from stateside bases.

Individual honors went to Capt. Jerry McMichael of the 326th FIS, Richards-Gebaur AFB, Mo., the only pilot to fire a perfect score. His team also competed in the F-102 category, finishing third.

The 62d FIS, K. I. Sawyer AFB, Mich., led by Col. A. E. Waage, placed first among F-101 Voodoo teams; F-106 Delta Dart honors went to the 71st FIS, Selfridge AFB, Mich., captained by Lt. Col. G. K. Dunaway; and the 331st FIS entry from Webb AFB, Tex., under Maj. I. J. Smith, won in the F-104 Starfighter category.

In SAC's fourteenth bombing-navigation meet at Fairchild AFB, Wash., in September, a B-52 crew representing the 454th Bombardment Wing of

CONTINUED

Columbus AFB, Miss., was awarded the Gen. Muir S. Fairchild Trophy as SAC's top bomber crew, winning out over forty-three other entries.

Gen. John D. Ryan, SAC Commander in Chief, presented awards in ceremonies concluding the event.

The 454th unit, led by Maj. Max L. Mihura, aircraft commander, was named the best B-52 crew in over-all bombing and in combined bombing and navigation. Other winners in both phases were units from the 380th Strategic Aerospace Wing, Plattsburgh AFB, N. Y., in the B-47 Stratojet, with Maj. Charles Patrick as pilot, and the 305th Bomb Wing, Bunker Hill AFB, Ind., in the B-58 Hustler, whose aircraft commander was Maj. Mackie L. Sorrell.

Second place in the Fairchild Trophy competition went to the 379th Bomb Wing, Wurtsmith AFB, Mich., which also led all B-52 units in navigation. Lt. Col. Robert A. Stefanik was aircraft commander. The 305th Bomb Wing was third.

In a related award, General Ryan presented the Saunders Trophy for SAC's best tanker crew to a unit from the 927th Air Refueling Squadron of Wright-Patterson AFB, Ohio.

☆

New projects in store for NASA-USAF X-15s at Edwards AFB, Calif., may yet produce "some of the most valuable contributions" to aerospace research, according to Paul F. Bikle, Director of NASA's Flight Research Center at Edwards, and John S. McCollum, Director of New Programs and Research Projects at USAF's Aeronautical Systems Division, Wright-Patterson AFB, Ohio.

At an X-15 technical conference in Washington early in October, they outlined a series of advanced research tasks being pursued with the high Mach experimental aircraft. The list includes ultraviolet stellar photography, atmospheric density measurements, meteorite collection, measurement of infrared and solar spectrums, and test of a horizon-scanning device destined for use in the midcourse maneuver of the Apollo spacecraft.

An "energy management" system is soon to be installed in the third X-15, they said. Employing a lightweight computer, the system will show the pilot his position in flight, the glide capability of his aircraft, and the distance and procedures he must follow to land safely.

This plane recently logged the 150 flight in the X-15 series. Piloted

(Continued on page 25)

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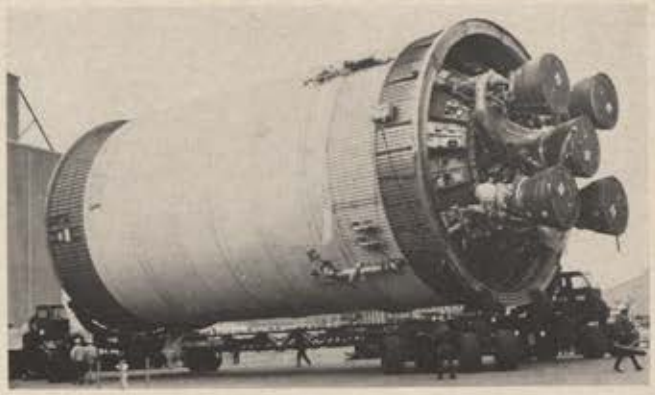
The first Boeing-built stage of the Saturn V booster is loaded aboard a barge at NASA's Michoud Assembly Facility near New Orleans, La., for shipment to the Marshall Space Flight Center at Huntsville, Ala., to undergo tests of its ability to withstand vibration, bending, and other stresses.



Second stage of Saturn V, built by North American Aviation, Inc., at Downey, Calif., is wheeled aboard a US Navy ship, bound via the Panama Canal for NASA's Mississippi test facility. This is a flight-weight, all-systems test vehicle, almost identical to flight stages to be launched in 1967.

by NASA's John B. McKay, it reached an altitude of 300,000 feet and a top speed of 3,682 mph while testing the horizon scanner and measuring boundary-layer noise and aerodynamic and structural loads on horizontal tail surfaces.

Other plans, which Bikle and McCollum noted have not yet been approved, include modifying an X-15 to carry experimental hypersonic ramjet engines and study of a new delta-wing configuration. These tests, they said, are designed to provide information vital to hypersonic aircraft design. Experiments now programmed will require at least fifty more X-15 flights, extending into 1968.

"Although the X-15 has essentially completed all of the studies originally conceived for the program," they added, "and is now being used to conduct various new research programs that evolved as the program progressed, we may find that now, eleven years after the initiation of the X-15 program, some of the most valuable contributions lie . . . ahead."

☆

The Soviets failed once again to soft-land an unmanned vehicle on the moon when their Lunik VII spacecraft crash-landed on the lunar surface early in October. A Soviet scientist, V. Ivanchenko, confirmed that Lunik VII was programmed for a soft landing and blamed the failure on its retro-propulsion system.

Last May, when Lunik V smashed into the moon in what had been billed as a test of soft-landing system elements, a Soviet expert explained that their main difficulty is in determining just when to fire the retro-rockets, and in anticipating that instant by the 2.5 seconds needed to

(Continued on following page)

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Dimensions of one section of new supersonic propulsion wind tunnel being built at Arnold Engineering Development Center, Tullahoma, Tenn., are illustrated by size of technicians checking its interior. It is lined with stainless steel to handle the 650° F airflow needed to simulate flight velocities up to Mach 4.

complete a signal relay from spacecraft to earth and back.

"To achieve a soft landing, one must . . . send one rocket after another to the moon," Ivanchenko is quoted as saying, "to assure us that everything will work at the moment of landing."

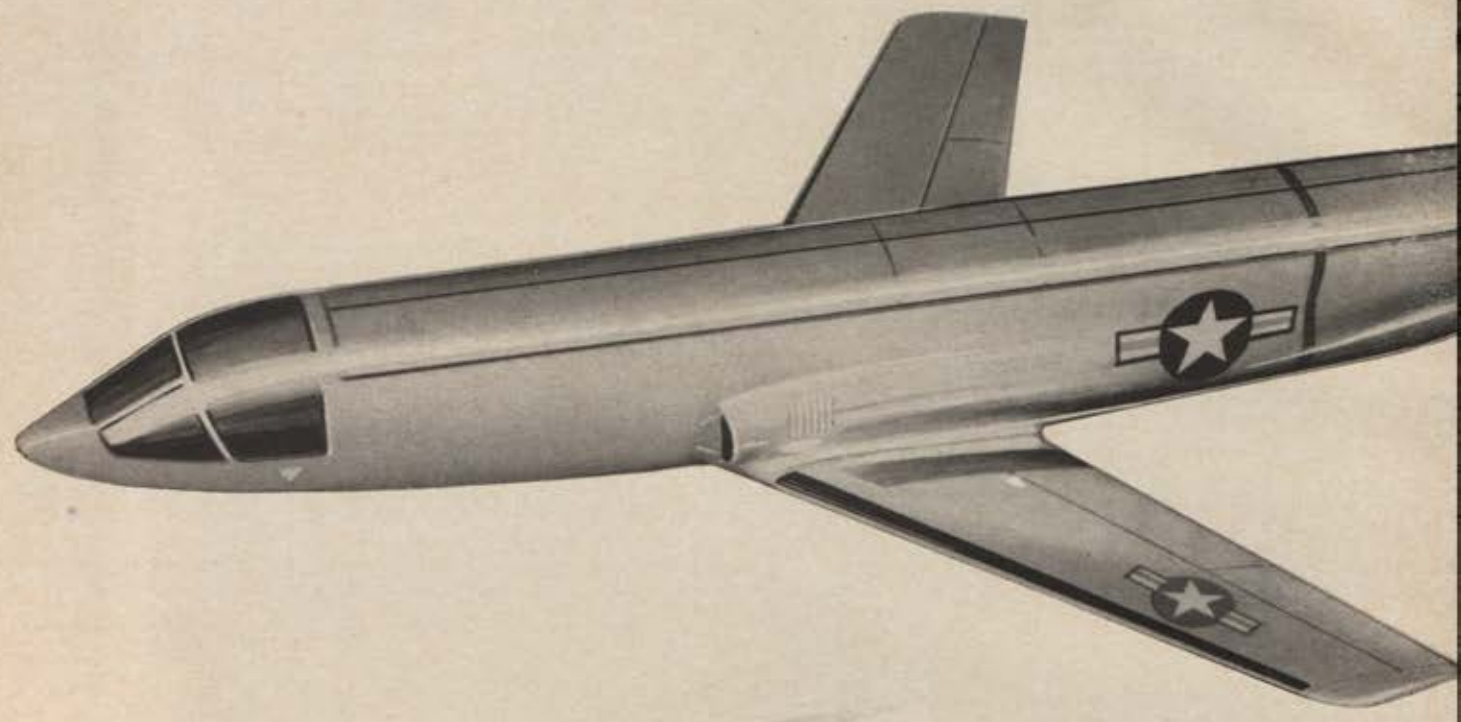
The US is expected to make its first lunar soft-landing attempt early next year when NASA launches the first vehicle in the Surveyor series.

☆

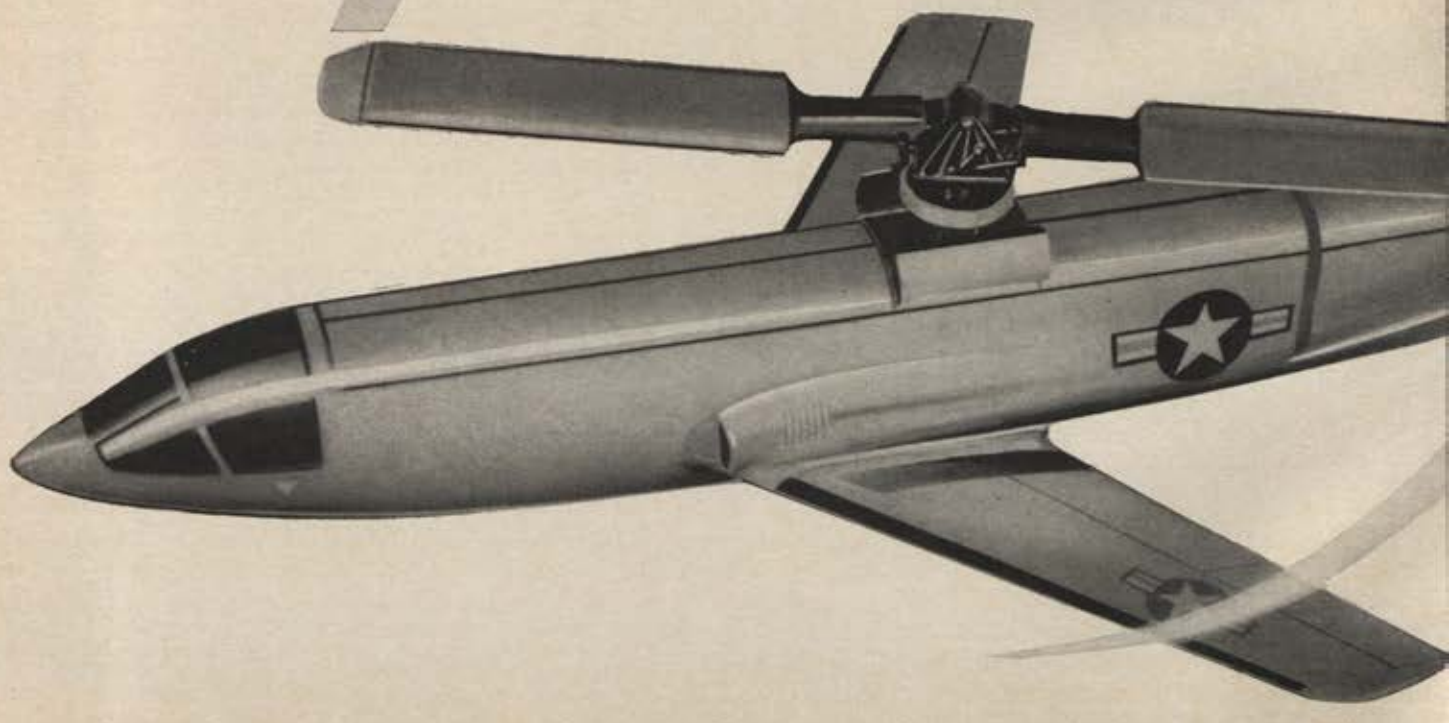
NEWS NOTES — The Air Force has presented to the **Smithsonian Institution** in Washington, D. C., the **guidance computer** used in the first three years of Atlas missile and booster launchings. The system, built for USAF by the **Burroughs Corporation,** had a perfect mission record at Cape Kennedy, Fla., without a single delay or failure attributable to the computer. At the Smithsonian, it takes part in a daily demonstration of missile and launch-vehicle guidance. The computer was replaced at Cape Kennedy by an improved version, also built by Burroughs, which has guided Atlas launch vehicles for astronauts in Project Mercury, the Ranger moon probe series, and for two Mariner spacecraft.

SAC is apparently preparing to expand its **force of B-52s** which are carrying out almost daily assaults against the Viet Cong in South Vietnam. The **Air Force Logistics Command** reports that "additional" B-52s are being equipped with wing racks to carry increased tonnages of conventional bombs. These modifications were performed last year on B-52s of SAC's 3d Air Division based on Guam. With external racks, each B-52 can carry a total of fifty-one conventional 750-pound bombs — twelve under each wing and twenty-seven in the bomb bay.

NASA's **Jet Propulsion Laboratory** in Pasadena, Calif., has broken off its telemetry connection with **Mariner IV,** after more than ten months of communications from the spacecraft, including the first closeup pictures of Mars last July. Since it was launched on November 28, 1964, Mariner IV has transmitted nearly fifty million engineering and scientific measurements on the interplanetary space environment. Next spring, JPL expects to resume tracking Mariner IV with a new 210-foot antenna being built at Goldstone, Calif. By mid-1967 the spacecraft's solar orbit will again bring it close enough to earth for JPL to pick up its signals if its transmitter is still operating—and perhaps even get it to recall something of what it encountered in the far reaches of its orbit. —END



Is Sikorsky best qualified to build a stowed rotor V/STOL aircraft?



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5. In 1958, Sikorsky completed plans for the first U. S. stowed rotor V/STOL aircraft. This company-funded project not only proved the concept, but laid the foundation for application of the concept to useful military missions.

6. Since 1958, Sikorsky has spent over one million man hours evaluating advanced V/STOL concepts.

7. The company has "flown" stowed rotor designs through its unique simulator. This simulator has thoroughly evaluated these designs without the prohibitive costs of building actual hardware.

8. Sikorsky has further evaluated its stowed rotor development with one of the largest analog and digital computer systems in American industry.

9. Additional facilities have included a variety of wind tunnels, test towers, fatigue laboratories, and flight research aircraft.

10. More military rotary wing aircraft have been built by Sikorsky than by any other manufacturer.

Sikorsky Aircraft has long followed a policy of "homework before hardware." Sikorsky has done its stowed rotor homework. It is now prepared to build the hardware.

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STRATFORD, CONNECTICUT

AIR FORCE
NOVEMBER, 1965

Educators from sixty-two countries discussed the scientific literacy requirements of the aerospace age, led by physicist and teacher, Dr. Edward Teller . . . industry displayed the latest aerospace systems to more than 4,000 government and military officials . . . the USAF Chief of Staff declared an "up curve" in the requirement for manned military aircraft . . . and AF Secretary Eugene Zuckert made his farewell address to AFA at the Air Force Anniversary Banquet celebrating the eighteenth birthday of the US Air Force at . . .

AFA's First Fall Meeting— A Record-Breaking Success

By Edgar Ulsamer

SPECIAL ASSISTANT TO THE EXECUTIVE DIRECTOR, AFA

PHOTOGRAPHS BY TSGT. GUY R. DYKE, USAF

MESSAGE FROM PRESIDENT JOHNSON

The following message from President Lyndon B. Johnson was read at the US Air Force Anniversary Banquet in the Sheraton-Park Hotel Friday evening, September 17, at the concluding event of the Air Force Association's first annual Fall Meeting:

THE WHITE HOUSE
WASHINGTON

"I'm proud to send my greetings to the Air Force Association as it pays tribute to our Air Force men and women whose job of protecting the freedom of our nation goes on around-the-clock around the world.

"The basic role of the Air Force, working in concert with our other armed services, is to maintain peace in a troubled world. Its full and awesome power has yet to be used—a dramatic demonstration of the Air Force's contribution to our national policy of deterrence against aggression.

"The American airman lives always with risks—whether he mans an early warning post in the far north, a missile site on the western plains, a SAC plane on vigil, an airstrip in South Vietnam, or carries the peaceful flag of the United States into outer space. All America is grateful for his vigilance, his sacrifice, and his devotion to duty.

"I am pleased and proud to join the Air Force Association in saluting the men and women of the global Air Force on the occasion of the eighteenth anniversary of the establishment of the United States Air Force as a separate branch of our armed forces."

FOR the sari-clad Indian school teacher and her Pakistani colleague, engrossed in friendly, lively conversation, the Kashmir crisis seemingly didn't exist. Along with some 600 other teachers and school officials from sixty-one foreign countries and the United States, they were caught up in the intellectually stimulating climate of an extraordinary seminar. Its challenging theme: How to bring school curricula into phase with the scientific-literacy requirement of the aerospace age. Triggering the discussions was a provocative speaker, the eminent physicist and teacher, Dr. Edward Teller.

In the huge exhibit hall below, Air Force Chief of Staff Gen. John P. McConnell, flanked by NASA Administrator James E. Webb and FAA Administrator Gen. William F. McKee, USAF (Ret.), viewed displays of the latest aerospace systems and listened as industry spokesmen explained what the exhibits were all about. The trio had just left a luncheon for some 650 chief executives from government and industry who heard General McConnell report that the requirement for manned military aircraft was on an "up curve"—refuting recent press reports on the alleged impending demise of the "flying Air Force."

Later, more than 1,800 government officials, military officers, and industry executives, assembled for a festive Air Force anniversary banquet, heard a moving tribute to the Air Force as keeper-of-the-peace from President Lyndon B. Johnson (*see box*), bade farewell to outgoing Air Force Secretary Eugene M. Zuckert, and extended a hearty welcome to Secretary-designate Dr. Harold Brown.

The setting for these many-sided activities was the

Some 600 teachers and school officials from sixty-two countries attended the International Aerospace Education Seminar and the Educator's Workshop. Above, sari-clad Indian teachers listen to key panelist Dr. Edward Teller.

Over 1,600 officers from the Army, Navy, and Air Force, as well as 122 foreign officers, attended the Aerospace Development Briefings this year. Above, US and foreign officers listen to an aerospace briefing at a typical booth.

first Fall Meeting of the Air Force Association and its affiliate, the Aerospace Education Foundation, held in Washington's Sheraton-Park Hotel, September 15-17. In both format and content, this novel, three-day event underscored AFA's role as spokesman and educator on behalf of aerospace power.

Voted into being by AFA's National Convention in September of last year, the Fall Meeting will be held every year in Washington, D.C., coinciding with Air Force Day. AFA's annual Convention, on the other hand, will be held every spring in a different city as befits a grass-roots organization. The first Convention under the new format is scheduled for Dallas-Fort Worth, Tex., March 22-25, 1966.

Events transferred to the Fall Meeting are the Aerospace Development Briefings, International Aerospace Education Seminar, Educators' Workshop, Educators' Luncheon, AFA's annual Chief Executives Luncheon exclusively for leaders of government and industry, and a climactic Air Force Anniversary Banquet, commemorating the September 18, 1947, birth date of the modern Air Force. The banquet served as the official kickoff for nationwide Air Force Day celebrations initiated and sponsored by the Air Force Association.

In spite of its newness, the first Fall Meeting broke attendance records across the board.

The Aerospace Development Briefings and Displays —pioneered by AFA and the model for modern aerospace industry exhibitions—served as the pivotal event of the three-day Fall Meeting. About 4,000 government and military officials — in small escorted groups—attended the briefings and heard top scientists and engineers from industry discuss the broad range of systems and devices assembled in the Exhibit Hall to bring the participants up to date on the latest in the aerospace state of the art. One hundred twenty-two foreign attachés and military officers from allied countries also attended the briefings. *(See page 68 for briefing summaries.)*

The formal kickoff event of the Fall Meeting was the International Aerospace Education Seminar on Scientific Literacy, attended by some 600 educators from the United States and sixty-two foreign countries—the latter under the auspices of the State Department and the US Office of Education. Aerospace Education Foundation Board Member Dr. Edward Teller, winner of the Enrico Fermi award for nuclear physics and Associate Director of the Lawrence Radiation Lab of the University of California, served as speaker and key panelist. He was up against a panel and audience that were anything but gun-shy. Dr. Lindley J. Stiles, the President of the Aerospace Education Foundation and Dean of the University of Wisconsin's College of Education, was the keynoter and moderator.

In outlining the pressing nature of the scientific literacy problem, Dean Stiles described society in the technological age as being split into various "islands, isolating the humanities from science, and, within science, the various fields of specialization." Scientific

(Continued on following page)

FAA Administrator Gen. William F. McKee, USAF (Ret.), left, and NASA Administrator James E. Webb, viewed the Aerospace Industry exhibits and listened to the briefers with Gen. John P. McConnell, the Air Force Chief of Staff.

Physicist, teacher, and Aerospace Education Foundation Board Member, Dr. Edward Teller was key panelist and speaker at the Educators' Seminar. He led discussion on problems of scientific literacy in the aerospace age.

Listening to a panel of distinguished scientists and educators discuss necessity of interesting students in physical sciences and mathematics were some 600 educators from the US and foreign countries attending Aerospace Education Foundation Seminar at first AFA Fall Meeting.

literacy, he said, is the "network of bridges between these various islands," the "common ground" on which the areas of specialization must be based. Without it, he warned, the danger of "intellectual poverty for many and a society managed by an intellectual elite becomes acute."

This, he said, could wither the democratic processes as we know them today and transform the enlightened electorate into a passive servant of forces it neither understands nor cares about.

Dr. Teller elaborated on this point, stating that widespread and persistent scientific illiteracy leads down a dark road to, "at best, an enlightened dictatorship." Projecting the problem on the educational plane, he said "in the minds of most students, science, physical science, particularly mathematics, looms as something that is both difficult and boring."

This attitude, according to Dr. Teller, is the result of outmoded and mediocre teaching methods. He said it was imperative to revamp the science education of those for whom science does not represent their life's ambition but is simply one of the vital elements of a complex world.

The answer, in his opinion, is an approach that eliminates the exacting details from such science teaching and results in "science-appreciation" courses much like those given in music appreciation.

"Every citizen should be able to appreciate science, for he loses at least as much by not appreciating science as he loses by not appreciating music. And there is yet a more compelling factor: We are living in the age of scientific revolution. In a democracy, the right decisions will be made only if our citizens are not scientific illiterates."

The panel, consisting of Dr. Henry David of the National Science Foundation, Dr. John K. Folger, affiliated with the National Academy of Science, and Dr. Milton O. Pella, Professor of Science Education, University of Wisconsin, helped vigorously in developing the points raised by Dr. Teller.

On Thursday, the foreign and US educators met again, along with DoD and Air Force personnel concerned with educational matters, for an Aerospace Education Foundation luncheon. Toastmaster Gen. Laurence S. Kuter, USAF (Ret.), the Chairman of the Board of Trustees of the Aerospace Education Foundation, focused on the sociological upheaval brought on by the scientific revolution and the implicit need for bringing education into step with the aerospace era.

If, because of scientific illiteracy, large segments of the public live "a shadow existence outside the mainstream of our political and economical life," he said, "we extend an open invitation to sinister philosophies to step into the vacuum.

"The combined forces of government, industry, and science—all three the products of education—have given us the three-dimensional scope of the aerospace age." The Aerospace Education Foundation, he said, believes that, in concert, "these same forces should be equally capable of uplifting the thin, two-dimensional civilization on this earth."

Luncheon speaker, Dr. Lynn M. Bartlett, Deputy Assistant Secretary of Defense for Education, presented a sweeping review of the educational programs conducted by the armed forces.

Describing these programs as "the largest single educational complex in history," he said the survival of the nation and the free world depends on "the contributions those in the field of education make to

MANAGEMENT AWARDS

Five US Air Force officers and a civilian USAF employee were honored by the Air Force Association on September 17 for outstanding management of aerospace resources.

Receiving AFA's 1965 Management Awards from President Jess Larson in the presence of Chief of Staff Gen. John P. McConnell were the following:

From the Air Force Logistics Command—

- COL. JACK L. TUELLER, Commander, 2705th Airmunitions Wing, Ogden Air Materiel Area, Hill AFB, Utah—The Logistics Executive Management Award.
- EDWARD A. HAWKINS, Chief, Requirements Provisioning Branch, Directorate of Materiel Management, Warner Robins Air Materiel Area, Robins AFB, Ga. — The Logistics Middle Management Award.
- CAPT. HATTIE I. LEE, Director of Materiel, Hq. Eastern Ground Electronics Engineering Installation Agency, Mobile Air Materiel Area, Brookley AFB, Ala. — The Logistics Junior Management Award.

Management Awards went to the following from the Air Force Systems Command—

- COL. JAMES H. VOYLES, Director of Manpower and Organization, Hq. AFSC, Andrews AFB, Md.—The AFSC Distinguished Award for Management.
- COL. RICHARD C. DINEEN, Director, Gemini Launch Vehicle Directorate, Hq. Space Systems Division, Los Angeles, Calif.—The AFSC Meritorious Award for Program Management.
- MAJ. WILLIAM A. STUDABAKER, Chief, Analysis Division, Guidance and Control Directorate, Hq. Air Force Missile Development Center, Holloman AFB, N. M.—The AFSC Meritorious Award for Support Management.

AFLC Commander Gen. Kenneth B. Hobson and AFSC Vice Commander Lt. Gen. W. A. Davis also witnessed the presentations.

Dr. Lindley J. Stiles, the President of the Aerospace Education Foundation and moderator at the Education Seminar, introduces Gen. Laurence S. Kuter, USAF (Ret.), seated, who was toastmaster at the Aerospace Educators' Luncheon.

At the Air Force Anniversary Banquet, AF Chief of Staff Gen. John P. McConnell, Mrs. McConnell, and Dr. W. Randolph Lovelace, AFA Board Chairman, greet House Armed Services Committee Chairman, the Hon. L. Mendel Rivers.

the constant upgrading of the capabilities of those who are in the military." He listed as the avowed goal of the armed forces "at least a high school education for every enlisted man and at least a baccalaureate degree for every officer."

Following the luncheon, the educators heard a presentation by Lt. Col. Paul L. Maret, Chief, Presentations Division, Air Force Systems Command, on the educational and manpower requirements of the scientific age, as typified by the US Air Force. A workshop dealing with ways to solve the scientific literacy problem concluded the program for the educators.

On Friday more than 650 chief executives from government and industry attended the Chief Executives Luncheon which toastmaster George D. Hardy, AFA's National Secretary, termed "our person-to-person, executive-to-executive program." Chief of Staff General McConnell was the speaker. (Because of the importance of his "broad-picture" analysis of the Air Force's future aircraft requirements, his remarks appear in their entirety on pages 36-39 of this issue.)

Prior to his speech, General McConnell awarded the first Air Force Citation for support of the Air Reserve Forces program to the American Telephone and Telegraph Company, represented by its President, H. I. Romnes (*photo on page 91*).

Another highlight of the Chief Executives Luncheon was the Air Force Association's presentation of annual awards to outstanding members of the Air Force Logistics Command and the Air Force Systems Command by AFA President Jess Larson in the presence of AFLC Commander Gen. Kenneth B. Hobson and AFSC Vice Commander Lt. Gen. W. A. Davis (*see box for details*).

The climax of the three-day Fall Meeting of the Air Force Association was the Air Force Anniversary Banquet on Friday evening, a glittering event launching AFA's nationwide Air Force Day celebrations and the platform for Secretary Zuckert's farewell and for AFA's welcome to his successor, Dr. Brown.

With AFA President Jess Larson presiding, the event got off to a fast start when a man-high, eighteen-candle, Air Force birthday cake fell under the knives of the two ranking cake-cutters, Secretary Zuckert and General McConnell.

(Continued on following page)

One of the highlights of the Air Force Anniversary Banquet was the man-high birthday cake celebrating the eighteenth birthday of USAF. After blowing out the candles, Secretary Zuckert, left, and Gen. McConnell cut the cake.

Gen. Benjamin Foulois, first Chief of Staff of the Air Corps, shown here with Gen. William H. Blanchard, USAF Vice Chief of Staff, heard his contributions to Air Force history reviewed at the Air Force Anniversary Banquet.

The mood changed after dinner when Jess Larson—in paying tribute to the Air Force Cross winners—announced that Lt. Col. Robinson Risner had that day been declared missing in action in Vietnam. The Air Force Association had invited Colonel Risner to attend the Anniversary Banquet as the only living recipient of the Air Force Cross. The nine other recipients lost their lives in winning the decoration. A hushed audience of 1,800 listened intently as Mr. Larson read Colonel Risner's wired reply, expressing his regrets and explaining that it was "more appropriate" for him to remain with his F-105 squadron engaged in operation in Vietnam. His wire, sent two days before he had to bail out over enemy territory, concluded with the hope that he might be able to come to AFA's annual Convention next spring.

Jess Larson combined the head table introduction with a tracing of the Air Force's history—beginning with the early flying experiences of the first Chief of Staff of the Air Corps, Gen. Benjamin Foulois, to the first Secretary of the Air Force, Stuart Symington, up to the present.

In introducing the banquet speaker, Secretary Zuckert, Mr. Larson presented him an Air Force Association Citation of Honor in recognition of "dedicated and enlightened leadership while holding the longest tenure of office as Secretary of the Air Force."

Reviewing the four and a half years of his stewardship, Secretary Zuckert singled out three areas of change which he said "had the greatest impact on the Air Force . . . national leadership, technology, and defense management."

In the first category, the "most notable change—at least for the Air Force—was increased awareness of the need of the military forces to meet limited war and insurgency threats, while at the same time maintaining superiority in nuclear deterrent forces," Mr. Zuckert said.

Under the heading of change through technology, he cited SAC's ICBM inventory, which grew from six operational ICBMs in 1961 to 850 at present; TAC's evolution from "secondary status five years ago" to "one of our most useful instruments of national policy"; a doubling in airlift capability resulting from the C-141, which made it from "drawing board to active duty in less than four years," and another sizable step-up on the horizon with the C-5A; the fact that counterinsurgency forces, nonexistent in 1961, now play a major role in many areas of the world; and the "solid" accomplishments in space.

Terming the Titan IIIC booster a "cornerstone of our future as well as an outstanding example of how we intend the relationship between government and our truly great defense industry to work," he predicted that the recent go-ahead on MOL "will give us a superb opportunity to determine many of the possible jobs that military men can do best in space."

The third major cause of "tremendous changes in the Air Force since 1961," he said, was the area of internal defense management. Sometimes, the far-reaching changes instituted by Secretary McNamara in this field have given unwarranted rise to a doubt

Senator Stuart Symington, first Secretary of the Air Force, left, was among the honored guests at the Anniversary Banquet. Above, he is shown with Deputy Secretary of Defense Cyrus R. Vance and new Secretary of the Air Force Harold Brown, who was welcomed at the birthday banquet.

Air Force Association President Jess Larson presents an AFA Citation of Honor plaque, recognizing his "enlightened leadership," to outgoing Secretary of the Air Force Eugene M. Zuckert at the Air Force Anniversary Banquet, which launched nationwide Air Force anniversary celebrations.

Gen. Benard A. Schriever, of AF Systems Command and newly assigned project manager for the MOL, is greeted by Air Force Secretary Eugene M. Zuckert and Mrs. Zuckert in the receiving line prior to the Air Force Anniversary Banquet at which AFA saluted the outgoing AF Secretary.

of the need for individual services, Mr. Zuckert said. But expanded operations in Southeast Asia in the past year have confirmed that *service identity* ". . . generates operational competence. It generates esprit. It is the wellspring of professionalism," he said.

"Today there is no such thing as a 'jack of all military trades'—a master of all the techniques and refinements of military operations in each of the three operating media [aerospace, land, and sea]," he said.

In contrast with five years ago, he said, today's Air Force is "better balanced between mission areas; better balanced in weapon systems; better equipped, trained, and educated; more flexible, responsive, and secure; more efficiently managed; more willing to question its own concepts; and more objective in its approach to defense problems."

Concerning the future, he said: "We have not reached a plateau in technology, strategy, concepts, or doctrine. All kinds of change will continue in both hardware and ideas. And no one can be effective who refuses to contemplate or accept a climate of change in the days to come."

Underlying the progress of the Air Force, Mr. Zuckert said, was the professionalism of its manpower, the support of AFA, which "helped to create a climate of public understanding in which our professional airmen could translate ideas into reality," and the leadership of Chief of Staff General McConnell who "represents the finest qualities of Air Force professionalism."

In introducing the Secretary-designate of the Air Force, Dr. Harold Brown, Secretary Zuckert termed him a "professional . . . whose vision, understanding, and high competence will prove to be of tremendous value in the days ahead. His special qualifications as a fine scientist and scientific administrator make him uniquely fitted to catalyze all that must be done to create a force for the future—a force soundly based on the present; one that will grow and respond to the inevitable changes and advances of science that we must anticipate."

The banquet, and thereby AFA's three-day Fall Meeting, concluded with President Larson extending AFA's official welcome to Dr. Brown.—End

The incoming Secretary of the Air Force, Dr. Harold Brown, left, was introduced at the Anniversary Banquet by the man he succeeded, Eugene Zuckert. Here, he is shown in receiving line prior to the Banquet with Gen. John P. McConnell, USAF Chief of Staff. Mrs. Zuckert is in the background.

The manned military aircraft is far from being on its way to the graveyard, as some have suggested. On the contrary, the need for manned airpower is expanding and can be expected to expand still further in the future. In addition, if manned aircraft are to meet the ever-changing threat to US national interests, the military airplane must continue its evolutionary advance, continually improving its performance and versatility. These are among the views of the USAF Chief of Staff in his discussion of . . .

The Future of the Flying Air Force

By Gen. John P. McConnell

CHIEF OF STAFF, US AIR FORCE

The following article is adapted from the address General McConnell made at the AFA Chief Executives Luncheon held on September 17, 1965, during the Air Force Association's first annual Fall Meeting.—THE EDITORS

I THOUGHT that today I would entitle these few remarks "Some Thoughts on the Future of the Flying Air Force." The reason I selected this subject was to attempt to correct certain uninformed or misinformed press media—some of which are aviation trade publications that actually should know better.

You may remember the famous story about the letter Mark Twain is said to have written to a newspaper editor who had reported his death. The letter went something like this:

"Dear Sir: I noted that your newspaper this morning announced the news of my untimely demise. I beg to inform you that this report is slightly exaggerated."

I am reminded of this story every time I hear or read a statement to the effect that the days of the flying Air Force are numbered. I would like to use this welcome occasion to present a few facts which I hope will show that the flying Air Force is still very much alive and that any reports of its impending demise are, in the words of Mark Twain, "slightly exaggerated."

The flying Air Force is still very much alive, according to USAF Chief of Staff Gen. J. P. McConnell. He outlined future roles of manned aircraft in an address to industry chief executives and USAF leaders at AFA's Fall Meeting.

With missiles assuming ever greater importance in our defense arsenal, it is understandable that questions arise regarding the future of the military airplane. It may, therefore, be well to examine those military missions and tasks which can be accomplished best or only by manned aircraft, now as well as in the future.

Last night I had the opportunity to discuss the role of airpower in the Vietnamese War. A review of this role brings out two facts which I believe are most pertinent to my subject today.

First, the requirement for manned aircraft in helping to support our national objectives has expanded greatly and can be expected to expand still further throughout the foreseeable future.

Second, the ever-changing nature and scope of the threat to our national interests demand continued evolution of the military airplane, both as to performance and versatility. Such evolution is assured by our impressive advances in aerodynamics, propulsion, and related fields. Let me dwell briefly on these two aspects.

Expanding Airpower Requirement

There are several schools of thought regarding the type of nuclear deterrent we should maintain in order to make nuclear aggression and general war as unlikely as humanly possible. But regardless of any differences of opinion in this respect, there seems to be general agreement that, as the potency and credibility of our nuclear deterrent increase, the likelihood of nuclear aggression and war decreases accordingly.

In Vietnamese War, some USAF aircraft—like this B-52 nuclear bomber delivering conventional weapons on a Viet Cong target complex—are employed on adaptations of traditional operations. Other missions, General McConnell notes, require new tactics to meet geographic, political, and military demands of that war.

It is also agreed that, as the likelihood of nuclear war decreases, our enemies will resort increasingly to local crises and conflicts in the pursuit of their objectives.

The Vietnamese War is demonstrating that airpower plays a vital role in dealing with such conflicts, and that this calls for manned aircraft of many types and for a large variety of both combat and support missions. Some of these missions can be adaptations of what, over the years, have become traditional operations. Other missions, however, require new tactics and, perhaps, modified if not new equipment in order to meet the peculiar geographic, political, and military demands of any particular conflict, and to achieve the specific objectives we have set for ourselves. This, too, is being demonstrated by our experiences in the Vietnamese War.

Our military assistance and participation in Vietnam have a dual purpose. For one, we must help the government and the people of South Vietnam defend themselves against the Communist-supported Viet Cong insurgents. Second, we endeavor to induce the Communist rulers of North Vietnam to cease their aggressive support of the Viet Cong and to agree to a negotiated settlement. In both these efforts we make extensive use of airpower, resorting to some novel approaches in either case.

New Uses for Airpower

Last February we began to bomb targets in North Vietnam, not only for the purpose of impeding the flow of supplies to the Viet Cong in the south but, perhaps even more so, in order to exact a mounting price from the North Vietnamese for providing these supplies. In this manner, we expect to help "persuade" them to accede to President Johnson's offer of peaceful negotiations.

This principle of "strategic persuasion" is unprecedented in aerial warfare. It is not designed to achieve the enemy's defeat and surrender, as was the case in World War II, but to apply pressure in measured steps until the enemy is willing to negotiate a mutually acceptable settlement of the conflict.

Toward this end, South Vietnamese and United States aircraft have been attacking North Vietnamese targets that are being selected very carefully and with the utmost discrimination. In thus permitting the controlled application of pressure that can be raised or lowered or withdrawn altogether, as conditions may warrant, airpower is providing our statesmen with a valuable new strategy which may also be useful in helping to resolve or prevent similar conflicts in the future.

Another novel task that has been assigned to airpower in Vietnam is its employment in antiguerrilla warfare. This demanding task is being accomplished in several different ways, some new and some more or less traditional. Among the latter are our extensive interdiction operations; that is, aerial attacks on the sources, routes, and means of supply so as to impede the incessant flow of reinforcements and materiel which the guerrillas are receiving from or through North Vietnam.

Among the new tactics is aerial defoliation of brush and trees near any area likely to be subject to sniper action or ambush by small guerrilla bands. Large and widely deployed guerrilla positions and facilities are subjected to area-bombing by SAC B-52s, which are proving most effective in this unusual nonnuclear role.

Tactical aircraft provide close air support to the ground forces despite the fact that there is no stable front, with the guerrillas likely to strike anytime and anywhere, throughout the expanse of South Vietnam. Forward Air Controllers, patrolling the skies in light observation planes over designated areas, are being used to spot such guerrilla attacks wherever they may occur and to direct fighter-bombers against them.

In addition to these combat operations against the guerrillas, our aircraft are performing spectacularly in support missions such as airlift, air rescue, and evacuation. Thus, while airpower is only part of the over-all effort that must be expended to bring the war in Vietnam to an acceptable conclusion, it should be evident that manned aircraft are contributing a most significant share to that effort.

Meeting Future Needs

The experiences we are gaining in Vietnam not only help us devise new aerial tactics for fighting local wars but should also lead to improvements and development of both aircraft and equipment to better meet the airpower needs in future crises and local conflicts. As I indicated earlier, we must expect to become involved in such emergencies, at any time and in any part of the world, throughout the indefinite future.

Airpower plays a vital role in all these conflicts, regardless of type and scope, as well as in the deterrence of nuclear war. We must, therefore, have the quality, quantity, and variety of aircraft necessary to adequately cover the entire spectrum of aerial operations. Let us briefly review some of the types of manned aircraft required in each of these areas.

In the strategic area, as you know, our present nuclear strike forces are composed primarily of the manned bombers and intercontinental ballistic missiles of the Strategic Air Command and the Navy's sub-

(Continued on following page)

Among new aircraft designed for antiguerrilla conflict is North American OV-10A, soon to enter operational evaluation tests at Edwards AFB, Calif., with the M-48 Charger.

Refueled by KC-135 tankers, SAC's B-52 bombers possess global range. Because it can strike targets whose location is not precisely known, manned bomber remains indispensable.

marine-borne Polaris missiles. We were able to decrease the number of strategic bombers as more and more missiles came into our inventory. However, we expect to maintain a bomber component for some time to come, as there is a continuing need for a mixed force of manned and unmanned strategic weapon systems in which we can exploit the unique advantages of both to the fullest.

Among the advantages of the manned bomber is its capability to strike targets that are mobile or whose location is not precisely known. As antimissile defenses improve, strategic bombers may have to serve as "penetration aids" for our missiles by destroying these defenses. And, to provide defenses against our bombers, potential aggressors must divert huge resources from their own offensive forces, although I am confident that, regardless of how sophisticated these bomber defenses might be, our aircraft will be able to penetrate to their targets. Moreover, the big strategic bombers are most effective in conducting a show of force and, as proved in South Vietnam, can be put to good combat use in local wars by carrying large payloads of conventional munitions to any target from their home bases.

Continuing Interest in AMSA

For these and related reasons, it is gratifying that there is continuing interest in an Advanced Manned Strategic Aircraft. We are financing long-lead-time items, such as propulsion and avionics. Our over-all strategic capability will also be enhanced significantly by the addition of another manned airplane—the highly advanced SR-71 reconnaissance aircraft.

As for the next area, tactical operations, I explained before that the Vietnamese War is demonstrating the tremendous importance of such operations in local conflicts. To meet the manifold demands of tactical airpower in conflicts at any level of intensity and under any conditions, a considerable variety of aircraft types is required. These types include fighter-interceptors to ensure indispensable air superiority; fighter-bombers to provide close air support to ground forces; medium bombers for attacking tactical targets and for interdiction; observation planes for tactical reconnaissance and for directing strikes.

Tactical aircraft will doubtless remain our most important aerial weapon in any local conflicts in which we may become involved. For this reason, we will need not only the types and numbers of aircraft required to cope with any emergency; we also need continued improvements in these aircraft so that they can cope with the ever more stringent environments of the future. In all its planned versions, the F-111 is an example of the great progress we are making in this respect.

In the area of air defense, we will continue to need high-performance interceptors, not only as part of our deterrent against a nuclear-bomber attack but, perhaps even more so, to help defend against any possible attack with conventional bombs. Manned interceptors still provide the most flexible, reliable, and economical means for the rapid and positive identification of unknown and suspected aircraft approaching friendly territory.

Bigger and Faster Airlift

Finally, in the area of airlift, the growing demands of mobility and flexibility in meeting our global commitments require cargo aircraft with ever greater capacity, longer range, and higher speed. Significant progress is being made in this area also. The C-141, the first all-jet aircraft developed from the start as a cargo airplane, is now entering our operational inventory. Our future needs will be served by the spectacular C-5A, which will be the largest aircraft in the free world and will be able to carry a payload of 250,000 pounds or 600 troops, will have a range of 7,000 miles and a speed of 550 miles per hour.

Still in the research stage is the vertical takeoff and landing airplane, which may prove of great value for assault airlift missions. Air rescue and evacuation are other important airlift functions in which manned aircraft will continue to serve.

Cutting across these general areas of aerial operations, a number of distinctive or modified types of aircraft are and will be needed to accomplish a variety of support missions and specialized tasks. The former include aerial refueling and airborne command and control. Examples of the latter are aircraft used for psychological warfare and defoliation, as employed in South Vietnam.

From what I have said so far, two conclusions can

be drawn. One, we will continue to need a large *variety* of aircraft to meet the airpower requirements for routine and emergency peacetime operations, for crisis management, for local conflicts, and for the deterrence of nuclear war. Both this requirement and the global extent of the threat to our security and national interests lead to the second conclusion, and that is the obvious need for considerable *numbers* of aircraft.

The growth of this need is reflected in our training programs for aircraft pilots. In Fiscal Year 1962 the Air Force trained only some 1,300 pilots. This figure increased to 2,000 for the current Fiscal Year. In Fiscal Year 1967 we expect to train over 2,700 aircraft and helicopter pilots. Depending on the seriousness of the international situation, these figures may increase further in the years ahead.

Research and Development

In addition to variety and numbers, I foresee continued and dramatic advances in the performance and capabilities of the military airplane. As in the past, several factors combine to bring about such advances. The principal factor, of course, is the need to meet specific military requirements resulting from new conditions, new threats, new operational environments. For instance, the requirement for a combat aircraft that can take off and land at relatively slow speeds but can cruise at very high speeds and altitudes has sparked the development of the revolutionary variable-sweep wing which is incorporated in the F-111.

A related factor stems from the airpower requirements of national policy. This is illustrated by the progress in aerial transports which was stimulated by the demands for ever greater mobility in support of our national strategy of flexible response. But as military and political requirements stimulate technological progress, the opposite is true also. Technological breakthroughs, which can be utilized in military aircraft, increase capabilities which lead to new applications and, in turn, generate new requirements.

Another factor in the continuing evolution of the military airplane is the need for steady advances in the state of the art along the entire spectrum of aerospace technology. This effort is not necessarily directed toward any particular military requirement but is intended primarily to provide the knowledge and basic data for any future applications. A striking example is the joint research project of the National Aeronautics and Space Administration and the Air Force, which culminated in the X-15 experimental airplane. This project has yielded invaluable information on the unprecedented problems encountered in manned flights at ultra-high speeds and altitudes.

Dramatic Improvements in Equipment

Beyond advances in aircraft performance and capabilities, we can expect equally dramatic improvements and developments in aircraft equipment, such as navigational aids, armament, defense against anti-aircraft missiles, and electronic countermeasures, to name but a few. The point is that the evolutionary curve of the manned airplane is not flattening out but, if anything, becoming steeper, with no end in sight. In so many words, there is no such thing as an "ultimate airplane," just as there is no ultimate weapon, because there is no limit to man's capacity for finding new and better ways of achieving his objectives, be they good or bad.

In June 1962 the X-15 flew at a speed of over 4,100 miles an hour. In a flight about a year later it reached an altitude of over 350,000 feet. This means that a manned aircraft, although still a research vehicle, has gone faster than and about as high as the German V-2, the first operational ballistic missile, which many people then believed to be the ultimate weapon.

Three Air Force officers, in addition to a civilian pilot from NASA, have exceeded an altitude of fifty miles in the X-15, thus qualifying for astronaut wings. In fact, I had the pleasure recently of awarding these wings to the youngest among them, Capt. Joseph Engle. Thus, a manned aircraft is beginning to bridge the gap between flight in the atmosphere and spacecraft. And what is experimental and daring skill today may well be operational and routine tomorrow.

What further proof do we need that, as far as manned aircraft are concerned, the sky is no limit! And in my book, that goes for the flying Air Force, too.—END

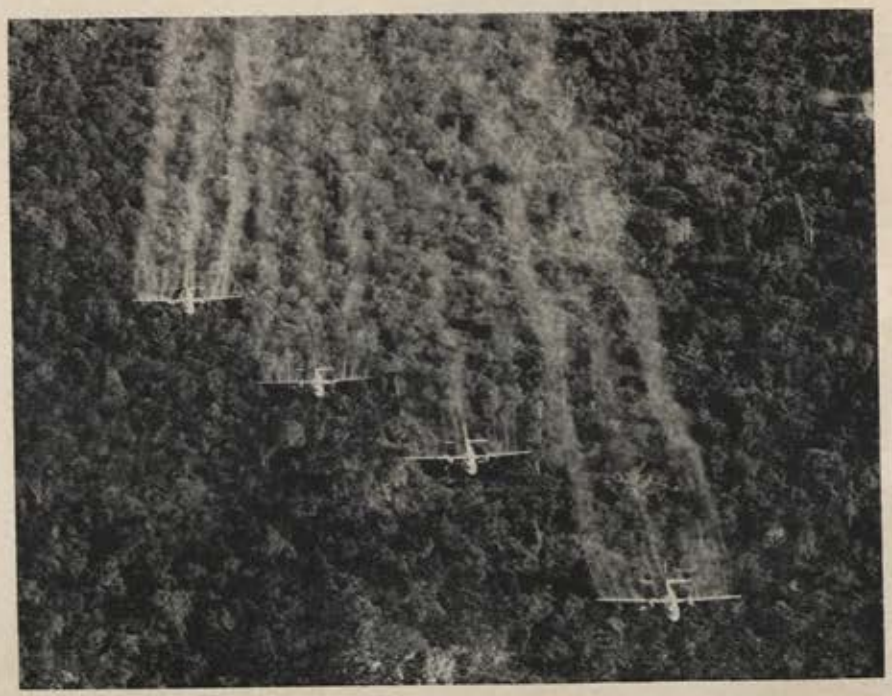
General Dynamics' variable-sweep wing F-111A was developed to meet requirement for a combat aircraft that can take off and land at relatively low speeds but can cruise at very high speeds and altitudes. Continuing evolution of the military airplane demands steady advances along the entire spectrum of aerospace technology.

C-123s leaving 1,000-foot-wide foggy trails, like cropdusters, as they perform defoliation missions . . . GIs feeding hungry children with supplies brought into villages that are surrounded by Viet Cong . . . these are just two of the unusual ways of fighting the war in Vietnam. Meanwhile, the more conventional task of bombing North Vietnam from far-off bases and hitting Viet Cong concentrations continues . . .

An AF/SD Photo Feature

Smoke and flames boil over a Viet Cong target in the Mekong Delta, South Vietnam, as 2.75-inch rockets are fired toward a riverside warehouse from an F-100 of the 481st Tactical Fighter Squadron. On this late September strike, pilots of the 481st destroyed eleven Viet Cong structures and three enemy sampans.

THE AIR IN



Flying just above the treetops on a slow, precise track, these four C-123 Providers leave a thick cloud of white spray over the South Vietnamese jungle as they perform one of the most unusual missions in the Vietnam war—defoliation. They are specially equipped "Ranch Hand" aircraft from the 309th Air Commando Squadron Special Aerial Spray Flight. Since 1961 these Air Commandos have been denying the enemy jungle cover with their "weed killer" and taking numerous hits in the process, due to the dangerous low-altitude requirement of their mission, despite support from fighter aircraft.

A USAF F-105 Thunderchief jockeys into position to take on fuel from a KC-135 aerial tanker. The fighter, loaded with six 650-pound bombs, is on its way to a target in North Vietnam. But high over the waters of the South China Sea, the air war seems very far away, and the only matter of importance is taking on the fuel which will give the Thunderchief the range needed to carry its bombs to their target. The KC-135s, out of Kadena AB, Okinawa, unerringly find their rendezvous point.

A young Vietnamese boy thoughtfully munches a handful of rice while watching food being distributed to the village elders. The supplies, flown in by USAF transports, are made available to villagers whose food stocks have been plundered by the Viet Cong. Although he can't understand the conflict, the boy does know hunger and welcomes friends who bring him food.

WAR VIETNAM

At Tan Son Nhut Airfield, South Vietnam, Headquarters of the 2d Air Division, Capt. Robert J. Donaldson, from Eau Claire, Wis., prepares for his 110th combat mission in his F-102 Delta Dagger. Captain Donaldson is receiving an assist from his crew chief, SSgt. Joseph E. Blackstone of El Paso, Tex. Both men are members of Detachment 3, 509th Fighter-Interceptor Squadron. Many USAF jet pilots stationed in South Vietnam have already built up impressive combat records in the short time since February 1965 when the first F-100 and B-57 jet strikes were made.

Built under Korean wartime pressures, to specifications seemingly near impossible at the time, and first introduced into Navy and Marine squadrons in 1956, the Douglas A-4 Skyhawk has shown—through five major model changes comprising almost complete redesign—a record of growth and performance that has made it the principal low-cost, ground-support aircraft in the US military inventory. With the Navy planning to keep the A-4 in its inventory at least until 1974, with a good combat record in Vietnam, and the general rise in interest in small, single-purpose, ground-support aircraft, the Skyhawk has a great potential . . .

SKYHAWK: A Proud Past and a Promising

By J. S. Butz, Jr. TECHNICAL EDITOR, AIR FORCE/SPACE DIGEST

THE BASIC design of the Douglas A-4 Skyhawk series took definite shape from 1950 to 1952—one of the most active, hectic, and prolific periods in aircraft development history.

All of the ingredients of crisis were present late in 1950. The Korean War was only a few months old and things were not going well. The military had not recovered from a punishing austerity drive. US setbacks at the hands of the North Korean Army had shocked the nation.

In aircraft technology the situation was scarcely less serious though not as much of a public issue. The Air Force and Navy were still transitioning to jets, with the major portion of their strength still in piston-driven aircraft. Jet-powered airplanes of the day, which were mostly fighters, had two great advantages—vastly superior speed and altitude performance, compared with propeller-driven aircraft.

Beyond these advantages, however, the jet record had not been great. The most serious performance problem was short range, only a small fraction of that of piston-engined aircraft. Payload, the companion performance factor, which trades off with range, also was severely limited. Jets simply were not in the same league with piston-powered aircraft in carrying large loads of conventional weapons for attacking ground targets.

In addition, the jets were much heavier than pro-

A-4 FAMILY COMPARATIVE PERFORMANCE SUMMARY

		A-4E	CA-4E	CA-4E with Spey engine
Sea-level Static Thrust	Engine	J52-P-6	J52-P-8	RB168-20
	Pounds	8,500	9,300	12,000
Takeoff Gross Weight (lb.)	Maximum	24,500	27,420	27,420
	Clean (Full Fuel)	16,216	16,300	17,058
Empty Weight (lb.)		9,853	9,937	10,695
Takeoff Distance (ft.)	Clean	1,710	1,610	1,200
	Maximum	5,280	6,320	3,820
4,000-lb. Bomb-Load-Combat Radius (nautical mi.)	Lo-Lo-Lo (Tanks Retained)	290	330	412
Maximum Speed (knots)	Combat Configuration	585	581	590
Stall Speed (knots)	Approach	92	92	96
Landing Distance (ft.)		3,410	1,600	1,750
Ferry Range (nautical mi.)	Tanks Dropped	2,195	2,120	2,575
	Tanks Retained	1,980	1,900	2,345

The outstanding bomb load, combat radius, and short-field performance of the latest member of the Skyhawk series, the A-4E, and the very large improvements which can still be expected from the basic design, are illustrated at left. The Rolls-Royce Spey-powered CA-4E has been proposed by Douglas to a number of nations. The configuration has great political as well as military attractiveness in Europe where, if selected, it probably would be built by a four-nation consortium.

The new TA-4E, Navy-Marine Corps advanced combat trainer, made its first flight last June. It is equipped with all A-4E avionics, five external stores stations capable of carrying over 9,800 pounds of ordnance, two 20-mm. cannon, J52-P-8 engine, wing-lift spoilers for improved crosswind landings, steerable nosewheel, and Douglas-built zero-zero ejection seats.

Future

peller aircraft for any given mission. The increased weight, plus the greater complexity of the higher performance jets and rising production costs, pushed their price up substantially—more than five times over the aircraft of 1940. A budget that would have bought 1,000 first-line fighters in 1940 would buy fewer than 200 in 1950.

This picture was further darkened by maintenance difficulties. Many of the major jet systems, including the engines, were brand-new designs and not based on firmly established technology. The best jet engines had less than one-third the overhaul life of piston powerplants. Unscheduled engine removals for major malfunctions were much higher on the jets. Maintenance experience was even worse with electronic navigation and weapon delivery systems, which, of necessity, were of a new order of complexity to handle the higher jet speeds. Total maintenance man-hours (including overhaul) per flight hour were up into the hundreds. The British even reported that one of their jet aircraft, after it entered service, required a total of 1,000 maintenance man-hours per flight hour.

The future was indeed not bright in 1950. Most advanced aircraft requirements called for flying at supersonic speeds, raising a whole new set of difficulties. The new aircraft could only make supersonic dashes for short periods and they had to cruise at high subsonic speeds. Consequently, they were what is called "two-design-point" airplanes, compromised so that top performance was not achieved at either speed. Range remained critical. Production costs continued to go up because a new order of manufacturing skill was demanded to maintain the proper skin smoothness. Designs continued to become more complex.

Backbone and pride of Navy and Marine Corps attack aviation, four Skyhawks are shown, above, in perfect formation. The first Skyhawks entered squadron service in 1956 and are slated to remain operational at least until 1974.

New black boxes were needed to improve stability and handling qualities to allow the pilot to use the aircraft effectively at all speeds.

And so it went.

Despite the problems, requirements for new military aircraft in 1950 generally called for pushing ahead to higher speeds, higher altitudes, and more sophisticated equipment. The steady advances in aviation technology in Western Europe and the Soviet Union, plus the operational experience in Korea, left no doubt that the US must move toward higher performance to retain its position as the world leader in aviation.

In this milieu the A-4 Skyhawk series was conceived and the original development completed, in near record time.

The Skyhawk is important because it was the first aircraft with which a concerted effort was made to reverse the trend toward larger airframes, increased complexity, and higher costs.

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The key to building smaller, less costly airplanes always has been to simplify components and thereby reduce weight. Airframe and engine designers know from frustrating experience that this is a tedious, often impossible, job. Airplanes are stubborn about surrendering pounds.

Ed Heinemann, then Douglas Chief Engineer, personally directed the Skyhawk design groups, and he set about the job with a vengeance. He set his sights very high, and seldom has there been a more effective weight-reduction program.

Heinemann and his colleagues had a head start on their task when the first Skyhawk design contract was let by the US Navy in June 1952. Many of them had participated in the company's design simplification studies in 1950–51, which had attracted the Navy's interest. This study had dual benefits, both vital to the speedy completion of the Skyhawk development. First, it gave the Douglas people some concrete experience in analyzing complex systems with an eye to simplifying them and cutting weight. Second, and perhaps more important, the study raised serious questions about the Navy's specifications in many areas and led to changes which aided the weight reducers.

Many of the Skyhawk designers also had a part in preparing the proposal for a compact fighter-interceptor, which was submitted to the Bureau of Aeronautics early in 1952. This proposal was based heavily on the simplification-study results, and it was the direct forerunner of the Skyhawk. The Navy bought the basic idea, but they wanted to switch the design from the fighter-interceptor mission and have it optimized for the ground-attack role. The intent was to procure a lightweight, carrier-based replacement for the piston-powered AD-5 (later redesignated A-1E).

Even coming close to duplicating the A-1's long-range attack performance with a jet aircraft was a prodigious task back in 1950. Recent experience in Vietnam has proven eloquently that there still is no match for the A-1 in the inventory when it comes to hauling a large armament load a long distance, orbiting in the combat area for well over an hour, or making multiple runs on ground targets.

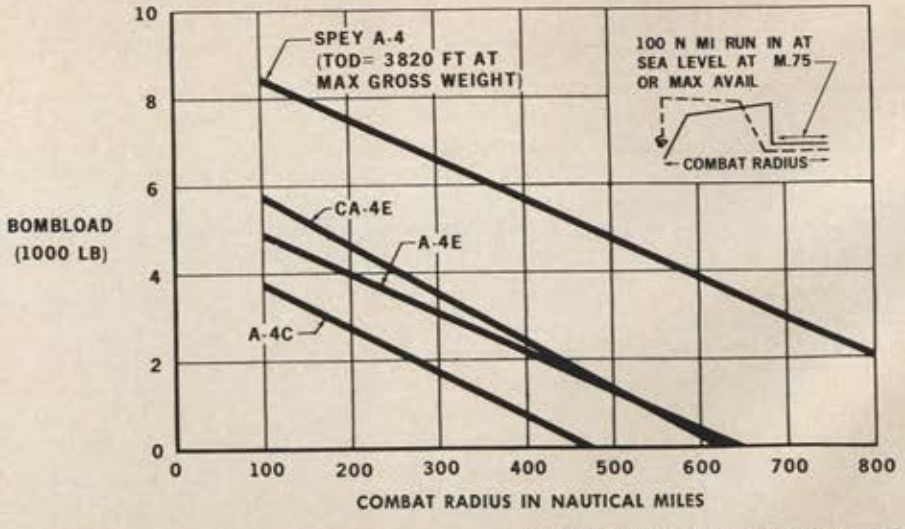
Many models of the A-1 have been built, but, on the average, a ground-attack version weighs a little under 12,000 pounds empty and normally has a takeoff weight of slightly less than 20,000 pounds. The "normal" maximum bomb load is around 8,000 pounds. At a maximum takeoff weight of 25,000 pounds the A-1 has carried as much as 12,000 pounds of bombs. Combat radius with a significant load of about 2,000 pounds of armament goes up to around 1,000 miles. The main drawback to the A-1 is its relatively low speed. A higher attack speed was needed to cope with modern defenses. And, just as important, a higher cruise speed was needed to cut the wear and tear on pilots. The A-1's best cruise speed is under 200 mph, and long-range missions take twelve hours or more.

The original Navy specifications for a "lightweight," jet-powered A-1 replacement called for a top speed of 500 mph, combat radius of at least 460 miles, the ability to carry 1,000-pound bombs, and a maximum gross weight of 30,000 pounds. The range was considerably advanced over fighters of that day, most of which couldn't fly out 300 miles and return, even without armament and without spending any time in the combat area. The weight target also posed a stiff challenge compared to other aircraft taking shape on the drawing boards. One relatively long-range Navy interceptor had a maximum takeoff weight of better than 35,000 pounds, and Air Force long-range, supersonic fighters were crowding 50,000 pounds.

Heinemann's group had some rather startling ideas as to how these requirements could be bettered. Commander John Brown, then in charge of attack aircraft design and procurement for the Bureau of Aeronautics, followed Heinemann's lead and assigned himself as the Navy's project leader. He worked with the Douglas team on a full-time basis to iron out the design and the exact specifications.

At the signing in June 1952, the development contract called for Douglas to deliver an airplane with an empty weight of 8,136 pounds and a maximum gross weight of 15,000 pounds. Its very small size and the fact that it was soon dubbed "Heinemann's Hotrod" gave a false impression of the Skyhawk's capacity. It might look like a tiny, stripped-down hotrod in

(*Continued on page 46*)



One of the strong arguments for single-purpose aircraft is illustrated at right. The A-4 was designed strictly to carry large external loads for long distances at high subsonic speeds. Few of the newest supersonic aircraft can match the A-4C performance shown here. The dramatic improvements in A-4 performance, with the operational A-4E, the proposed CA-4E, and the Spey A-4, are due to improved engines with lower fuel consumption. The mission illustrated here involves 100-nautical-mile runs at sea level, into the target and out again. It is relatively difficult and the aircraft have a better range bomb load capability for many other missions.

Marine Sgt. Bruce G. Gregory arms an A-4 of VMA-225 at Chu Lai, Vietnam. Skyhawks operating from this field have participated in close-support operations in South Vietnam and in interdiction bombing of North Vietnam.

Heavily armed A-4 is directed out for takeoff at Chu Lai by Marine Pfc. Ray Markley. The aluminum matting forming the Chu Lai strip was laid on deep sand stabilized with asphalt. A portable arresting gear also has been installed.

Air view of Chu Lai shows A-4 maintenance being conducted out of doors. Tail section of aircraft at upper left has been removed, exposing the engine. Marines are encamped in tents at this field where temperatures often exceed 100° F. Chu Lai is about fifty miles south of Da Nang.

Gun-camera sequence above shows an A-4 Skyhawk attacking a train in North Vietnam with high-speed Zuni rockets. In the top photo, the rocket has just been launched. At the bottom, the Zuni kicks up a sizable geyser of earth near the train. In the several months that the A-4s have been in action in Vietnam a great deal of information has been gathered on their performance. The aircraft has operated on thousands of sorties, often against strong radar-directed antiaircraft defenses, with low loss rate.

A wide variety of armament loads can be accommodated on the A-4. One of the most important weapons, the Martin Bullpup, is shown being launched above. The Bullpup has been used in action many times in Vietnam by A-4 pilots. They have used its radio guidance feature to destroy pinpoint targets such as radar antennas and concrete command posts.

the clean configuration with no bombs under its wings, but the Skyhawk proved to be a champion weight lifter with exceptional range for a jet aircraft. The first model, the A4D-1 (now called the A-4A), could meet the Navy's 460-mile combat radius requirement with a small bomb load, and over short distances it could deliver 8,055 pounds of armament. Its empty weight was 8,400 pounds, slightly higher than specified in the June 1952 contract, but the increase paid off well for it made a maximum takeoff weight of 22,000 pounds possible.

The success of the Skyhawk weight-reduction project can be attributed primarily to three things. First, one of the most advanced engines available in 1952 was selected, the Curtiss-Wright J65, a version of the British Sapphire turbojet. It had a thrust-to-weight ratio of about 2.8 to 1 and a specific fuel consumption near 0.91.

Second, the fact that the Skyhawk was strictly a one-mission, single-design-point airplane was of great importance. The wing, engine installation, and the entire configuration were designed to give optimum performance while cruising at subsonic speeds over long distances with large loads hung externally from the wings. No compromise was necessary to give the aircraft dual purpose, to make it the equal of contemporary fighters in air-to-air combat at any altitude or in bad weather.

The third element was plain, straightforward attention to detail, with a good bit of engineering ingenuity thrown in. An example was a major effort to reduce the drag of bombs, rockets, napalm containers, fuel tanks, atomic weapons, and all other containers hung beneath the aircraft. The Douglas Company made a real contribution in this area. The meticulously streamlined series of bodies had considerably lower drag than the equipment then in service, and they played a material part in giving the Skyhawk good range. The industry as a whole also benefited, and "Douglas-shapes" appeared on many configurations.

Another example was the consolidation of the avionics gear into a single package. The communications, navigation, and identification equipment was packaged as a single unit, which was sealed and filled with nitrogen gas to protect against the elements and to increase reliability. The package was bolted to the fuselage frame just ahead of the cockpit. It had a single cabling outlet, and the whole affair could be removed from the aircraft by one man in a matter of minutes, an important maintenance advantage. It was estimated that this packaging saved forty-eight pounds over a conventional installation.

The avionics package was a major item in the weight-cutting program for, according to the aircraft designers' quick rule of estimating, the Skyhawk group had to cut between 1,000 and 2,000 pounds of dead weight to get the maximum gross down near 20,000 pounds. That is, the first generation of "Heinemann's Hotrod" weighed about 10,000 pounds less than the original Navy estimate of 30,000 pounds for a maximum gross weight "lightweight" attack airplane. By the designers' rule, every pound cut from the aircraft's empty weight will actually reduce the maximum gross weight by five to ten pounds, because it reduces

Snakeye bombs are among the new weapons being employed against the Viet Cong. The cross-shaped drag brake slows the bombs rapidly and allows the aircraft to pull away from them and escape blast damage during low-level attack. The A-4 also is equipped with two 20-mm. guns in the wings and others in pods to aid in low-level assault maneuvers.

the necessary structural weight, the fuel needed to travel a given range, and the size of the powerplant needed. So the Skyhawk group worked to cut 1,000 to 2,000 pounds from the dead weight and ended up with a very small aircraft that was still extremely efficient.

Development of the first Skyhawk proceeded rapidly. A team of engineers went to Korea immediately to update their information on the problems of operating attack aircraft from carriers and land bases. By October 1952, this data, plus the initial design information, had been incorporated in the first mockup.

The Navy's usual procedure of building and testing some experimental models before fixing the design was waived. Preparation of the production tooling began almost at once. Production of the first ten Skyhawks was begun in November 1952. By January 1953 the production tooling was essentially complete, and high-volume production began on many components. The second mockup inspection was completed in February 1953, and the first aircraft was rolled out of the El Segundo plant in February 1954. The first flight, delayed several months because of technical difficulties, took place on June 22, 1954, with Douglas test pilot Bob Rahn in the cockpit. The second aircraft flew the following September, and soon afterward intensive flight testing with several aircraft began. About two years later, in 1956, the first squadron of Skyhawks was declared operational. Moving from initial design to squadron service in only four years is still extremely good program performance.

The Skyhawk's service record has been exemplary. In October 1955, the aircraft even set a world speed record of 695.163 mph over a 500-km. closed course. More important, it has been an effective attack aircraft. Its maintenance requirements have been relatively low. And its all-over operational costs might be called rock bottom in the jet-powered world. The latest Skyhawk—the A-4E—sells for about $720,000, completely equipped, with an average expenditure of approximately thirteen maintenance man-hours per flight hour at the squadron level.

During the fifteen years since 1950, the cost/effectiveness picture has improved for all jets, including the most advanced, high-performance, supersonic, multipurpose, fighter-attack aircraft. In fact, nobody in 1950 foresaw just how much the effectiveness of jet operations would improve and how much cost/effectiveness would improve. Still, however, no available jet aircraft can yet match the cost/effectiveness of the Skyhawk for the mission of carrying heavy armament over long distances.

The Navy has purchased four combat versions—the A-4A, A-4B, A-4C, and the A-4E. Each has been improved in various ways. The newest version, the A-4E, retains almost the same external dimensions and wing and tail configuration as the original Skyhawk, but its empty weight is up 1,453 pounds—to 9,853 pounds—and its maximum takeoff weight has gone up more than a ton, to 24,500 pounds. Attack performance has been greatly improved. The maximum bomb load is now 9,155 pounds and can be carried at five wing stations instead of three. The

(Continued on following page)

most important improvement, however, is in range. The A-4E can carry 2,000 pounds of bombs nearly 700 miles, fight, and return 700 miles. The main reason for this improvement is the Pratt & Whitney J52 engine, with a higher thrust-to-weight ratio and a lower specific fuel consumption than the J65 in the A-4A.

The A-4E and A-4C also enjoy an improved electronic package with autopilot, a low-altitude bombing system, and terrain clearance radar that are not in the earlier models. Substantial structural improvement also has been necessary with each new model to improve operational characteristics and accommodate the higher weights, while retaining the Skyhawk's ability to withstand 7G loads in the attack.

Production runs of the Skyhawk have been substantial. A total of 165 A-4As, 542 A-4Bs, and 638 A-4Cs were built, with 500 A-4Es either built or on order in a production program that is due to be completed late in 1966.

A two-place trainer version of the Skyhawk, now in production for the Navy, also could be classed as an operational aircraft. This airplane, the TA-4E, is an improvement over the A-4E in many respects because it is powered by a new version of the Pratt & Whitney J52, which has slightly better thrust-to-weight ratio and fuel specifics than the version in the A-4E. The first TA-4E has flown, and the initial contracts call for production of 139 aircraft. However, the estimates for the number of new operational trainers needed by the Navy range from 400 to 500.

Current plans call for the Navy to keep the A-4E in squadron service, backed with a full support system, at least until 1974. The trainer version undoubtedly will be around many years longer.

During the last few years, as close air support and attack aviation have come to the forefront as a major military problem, the A-4 has been evaluated by a number of groups outside the Navy. The aircraft has fared well in these evaluations, both the paper type and the flight and field trials. In most cases, the Navy and Marine Corps experience in short-field, forward-area operations has been revalidated.

The nub of any of these evaluations, of course, is the old debate about the multipurpose vs. the single-purpose airplane in the tactical air war picture. But on one point there is universal agreement among the military of all Western nations: Tactical aviation must be beefed up. Many nations began reequipping their fighter forces with high-performance aircraft, such as the Lockheed F-104, several years ago.

The F-104 is now operational in fourteen countries. And recently the specialized lightweight attack aircraft and lightweight dual-purpose fighters, such as the Northrop F-5, have been receiving more attention. The F-5 now has been selected by nine nations. Argentina is negotiating with the US for the purchase of a force of fifty A-4Bs, and these aircraft will be overhauled and modified by Douglas before delivery.

Several air forces are currently in the process of selecting new aircraft. More competition is expected in the future.

Two Air Force evaluations probably will be influential in the selection of new equipment in many allied air forces, as well as for the USAF. One of the evaluations, code-named Spring Robin, was a paper study of the A-4, the Northrop F-5, the Grumman A-6, and the Ling-Temco-Vought A-7 to see if any of them would be suitable as an interim aircraft to reinforce the Tactical Air Command before the new FX lightweight fighter becomes available in the early or middle 1970s. Sparrow Hawk, a field competition using the same four aircraft, was run this past summer and the final results submitted to higher USAF headquarters for review.

Another type of evaluation, now under way, probably will have the most influence on future aircraft selection in the non-Communist nations. This is the air activity in Vietnam. The operational details of this action undoubtedly will not be made public for many months and possibly many years. Enough information is available, however, to indicate some trends. First, the Skyhawk has done well in the two major types of Vietnam action—the close support of troops in South Vietnam and the interdiction operations against targets in North Vietnam.

The aircraft's availability rate has been very high for Marine units operating from forward airfields and for Navy squadrons on carriers. An average of ninety-five percent of the A-4s have been available for service each day. The squadron rates of maintenance man-hour per flight hour did not rise when the aircraft entered combat. The A-4 also has shown an ability to absorb considerable punishment. For example, one Skyhawk was hit by four 37-mm. cannon shells and still was able to return 230 miles to base.

Vietnam is also producing other data of even greater interest, which could otherwise be obtained only through very elaborate field exercises, if at all. Such data involves tactics, radar cross-section, vulnerability, attrition rates, the aircraft's success in attacking defended targets, its success as an antiaircraft destroyer, and so on. This kind of data is closely held military information, but it could have a controlling effect on the future of all the aircraft currently used in Vietnam and on the tactical philosophies of the services.

Douglas obviously is pleased with the A-4's record in Vietnam and optimistic about its chances for being selected by many allied air forces. This is indicated by the company's offering of two new Skyhawks for export—the single-place CA-4E and the two-place CA-4F, which are improved versions of the A-4E.

Regardless of what happens in the future, "Heinemann's Hotrod" is assured of a prominent place in aviation history. The design precedents it set as a lightweight, low-cost, long-range, heavy-payload, attack aircraft, and the fact that it will stay in the inventory for at least eighteen years in its various combat versions, will guarantee that place. The renewed worldwide emphasis on attack aviation and the Vietnam action may combine to bring the Skyhawk into new prominence, to stretch its useful life far into the future, and to leave it with an ever brighter place in aviation history.—END

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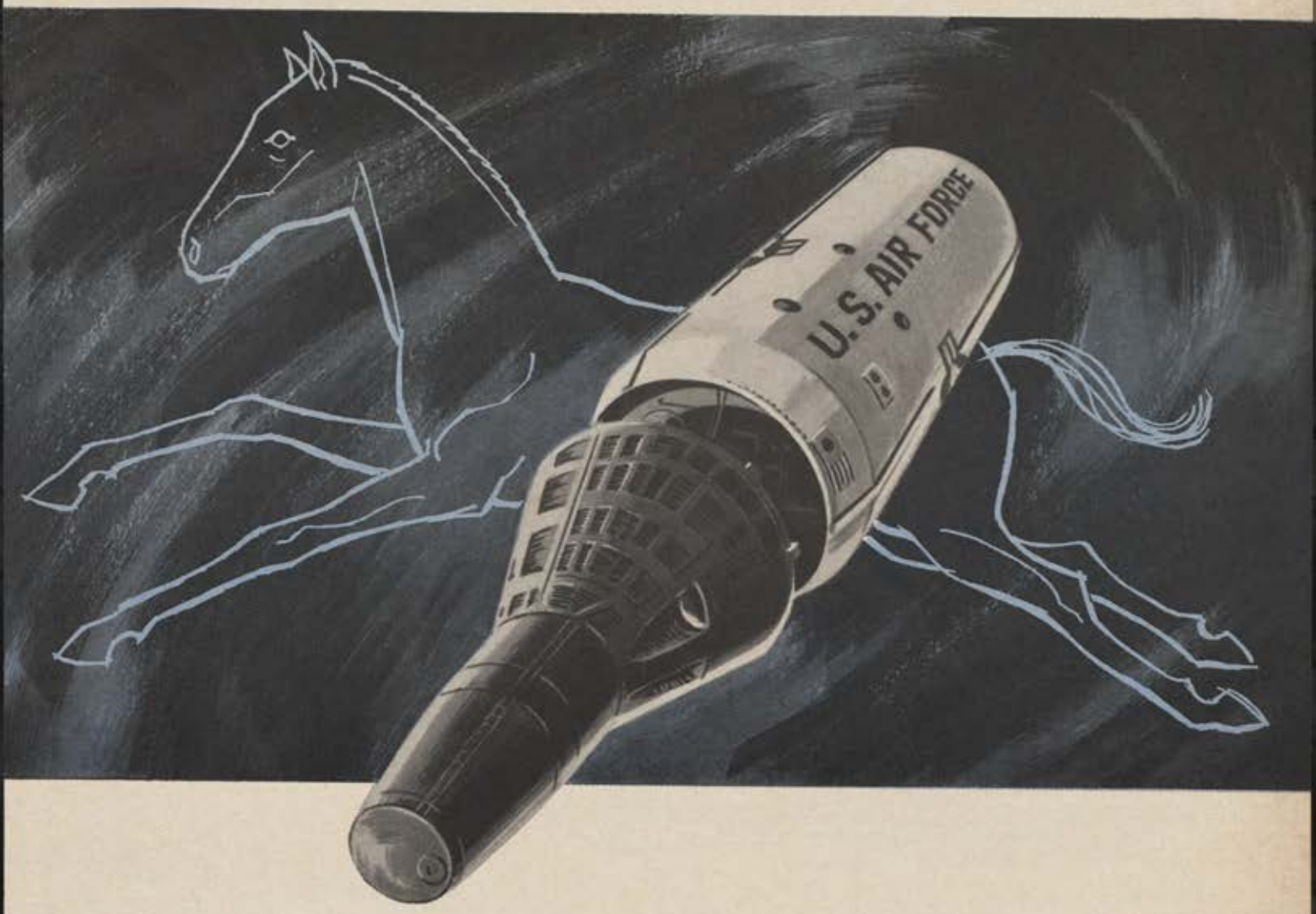

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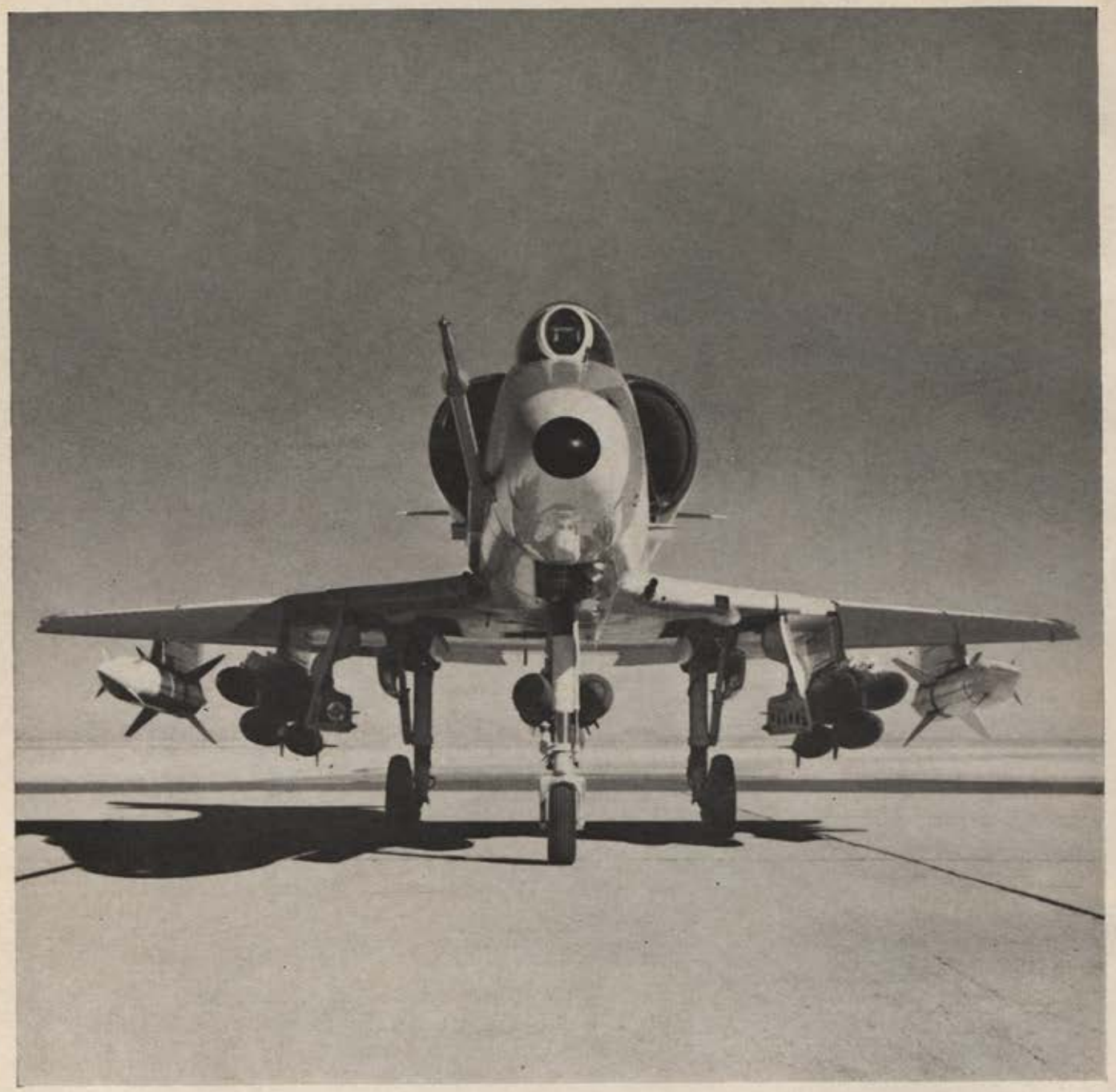

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THE SPACE AGE IN PERSPECTIVE

SPACE DIGEST

VOLUME 8, NUMBER 11 • NOVEMBER 1965

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There is a distinct imbalance between the way we use our brains and talents in solving the physical problems of space development and the way we go about determining the effects on society of the new science and technology. What is required is a scientific approach to the matter of . . .

Examining the Human Implications of the Space Age

BY JOSEPH M. GOLDSEN

I BELIEVE there is an imbalance in space activity: not an imbalance in the allocation of dollars between manned vs. unmanned space vehicles, or between space for defense vs. space for science—but a cleavage in a state of mind.

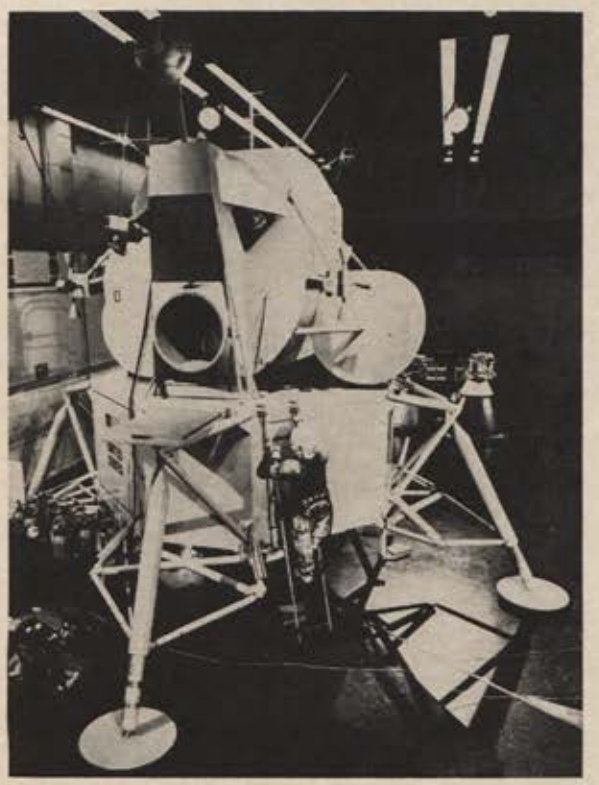
There is, I believe, a contrast between the way we use our brains to solve the problems of hardware for space and the manner in which we make up our minds about the human worth of space programs themselves.

I appreciate that the exact or "hard" sciences are not all that hard or exact even in solving their own problems. Judgment, common sense, intuition, and good luck sneak into the scientific methods employed in space research. There is some touch of madness in scientific methodists, blended with the touch of genius which has achieved so much in so short a time—and at such cost.

Yet, when it comes to analyzing the social purposes and consequences of the space effort, it is systematic research which does the infiltrating. The rigors of the scientific approach of data collection and analysis—standard operating procedure to the builders of space gadgetry—are all too often avoided by these able practitioners of science and technology as they soar into the arenas of politics, foreign and domestic; of economics; of national defense; of health; of education; of welfare; of philosophy; and the farther-out domains.

What concerns me here is not the pop art of C. P. Snow and his *Two Cultures,* nor a fear of "Big Science," the space age analogue of earlier fears of "Big Business" or "Big Government." Nor would I want to muzzle the freedom of speech of members of the scientific community in their role as citizens.

My peeve is with the scientist or engineer of high and deserved reputation in his profession who too often, whether he knows it or not, trades on that reputation to enhance his pronouncements when he assumes, or is pushed into, the role of the omniscient one, be it as a political scientist, economist, or sociologist. Just how this comes about, how to draw the line between the due processes of politics and the politicians of science, how to assess the signal-to-noise ratio of this phenomenon, how to gauge its impact on our



The hardware comes easy, compared with the study of what the new technology means in human terms.

space issues. Competition with the Soviet Union; programs of international cooperation in space science and in such practical applications as communications and meteorology; the addition of space technology for military security needs; the United Nations Committee on Peaceful Uses of Outer Space; the jurisdiction of the International Telecommunications Union; the *n*th countries in space in Europe, in Japan, and elsewhere—these are just a few of the outer-space issues already in world politics. There now exist a shelf of books on the subject and a ton of legal writings. To put it mildly, the quality of the knowledge assembled hardly matches the quantity or the need.

Domestically, the executive and legislative branches of government wrestle with a flood of new issues brought down to earth from space. What do we mean by a "national policy for science"? What do we know, with sufficient validity, about the probable consequences for the skilled manpower inventory of the country of alternative allocations of federal support for science, for graduate student aid, for construction of laboratories and facilities? What are rational choices and how do we evaluate them with respect to support for the space sciences, for other sciences, society—these also are challenging topics for systematic research by a breed of scholars known as social scientists.

Lest I appear too parochial, let me hastily add that the relative neglect of systematic research on the topic of this panel discussion is, in the first instance, the fault of the social science community itself. Why this is so could be systematically documented. I am an expert critic on the state of the art of the social sciences, and I think I can outmatch hard scientists when it comes to exposing the limitations of us in the social sciences. Furthermore, I don't mean to suggest that there is a total absence of careful thought, analysis, and good judgment in the land. I do contend that relative to the magnitude of the technical space effort and relative to the importance of its consequences, more work and less loose talk are needed.

If we list only a sample of the many questions imbedded in the phrase "social implications of space," you will agree that something better can and ought to be done to chart our future than to seek it from a perch atop a Tower of Babel.

The international political arena has been enlarged in the past eight years by the addition of

A more scientific approach to the analysis of the implications for society of the space age will make life for these youngsters more meaningful in the future.

Already the impact of automation has had major effects. More—and focused—research to explore the meaning of this impact is needed if we are to approach an understanding of how computers change our lives.

for education? What criteria can be devised to better measure the trade-offs between earth needs and space needs?

Of what consequence to the commercial-civil economy is the national expenditure on space? In what terms does it make sense to argue about whether one percent of the GNP is too much or too little for the annual NASA budget? Is it really true that space spending adds a significant "multiplier" to national economic growth—either from the $5 billion a year expenditure itself, or from the "spinoffs" of new materials or processes to the private sector of the economy? Is the "multiplier" nationally significant or should the focus be on regional-specific payoffs? A corps of competent economists could be kept usefully busy restructuring the national economic data base so as to better test the claims and counterclaims of debaters on the economic worth of space expenditures.

Or take the case of the most significant space application thus far introduced: the communications satellite.

Already it has been the subject of Presidential policy pronouncements, for one of the longest congressional filibusters on record, for policy participation by the Departments of State, Defense, Justice, the Federal Communications Commission, the New York Stock Exchange, and thousands of stockholders. The space portion of the Comsat system has an international ownership divided among more than forty-five countries—including Yemen. A potential competitor to the Comsat international consortium has arisen with the successful launching of a Soviet quasi-stationary communications satellite now linking Moscow and Vladivostok. But this is only the beginning.

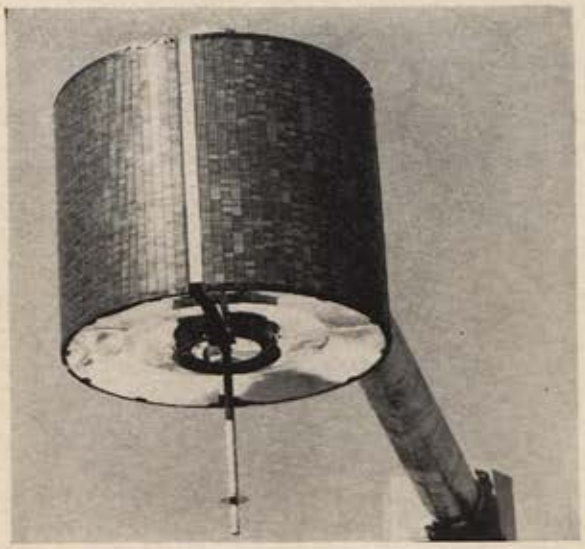
For coming soon will be communications satellites carrying aloft a transmitting wattage of vastly higher power than the Early Birds. Such satellites already beckon the US radio-television networks to shake loose from the near-monopoly of AT&T in carrying network traffic to their affiliated stations at a cost of $50 million a year. The American Broadcasting Company is considering the purchase of its own satellite system for private carriage, and if other private carriers want to enter the field, a new era of issues will beset the FCC and all aspects of national telecommunications policy: monopoly, rate-setting, frequency allocation, and the grappling anew for a meaning to the formula of "in the public interest, convenience, and necessity."

Originally, the communications satellite system was conceived principally for the purposes of international radio, telephone, data, TV, and related types of point-to-point traffic. The utility of satellites for domestic US communications needs was not taken seriously: the costs of the space system were overestimated and were forecast to be unable to compete with the low cost of ground linkage through microwave relay systems.

The ABC proposal is opposed by the Comsat Corporation which takes the position that Congress intends it to be the sole operator of commercial satellites, not only domestically but, hopefully, worldwide. Thus it wants to launch and operate the ABC-intended satellite service. Yet Comsat's satellites are now owned by more than forty-five countries through the present consortium. Try to guess what Congress would say if the French or German partners veto the idea of Comsat entering domestic markets.

High-powered satellites will soon make it possible to bring television and voice into home receivers, at first through community antenna ground stations and later through direct broadcast. What policies will optimize the interests of the local stations if anyone, almost any place, can tune to dozens of channels instead of only to the relatively few now within line of sight of his rooftop antenna? Will the multiplicity of TV channels have an effect on the content of programs—for better or for worse?

Abroad, particularly in the less developed countries, what role can cheap TV and telephone service play as a catalyst of economic development? For all of the attention devoted thus far to US economic assistance and to the study of



Spaceborne communications, including synchronous satellites such as Early Bird, shown above, have galloped ahead, faster than thought feasible a few years ago. We must understand how such technology can best be put to work for national and international good.

causes of economic growth and stagnation, very little is known about how to use modern communications media for speeding up the process of growth, the transfer of skills, information, and understanding. Hereby hangs a challenge to the combined imagination and hard work of economists, anthropologists, psychologists, linguists, and statesmen.

And, finally, far from exhausting the issues for serious study: What can we learn from the organization and administration of the national space program itself? In addition to the spinoffs of new gadgets and materials to the civil economy, there may be a much more important spinoff to the nation as a whole.

The achievements of the US in space are incredibly great in a short eight-year period. We were able to employ, train, and organize men into a totally new, huge-scale, science-based industry. Costly, but it worked. What can we learn from these complex organizational and administrative arrangements for adaption to the mundane problems of urban decay, congestion, pollution of air, earth, and waters, to the problems of antiquated educational systems? Within the framework of a democratic society, can we afford to fail on the ground while we are succeeding in space?

Would it be asking too much for each space agency and major contractor to set aside a tithe amounting to a tiny fraction of one percent, for the self-study of its own operations, for the study of the economic and social implications of its own exciting output, and to learn how to mobilize techniques of organization and achievement to the nonspace needs of the human environment from which it was begat?

Five years ago I undertook a special two-month assignment for the chairman of the board of one of the nation's largest space-missile corporations. The purpose was to investigate the state of research on the interplay of technological change and society in its economic, psychological, legal, and related facets. The disappointing discovery was that we were in sad shape indeed.

Here was the most technocratic country in the world, priding itself in, if not worshipping, technology. The concept of "progress" itself is viewed as almost synonymous with technical advance. There were warnings from many sectors of this society about the urgent need to better anticipate and prepare for the rapidly accelerating rates of technical change. Yet there did not exist in May 1960, nor does there exist today, even one major research center or institute focused on this complex phenomenon.

True—many universities and small groups of scholars give courses and conduct specialized studies on this or that detail. In other fields, institutes have sprung up in response to social needs: institutes on race relations, on crime and delinquency, on family relations, and so on. But on "science and society," to use a blanket phrase, there is no distinguished center or institute to set the vistas, the standards of excellence, the intellectual leadership for other centers or university groups to emulate and interact with.

We who have been so imaginative and ingenious in organizational as well as in technical invention, owe it to our self-interest, if not our consciences, to see to it that this country puts together an unprecedented center—perhaps with satellite centers—for the comprehensive study of the social implications of our space activities. —END

The author, Joseph M. Goldsen, heads the Social Science Department of the Rand Corporation, Santa Monica, Calif. The views are the author's and should not be interpreted as reflecting the views of the Rand Corporation or the official opinion or policy of any of its governmental or private research sponsors. This article is adapted from Mr. Goldsen's lecture to the American Astronautical Society National Meeting on the Impact of Space Exploration in San Francisco, Calif., on August 18, 1965.

HOW TO RUN A NUCLEAR OBSTACLE COURSE

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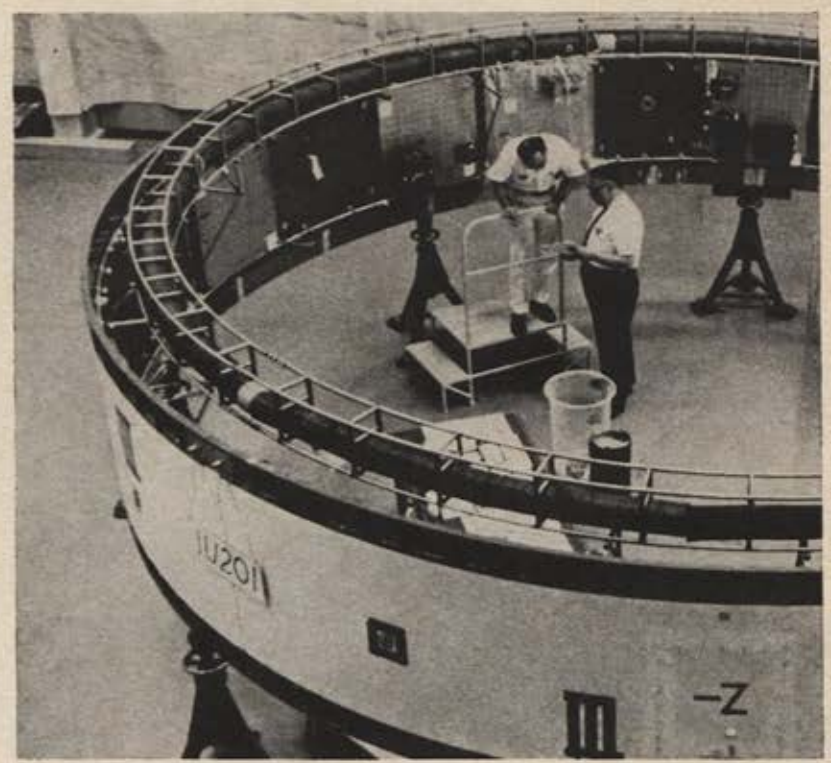

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Speaking of SPACE

BY WILLIAM LEAVITT
Associate Editor, AIR FORCE/SPACE DIGEST

They Have Their Troubles, But . . .

WASHINGTON, D.C., OCTOBER 11

By the time this is read, if all goes well, a major advance in US astronautical prowess will have been achieved. This is the scheduled rendezvous and docking of the Gemini-6 capsule with the separately-launched Agena vehicle, which is the principal purpose of the upcoming fourth manned flight in the NASA Gemini program.

Assuming that the rendezvous and docking occur as planned and in advance of any such similar Soviet accomplishment, there will probably be a spate of claims in the post-Gemini-6 enthusiasm that we have shot considerably ahead of the Russians in the continuing space competition. This may seem quite natural, but it is a dangerous way of looking at things. Despite the political upheavals that have jolted the Russians in the past year, there is no evidence that they have lost interest in their space effort. They have continued to launch space vehicles—the latest an apparent soft-landing attempt on the moon, which crash-landed instead, according to the British tracking station at Jodrell Bank.

At the same time, it is refreshing, from our point of view, to note that the high cost of space research and development in the Soviet economy, more narrowly based than ours, has presented the Soviets with some serious problems of resource allocations. At least this is the tone of reports circulating in Washington.

The Gemini-6 astronauts, Mercury veteran Walter M. Schirra, Jr., and Thomas P. Stafford, are scheduled to attempt history's first space rendezvous and docking.

Thus, in a roundabout way, the space competition, which has been derided by many observers as a waste of money and talent and attacked by others as a kindling mechanism in the cold war, has actually aided the cause of peace by damping down the Soviets' space militancy. Nevertheless, the Russians surely intend to continue their efforts to attain propaganda effects from spectacular space achievements; their program investment is already too large to be dropped or even sharply curtailed. But they are faced with the double problem of (1) finding the resources in an economy that is not reaching the growth rates once boasted about by ex-Premier Khrushchev and (2) designing sufficiently spectacular feats in space to startle the world as did their earlier achievements. In one sense, the Soviets are falling victim to that old Marxist-Leninist bugaboo, competition.

This subtle change in the nature of the space competition should be acknowledged but not overemphasized. The price of overemphasis would be complacency of the sort that permitted the Soviets to outdo us so dramatically a few years ago.

The Soviets are a purposeful breed and, despite the internal resource-allocation problems they seem to be facing, they have undoubtedly not lost their enthusiasm for the propaganda payoffs, albeit reduced, of space spectaculars. Their propaganda machine, from all accounts, was geared and ready to go full blast had their apparent attempt to soft-land a vehicle on the moon been successful.

It is a matter of wonder that, being such experts in the art of propaganda, they did not switch signals when the soft-lander became a hard-

lander and describe it as part of a continuing research effort in connection with projected exploration of the moon. They could have done this because of their style, which is not to say what they are trying to do until they can claim that they have indeed done it.

The Military Program

A particular area where US overconfidence, arising from continuing space achievements by our NASA program, should be avoided is the military potential of space. Gen. B. A. Schriever, Commander of the Air Force Systems Command, now wears an additional hat as program director for the Air Force Manned Orbiting Laboratory program, reporting directly to Air Force Secretary Dr. Harold Brown. General Schriever had some significant things to say on this point in a recent speech to the Governor's Conference on Oceanography and Astronautics in Hawaii:

"It would be wishful thinking of the worst kind to ignore the military potential of space," he said. "Rather, we must take the prudent actions which will ensure that space will not be used successfully for aggression by any nation.

". . . We have successfully developed a number of space systems to fulfill a number of support functions. From our experience we are fully confident that missions such as communications, nuclear detonation detection, weather observation, and navigation can be more reliably and effectively accomplished by satellites than by the use of earth-based systems alone."

This latter assertion is of high importance. General Schriever is saying that, from the point of view of significantly enhancing several important traditional military functions, space has already proved itself. It is no longer a matter—as it was in the very early days after Sputnik—of exploring the question of space's utility. The question has been answered in the affirmative.

"Let me mention two examples of these unmanned satellite systems," General Schriever told the conference. "One is the Nuclear Detection Satellite Program, which consists of experiments to gather knowledge of radiation backgrounds in far space and to define an operational nuclear detection system. Six Vela satellites are now functioning. They not only provide the necessary background radiation data and scientific information on solar phenomena but also constitute an atmospheric test-ban-monitoring capability on an interim basis."

AFSC Commander, Gen. B. A. Schriever, wears a new hat as MOL program director, reporting to Air Force Secretary Dr. Harold Brown. Military space program is geared to US security and prevention of technological surprise by the Soviets.

General Schriever indicated that the success of this first batch of Vela satellites has allowed planners to move the research and development program in radiation detection ahead by a year, not only saving money but also, presumably, bringing a full-scale operational system closer to achievement.

The last two Vela satellites have "significantly greater" detection capability than the first four launched, he said, and the next two Velas will use completely redesigned spacecraft to investigate new approaches to nuclear detection. Those last two will be launched by the Titan IIIC and presumably be much heavier than their predecessors.

General Schriever was just as optimistic about military space communications. He pointed out that the Department of Defense has now authorized a communications satellite system "to satisfy military requirements," with an initial research-and-development system planned for launch early in 1966. This will consist of up to twenty-three satellites circling the earth in random spacing at an altitude of some 21,000 miles. These satellites will be launched in clusters of eight by three Titan IIIC boosters, then positioned along an orbital path. The advanced system, as planned, will increase the anticipated lifetime of each communications satellite from one-and-a-half years to between three and five years.

General Schriever also cited in his speech the existing antisatellite capability, using Thor and Nike-Zeus components, already announced by President Johnson.

It should be pointed out that these systems are relatively primitive, but they do represent at least a start in the development of systems to meet a requirement that has troubled Defense Department planners.

MOL: In Some Detail

General Schriever reported also on Air Force MOL plans, as now conceived:

"The idea for such an experiment, of course, is not brand new," he said. "The Air Force first studied and proposed exploratory manned flight as early as 1957, and during the past year and a half the MOL concept has been studied in great detail. The initial questions and alternative technical considerations have been largely resolved. Maximum use of hardware and subsystems from other space programs will minimize development risks and costs."

He pointed out that, in contrast to other manned spaceflight programs, MOL will allow considerably more room inside the vehicle for flight-crew operations. "Much greater physical activity will be possible than in the Gemini and Apollo spacecraft," he said, adding that this would be an important factor in maintaining the well-being of the flight crew during extended missions.

"The MOL will enable us to test and evaluate prototypes of space subsystems and components in actual orbital conditions, and on-the-spot analysis and corrective solutions can be applied," he said, pointing out that such a capability will permit the development of more reliable space-proved equipment more cheaply and in less time.

General Schriever's command embraces the entire aerospace medical research establishment of the Air Force, headquartered at Brooks AFB, Tex. He described current tests at the aerospace medical center in which four volunteers will spend some sixty days in an oxygen/helium atmosphere. This is the longest test ever attempted.

Volunteers at USAF's Aerospace Medical Center at Brooks AFB, Tex., are spending some sixty days in oxygen/helium atmosphere, testing the mixture for possible use in forthcoming MOL project. Above, team from which four-man crew was chosen is briefed. Simulated altitude, using seventy percent oxygen, thirty percent helium mix, will be 27,000 feet.

Both NASA and the Air Force are studying helium as a possible second-gas diluent in two-gas space cabin atmospheres, but at the same time there is hesitancy to use it because of the lack of knowledge of its long-term effects.

Until recently, it had been believed that helium presented less of a hazard of bubble formation in the body ("bends") in the event of pressure loss, but many researchers now doubt this.

Helium does appear to reduce somewhat the fire hazard presented by the oxygen in the atmosphere. Its higher-than-nitrogen thermal conductivity could decrease ventilation requirements for spacesuits. Helium does have a kind of "Donald Duck" effect on the voice, but many researchers believe the problem can be beaten with special crew training.

One of the great dangers in one-gas oxygen atmospheres is fire. Thus far in the NASA manned spaceflight programs this hazard has been admirably controlled. Also, pure oxygen exposure on long-term missions seems, according to some aeromedical researchers, to have a deleterious effect on the blood, though not necessarily permanent. The advantage of pure oxygen, of course, is the simplicity of the system. But as noted above, MOL will have a two-gas atmosphere.

Cheaper Boosters to Come

While praising the Titan IIIC booster as "the . . . first . . . developed specifically for space applications," General Schriever did some forecasting in the field of even more economical access to space.

"Looking beyond Titan II," he said, "we are interested in advanced launch vehicle concepts, which offer more economical access to space. The Titan III is expected to reduce the present direct operating costs of more than $1,000 per pound in low earth orbit to something in the neighborhood of $500 per pound. New expendable boosters show promise of reducing the cost to between $100 and $200 per pound."

He described Air Force propulsion technology programs designed to attain these lower prices. Among these, he said, are very high chamber-pressure cryogenic (super-cold-fueled) rocket engines, which are expected to yield a fifty percent increase in payload for recoverable vehicles. "These engines," he said, "will also be capable of

MOL lives here

The Douglas Space Systems Center in Huntington Beach, California—where the Air Force MOL (Manned Orbiting Laboratory) will be built. This master facility for the research, engineering, testing, and production of space systems and vehicles is the only major plant of its kind and size in the free world.

Built by Douglas at an initial cost of $25 million, it's being enlarged by another $11 million of Douglas money to create new buildings, laboratories and equipment for an additional three thousand space-minded specialists. They'll join five thousand people who are literally living in a future where schedules read like science fiction: MOL by 1968, the moon circa 1970, Mars maybe a decade later. And on the planning agenda are voyages to Saturn, Jupiter and the dark planets.

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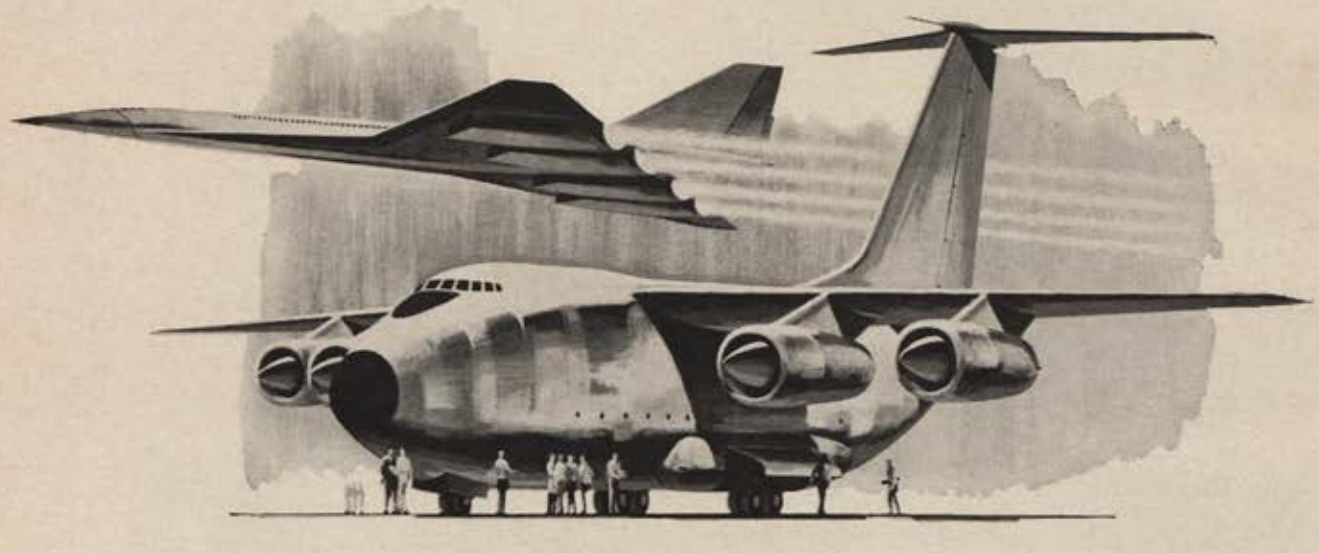

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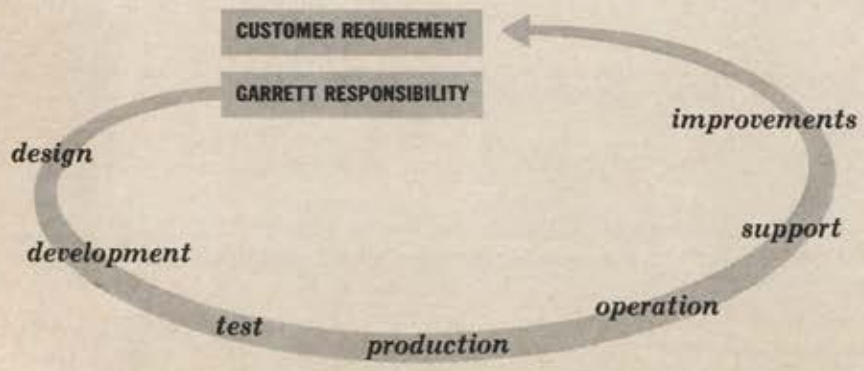

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being throttled, an advantage which will provide future recoverable vehicles with a better maneuvering capability."

He talked, too, about the Scramjet—the supersonic-combustion ramjet—which is essentially a ramjet in which the flow is supersonic throughout. A kind of "flying stovepipe," the Scramjet would avoid the large energy losses that occur in a subsonic-burning ramjet, in which incoming air is slowed down, burned, then speeded up again. The feasibility of combustion in a supersonic airstream has been demonstrated, although it was once thought unattainable.

"The Scramjet offers outstanding fuel economy," General Schriever said, "and shows real promise for operations within the sensible atmosphere to the edge of space."

Out of such developments may someday come the realization of the "aerospace plane" concept, that of an airplane that can take off from the ground, fly into space, and fly home again, combining aeronautics and astronautics.

The Systems Command chief also described an Air Force research effort in development of spacecraft able to maneuver during reentry—the Air Force START program, short for Spacecraft Technology and Advanced Reentry Tests, in which lifting bodies are being studied for their ability to enlarge the "footprint" or general landing area. If enough maneuverability and precision are developed in this important effort, the use of such lifting reentry vehicles would permit horizontal landings on existing runways. A radiation-cooled, unmanned, winged glider, ASSET, built by McDonnell, successfully completed its hypersonic flight program this year.

The next phase in the program involves the use of an SV-5 lifting-body reentry vehicle that derives its lift from the fuselage. The Martin-built SV-5, according to General Schriever, has enough maneuverability to provide a "reasonably large footprint." Four hypersonic SV-5 flight tests are planned for 1966 and 1967, in which the vehicles will be launched from Vandenberg AFB, Calif., into ballistic paths and then reenter at orbital velocities, maneuvering down to aircraft speeds.

Midwest Research Institute, Kansas City, Mo., researchers are studying lighting conditions in space, using parabolic mirror and scale model of Apollo vehicles, to determine heat loads on the mooncraft in various spacecraft attitudes in relation to the sun. Data is needed to determine possible ambient temperature effects on instrumentation. Capsule, above, is the Apollo Lunar Excursion Module (LEM).

A National Program

Commenting on the need to proceed with such efforts, General Schriever pointed out three facts he said are basic to the US military space effort.

- "First, it is being conducted in response to existing and anticipated threats. The Communist hostility . . . is a well-known fact. The long-term Soviet interest in space is equally well-known. Their achievements have surprised us more than once. . . .
- "Second, military experiments and developments are a closely coordinated part of the national space effort. We work in continuing cooperation with the National Aeronautics and Space Administration. Nearly 200 high-quality military people are assigned to NASA, and NASA people are in turn assigned to Department of Defense space programs. . . .
- "Third, our military space efforts are only part of the total military task of deterring war and countering aggression on all levels. We are going to push ahead vigorously with the MOL program and related activities, but I can assure you that the Air Force has no interest in becoming a 'space force' to the exclusion of everything else. As a matter of fact, in my command, we are now increasing our research and development efforts in the limited war area to meet more fully the challenges confronting us in Vietnam." —END

Capability: When you think of communications capability, bear this in mind. Western Union has proved that

it has the administrative, technical and engineering skill to conceive, design, install and maintain the most sophisticated, complex communication systems ever devised. Beyond that, Western Union has proved that it has the flexibility to work with military and civilian government engineers and communications experts, and with the operating agencies, in the development of systems that meet each user's needs.

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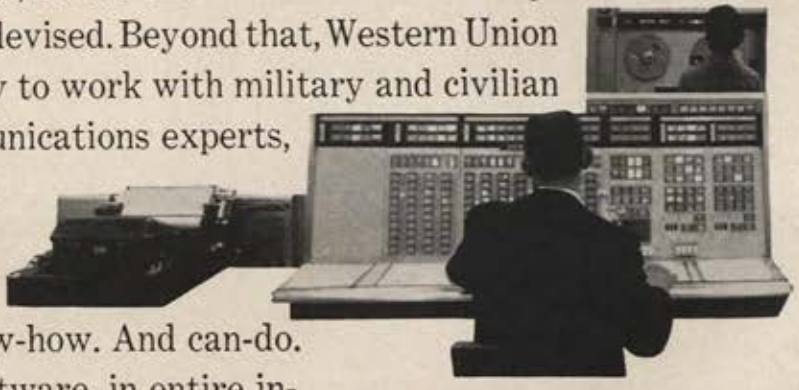

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user's needs. It calls for technical understanding that keeps pace with today's advancing knowledge. It requires managerial judgment; the resources, techniques and tenacity that bring a contract in as ordered, as promised.

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That's Western Union for you.

The reaction of the almost 4,000 government, military, industry, and educational leaders who attended AFA's Aerospace Development Briefings in Washington ranged from favorable to enthusiastic. Here are abstracts of the briefings they heard as each spent at least two hours of his time in the Sheraton-Park's mammoth exhibit hall listening to the briefers . . .

TELLING THE AEROSPACE STORY

AN AIR FORCE/SPACE DIGEST SPECIAL REPORT

AC Electronics Div., General Motors Corp.

The work that AC Electronics Division of General Motors is accomplishing in the field of inertial guidance and navigation can be ably illustrated in the inertial guidance system supplied to the Air Force for the Titan III program.

Since Titan III is inertially guided, when the missile leaves the launch pad all flight control links with the earth are severed and the inertial guidance equipment controls the flight of the vehicle. The inertial measurement unit senses changes in missile attitude and velocity. The missile guidance computer uses this data to solve the flight equation and then issues missile steering signals which are sent to the appropriate engines.

Missile capabilities of the Titan III using AC inertial guidance include: direct injection into circular orbit and boost, coast, and injection into a high-altitude orbit. These capabilities can be used for injection of twenty-four-hour synchronous communications satellites, support of a manned orbital laboratory, and rendezvous. During flight, the AC guidance system can turn on and off the various engines according to the flight equations for thrust control; provide steering signals to all engines; maintain the transtage attitude; perform the depitch maneuver; transfer orbits; and release payloads. While performing these maneuvers, in no way is the guidance system dependent on any external signals.

To date, the AC system has proven its capabilities in four Titan IIIA and one Titan IIIC flights.

American Telephone and Telegraph Co.

The coordinated teamwork of the Bell System—a blending of research and development, manufacturing and installation, and operations and traffic control—is geared to meet the System's aim of uninterrupted communications service.

This was the theme of American Telephone and Telegraph Company's presentation, "Countdown to the Seventies," a progress report on the Bell System's operational plan for what it calls "Continuity of Communications Service."

Through long-range planning, the Bell System is meeting the challenges of accelerated growth, damage from natural causes, and national emergency by expanding and reshaping its communications routes and developing new emergency procedures.

The nationwide Bell System communications network is a combination of regular cables, coaxials, and microwave towers, and now includes a recently completed hardened coaxial cable route that spans the continent.

Diversity and avoidance are two important features that are being built into this network to ensure maximum service continuity. New automatic switching equipment seeks alternate routes during periods of peak usage. A call from Boston to Atlanta, for example, could be routed by way of San Diego. Large cities have been bypassed so that a major service interruption within a city will not affect long-distance traffic.

To avoid collateral damage from an enemy weapon directed at a nearby target, the coast-to-coast hardened cable route has been designed to withstand nuclear blast short of a direct hit. Spaced at intervals along this route are buried repeater stations constructed of heavily reinforced concrete and supplied with emergency power. Key stations are manned and supplied with sufficient food and water to operate buttoned-up and protected from nuclear fallout for at least three weeks.

Elsewhere in the nation, the Bell System is taking special steps in construction of buildings to protect personnel and vital equipment. A building in New York City, for example, has foot-thick walls of concrete faced with four inches of brick and is self-contained and self-sustaining.

Because of the diversity of the network, restoration control offices throughout the country can reroute calls immediately when a service disruption occurs. Telephone crews are now trained to put up a new microwave tower in as little as twenty-

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planning based on "hover out of ground effect" as a minimum planning criterion. The CH-47's ease of deployment, using naval aircraft carriers, Air Force transports, and its own ferry capability, with potential air-to-air refueling techniques, were presented.

The R&D activities covered a wide range of subjects, from detailed improvements of theoretical methods of predicting helicopter-rotor aeronautical environments to broad parametric studies of advanced V/STOL aircraft design for future military requirements.

Rotor-blade development is being furthered, using full-scale fiberglass blades, which permits the design of optimum blade geometry (twist, cord, camber) required for greater speeds and payloads without increased blade weight and cost.

Other activities are associated with investigation of noise and vibration and methods to reduce these parameters in V/STOL aircraft.

Development of composite helicopters and tilt-wing aircraft is also under way. These aircraft offer greater speed and range potential than is presently achieved with conventional helicopters. The keynote of these programs is over-all simplification with increased systems reliability.

Burroughs Corp., Defense and Space Group

The Burroughs briefing traced the steps which were followed in the evaluation and development of modular information processing systems. The same process was used in the design of our nation's new air defense system, the BUIC System, as well as the automatic digital relay currently being installed for NORAD at Colorado Springs.

The briefing reviewed the requirements for military information systems which include user responsiveness, growth potential, reliability, flexibility, and ability to perform specific jobs. Various approaches to the solution of the problem were reviewed, including the use of specialized functional modules, the use of multiple computers, the use of master and slave computers with a separate computer to control job assignment, and, finally, the function-dependent modular computer system. The latter approach eliminates the need for standby or control computers and allows the modules themselves to perform all functions under the direction of an executive scheduling program. It meets all of the criteria originally outlined for the ideal military information system.

Chicago Aerial Industries, Inc.

The mission of tactical aerial reconnaissance is to collect, evaluate, and disseminate timely and accurate information regarding the capability, disposition, and movement of friendly and hostile forces day and night, for the field commander.

To meet the ever-changing patterns of warfare, the modern reconnaissance aircraft is a multisensor weapon system employing side-looking radar (SLR), infrared (IR), and electronic intelligence (ELINT) sensors in conjunction with the battle-proven conventional photography of the aerial cameras. The all-weather capability of SLR is somewhat offset by its active operation and limited resolution of ground detail. IR sensing systems are passive but limited in all-weather operations and resolving power. ELINT serves primarily as a correlating sensor in detecting radar and communications installations.

The aerial camera has inherent qualities of complete passivity and extremely high resolution of terrain details, together with the ability to meet all environmental requirements of greatly increased aircraft speeds and altitudes. The KA-45A camera developed by Chicago Aerial Industries, with its 1/3000th second focal-plane shutter, made possible the low-level transonic Cuban missile site photography in 1962. It is now followed by the high-speed serial-frame cameras operational in current reconnaissance aircraft, for both day and night photography with the CAI electronic flash system.

Continental Motors Corp.

Continental's T67-T-1 Twin Turbine Powerplant is the world's first twin with completely automatic power-sharing control. This outstanding feature allows the twin powerplant to be operated by one pilot as though it were a single engine. However, each component engine has its own control, fuel, and lubrication systems, so there is no limitation on single-engine operation, and for twin operation the loss of power from one of the engines causes the power-sharing system to instantly and automatically raise the power on the remaining engine to meet the load demand.

The T67-T-1 military rating is 1,540 shp at a specific fuel consumption of .56 lb/hp-hr. Its weight, including all engine-furnished accessories and the combining gear box, is 519 pounds.

Flight testing of the T67 is under way, with the powerplant installed in a Bell Model 208 (UH-1D) helicopter. Performance of the T67 powerplant, and particularly the power-sharing system, is excellent. Power transfers and starts and stops from twin- to single-engine power have been made many times in flight. Power balance between the component engines is maintained automatically to within ten hp by the power-sharing system. Additional flight tests are currently being conducted by the Army Aviation Test Activity.

Control Data Corp.

The Government Systems Division of Control Data Corporation has developed a new family of microelectronic computers for aerospace and avionics systems. Packaging and fabrication have been developed by GSD to produce these microelectronic computers, combining the unique advantages of integrated circuits, thin film memories, and multilayer etched wiring.

One computer, the 5500 Engineering Model containing 8,000 twenty-six-bit words of thin film memory, is a general purpose unit, and features the foldout page multilayer board construction with integrated circuits. This package measures .39 cubic feet and weighs twenty-eight pounds, including the environmental case and the power supply.

The Advanced 5500 is for Airborne Force Control Applications, features 12,000 twenty-four-bit words of Non-Destructive Readout (NDRO) thin film memory, and 4,000 words of Destructive Readout (DRO) core memory. It operates at an average instruction speed of three microseconds, and also has foldout multilayer boards with integrated circuits, measures 1.1 cubic feet, and weighs forty-five pounds.

A third computer is the Miniature Integrated Circuit Computer (MICC), designed with pluggable printed circuit cards to provide "Quick Turnaround," with maintenance at the field-installation level. This computer features 8,000 twenty-four-bit words of core memory, expandable to 32,000 words, weighs thirty-five pounds, and measures .6 cubic feet. These computers are designed to meet the requirements of MIL-E-5400.

Douglas Aircraft Co. (DC-9)

The design philosophy for the new Douglas DC-9 was to produce a dependable, reliable, and economical airplane. When the design was initiated, it was realized that the challenge of low maintenance costs must be met. Installation accessibility and features which enhance the ability to work on the aircraft were considered most important, if low maintenance costs and minimum aircraft down time were to be realized. As an example, the engine package and those elements attached to it, except for the starter duct and the nose cowl, are interchangeable between right and left. The nose cowl is attached to the engine with twelve bolts and can be quickly changed. A complete engine change has been accomplished in less than the design goal of sixty minutes.

This design philosophy is expected to result in the DC-9's having a mechanical delay rate of less than one percent.

Redundance of function as a means of safety in the event of component failure was considered together with other factors, such as dispatch reliability. Exhaustive failure analyses considered all possible types of failures within the systems and the related consequences or need for crew action. These failure analyses, plus maintenance planning and trouble shooting procedures concurrently developed with the basic design, helped to shape the final configuration of the DC-9.

(Continued on page 75)

ON THESE and the following pages we provide, for those readers who were unable to attend AFA's Aerospace Development Briefings in Washington's Sheraton-Park Hotel, September 15-17, abstracts of these briefings as provided by the companies involved.

By any measure, the briefings were an unqualified success. Almost 4,000 government, military, industry, and educational leaders visited the industrial display areas. Most spent two hours or more as they were escorted, in small groups, from briefing to briefing. Government agencies involved included the Departments of Defense, Air Force, Navy, and Army, the National Aeronautics and Space Administration, the Federal Aviation Agency, the Atomic Energy Commission, and the Civil Aeronautics Board, as well as delegations from the House of Representatives and the Senate, including key committee staff representatives, and from the National Aeronautics and Space Council of the White House.

Attendance was audited by a firm of Certified Public Accountants and some of the statistics are revealing. For example: Total military attendance was 1,340, including fifty-three generals or admirals, 301 colonels or Navy captains, and 454 lieutenant colonels or commanders. Officers of allied countries in attendance totaled 122, and educators added up to 640, representing sixty-one foreign countries and thirty-six of the fifty states in the US.

Reactions ranged from favorable to enthusiastic. The Navy reported, for example, that Navy personnel in attendance were so in favor of the program that the few negatives received were not worth noting. And an Air Force survey showed that 97.6 percent of those in attendance thought their time well spent and welcomed a repeat performance.

Thus, AFA's Aerospace Briefings are firmly established as an annual event. Next year's dates are September 14, 15, and 16, in Washington, and again in the Sheraton-Park's mammoth exhibit hall.—THE EDITORS

two hours when one is damaged and put out of service by a storm.

The Bell System is constantly improving its nationwide switching system to provide this continuity of service.

Battelle Memorial Institute—Columbus Labs

Research and development is pointing the way to achieving improved levels of readiness, reliability, and maintainability for today's and tomorrow's complex aerospace systems, and to do so at lower cost. The Battelle briefing described R&D in progress at Battelle-Columbus on (1) improved fluid systems connector fittings, (2) a radioisotope energy-conversion spacepower package, (3) elastohydrodynamic lubrication studies, (4) drift failure analysis methods for electronic and electromechanical components, and (5) studies of the physics of failure of electronic components.

Featured was a programming language for automatic checkout equipment (ACE). Known as PLACE, it will simplify the programming of ACE by replacing machine language coding with English-like statements. This language is intended to serve as a common language which can be used by test engineers to program many different checkout machines. PLACE simplifies program writing, modification, and documentation, and was developed for the Air Force Aero Propulsion Laboratory. It contributes to the operational readiness of complex equipment and weapons systems.

Techniques also have been developed which will reduce the time and cost for implementing PLACE translators. The PLACE language and these techniques have been demonstrated with the AN/GJQ-9 checkout machine and will soon be demonstrated, using a computer-controlled checkout system. Previewed at the briefings was a training manual prepared by Battelle psychologists, using some of the latest self-instruction techniques, for using PLACE to program the AN/GJQ-9.

Beech Aircraft Corp.

Storage of fuel cell reactants and breathing oxygen at or near the boiling point of these fluids offers the lightest weight system. Storage containers are double-walled, vacuum insulated, operating at supercritical pressures, thus providing a single-phase fluid. Tank pressure is maintained by natural heat leak through the insulation and by periodic operation of electrical heaters located within the tank. Minimum flow rate requirements are satisfied by natural heat leak. Demands for higher flow rates are accommodated by actuation of tank heaters. Tank pressure is monitored by a pressure transducer. This signal is fed to a pressure switch.

The pressure switch energizes electrical heaters when minimum tank operating pressure is approached and disengages the heaters when maximum operating pressure is approached. Thermal equilibration is accomplished through actuation of motor fan combinations which ensure even distribution of the heat within the tank and thus prevent any sudden pressure drop. Capacity and mission life for MOL tanks are considerably greater than present applications; therefore, for MOL tanks, special consideration must be given to material compatibility, efficient insulation, and adequate control devices for successful operation.

Boeing Co.

The Boeing Company briefings were conducted by the company's Vertol Division. Specific details on one of its two current production helicopters, associated research and development projects, and advanced V/STOL aircraft design were the subjects presented.

The CH-47 production helicopter portion of the briefings was concerned with inherent tactical advantages of this heavy lift, water/land operational helicopter, with emphasis on mission

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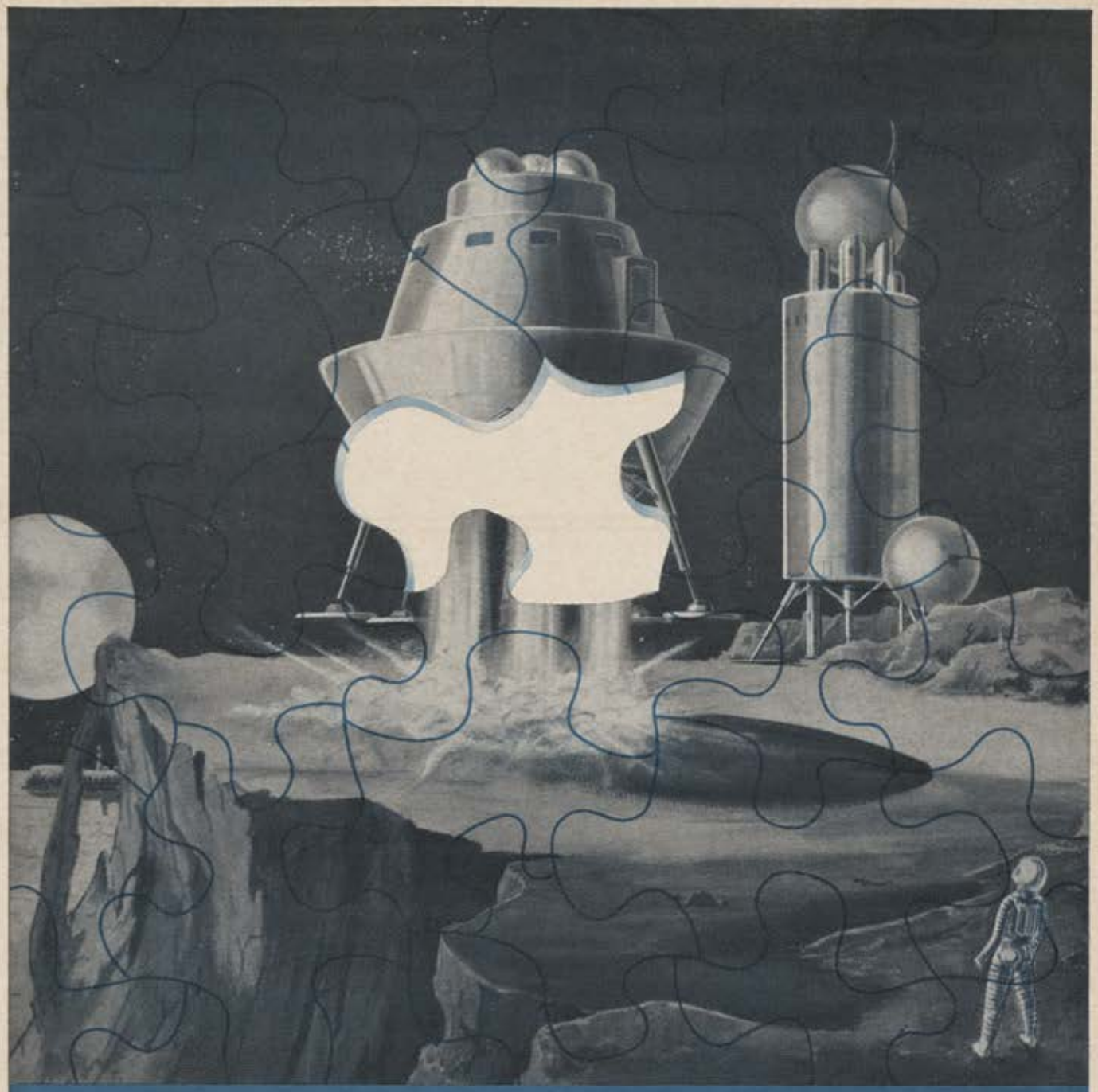

Which counts more: the sum or the parts?

A successful space mission requires the focusing of many viewpoints. One man sees the capsule as dead weight to be accelerated. Others view it as a problem in control, stress, thermodynamics, life support. Each view is correct; none is complete in itself.

At United Technology Center, we specialize in propulsion. Solids, liquids, hybrids, ranging from powerful boosters to tiny, variable-thrust motors for landing or docking. Just as important, our capabilities include a deep **identification with the total mission,** not just our part of it.

Put another way, we're team players—from the first word of the contract all the way to the final touchdown.

United Technology Center DIVISION OF UNITED AIRCRAFT CORPORATION

ASSOCIATE PRIME CONTRACTOR FOR THE AIR FORCE'S TITAN III PROGRAM.

THE 7½ POUND JUNGLE KILLER

Our miniature jungle radio is a tiger. Kills jungle absorption because it's "skip wave." The signal leaps over heavy foliage to the ionosphere. Can be read 5 by 5 from a few yards to well over 500 miles.

The unique portable unit was developed by Delco Radio in cooperation with the United States Army Limited War Laboratory. It is compact, lightweight. Only 7.5 lbs., of which 2.5 lbs. is the mercury battery.

Our specialty is solving any tricky radio problems you may have in lightweight, portable communications. And we have the production ability to deliver on time. Just phone or write Delco Radio, Military Requirements Department, Kokomo, Indiana.

DELCO RADIO

DIVISION OF GENERAL MOTORS, KOKOMO, INDIANA

Douglas Aircraft Co. (Missiles & Space)

Douglas has undertaken a comprehensive program to investigate various atmospheric compositions consisting of mixtures of nitrogen/oxygen and helium/oxygen at 5, 7, and 10 psia, with oxygen at 3.5 psia partial pressure.

Integrated subsystems for advanced spacecraft were tested in a manned space cabin simulator. Spaceflight conditions are closely approximated in this double-walled, 4,000-cubic-foot laboratory. To date, sixty-two days of testing have been run with four-man crews.

An earth surveillance, approach, and rendezvous simulator was especially built by Douglas to determine the effects on human proficiency, if any, of the space cabin atmosphere and pressure.

A comfort simulator was used in tradeoff studies of helium/oxygen and nitrogen/oxygen, with results indicating that subjects were comfortable at higher cabin temperatures when helium was used as a diluent.

A Sorption Bed—a test facility that duplicates a closed-loop space cabin atmosphere—was used to evaluate different sorption processes and materials to remove carbon dioxide from the cabin atmosphere.

The Fortran G-189, a Douglas-developed computer program, simulates spaceflight conditions. It synthesizes any environmental-control and life-support subsystem and evaluates it against the man interface. Size, weight, arrangement, and performance of components are computed and iterated to improve the program and finalize design.

Dow Chemical Co.

The chemical industry is continually faced with problems associated with exposure to many chemicals. These occur in manufacturing and use, presenting a health hazard if detection and control methods are not used.

As an outgrowth of environmental health work in The Dow Chemical Company, a research team was formed. Volunteers were exposed to various chemicals under controlled conditions, and physiological data on their effects and analytical data on their concentrations in blood, urine, and breath were obtained.

Breath analysis, using infrared spectroscopy and gas chromatography, proved to be a rapid, simple, highly sensitive method for detecting a wide range of exposures. Infrared is superior at identification and gas chromatography for sensitivity.

Breath analysis has potential use whenever people are confined in an area with its own air system. Environments in the aerospace industry, where this technique may be used, include space capsules, missile silos, underground command centers, air-raid shelters, high-altitude aircraft, and white rooms. Analysis of breath of personnel operating in these environments could:

- Indicate exposure to toxic materials, even when no longer present.
- Indicate inadequate air-purifying equipment.
- Identify defective refrigerating or other equipment.
- Serve as a backup for other monitoring systems.
- Aid in diagnosing exposures to toxic materials.

Electronic Communications, Inc.

Two characteristics are essential in strategic command and control: (1) a survivable environment for a decision-making authority, who has adequate data at hand to ensure control of the weapons at his disposal, and (2) a survivable communications system.

The Airborne Command Post of the Strategic Air Command meets both these requirements. A command post aircraft with a command staff embarked is continually aloft, ready to assume direction of the SAC force in the event that ground command posts are lost.

SAC's AN/ARC-89(V) communications system, for which Electronic Communications, Inc., is prime contractor and system integrator, is a survivable, highly sophisticated UHF system with 1-kw. transmitters, solid-state multiplexer sets, and automatic electronic switching. Relay aircraft extend the line-of-sight communication potential to the desired geographic coverage. The system has completed nearly five years of operation.

For subsequent command and control programs, ECI is now producing transmitter/receiver sets which are all solid-state up to the final power amplification stages. These will ensure the highest reliability, while achieving significant savings in size and weight. Radio sets incorporating these features and offering a seventy-five percent module commonality are in production for the Air Force, Navy, Army, and Marine Corps.

Electronic Specialty Co.

"Miss Better-Half," a magical effect featuring the top half of a woman, was used to dramatize two important new systems developed by Electronic Specialty Co. of Los Angeles: electronic reconnaissance and data acquisition (DATU).

The highly accurate electronic reconnaissance system utilizes a patented ultra-fast phase-measuring technique and wide-open (broad-band) receiver to obtain complete measurement of elevation and azimuth angle, frequency, pulse repetition rate, and pulse width. With the addition of an airborne computer, this system could make available a one-mission recon-strike capability for the first time, since enemy radars could be located and identified in minutes, eliminating the usual requirement for lengthy ground data processing. The lightweight system, which simultaneously handles even the most sophisticated radars, such as frequency agility and variable-pulse repetition frequency (prf), has successfully passed Air Force flight testing for virtually every parameter, including accuracy.

The ES data acquisition system has two distinctive features. First, the sensors are strung along the same line and interrogated individually by a coded pulse train, instead of having a separate pair of wires for each sensor as in conventional systems. Second, for each parameter to be observed, safe limits are determined and set into the sensor. Each reading is automatically compared to the limits; safe readings are ignored; and only out-of-spec readings are recorded, flashed to the pilot, etc. It has been estimated that this approach could cut the down times of our aircraft in half. The system makes possible simplified test installations, improved records, greater reliability, continuously verified calibration, and reduced maintenance skills.

General Dynamics Corp.

The General Dynamics briefing consisted of a flight-test report on the F-111A tactical fighter and Charger close-support aircraft and a demonstration of the F-111's avionics aerospace ground equipment.

First flight of the F-111A variable-sweep-wing fighter was on December 21, 1964. As of September 17, 1965, six F-111s on 157 flights had accumulated 215 hours in the air. Of these, nine hours and nineteen minutes have been supersonic.

During these flights, 3,000-foot takeoffs and 2,000-foot landings have been routine. Reliable operation of the basic airplane systems is being demonstrated daily. Hydraulic, electrical, flight control, environmental control, and other systems have been operating almost fault-free.

The F-111's variable-sweep wings have functioned perfectly in every instance. Airplane handling and response have been excellent at all sweep angles. In full sweep, the aircraft has flown in excess of Mach 2 on several occasions and has demonstrated excellent ride qualities in response to gust loads and turbulence.

The lightweight, twin-turboprop Charger employs deflected slipstream to provide maximum lift in STOL modes. Charger has been flying since November 1964. As of mid-September, it had made 161 flights for a total of 157 hours, forty-six minutes in the air. The plane has made more than 120 STOL landings and takeoffs.

With a 1,200-pound payload, Charger can take off in less than 230 feet and clear a fifty-foot obstacle in 560 feet. Its versatile design suits it to surveillance, escort, liaison, evacuation, logistics, and close-support missions.

In recent simulated operational flights over mountain terrain, Charger has flown thirty-five feet from the mountainside in wind

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gusts up to twenty-five knots. Stability and control were consistent with the best handling characteristics of aircraft now in service.

A successful ten-hour NASA evaluation of Charger's STOL capabilities has also recently been completed.

General Electric Co. (V/STOL Propulsion)

No one V/STOL propulsion system can satisfy all missions and applications. For this reason, literally dozens of V/STOL propulsion systems and aircraft are currently being developed and tested worldwide.

Five broad applications are currently being pursued: heavy lift crane, combat support transport, rotary wing/compounds, subsonic surveillance/strike, and supersonic tactical fighter.

General Electric has propulsion applications to meet specific requirements in all five of the above areas; the T58, T64, and J85 engines are all available in production versions; several types of lift and lift/cruise fans are in flight test and wind-tunnel stages of development; the GE1 "building-block" systems are under development; and a direct-lift demonstrator vehicle is currently undergoing testing.

Applications using the T58 engine include the triservice (Bell) X-22A V/STOL; the Army (Kaman) UH-2 and (Piasecki) 16H-1A compound rotorcraft; and eleven other conventional and experimental helicopters, including three helicopters for commercial airlines.

T64 applications include the triservice (Vought-Hiller-Ryan) V/STOL XC-142A, the Army (de Havilland) CV-7A STOL transport, the Army (Hughes) XV-9A Hot Cycle, and the Marine Corps (Sikorsky) CH-53A heavy assault helicopter. In addition, the T64 has been selected to power the Army's new escort compound rotorcraft, the Advanced Aerial Fire Support System (AAFSS).

The third production General Electric V/STOL engine is a derivative of the J85 afterburning engine. Twin J85s power the Army (Ryan-GE) XV-5A, the NASA (Bell) X-14, and a single J85 augments the Kaman Army UH-2 compound rotorcraft. In addition, the Lockheed-California Company is testing a VTOL "bedstead" which uses six J85s as direct lift engines.

The GE1 approach involves the use of one gas generator as the heart of a family of advanced propulsion systems. Components—turbofans, thrust vectoring devices, etc.—are added to provide specific performance and configurations tailored to specific aircraft designs and missions. An augmented, vectored turbofan for use as a lift/cruise engine; a turboprop configuration for transport missions; a turboshaft application for high-weight class rotorcraft; a nonaugmented vectored turbojet or turbofan engine, which can be coupled with direct lift devices; a GE1/lift fan propulsion system; and a lift fan-cruise fan arrangement for transport applications can all be derived from the common GE1 gas generators. The GE1 offers thrust versatility spanning a range of almost six times the basic gas generator thrust.

General Electric is currently working under military contracts to develop components and technology applicable to future direct lift engines. Technology from these programs is being considered against future V/STOL requirements, especially in the design of high-performance fighter aircraft. Reduction of over-all engine size and weight, increased performance, simplified maintenance and controls—these are among the direct lift objectives.

With V/STOL propulsion and airframe development being pursued on many fronts, the next step will be true operational testing under actual or simulated environments.

General Electric Co. (Flight Propulsion)

The takeoff thrust of General Electric engines has grown from the early J79 at 14,800 pounds in 1953, to the J93 in the 30,000-pound thrust class in 1957, to the GE4/J75 in the 50,000-pound thrust class in 1965.

The J79 incorporated several design breakthroughs, including a variable-area ejector nozzle, 17-stage, single-spool compressor with variable stators. The newest addition to the J79 turbojet family, the J79-10/-17, produces 17,900 pounds of takeoff thrust. It features a guided-expansion exhaust nozzle for improved fuel consumption and Mach 2 performance. At Mach 2, the J79-10/-17 produces 2,000 pounds more thrust than the J79-8/-15, which now powers the McDonnell F-4 Phantom II.

To meet the Mach 3-plus requirements, General Electric's J93 turbojet combines proven advanced concepts of J79 variable stator compressor and simple three-main-bearing design with significant technological breakthroughs in design and in the use of high-temperature lightweight materials.

Specialized cooling techniques were developed in J93 design, including convection cooling of turbine blades, engine-case cooling by inlet-duct boundary-layer bleed air, and insulation of controls and accessories in a lightweight honeycomb pod. The unique convergent-divergent exhaust nozzle design of the J93 ensures high efficiency for acceleration through its wide range of Mach levels.

The design, development, and flight-test experience of the J93 program are already being applied to General Electric's GE4/J5 augmented turbojet for the supersonic transport. To meet the specific economic and operational requirements of the SST, the GE4/J5 also incorporates further advancements in design beyond the J93. Comprehensive design and component testing is now under way, with full-scale engine testing planned during 1966.

Grumman Aircraft Engineering Corp.

One Grumman E-2A Hawkeye can monitor all the air traffic between Boston, Mass., and Washington, D. C., including all traffic into and out of metropolitan New York airports.

This statement gives some indication of the command and control capability of the E-2A Hawkeye, developed for Fleet Air Defense as an airborne early warning and control system for operation as a complement to the Naval Tactical Data System (NTDS). In development at Grumman since 1957, E-2As have been in the Fleet inventory for about two years. Forty-two systems have been delivered to date.

The E-2A is an existing, operational system offering the benefits of:

- Built-in compatibility with NTDS, and just the addition of some existing communications equipment gives it true triservice compatibility.
- An immediately applicable semiautomated AEW&C system.
- Can control radar and beacon tracks simultaneously.
- A self-contained mobile/airborne system, operating self-sufficiently and interchangeably, ground-based or airborne.
- Take off at takeoff gross weight over a fifty-foot obstacle in less than 2,500 feet.
- A system which already has integrated the best detection/tracking system and will accept the APS-111 into the same system when development at Grumman is completed.

The E-2A can remain on station at high altitude to provide early detection of low-flying attackers, as well as controlling the interception and destruction of those attackers. High altitude provides most effective detection but increases area affected by surface return. E-2A has a very effective AMTI (Airborne Moving Target Indicator) for canceling sea clutter and allowing detection and tracking in the clutter area.

Communication of the inherent large volume of command and processed display information is handled by voice and digital data link to controlled aircraft and to NTDS, MTDS, or any additional airborne or ground-based installations equipped with repeater indicators for real-time situation evaluation. The display in the E-2A and the repeater installations, even more than 1,000 miles away, can be shown motionless above a selected geographical point. The ground-stabilized capability, teamed with the inertial and doppler navigation system, provide an accuracy of control capability superior to any existing airborne early warning and control system.

Information on the E-2A, including the recent TAC Evaluation, can be provided by Mr. Francis X. Crane, Business Development Department, Grumman Aircraft Engineering Corp., Bethpage, N. Y., telephone: 516 LR-5-3441.

(Continued on page 79)

Who's zeroed in on air-launch weapons requirements—*for today and tomorrow?*

With vast numbers of qualified Falcon and Bullpup motors in Air Force and Navy inventories, Thiokol is the nation's largest producer of air-launch systems—setting the pace for versatile, reliable propulsion.

No other contractor has equivalent air-launch experience in solid and liquid propellants, and air-augmented technology—backed up by a 99 per cent reliability record.

Thiokol is now producing proven systems with temperature and environment ranges far beyond existing air-launch rocket hardware. Important programs to advance the state of the art are being conducted in new propellants, structural materials, and components.

At Thiokol, tomorrow's air-launch propulsion is now being developed, just as today's requirements were met in times past.

Interesting positions in air-launch propulsion development and other advanced liquid rocket applications are available at Thiokol's Reaction Motors Division in Denville, New Jersey. For further information, write to Mr. R. Swenson, Thiokol Aerospace Center, 3340 Airport Road, Ogden, Utah. An equal opportunity employer.

Thiokol

CHEMICAL CORPORATION
Aerospace Center: Ogden, Utah

there are field teams, field teams, & FIELD TEAMS

the first of them all were Dynalectron field teams, and the best are still Dynalectron's

Dynalectron Corporation is first in field teams for two reasons, both wrapped up in one sentence: Dynalectron developed and pioneered the field team concept in 1951, and nobody has caught up with Dynalectron since then. Dynalectron field teams are working everywhere in the free world, on any day you care to name . . . in Viet Nam, today, for example . . . repairing, maintaining, modernizing, and overhauling aircraft, helicopters, missiles and rockets, space vehicles, or any other aerospace device yet developed or to be developed.

A Dynalectron field team in Viet Nam, working on helicopters needed for today's operations.

What is a field team?

A ready force of expert, fully-equipped, highly-trained technicians and mechanics, unequalled in all aspects of overhaul, maintenance, modification, retrofit, modernization . . . of any aircraft or missile . . . one man or more than 500, quickly sent to any on-site location in the free world.

Dynalectron pioneered it

No other organization can come anywhere near matching the experience, the capabilities, and the provable performance of Dynalectron field teams, anywhere in the world today. This means fast reaction, absolutely outstanding work, low cost . . . because Dynalectron stamps out "re-work."

Dynalectron field teams, like fixed-base crews, put maximum cost-effectiveness first, concentrate on low downtime, stamp out "rework."

A stateside field team from Dynalectron in a customer's own hangar location.

Unlimited capabilities

All capabilities, from PARC and IRAN to modifications involving the most advanced fire control or ECM weapons systems, are present in Dynalectron. Its field team capacity embraces as many aircraft, helicopters, missiles, or space vehicles as are necessary to meet your requirements.

Maximum cost effectiveness

This is the best reason for field teams, though there are many other good ones. They go where the aircraft or missiles are, and that means less downtime, increased operational use. This appeals to Dynalectron customers, as it should to anybody.

Qualified engineers and technicians invited to submit resumes in confidence. An equal opportunity employer.

DYNALECTRON CORPORATION

2233 Wisconsin Avenue, N.W.
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Hamilton Standard Div., United Aircraft Corp.

Over the past five years Hamilton Standard has been conducting an extensive program on major propeller developments, aimed principally at meeting the stringent requirements of the next generation of subsonic V/STOL aircraft. The objective of this program was to develop a "new look" family of propellers with significant improvements in lower specific weight, higher specific performance, improved operational reliability, and improved structural integrity.

These objectives have been embodied in three radically new propeller developments: the fiberglass-shell, steel-spar blade; integral gearbox propeller; and variable-camber propeller. The first two programs cater primarily to weight reduction, and it has been demonstrated that the combination of the two provide a weight savings of thirty-five to forty-five percent compared to previous propellers. The variable-camber propeller represents a significant breakthrough in a long-standing problem in off-design propeller performance. In a manner analogous to the use of flaps on wings, the variable-camber propeller has been shown to provide as much as thirty to forty percent improvement in thrust under off-design conditions.

In addition, these new propellers have been designed to offer a new level of improved structural integrity, operational reliability, and field maintainability.

Each of these new propeller types has successfully completed full-scale prototype hardware development and two of these—the fiberglass blade and the integral gearbox—have been in flight status on the triservice XC-142A for approximately one year and will soon be in flight test on the X-22A aircraft. The variable-camber propeller is scheduled to begin flight test in early 1966.

This "new look" family of propellers offers remarkable mission gains for several classes of advanced subsonic aircraft. For example, there is a potential gain of over 100 percent in payload-range for a second-generation V/STOL transport. Other types that could profit significantly are low-level attack and long-endurance picket-line aircraft.

IBM Corp., Federal Systems Div.

The IBM Federal Systems Division spokesmen, within a theater-like enclosure at the Air Force Association meeting, utilized a unique multiple-slide projector presentation to describe how a new IBM computer concept can solve the logistics, flexibility, and cost problems associated with today's special-purpose aerospace computers.

The new family concept of aerospace computers, called System/4 Pi, features: common architecture, standard data flows, and modularity. Further, processor programs—the software that controls the guidance navigation and other data-processing tasks—could be developed and tested on an IBM System/360 and then used directly on these operational computers. Alteration for growth is easily effected without extensive reprogramming, retraining, and additional parts provisioning.

The largest member of this family concept is planned to have a speed 100 times greater and a memory capacity over 1,000 times larger than its smallest counterpart. Programs developed for one machine will run directly on larger systems, without reprogramming. The demonstration showed how these features could meet the varied requirements of guided missiles, aircraft, spacecraft, or even the large-scale computing requirements of space stations.

IBM System/4 Pi is a new family concept of digital computers for aerospace applications backed by an extensive IBM development program. Based on the IBM System/360 commercial data-processing concept, it is being bid for 1966 delivery.

LTV Aerospace Corp.

The A-7A Corsair II attack bomber, now flying at Dallas, can carry more ordnance further with one engine than the World War II B-17 could with four. It has a 20,000-pound fuel capacity, internal and external, and could fly from Newfoundland to Rome on internal fuel alone.

Eight weapons-carrying wing and fuselage stations permit the A-7A to carry almost everything in the conventional arsenal. It could be equipped with a short afterburner engine, which would decrease takeoff distance with higher payloads and with little decrease in radius capability.

The XC-142A triservice V/STOL assault transport, with nearly 200 test flights in four aircraft to its credit, gives armed services helicopter takeoff and landing capabilities with 430-mph forward speeds. Two of the aircraft are being flown by military pilots at Edwards AFB, Calif. The tilt-wing plane has a design gross weight of 37,500 pounds and will transport thirty-two fully equipped troops on a radius of action mission of 200 nautical miles. It has a ferry range of nearly 3,000 miles. A score of pilots have successfully accomplished hover, conversion, and reconversion maneuvers, which are described as uncomplicated because of the excellent handling and flying qualities.

In 1966, as part of experiment D-12, an astronaut will leave the Gemini capsule and operate in space using the USAF Astronaut Maneuvering Unit (AMU), a compact back-pack device which converts an astronaut in a pressure suit into a one-man space vehicle.

The AMU, developed by LTV, contains its own propulsion, life support, automatic stabilization, communication, and power systems, with redundancy in all critical areas. The Gemini experiment will mark an initial step toward anticipated uses such as assembly and servicing of spacecraft and space stations, vehicle-to-vehicle transfer, cargo handling and docking assistance, maintenance, rescue, and performance of numerous other operations which will contribute importantly to advancing the nation's space efforts. An unmanned, radio-controlled Remote Maneuvering Unit (RMU) also is under development by LTV.

Litton Industries, Data Systems Div.

Litton Industries' Data Systems Division of Van Nuys, Calif., introduced its latest family of microelectronic computers, designated the L-300 and L-3000 series, at the Aerospace Briefings.

The first prototype in the family, the L-304 General Purpose Computer, was put through its first public demonstration at the Briefings. It is the smallest and lightest computer to offer militarized real-time data processing with multiple program and multiple computer capability.

While the L-304 is organized as a general purpose computer, it includes special features that make it effective in real-time command and control and intelligence data processing.

The unit demonstrated weighs only thirty-four pounds, including the power supply, and is contained in a rugged case measuring .3 cubic feet—about the size of two cigar boxes. It contains 4,096 thirty-two-bit words of memory. The package enables a selection of plug-in drawers including memory, arithmetic and control, input-output, and power supply.

The design of L-304 is unique in that it can be used efficiently for a wide range of applications. Its memory is expandable to 32,000 thirty-two-bit words and, with the addition of memory extension logic, it can be increased to 131,072 thirty-two-bit words.

Computational capability also is expandable through a multiple computer configuration. Each computer can communicate with up to sixteen memory modules at 8,192 words each, and each module can communicate with up to four computers.

Read-write cycle time is 1.6 microseconds for a memory composed of 4,096-word modules or 1.8 microseconds for a memory composed of 8,192-word modules.

Lockheed-California Co. (Composite Aircraft)

A composite aircraft that changes in flight from a compound helicopter into a high-speed, fixed-wing plane is under study at the Lockheed-California Co.

This aircraft combines helicopter rotor blades with the fixed wings and forward-thrust jet engines of the conventional plane. After a vertical takeoff, the composite aircraft will be able to stop its rotor blades, fold them back, stow the stacked "pack" in the fuselage top, and fly on as a fixed-wing plane.

The study aircraft would transition at approximately 160 mph.

(Continued on following page)

This stored-rotor vehicle could reach speeds of more than 500 mph. Featuring the Lockheed rigid-rotor system, it would provide the Air Force with a quick-response craft capable of performing a great variety of missions.

Upon completion of whirl-tower tests, now under way, a full-scale stopped and folded rotor aircraft system, designed and built by Lockheed, will be "flown" in the NASA-Ames wind tunnel later this year.

Lockheed progress in rotary-wing aircraft development stems from the success of its rigid-rotor system. The concept was proved in a Lockheed research helicopter which first flew in 1959. Achievements of this program led to the rigid-rotor XH-51A helicopters, built under a joint Army-Navy contract. The compound version of the XH-51A, which has reached 272 mph, is the world's fastest rotorcraft. Now being flight-tested for FAA certification is the new Lockheed rigid-rotor helicopter, the five-place Model 286.

Lockheed-California Co. (CL-981)

The CL-981 is one configuration resulting from a series of advanced design studies directed at providing near-term air-superiority derivatives of the Starfighter. This version incorporates a more powerful engine, increased wing area, fuselage strakes, and a retractable canard which combine to increase the air-fighting potential and expand the present performance envelope.

It is intended to meet the interim need for a fighter-bomber that will strengthen the air-superiority capability of free world Air Forces during the latter part of this decade.

It retains the internal 20-mm. Vulcan cannon and missile options for air-to-air combat as well as the ability to deliver a wide variety of conventional air-to-ground ordnance.

The canard surfaces, mounted behind the canopy at the top of the fuselage, automatically extend above speeds of Mach 1 to improve acceleration throughout the supersonic envelope. A longitudinal strake on each side of the lower aft fuselage improves supersonic stability well beyond Mach 2.

The design radius on a high-low-high mission, carrying tip tanks and five M-117 bombs, is 500 nautical miles. The design unrefueled ferry range with military specification reserve fuel allowances is 2,050 nautical miles. With boom-type, in-flight refueling, the range is limited only by the pilot's endurance.

Lockheed-Georgia Co.

Lockheed-Georgia is proud of the contributions which have been and are being made by the Air Force with its two famed airlifters, the C-130 Hercules and the new fast fanjet C-141 StarLifter.

In the service of virtually every major Air Force command, the C-130 is used as a weather bird, missile launcher, satellite-recovery vehicle, aerial photography platform, assault transport, strategic airlifter, and for various special missions. Additionally, it serves in the Navy for fleet support and, with skis, supplies our South Pole scientific effort. Equipped with fuselage tank and refueling pods, the Marine Corps employs the C-130 as an aerial tanker. The Coast Guard, too, uses the C-130 for search and rescue, and the Hercules proudly flies the flags of twelve other nations. More than 800 C-130s have flown over two million hours and compiled an outstanding performance record.

The twenty-ninth version of the Hercules, the HC-130H, designed expressly for the Air Rescue Service, is a vastly improved search and rescue system with an aerial recovery capability to pick up men and materials from areas too distant for helicopters and too small for landings. It becomes operational late this year. Version thirty, the C-130K for the United Kingdom, is now going into production, and the thirty-first, designed for consideration by the Air Force, is the advanced assault Hercules. It is capable of landing and taking off in little more than 1,000 feet and delivering ten-ton payloads on fields laced with ten-inch bumps, stumps, rocks, holes, and gullies.

The fanjet C-141 StarLifter entered operational service at Travis AFB this past April. It is now carrying a large portion of the Pacific military airlift workload, including air evacuation of casualties. Even now, while flight testing is still going on, the Military Air Transport Service is programming its StarLifters for eight hours daily.

The C-141 can carry nonstop almost 70,000 pounds of cargo transatlantic. It has also parachuted its 70,000 pounds of cargo for a new world airdrop record. In addition to its long-range, heavy-payload capability, the C-141 can carry a substantial payload into and out of landing strips as short as 3,000 feet.

The C-141's future is not only in airlift. It is ideally suited for many other applications, like the Airborne Warning and Control System. Present conceptual studies for TAC and ADC have shown that substantial surveillance, command and control, and battle management capability can be provided on board the C-141 using existing or near state-of-the-art electronics equipment.

Already established is the feasibility of giving the C-141 a high flotation gear which would give it the battle theater capability which is planned for the C-5A. Readily within reach is an extended range version able to carry over 50,000 pounds 5,000 nautical miles. Also in reach is a tanker with short-field capability and which, if coupled with a high flotation gear, could easily service both SAC and TAC from widely dispersed, substandard airfields.

Not part of the *immediate* airlift story, but part of aviation's future, is V/STOL. We at Lockheed-Georgia today are exploring every avenue of this new frontier with one successful evaluation V/STOL airplane, the XV-4A Hummingbird, already to our credit and with much future activity slated for the development of what is often referred to as the V/STOL replacement for the C-130, due out in the early 1970s.

Lockheed Missiles & Space Co.

The Agena ascent vehicle and satellite was first launched by a Thor booster in February 1959. During the intervening six and one-half years, it has flown over 175 times with both the Thor and Atlas as first-stage boosters. The first Agena was conceived by the Air Force as a combined upper stage and orbital satellite, and since that time the great majority of missions have used this dual capability.

The Agena is the most-used and the most reliable operational space vehicle in the US inventory. Agena uses storable-liquid hypergolic propellants. It has a single restartable 16,000-pound thrust main engine with a 45 to 1 expansion ratio. The standard version of the Bell 8096 engine is capable of two starts, while the optional version, used with the Gemini Target Vehicle, is not limited in the number of starts.

The majority of all Agena missions flown utilize the vehicle as a satellite in earth orbits of extended duration. Such missions may require extensive in-space maneuvering, involving widely varying demands for power, command and control functions, and communications.

For these reasons, and to permit maximum economy and flexibility, the Agena is manufactured in a basic, standardized version. The using programs then select from a large assortment of optional kits and equipment those features that meet their specialized requirements.

With only minor kit changes the same standard Agena can be boosted by any of the larger Air Force boosters, including all versions of Thor, Atlas, and Titan. This selection of boost vehicles permits Agena to economically launch payloads ranging in weight from less than 1,000 pounds to over 25,000 pounds.

Agena is continuously in a process of evolution, permitting it not only to remain current with the state of the art but to constantly extend its capabilities. A few of the more significant planned changes are worth mentioning. Now under study is a proposal to use storable nitrogen tetroxide and aerozine-50 propellants. This change will give a substantial increase in payload capability and will strengthen the time the Agena may be stored on the pad with propellants loaded.

A second proposal under study will allow the secondary propulsion system to draw propellants from the main tank. This will, with the restartable main engine, increase the versatility relative to in-space maneuvers, permitting velocity changes of

(Continued on page 83)

ASW runs deep.

Our work in anti-submarine warfare has taught us some things: How to work on a whole systems problem and help solve it.

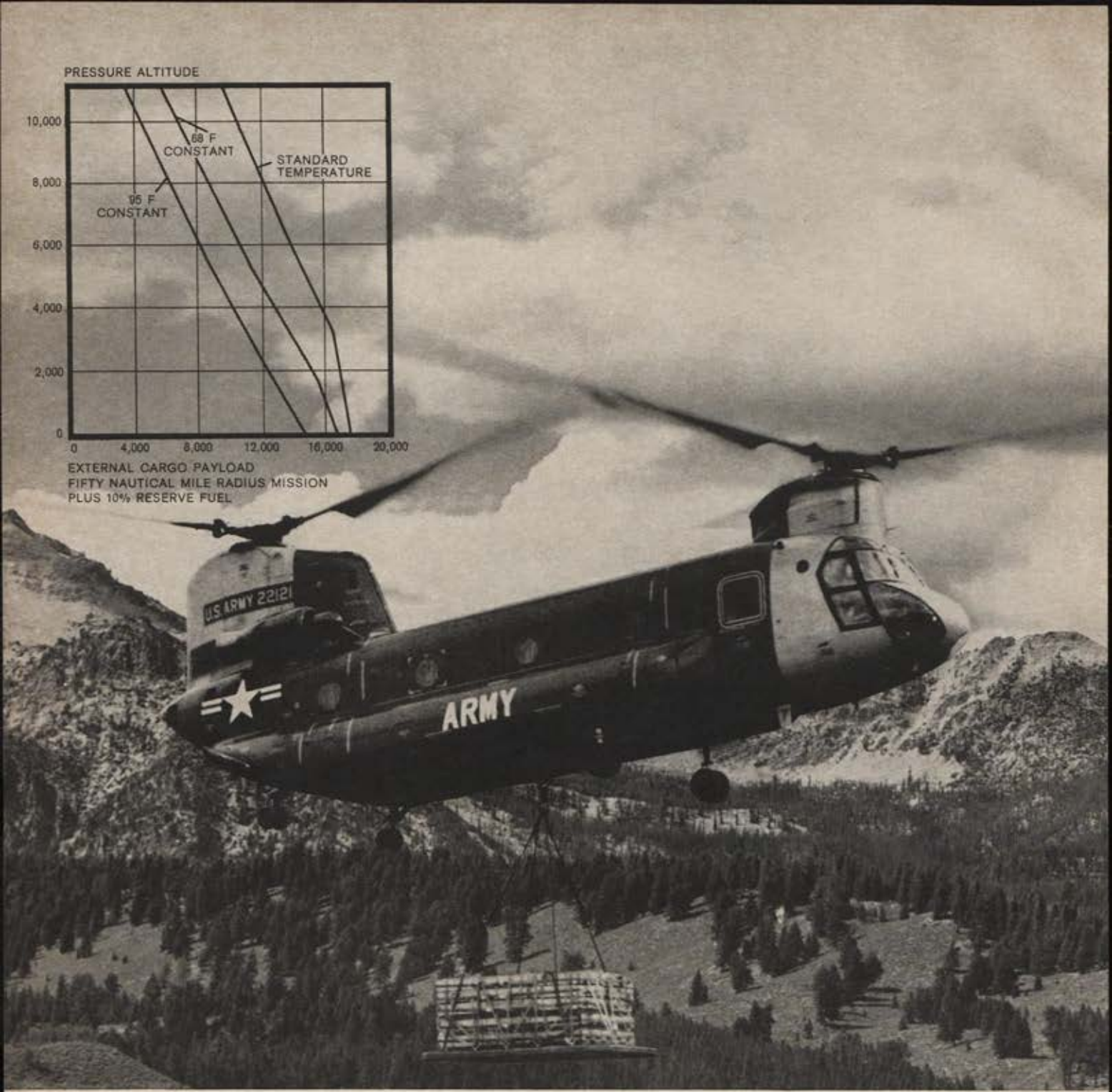
How to work on the operational level to come up with practical solutions to real problems.

That simplicity of design is the key to reliability, economy, and successful operation the first time out.

That a company must be deep at all levels of its operation; science, engineering, technology, production.

We think that these same principles of operation can be applied to any facet of our special field—avionics sub-systems for warfare. And we're proving it. Where subs are a problem and where they aren't.

Loral Electronic Systems
A Division of Loral Corporation
825 Bronx River Avenue, Bronx, N.Y. 10472



Take to the hills...and hover

High terrain may be the optimum for line-of-sight communications links, but it poses tough transportation for men and equipment.

And here's where the CH-47A Chinook will prove itself invaluable for the USAF's Tactical Air Control System, key to joint Air Force & Army coordinated operations. This versatile helicopter, with its remarkable hover capability, can externally lift radar and communication systems, supplies and ancillary equipment with the systems personnel in the cabin. Other missions in the Tactical Air Control System such as the deployment of vehicles, equipment and personnel of the Forward Air Control Parties can be totally carried internally. All can be accomplished in a minimum of time and with a minimum of landing site preparation.

Part of this is due to the tandem-rotor configuration which develops high lift and exceptional balance and stability. It gives the Chinook the ability to hover out of ground effect at a 6,000 foot altitude in temperatures of 95 F; lift an external load of 8,200 pounds; take it on a 50 nautical mile mission and return to base. On missions to low-lying savannahs it can perform even better, carrying up to 17,850 pounds external payload for the same 50 nautical mile range.

The CH-47A Chinook is in volume production and as a result of extensive field operations and testing was designated by the Dept. of Defense as "Standard" equipment. It is the product of creative engineering and forward-thinking weapons system management of the Boeing Company.

BOEING
VERTOL DIVISION
MORTON, PENNSYLVANIA

from a few feet per second to many thousands of feet per second.

We at Lockheed are proud of the Agena, and it is gratifying to be a member of the USAF team exploring and using space.

McDonnell Aircraft Corp.

ASSET was an advanced technology program designed to investigate the little-explored area of lifting reentry or the environmental effects of hypersonic flight in the atmosphere. Under contract to the Air Force's Research and Technology Division, McDonnell flew six ASSET vehicles in less than four years.

The maneuver capability required for precise touchdown control in returning from orbit is inherent in the lifting or glide concept of reentry. ASSET was conceived to better define the actual environment of reentry. It was designed to provide for correlation of flight-to-ground test results. The prime objective was to obtain data. Major experiment categories were the aeromechanic disciplines and communications.

Two types of ASSET vehicles were built—four aerothermodynamic structural (ASV) and two aerothermoelastic (AEV) vehicles.

The ASV vehicles were designed to measure temperatures and pressures and evaluate performance of high-temperature materials and structural concepts. The AEV vehicle, in addition, measured the structural dynamic response of the vehicle to the environment.

The ASSET vehicles could well be called flying materials laboratories. A basic problem to be overcome is the tremendous heat generated during hypersonic flight. The method of heat rejection used for ASSET was reradiation into space. This required the use of high-temperature refractory and super alloy materials.

The ASSET vehicles were boosted by Thor or Thor-Delta launch vehicles from Cape Kennedy. The ASVs were programmed to start their glide in the Mach 18 and 200,000-foot-altitude range, while the AEVs began their glide at Mach 12 at 170,000-foot range.

The flight program was considered an unqualified success by both the Air Force and McDonnell. Except for ASV-2, which failed because of second-stage booster malfunction, all flights were successful in trajectory, flight, systems operation, and data transmission.

Marquardt Corp.

An evaluation of Scramjet (Supersonic Combustion Ramjet) propulsion, under actual flight conditions at hypersonic speeds, has been initiated by the Marquardt Corporation under a $5 million Air Force contract. Teamed with Marquardt are its subsidiary, General Applied Science Laboratories (GASL), and Lockheed-California Company.

The program provides for the development of modular Scramjet engines and for the design of a special flight-test vehicle. It is proposed that the rocket-boosted flight-test vehicle initially will demonstrate Scramjet operations at speeds in excess of Mach 5 at altitudes above 50,000 feet. Subsequent flight tests to different Mach numbers and trajectories are planned.

The flight-test program will be preceded by ground-test evaluation of all components of the Scramjet propulsion system and vehicle. From this will evolve an initial engine configuration design suitable for operational flight testing.

Scramjet operates on the same principle as the conventional ramjet, the major difference being that in Scramjet the air is compressed to a much lesser degree, thus maintaining supersonic flow throughout the engine and giving Scramjet a potential of efficient propulsion from low supersonic to orbital speeds.

The simplicity and high-performance potential of Scramjet make it a system with a wide range of potential applications. Among them are manned hypersonic cruise vehicles, reusable orbital vehicles, and second-generation supersonic transports. Its missile applications are equally as broad, offering attractive propulsion capabilities for ground- or air-launched tactical missiles, for air-to-air or air-to-ground missiles, and for in-flight trajectory control for interceptor missiles and reentry vehicles.

Martin Co. (ITL Facility)

The Integrate-Transfer-Launch (ITL) facility at Cape Kennedy was built for the Air Force's Titan III Standard Space Launch Vehicle and affords the national space program a most effective and versatile launch complex.

In contrast to earlier space booster-launching facilities, ITL has significantly reduced checkout and on-pad time. It gives greater flexibility in vehicle configuration, mission, and payload. The quick-reaction time of ITL provides unsurpassed capabilities for meeting preselected launch windows and increased launching rates.

The Martin Company demonstration used scale models to illustrate a typical launch-vehicle assembly, checkout, and launch operation. Preliminary assembly and checkout take place at an off-pad area. ITL functions as a giant "conveyor belt"—its own rail system moves boosters through the assembly and checkout buildings to the end of the line, the launch pad, ready for firing.

Martin Co. (Lifting Body)

The SV-5 spacecraft is a lifting reentry body that features a high degree of maneuverability, wide lateral range, and horizontal landing capability. It is a cone-shaped configuration, flattened at the bottom, with fins and control surfaces. To protect SV-5 against the heat of reentry, Martin Company developed an ablative heat shield that has sufficiently high thermal protection efficiency to employ it over the entire vehicle.

This elastomeric silicone ablator permits the vehicle's load-carrying metal shell to operate reliably at temperatures in the structurally efficient range of 400° to 800° F, as well as at orbital temperatures of −100° F. Its ability to withstand differential contraction, as the SV-5 moves from the cold of space into reentry heating, was demonstrated by immersing an elastomeric silicone-coated aluminum cylinder in liquid nitrogen.

The lecture also included a description of the technique developed for bonding the ablator to an 800° F metal surface.

North American Aviation, Inc.

No computer, no laboratory, no wind tunnel, no black box, no engineer can prove the design of an aircraft as well as actual flight. The proof of the design is in the flying. North American has been conducting flight tests since the 1920s, and we are still at it with the X-15 and the XB-70. From every flight, knowledge has been gained.

Let's start with the F-86 Sabrejet, a plane which gained its greatest fame demonstrating a 10 to 1 kill ratio over the Russian-built MIG-15 in Korea. It started as a straight-wing craft, but, entering an unexplored area of flight, we swept the wings back thirty-five degrees and introduced a new era of high-performance aircraft.

In 1953, the F-100 Supersabre exceeded the speed of sound in level flight for the first time. In today's time, the T-39 Sabreliner, the twin-jet aircraft approved for three federal agencies—the USAF, the USN, and the FAA—is used more for high-speed transportation of military and DoD management personnel than any other support aircraft in the government's inventory. And it carries them three times as far without stopping, three times as fast, and at one-third the cost of propeller-driven craft.

We are active in high-speed testing of aircraft able to hover and fulfill the V/STOL parameters. Our work with the X-15—a project called by NASA Administrator James Webb "the world's most successful rocket research program"—is known. And, finally, an aircraft very much in the forefront of high-speed testing today, the XB-70, is heading toward Mach 3 at 70,000 feet. [*These objectives were reached Oct. 14*—Ed.]

Northrop Corp.

Lifting bodies, because they are maneuverable and can enter the earth's atmosphere from space at relatively low load factors and heat rates, offer distinct advantages as a configuration for manned spacecraft. The lifting body concept, developed in 1957 by Dr. A. J. Eggers, Jr., of the Ames Research Center, NASA,

(Continued on following page)

has been verified in NASA programs extending from analytical studies and wind-tunnel tests to the design, manufacture, and flight test of the piloted M2-F1, a 1,200-pound plywood vehicle. The success of these programs warranted additional research and led to an industry-wide competition by the Flight Research Center of NASA for a contract to design and manufacture two lifting body vehicles, the M2-F2 and HL-10. Northrop Norair was awarded this contract in May 1964.

These vehicles are made of conventional aluminum structure designed for flight load factors up to four, and incorporating flight control systems for flight up to Mach 2. The M2-F2 was delivered to NASA on June 15, 1965, and has subsequently undergone wind-tunnel tests at NASA Ames. Piloted flight tests, beginning this fall, will consist of glide flight and landing after release from a B-52 aircraft at 45,000 feet and up to Mach 0.8.

Provisions have been made for the installation of an XLR11 rocket engine to enable flight testing up to 85,000 feet at supersonic speeds should NASA decide to extend the program. Accomplishment of a similar flight test program on the HL-10, scheduled for delivery in January, will enable NASA to verify subsonic and supersonic aerodynamic characteristics, determine control characteristics at speeds below Mach 2, and assess pilot/vehicle compatibility for both M2-F2 and HL-10 configurations.

Before manned lifting-body entry vehicles are developed for operational logistics or military missions, experimental vehicles probably will be flight-tested first under operational conditions. The basic design of the M2-F2 or HL-10 vehicles can be adapted to a configuration suitable for experimental flight tests under actual launch and entry conditions. Northrop Norair, under contract to the NASA Flight Research Center, is conducting a study to determine the feasibility and cost of a minimum manned flight-test research program, using an M-2 vehicle for an eastward flight from Cape Kennedy to Edwards AFB, Calif.

Northrop has applied the knowledge and experience attained on the M2-F2/HL-10 program to preliminary design studies of the SV-5, a lifting body shape developed by the Air Force for maneuverable entry mission requirements. These studies indicate that a manned configuration of this shape could indeed be very similar in structure to the M2-F2 and HL-10 with a high degree of subsystem commonality.

Before maneuverable entry vehicles are operational, pilots must be trained to fly them. Another concept developed from the basic design of the M2-F2 and HL-10 vehicles is for a lifting-body trainer. Installation of jet engines and fuel tanks in place of the provisions for rocket engine and fuel would create a vehicle with ground takeoff capability that could fly to a terminal approach altitude of approximately 25,000 feet. The pilot could then glide and maneuver to landing, thus simulating the terminal phase of an actual entry flight.

Republic Aviation Div. of Fairchild Hiller Corp.

TAC's F-105 Thunderchiefs in Southeast Asia are proving the USAF tactical operation philosophy. Based upon tactical doctrine developed in World War II and Korea, the F-105 has a long, successful heritage and incorporates the answers to problems solved the hard way. This doctrine dictated the design features of Republic's F-105 Thunderchief, a low-altitude fighter-bomber.

Flying high is one thing, but war-winning targets are at twelve o'clock low—Thunderchief territory.

Technical forecasts were well made. Air Force planners optimized the F-105 for low-altitude operation, and their foresight has made a weapon system available now to fight this new war. However, the war that will be fought tomorrow, obviously, must be planned today.

Since the early 1950s, Republic has been working toward solutions of the problems associated with vertical-takeoff fighter aircraft. The work has ranged from the zero-speed flight controls and VTOL landing aids, to the critical area of logistics studies and to several complete weapon systems. One of the more important programs now being worked on at Republic is the FX aircraft. The FX aircraft will give new dimensions to tactical-maneuver capabilities, ensuring its tactical effectiveness through the 1970s. Republic's efforts in the FX give the Air Force, for a given investment, a much greater effectiveness of current inventory items; and, although the FX aircraft is supersonic, it can be shown that supersonic aircraft cost very little more than well-designed aircraft with high subsonic capabilities.

Sikorsky Aircraft Div., United Aircraft Corp.

How can helicopters achieve higher speed and greater range without sacrificing their unique hovering and low-speed qualities?

The Air Force CH-3C, currently in production, has a maximum speed of 143 knots at 19,500 pounds weight. The highest speed production helicopter in the western world is the CH-53A Marine Assault Helicopter which can transport a payload of 8,000 pounds over 200 nautical miles and has a maximum speed of 170 knots.

Research has shown, however, that much higher speeds can be attained without sacrificing the unique VTOL characteristics of the helicopter, which are its low downflow velocities, efficient hover and high degree of controllability, and safety in hover and low-speed flight. Two specific design solutions are possible.

First, if the maximum required speed is under 300 knots, the use of a wing to unload the rotor in conjunction with a propeller or a Sikorsky ROTOPROP to supply propulsion, permits attainment of speeds as high as 300 knots.

Second, for speeds from 300 knots to supersonic speeds, a stowed rotor aircraft is the solution. Here the aircraft takes off as a helicopter and, at a selected low speed, transfers the rotor load to the wings, stops the rotor, and stows the rotor in the fuselage to provide a clean, high-speed, fixed-wing aircraft.

These two design approaches permit VTOL aircraft with helicopter characteristics to achieve any desired maximum speed.

Standard Manufacturing Co.

Because time is one of the most important tactical weapons, and since aircraft flying speed increases almost daily, similar advances are also needed in aircraft reaction time—the time required to arm and load or rearm and reload a given aircraft.

The ever-increasing payload of new aircraft, multiple bomb racks, and a wider assortment of aerial weapons for different tactical missions represents a formidable challenge to load crews. The MJ-4 Weapons Handling System was developed and is in production to meet this challenge. This new system, with its ability to handle prepackaged multiple weapon packages, can load the newest operational aircraft in better than one-third the time of yesterday's system.

Using the new MJ-4 System, a wing of F-4C aircraft with multiple and triple ejector racks can be fully loaded for launch in sixty-nine minutes, whereas the old loading system requires four hours and fifteen minutes. Similar results can be obtained during aircraft turnaround as well as during reconfiguration of aircraft loads for different types of missions.

With a wing of F-4C aircraft having a two-hour mission time and fourteen hours of daylight, the new loading system permits five missions per day compared to only three missions per day for the old system. This means that the cost per aircraft flying hour can be reduced from $125 to $75. Furthermore, the cost of the new system in terms of dollars per ton of ordnance handled is actually less than that of the old system.

Sylvania Electronic Systems

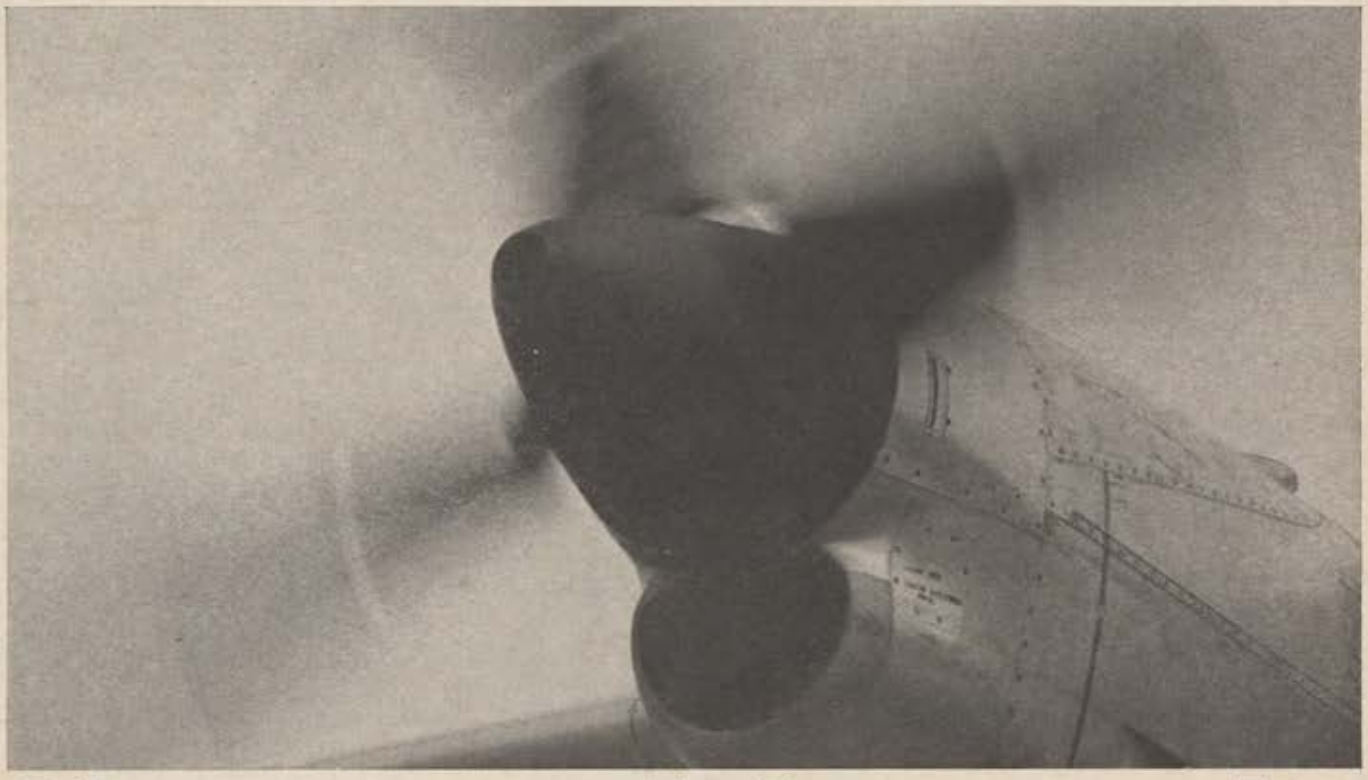
Sylvania Electronic Systems has many antenna systems for communications with satellites, aircraft, and fixed-site, shipboard, mobile, and transportable surface terminals.

Two antenna system designs are currently under development for spin-stabilized satellites, one a mechanically despun antenna and the other an electronically despun antenna.

Another antenna system development communicates and tracks by the retrodirective array principle. Development of this concept has resulted in an array flush-mounted on aircraft or spacecraft surfaces and integral with the structure. A special

(Continued on page 87)

the workhorse



the workhorse's workhorse

They call the C-130 Hercules "The Workhorse" because this versatile plane transports anything most anywhere.

The C-130 gets its power from Allison's T56 turboprop engine—"The Workhorse's" Workhorse.

Since T56 was introduced 11 years ago, its rating has increased by 1160 horses—to 4910 horsepower. And the latest increase comes from an Allison development — air-cooled turbine blades. They permit the T56 to operate at higher turbine inlet temperature — 200° higher — for 22% more power with 5% less fuel consumption and longer life between overhauls.

T56 engines not only power the Air Force C-130 Hercules "Workhorse," but also the Navy ASW aircraft: the P-3A Lockheed Orion: the AEW Grumman E-2A Hawkeye and the C-2A COD. The commercial model 501-D13 powers Lockheed Electras and Convair 580's.

Improved efficiency for T56 engines is another demonstration of Allison's broad capabilities in research, engineering and production. Capabilities that help keep defense, aerospace and nuclear projects *on target*.

Zero Defects... a way of life at

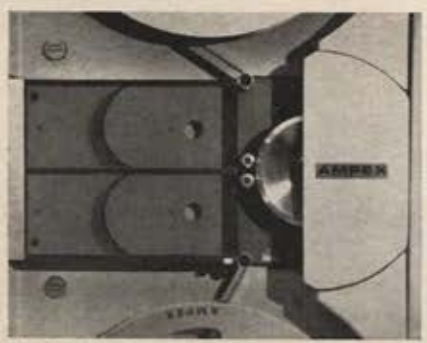
Allison GM

The Energy Conversion Division of General Motors, Indianapolis, Ind.

Announcing a new generation of instrumentation products. The "first family" in magnetic recorders.

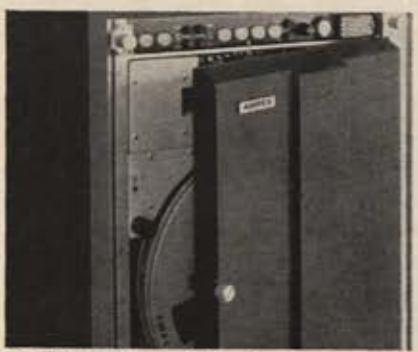
New Ampex 1600 series: a matched family of 2 Mc recorders—the first recorders designed to work together to improve overall systems performance. The 1600 lab-type, portable and airborne recorders feature full 2 Mc record/reproduce capability with near-absolute time base accuracy. This makes it possible to gather and re-create with great precision more usable data on *any recorder in the family.*

All 1600 recorders feature an important design innovation: a new, fast-response servo that gives a Time Base Error of ± 0.5 microsecond at 120 ips when reproduced on the lab recorder; a TBE of ± 2.0 microseconds when reproduced on the airborne and portable units. All offer direct and wideband FM recording. Envelope delay is uniform over the pass band.



FR-1600 Lab-Type Recorder

Unique vacuum drive system insures stable tape motion; reduces ITDE, TBE; minimizes flutter to less than 0.2%. Reels up to *16 inch* for 33% more playing time. Up to 14 channels of record and reproduce in one cabinet.

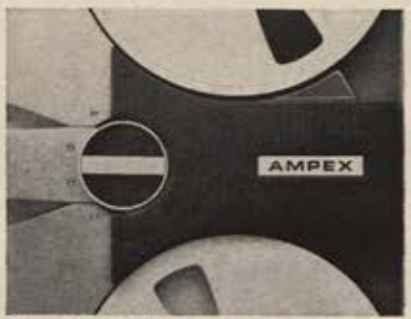


AR-1600 Airborne Recorder

Operates up to 70,000 feet. A rugged, compact 14 channel recorder *and* reproducer with coaxial *14 inch* reels. Flutter: less than 0.3%. Aircraft environment and power.

PR-1600 Portable Recorder

For field, van, shipboard and submarine use with performance same as AR-1600. 60 cps, 400 cps or 28 v.d.c. power.



Also Ampex FR-1800: a new 1.5 Mc recorder.

The FR-1800 is a virtually fail-proof recorder featuring full compatibility with 1.5 Mc, 300 Kc Direct—Wideband 400 Kc FM—Standard band 20 Kc FM, Frequency Shift Modulation and Pulse Duration Modulation. The transport eliminates 60% of the parts found in comparable recorders. Result: new reliability, reduced maintenance and parts inventory. Excellent time base accuracy and low flutter substantially improve system performance. A fast-response, servo-controlled zero loop capstan gives a TBE of less than ± 4.0 microseconds at 120 ips. ITDE: ± 0.3 microsecond at 120 ips. Flutter: 0.25% from 0.2 cps to 10 Kc. For complete details on the FR-1600 series and the FR-1800 recorder, write Ampex, Redwood City, California.

AMPEX

adaptation of the retrodirective array concept, known as a redirective antenna system, would enable active and pseudo-passive repeater stations to form and direct communication beams from one fixed point to another via the repeater station.

In the field of surface-based antenna systems, Sylvania is active in large, transportable antennas (forty-foot diameter or more), as well as lightweight, mobile units, truck-mounted or suitable for shipboard use. Moreover, Sylvania has total systems integration capabilities and experience in ground-based communications terminals.

Texaco Experiment, Inc.

Boron is an outstanding example of the new materials technology which is being wrought through research sponsored by government and industry.

Superior properties of this unique structural material give it a high application potential in aeronautics where weight, strength, stiffness, and temperature resistance are important factors. Boron is fifteen percent lighter, six times stronger, and six times stiffer than aluminum; and has a melting point of 3,700° F, three times more than that of aluminum. It has the best combined properties of magnesium, aluminum, titanium, and steel. Glass is strong but not stiff. Beryllium is stiff but not strong. Boron is both strong and stiff.

To employ monofilament in airframe construction, intermediates of tapes, sheets, plates, bars, and rods are bonded together with metal or resin matrices. These composite forms offer wide application in aerospace structures, propulsion systems, underwater craft, pressure vessels, instruments, and electronics. Once manufacturing barriers are overcome—and the cost diminishes with increased production—the material will also find use in construction ranging from bridges to golf clubs.

Other substances, such as graphite, carbon, beryllium, and silicon carbide, are also being funded for development. These, too, have interesting qualities and at some time in the future may complement boron. However, boron has passed rapidly through its early research stages. It is now more than a mere dream.

TRW Systems

Using existing components and subsystems, it is now feasible to employ comsats in tactical situations below the level of the unit commander.

This conclusion is based upon a feasibility study conducted by TRW Systems engineers on the practicability of tactical communications satellite systems and was presented at the Air Force Association's recent Aerospace Briefings.

The TRW report indicated the current possibility of a satellite system that could provide from twenty to 200 voice channels within a broad tactical theater, using twenty-watt ground transmitters.

Key to such a system would be the performance tradeoff between ground stations and satellites. The satellites would be equipped with large deployable antennas, like the Sunflower-type solar simulator.

Improved satellite antenna gain would permit simple, hemispherical dipole antennas to be used on the ground. Highly mobile ground units would be practical because of the significant reduction in ground antenna weight and pointing problems.

Additional advantages revealed by the TRW study were ease of channel expansion either by increasing the number of satellites or transponders, up to about ten for a 200-channel capacity per tactical theater. Multiple repeater redundancy would permit operability even with as much as ninety percent loss of power output stages.

United Aircraft of Canada Ltd.

The Pratt & Whitney Aircraft T-74 engine has been developed by United Aircraft of Canada Ltd., as a versatile powerplant for turboprop, turboshaft, marine, and industrial applications. The engine weighs between 270 and 300 pounds, and models of the engine are available with ratings from 550 through 750 shaft horsepower.

The primary features of this engine that suit it to military applications include a very low noise level as a result of the buried compressor inlet; a large area inlet screen, completely eliminating foreign objects ingestion; a configuration designed to permit ease of maintenance by grouping the accessories in one location at the back of the engine and which permits ease of accessibility to the hot section parts. The T-74 is a free-turbine engine, permitting complete control of output speed. This control of output speed permits the use of maximum rpm for takeoff, resulting in maximum static thrust, and permits reduction in propeller rpm for cruise to provide maximum propeller efficiency and fuel economy. For nonaviation uses the free-turbine arrangement provides a built-in fluid coupling, permitting complete controllability of the driven component, be it a marine propeller, wheels, or tracks.

The T-74 has completed over 22,000 hours of development and 50,000 hours of trouble-free service in the field. The engine is installed in twenty-two different aircraft and vehicles, and has demonstrated the manufacturer's claims of versatility. The engine powers the Beechcraft King Air and its Army counterpart, the NU-8F, the de Havilland Turbo Beaver, Fairchild-Pilatus Turbo Porter, the Helio Stallion, and the Lockheed rigid-rotor helicopter. At the present time, this engine is powering the General Dynamics Convair Model 48 Charger COIN aircraft at a rating of 650 shaft horsepower. Over 160 hours of trouble-free flight have been completed in this installation.

United Technology Center

As an associate prime contractor in the Air Force's 624A (Titan III) Program, United Technology Center has responsibility for developing the solid-propellant booster stage of the Titan IIIC.

Each Titan IIIC uses two 120-inch-diameter motors, which are attached to opposite sides of the Titan III core. Each booster motor contains the solid-propellant propulsion, thrust vector control (TVC), thrust termination and destruct systems, and instrumentation, as well as the structural attachments and fairings required by a complete stage.

The 120-inch-diameter motor development program began in December of 1962. Requirements of high reliability, minimum development time, and minimum cost were met by using conservative state-of-the-art design philosophy for motor components. This approach was possible because much of the component design was a scaled-up version of similar designs for motors up to 100 inches in diameter, which were tested earlier by UTC.

The ground-test phase of the development program included static firings of fourteen full-scale motors and was completed in twenty-eight months. The flight-test phase began June 18, 1965, with a perfect flight from Cape Kennedy.

The motor contains more than 420,000 pounds of aluminized PBAN propellant and has an initial thrust of about 1.2 million pounds. Each motor has five identical center segments with a tapered core and restriction on the forward ends. The aft closure has a simple cylindrical core and the forward closure core an eight-pointed star configuration. Segments and closures are held together by a tongue-and-groove joint with clevis pins. Action time is 110 seconds at eighty degrees F.

The nozzle consists of three pieces—throat section, exit cone, and exit cone extension. TVC is a liquid injection system pressurized by gaseous nitrogen which injects nitrogen tetroxide into the nozzle expansion cone. The TVC system has demonstrated side force in excess of ten percent of motor axial thrust at greater than 200 seconds of side specific impulse.

Weber Aircraft Co.

USAF statistics show that, during the past five years, fifty percent of the ejections occurring below 500 feet and under 200 knots resulted in fatalities.

Zero-zero ejection means an escape seat that will safely re-

(Continued on following page)

cover a pilot from his aircraft while parked on the runway. Other ejection-seat devices have speed and altitude restrictions. Weber's zero-zero concept removes these limitations, providing fighter aircraft pilots with an ejection seat that covers the entire operating envelope from zero airspeed to more than 500 knots, and zero altitude to the maximum altitude of the aircraft.

This system is no dream; it is under contract, in production, and delivery to USAF F-106 squadrons began in mid-October 1965. There are other ejection-seat manufacturers who claim zero-zero capability, but this is only half true. These contractors have successfully performed a few zero-zero tests, but with five times that number of failures. Weber has conducted twenty-two consecutive tests without a malfunction. The system has also been successfully demonstrated on the F-101, F-102, F-105, F-106, and XC-142 escape systems.

The Weber concept can be easily retrofitted into most American-built seats with little modification to the unit.

Western Union

Modern electrical data codes began their evolution in 1837 with Morse's development of a successful telegraph system. The Morse code is a variable length code. Baudot's invention of a five-key multiplex telegraph system in 1874 required that he use a fixed-length, five-level code. When the teletypewriter came into use, the original Baudot code assignments were changed by Murray so that the machine parts would be subjected to more uniform use.

Data transmission implies precision. The presence of interfering signals on a data circuit can transpose one character into another unless special precautions are taken. Accordingly, error-detecting and error-correcting codes are now being used. With such codes it is possible to identify characters that have been interfered with, to retransmit data blocks in which errors have occurred, or to automatically correct the distorted characters. A common error-detecting code provides for a parity bit to guarantee an odd number of marking bits for each character generated. If interference deletes or adds a bit to the code sequence for any character, the resulting even total indicates an error.

Because of the need for data code standardization, the Army Security Agency has developed the American Standard Code for Information Interchange (ASCII). It has great flexibility and detects errors. As data-communications needs change, it can be anticipated that data codes will change to meet these needs.

Westinghouse Electric Corp.

The Westinghouse Lunar Television Camera is destined to go on the Apollo mission to the moon. Westinghouse holds a contract with the Manned Spacecraft Center, NASA, Houston, Tex., to develop and build sixteen of these cameras.

The Lunar TV camera will be used by the astronauts during the entire Apollo mission from the launch, through the c/s-lunar phases, and while on the lunar surface. Designed to operate automatically through all the hostile environments encountered, the camera has several unique features that distinguish this device from ordinary television cameras.

Maximum utilization has been made of molecular integrated circuits in developing the circuitry for this camera. There are over fifty of these devices used in the camera and they represent about eighty percent of the total circuitry.

The Lunar TV Camera contains no provisions for heating or cooling and depends on passive techniques to maintain internal operating temperatures between +20° F and +175° F, while operating under background temperatures from −300° F to +250° F.

With a requirement that the camera operate in illumination levels varying between .007 and 12,600-foot candles, this camera uses a special Westinghouse-developed imaging tube, the SEC Vidicon tube. This tube has the low light level capability of the standard image orthicon, but the generally more desirable features of a standard vidicon, such as low power consumption, simplicity of required circuitry, and capability of being contained in a small lightweight package.

The Lunar TV Camera, a seven-pound and 160-cubic-inch package, is a completely self-contained device, requiring only an unregulated primary power source of 26 volts DC. On the Apollo mission, this voltage will be supplied by a cable connecting the camera to the spaceship.

The television signals that are generated by the camera will be telemetered back to the earth through the available telemetering channels on the spacecraft. As the signal is received on earth, it will be put through a scan converter which will make the signal compatible with commercial television and broadcast to a worldwide television audience.

Whittaker Corp.

Whittaker reported on its design-production-fabrication cycle for composite materials and structures work by its NARMCO Research and Development Division.

NARMCO Materials and Advanced Structures Divisions constitute a design-material-structure team which has completed some impressive studies and fabricated unique structures. Composites with inorganic fibers in an organic matrix have great potential. Inorganic fibers being studied by NARMCO include boron silico, carbide and carbon, and whiskers of iron, aluminum oxide, silicon-carbide, boron-carbide, and graphite.

Composite materials and structures enable the designer to satisfy most requirements. The aim is to achieve a structure with a high strength-to-weight ratio and high modulus-to-weight ratio. Reinforcements are the principal load-carrying elements in the stabilizing matrix medium. The fiber modulus is greater than that of the matrix, but the strength of the matrix must be high enough to allow development of the fiber strength potential.

To realize the theoretical potential of fibers, Whittaker is studying problems encompassing matrix shear and bearing strength load diffusion and fabrication techniques. A distinct departure from conventional design procedure is mandatory, says Whittaker. Interplay between basic research scientists and development personnel, design engineers, and manufacturing groups is required. With composite materials, strength, rigidity, and form are imparted by the hardware manufacturer rather than by the material supplier.

Whittaker studies applicable to complex requirements include components and subassemblies for hypersonic space vehicles and crafts, as well as helicopters and engines which, with proper design and material marriage composites, will become as strong as steel, as light as magnesium, and as stiff as beryllium.

Wyman-Gordon Co.

Sole exhibitor of hardware at the AFA Aerospace Development Briefings was Wyman-Gordon Company, Worcester, Mass., a leading world supplier of forgings for aircraft and space vehicles. All of the larger components shown were forged at North Grafton, Mass., in the plant leased from the Air Force and on the western world's largest closed die-forging press of 50,000-ton capacity.

Dominating the Wyman-Gordon exhibit was a fourteen-foot aluminum hold-down post. Four of these, together with nine smaller ones, will be supports in the Saturn first-stage booster. Other large forgings included the largest wheel ever produced from Astroloy, a twenty-two-inch diameter beryllium bowl, and a titanium bulkhead support. Hardware shown also included a number of titanium engine mounts for helicopters, which were forged conventionally and required machining only on contact points, several aluminum closed die forgings, and tungsten forgings.

Wyman-Gordon has forged components for virtually every important aircraft and missile program in the US and from practically every material. In addition to the North Grafton plant which houses the Air Force's Heavy Press Program, including closed die presses of 18,000- and 35,000-ton capacity, the company has plants at Worcester, Mass., Harvey, Ill., South Gate, Calif., and North Dighton, Mass., as well as Bombay, India.—END

The World's Fastest Station Wagon

Look closer.

This is the Lockheed C-140. Now more than ever before the most versatile utility jet in the military inventory.

Have to transport 19 men to a point of need fast? It's an unmatched compact personnel carrier. Want to carry both passengers and cargo? The C-140 can be converted rapidly to double up in duty. Need to jet-speed 3500 pounds 'cross the continent? Fold the seats, load it up, and take off. Need an airborne classroom, or an aero-medical evacuator? The C-140 now comes in two more versions to meet these missions, too. It can carry five students and two instructors with their own electronic consoles for multi-purpose training missions... or six litters plus six ambulatory patients to major medical centers.

And versatility is only one of the C-140's advantages. It can reach its destination in less than a quarter of the time of a piston-engine plane. And it's actually less expensive to operate per mile.

Consider the Lockheed C-140. It's still without equal in speed, size and range in its class—and, with more than 38,000,000 miles of service, proven as no compact jetcraft will be for years to come.

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THE BULLETIN BOARD

News and Comment about Air Force People . . .

By Jackson V. Rambeau

AFA DIRECTOR OF MILITARY AND INDUSTRIAL RELATIONS

Manpower and the National Interest

The whole subject of manpower in the federal government, and particularly in the Defense Department, is scheduled for an extensive review in the next few months. We refer to the three principal sources of manpower for military missions—uniformed, civilian, and contract personnel.

Secretary McNamara's announcement in mid-September that DoD plans to replace 75,000 military personnel in noncombat jobs with 60,000 civilians is one factor in the exercise. Another is the question of civil service vs. contract service to do certain tasks. A third is the potential role of the military retiree, whose skill and experience are valuable either in civil service or contract status. And interwoven with all of these is the growing influence of civil service unions on Congress and DoD.

How do the unions enter the picture? Civil service unions have been in existence for many years, but it was not until 1961 that President Kennedy gave formal bargaining rights to any union representing a majority of employees in a given installation, or a given skill on an installation.

Since that time, union influence has grown enormously. For example, in 1959, under President Eisenhower's philosophy of private enterprise, the Executive Branch announced as its policy that government would not start any activity which could properly and economically be contracted to private industry. Under that policy, many private firms now provide services to the armed forces and other government agencies. Now, however, largely through the efforts of civil service unions, a bill has been introduced in Congress by Rep. David N. Henderson, (D.-N. C.), Chairman of the Subcommittee on Manpower Utilization of the House Post Office and Civil Service Committee, which would largely reverse that policy.

"It is declared to be the policy of the Congress," the bill reads, "that, in order to promote the full utilization of career civil service employment in the performance of the functions of the government, personal services . . . shall not be obtained by contract with the person who is to perform the service or with an organization which agrees to furnish the individuals to perform the services, unless as otherwise indicated herein."

The bill requires that the head of a government agency who proposes to issue a service contract must make a statement to Congress on four points in connection with the contract. The first three require him to state that the work cannot be performed in-house; that contract work would be more economical, satisfactory, or otherwise more appropriate; and that the proposed contract complies with all pertinent federal laws and regulations. Certainly no one can reasonably object to points two or three.

But the fourth point would require the agency head to certify that no manpower limitation or ceiling is the basis for proposing to contract for such services. Anyone who has been around Washington knows that manpower limitations are so common to government operations that this clause alone, if enacted, could make it virtually impossible for any agency to contract for outside services.

From the language of this bill, it is apparent that civil service unions are now strong enough to effectively influence Congress in the interest of their members. In the processes of democratic government, union strength is a healthy situation—provided the unions involved recognize their responsibility to the national interest.

Hearings on the bill will be held soon before Congressman Henderson's subcommittee. Mr. Henderson himself cogently expressed the national interest on this subject in a related hearing last year, when he said: "The one test to be applied to all decisions regarding the type of labor to be used [in government work] is: 'What is the most economical and the most effective way to get the job done?' "

If the pending hearings produce agreement on that question, none of the three manpower elements will

Robert McAllister, nine-year-old son of Maj. William W. McAllister, who died on his last scheduled mission in Vietnam in the crash of his O1-E Bird Dog spotter plane, receives the Air Force Cross, USAF's highest award for valor, one of six medals presented recently to Major McAllister's family at George AFB, Calif., by Lt. Gen. William K. Martin, Fifteenth AF Commander.

USAF Award for Outstanding Support of Air Reserve Forces is presented by Gen. J. P. McConnell, USAF Chief of Staff, to H. I. Romnes, President of American Telephone and Telegraph Company, at AFA Fall Meeting in Washington.

Hugh E. Witt, Deputy Assistant Secretary of the Air Force for Supply and Maintenance since October 1961, receives USAF Exceptional Civilian Service Award from former Air Force Secretary Eugene M. Zuckert. A graduate of the University of Kentucky, Mr. Witt has been with the Air Force since 1951, attended MIT in 1956-57 on a Sloan fellowship.

have reason to complain. But, considering the divergent viewpoints involved, we will be surprised if any substantial agreement is reached. It's a good bet that service contractors now performing work for the government can, in many cases, present facts and figures showing that they can do their work more economically and effectively than it can be done in-house. Their performance records deserve thorough consideration before Congress acts on this bill.

In hiring 60,000 civilians to fill jobs now held by military personnel, a DoD official has expressed the hope that retired military personnel will apply for the vacancies, since many retirees have the background and skills that will be needed.

If that's the case—and we certainly agree it is—now is the time for Congress to change the law which prevents hiring a military retiree until he has been out of the service at least six months. It's no secret in Washington that civil service union pressure had much to do with establishing that policy, partly to give civilian employees first chance at vacancies, but also because union leaders feel—perhaps mistakenly—that retired military personnel are poor prospects for union membership.

The purpose in hiring civilians to replace uniformed men is, according to Secretary McNamara's announcement, to speed up and to reduce the cost of the nation's military buildup by reassigning large numbers of military personnel now in noncombatant support-type assignments. The positions to be filled include administrative and clerical, supply and maintenance, medical, food service, and transportation. These are positions which require individuals of skill and experience in military procedures. Military retirees represent the best qualified source. In the national interest, we suggest that union leaders join with DoD in urging Congress to eliminate the artificial barriers which prevent a substantial segment of this highly qualified resource from serving the nation. The nation can ill afford this flagrant waste of skilled manpower.

Why Dual Standards?

A "dislocation allowance" for federal civilian employees is provided in a bill now pending in both houses of Congress. As AFA's Civilian Personnel Council has long pointed out, civilian personnel are at a disadvantage in comparison to military personnel when they are transferred for the convenience of the government. As things now stand, the military member is authorized a greater weight allowance than his civilian counterpart and he receives an extra month's quarters allowance to help defray incidental expenses of moving.

Administration-supported legislation introduced by Rep. Benjamin S. Rosenthal (D.-N. Y.) would put the civilian employee well ahead of his military counterpart, for example by granting him an additional two weeks' pay and authorizing a government-paid househunting trip to the new station for the employee and his wife prior to the move, besides increasing his weight allowance.

There is no question that military and civilian families lose money in addition to the many other adjustments involved in a change of station. The Rosenthal bill would alleviate these problems for civilian employees.

(Continued on following page)

New Director of Women in the Air Force is Col. Jeanne M. Holm, promoted to colonel upon assuming the post November 1 following retirement of Col. Elizabeth Ray. A native of Portland, Ore., Colonel Holm joined the WAF in 1942. In her last assignment, following NATO service in Italy, she was USAF's expert in testifying on manpower and organization problems before Congress.

For directing emergency communications support operations for AFCS in Vietnam, Cuban crisis, and other contingencies, SMSgt John J. Hinkle of Wharncliffe, W. Va., now assigned to PACAF, was awarded Legion of Merit.

Lt. Gen. Harold W. Grant, USAF (Ret.), former AFCS Commander and for past three years Deputy Administrator of Federal Aviation Agency, has been named Director of Telecommunications Policy in Defense Department.

Once termed Air Force's "human guinea pig" for subjecting himself to tests of equipment he designed, Brig. Gen. Ernest A. Pinson has succeeded Maj. Gen. Don Ostrander as Chief of USAF's Office of Aerospace Research.

But why should Congress continue to legislate different standards for civilian and military personnel? Why not give the *same* treatment to all federal employees? The new bills would apply, of course, to all federal agencies, but the Defense Department should take the lead in pressing the Administration and Congress to give equal consideration to its uniformed and civilian members.

Problem Solving

There is certainly no shortage of problems facing the Air Force and its personnel. But there is often a shortage of ideas on how to solve those problems. One of the benefits of belonging to AFA is that members, who can come up with workable solutions, are assured that their ideas will be heard at top levels of the Air Force, Defense Department, and Congress. The channel for reaching these leaders is through AFA's Councils, made up of AFA representatives well qualified in their fields. If you have a problem of general concern, and a suggestion toward overcoming it, the Councils will welcome your ideas. You may write to them through AFA headquarters.

The Medical Council was to meet in Washington on October 25. Air Guard and Reserve Councils will meet jointly on November 15; the Civilian Personnel Council will meet on December 10, and the Airmen's and Retired Councils early next year.

SENIOR STAFF CHANGES . . . **Maj. Gen. George S. Boylan, Jr.,** from Cmdr., US Forces, Lajes AB, Azores, and Cmdr., 1605th AB Wg., to DCS/Plans, Hq. MATS, Scott AFB, Ill., replacing Maj. Gen. James C. Sherrill . . . **Brig. Gen. William H. Brandon,** from Vice Cmdr., WESTAF, MATS, Travis AFB, Calif., to Cmdr., US Forces, Lajes AB, Azores, and Cmdr., 1605th AB Wg., replacing Maj. Gen. George S. Boylan, Jr. . . . **Brig. Gen. Roland A. Campbell,** from Representative for CinCSAC on Joint Strategic Target Planning Staff, Hq. SAC, Offutt AFB, Neb., to Dep. Dir. of Materiel, SAC, replacing Brig. Gen. William H. Reddell . . . **Arthur E. Fitzgerald,** from President, Performance Technology Corp., Waltham, Mass., to Dep. for Management Systems, Office, Asst. Secy. of AF for Financial Management, Hq. USAF.

Brig. Gen. John E. Frizen, from DCS/Operations, Hq. AFCS, Scott AFB, Ill., to Dir., Communications and Electronics, Hq. ADC, Ent AFB, Colo. . . . **Dr. Arthur H. Guenther,** from Supervisory Research Physicist, Weapons Lab, Research and Technology Div., AFSC, Kirtland AFB, N. M., to Scientific Adviser, Effects Branch, and Chief, Simulation Gp., Weapons Lab . . . **Brig. Gen. Stephen W. Henry,** from Cmdr., 3535th Navigator Training Wg., ATC, Mather AFB, Calif., to Dep. Dir., DoD Component, Special State-Defense Study Gp., OSD . . . **Brig. Gen. Henry L. Hogan, III,** from AF Member, Chairman's Staff Gp., JCS, to Cmdr., 810th Strat. Aerospace Div., SAC, Minot AFB, N. D. . . . **Lt. Col. Jeanne M. Holm,** from Planning and Programming Officer, Manpower and Organization Directorate, Hq. USAF, to Dir., WAF, replacing Col. Elizabeth Ray, who is retiring . . . **Maj. Gen. Harold E. Humfeld,** from Dep. Cmdr., 15th AF, SAC, March AFB, Calif., to Asst. to Cmdr., 15th AF . . . **Brig. Gen. George M. Johnson, Jr.,** from Dir. of Military Assistance, DCS/Systems and Logistics, Hq. USAF, to DCS/Materiel, USAFE, Lindsey AS, Germany . . . **Brig. Gen. David C. Jones,** from Cmdr., 33d Tac Fighter Wg., TAC, Eglin AFB, Fla., to Dep. Cmdr., 17th AF, USAFE, Ramstein AB, Germany.

Brig. Gen. Leo A. Kiley, from Cmdr., AF Cambridge Research Lab, OAR, L. G. Hanscom Field, Mass., to Cmdr., AF Missile Development Ctr., AFSC, Holloman AFB, N. M. . . . **Brig. Gen. John W. Kline,** from Dir. of Ops., 8th AF, SAC, Westover AFB, Mass., to C/S, 8th AF . . . **Brig. Gen. Jack C. Ledford,** from 1040th USAF Field Activity Sq., Bolling AFB, Washington, D. C., to Dir. of Special Projects, Military Boards and Committees, Hq. USAF . . . **Dr. Robert G. Loewy,** from Associate Professor, University of Rochester, N. Y., to Chief Scientist, Office C/S, Hq. USAF . . . **Brig. Gen. John L. McCoy,** Dir., Minuteman Program, Ballistic Systems Div., AFSC, Norton AFB, Calif., assigned additional duty as Cmdr., Ballistic Systems Div., AFSC, during temporary absence of Maj. Gen. Harry P. Sands, Jr. . . . **Brig. Gen. Hugh B. Manson,** from Vice Cmdr., Aeronautical Systems Div., AFSC, Wright-Patterson AFB, Ohio, to Cmdr., Systems Engineering Gp., with additional duty as Dep. Cmdr., Research and Technology Div., replacing Maj. Gen. Fred J. Ascani, now Vice Cmdr., 5th AF, Japan.

Brig. Gen. Martin Menter, from Associate General Counsel, General Legal Services Div., FAA, Washington, D. C.,

CONTINUED

to Cmd. Judge Advocate, Hq. ADC, Ent AFB, Colo.

Brig. Gen. Roy W. Nelson, Jr., from Cmdr., AWS, MATS, Scott AFB, Ill., to Vice Cmdr., WESTAF, MATS, Travis AFB, Calif., replacing Brig. Gen. William H. Brandon . . . **Dr. Harrell V. Noble**, from Technical Dir. and Asst. Chief of Electronic Technology, AF Avionics Lab, Wright-Patterson AFB, Ohio, to Chief, Electronic Technology Div., AF Avionics Lab, replacing Lt. Col. Louis O. Carroll, who has retired . . . **Dr. Thomas E. Oberbeck**, from Research Staff, Weapons Systems Evaluation Div., Institute for Defense Analyses, Arlington, Va., to Mathematical Adviser (Research Operations), Office of Research Analyses, OAR, Washington, D. C. . . . **Brig. Gen. Arthur J. Pierce**, from Vice Cmdr., 13th AF, PACAF, Clark AB, P. I., to Asst. to Cmdr., 13th AF . . . **Brig. Gen. Russell K. Pierce**, from Cmdr., 3d Weather Wg., MATS, Offutt AFB, Neb., to Cmdr., AWS, Hq. MATS, Scott AFB, Ill., replacing Brig. Gen. Roy W. Nelson . . . **Brig. Gen. Ernest A. Pinson**, from Dep. Cmdr., OAR, Washington, D. C., to Cmdr., OAR, replacing Maj. Gen. Don R. Ostrander, who has retired.

Maj. Gen. Austin J. Russell, from Dep. Cmdr., 8th AF, SAC, Westover AFB, Mass., to Dep. Cmdr., 15th AF, SAC, March AFB, Calif., replacing Maj. Gen. Harold E. Humfeld . . . **Maj. Gen. John S. Samuel**, Dep. Dir. of Plans, Hq. SAC, Offutt AFB, Neb., assigned additional duty as Representative for CinCSAC on Joint Strategic Target Planning Staff, replacing Brig. Gen. Roland A. Campbell . . . **Maj. Gen. Harry J. Sands, Jr.**, from Cmdr., Ballistic Systems Div., AFSC, Norton AFB, Calif., to temporary duty as Senior Member of the UN Command Armistice Commission, Korea . . . **Ernest C. Simpson**, promoted as Dir., Turbine Engine Div., Aero-Propulsion Lab, Research and Technology Div., AFSC, Wright-Patterson AFB, Ohio.

Jackson R. Stalder, from Dir. of Programs and Chief, Engineering-Physics Div., Vidya Div., Itek Corp., Palo Alto, Calif., to Chief Scientist, Flight Dynamics Lab, Research and Technology Div., AFSC, Wright-Patterson AFB, Ohio . . . **Brig. Gen. Eugene L. Strickland**, from Dir., Near East, South Asia Region, OASD (ISA), to Asst. to DCS/Personnel, Hq. USAF . . . **Brig. Gen. Frederick J. Sutterlin**, from Dir. of Personnel and Support Operations, Hq. AFLC, Wright-Patterson AFB, Ohio, to IG, AFLC . . . **Maj. Gen. Selmon W. Wells**, from Cmdr., 1st Strat. Aerospace Div., SAC, Vandenberg AFB, Calif., to Dep. Cmdr., 8th AF, SAC, Westover AFB, Mass., replacing Maj. Gen. Austin J. Russell . . . **Maj. Gen. Thomas B. Whitehouse**, from C/S, US Military Assistance Command, Thailand, to Dep. Cmdr., MAC, Thailand.

RETIREMENTS . . . Brig. Gen. Theron **Coulter**, Brig. Gen. George M. **Higginson**, Maj. Gen. Don R. **Ostrander**, Col. Elizabeth **Ray**, Brig. Gen. James L. **Riley**, Maj. Gen. Albert T. **Wilson**, Jr.—END

PLAN NOW TO ATTEND AIR FORCE ASSOCIATION'S 20TH ANNIVERSARY NATIONAL CONVENTION
Dallas-Ft. Worth, Texas • March 22-25, 1966

GENERAL INFORMATION

Air Force Association's 1966 National Convention will be an anniversary affair, with a reunion atmosphere prevailing, in recognition of AFA's 20th year and, more important, in tribute to the 20th anniversaries of the Air Force combat commands—SAC, TAC, and ADC.

Major Convention events will include Aerospace Day at Carswell AFB, a SAC B-52 base near Fort Worth. Here, on Thursday, March 24, the annual Chief of Staff's Luncheon will be held in a huge B-36 hangar surrounded, inside and out, by Air Force displays of the latest aerospace equipment. And here Convention delegates will visit the flight line to view action-packed air demonstrations.

The dramatic Air Force Honors Night program, featuring the annual presentation of major Air Force awards, will be held in the magnificent new Great Hall of the Apparel Mart near Dallas on Friday, March 25.

All other events will be held at the Sheraton-Dallas and Statler Hilton Hotels in Dallas, two of the six Convention hotels.

AFA HOTELS · MOTOR HOTELS & ROOM RATES

HOTEL	Single	Twin & Double	1-B/R Suite	2-B/R Suite
Adolphus	$ 6.50-12.50	$10.00-19.00	$20.00-29.00	$34.50-85.00
Baker	$ 6.50-11.00	$ 9.50-15.00	$25.00-28.00	$36.00-66.00
*Cabana	$13.00-14.00	$17.00-19.00	$43.00	$100.00
*Marriott	$10.00-14.00	$13.00-18.00	$35.00-75.00	$60.00-90.00
Sheraton	$10.50-15.00	$15.00-20.00	$38.00	$53.00-100.00
Statler	$ 8.00-10.00	$13.50-20.00	$29.50-42.50	$49.50-$59.50

*Motor hotels. **NOTE:** All of the hotels and motor hotels listed offer free parking for registered guests.

TENTATIVE PROGRAM

Tuesday, March 22

Reunion Fly-in of Former Air Force Pilots

Wednesday, March 23

Opening Ceremonies and AFA Award Presentations
Chief Executives' Event (Invitation Only)
AFA Business Sessions
Outstanding Airmen Reception and Dinner

Thursday, March 24

Aerospace Day at Carswell AFB
- Memorial Service
- Air Force Displays
- Chief of Staff's Luncheon
- Air Demonstrations

Reception for Air Force Secretary and Chief of Staff

Friday, March 25

Secretary of the Air Force's Luncheon
Aerospace Symposium
Air Force Honors Night Program

HOTEL RESERVATION FORM • 1966 AIR FORCE ASSOCIATION CONVENTION

DALLAS - FORT WORTH, TEXAS · MARCH 22-25

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_____ 1st Choice Hotel

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_____ Type Room—Be specific for double-bed or twin-bed room.

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Please complete this form in FULL and mail to the following address:

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Be sure to list first, second and third choices of hotels, and arrival DATE and TIME. If room is not available at rate requested, next nearest available rate will be assigned. For arrivals after 6:00 p.m., reservations must be guaranteed.

AFA NEWS

CHAPTER OF THE MONTH

Altus Chapter, Oklahoma, cited for

extremely effective programming, thereby calling widespread area attention to the Air Force Association mission.

The Air Force Association led the nation in **Air Force Day** observances marking the **eighteenth anniversary of the US Air Force** as a separate service, on September 18, 1965.

The national kickoff program, an **Anniversary Banquet** sponsored by the Air Force Association in conjunction with its first annual **Fall Meeting,** was attended by more than **1,800 leaders** of the Air Force, aerospace industry, government, and AFA. The Honorable **Eugene Zuckert** delivered the principal address in his last appearance before AFA as Secretary of the Air Force. (See report on AFA's Fall Meeting on page 30 of this issue.)

Many service clubs, such as Kiwanis, Civitan, Optimist, Lions International, National Exchange, Rotary, American Legion, Jaycees, and Chambers of Commerce, responded to an invitation from AFA to participate in the celebrations by having Air Force speakers at their September meetings and publishing articles and photos in tribute to the Air Force anniversary.

While a number of AFA Chapters sponsored local observances of the anniversary, more than can be covered here, the following accounts are typical of the local AFA programs.

In the **Northeast Region, New York** celebrations were kicked off at the **Suffolk County AFB,** where **AFA's Suffolk Chapter** and the base cohosted a banquet celebrating the anniversary and honoring the Air Force's aerobatic team, the Thunderbirds, who performed at an Open House at the base before 30,000 spectators the following day. Nearly 200 persons, including Chapter members, base personnel, and civic leaders from neighboring communities, attended the banquet.

Col. Francis S. Gabreski, the nation's top living fighter ace and commander of the 52d Fighter Wing at the Air Defense Command base, presided over the banquet. During the evening, **Robert Johnson,** World War II fighter ace and former National President of AFA, presented Colonel Gabreski with a charter membership in the T'Bolt 47 Fighter Pilots Association. The association was formed in 1960 while Colonel Gabreski was overseas. **Robert Lansing,** who starred in ABC's "Twelve O'Clock High" TV series last season, was the banquet speaker.

The banquet was the first major social activity sponsored by the Suffolk Chapter, which received its charter in January 1965. Its members and President **Bob Tennenberg** are to be congratulated for staging an outstanding event.

Carl R. Cording, manager of General Electric's Crew Systems and Simulation Activities Laboratory at Valley Forge, Pa., discussed the application of simulation in design and development of manned space systems at the **Colin P. Kelly Chapter's** Air Force Anniversary Dinner in Rome, N. Y.

More than 100 persons attended the dinner, including Rome's **Mayor and Mrs. William A. Valentine; Col. Frederick H. Foerster, Jr.,** Griffiss AFB Commander; **Col. Curtis D. Sluman,** former commander of the base; **Maj. Gen. Daniel C. Doubleday,** USAF (Ret.), Oneida County Aviation Commissioner; **James Wright,** President of the New York State AFA Organization; and **Joseph A. Torio,** President of the sponsoring Chapter.

During the dinner, Mr. Wright read a proclamation from New York's **Governor Nelson A. Rockefeller,** declaring September 18 "Air Force Day" in the state. An Air Force Anniversary proclamation from Mayor Valentine was published in the local newspapers.

In the **Great Lakes Region,** Mt. Clemens, Mich., **Mayor Abraham S. Levine's** AF Day proclamation was read at the Anniversary Banquet sponsored by **AFA's Mt. Clemens Chapter.**

The celebration, held at the **Selfridge AFB** Officers' Club, included a social hour and banquet followed by a presentation on the Air Force Systems Command by **Lt. Col. Paul L. Maret,** Chief of the Presentation Division, Hq. AFSC, Andrews AFB, Md.

Using color slides and motion-picture film, Colonel Maret introduced his audience to the Systems Command's divisions and centers at Air Force bases throughout the nation and showed their part in Air Force aircraft, missile, space, electronics, and research programs.

The Chapter also arranged for Colonel Maret to appear on two radio programs and to speak at a joint Service Club Luncheon attended by members of three Kiwanis Clubs, the Jaycees, and the Exchange and Hi-12 Clubs. This meeting opened the Chamber of Commerce-sponsored Farm City Festival in Mt. Clemens.

In AFA's **Southwest Region,** the **New Mexico State AFA Organization** and the **Albuquerque Chapter** cosponsored a dinner in the **Kirtland**

(Continued on following page)

Sitting at the head table during the Suffolk, N.Y., Chapter's Air Force Birthday Banquet were, from left to right, Chapter President Bob Tennenberg; Lt. Col. Ralph Maglione, commander of the USAF Thunderbirds aerobatic team; Bob Lansing, former star of TV series "Twelve O'Clock High"; and Col. Francis S. Gabreski, top living US ace and Commander, 52d Fighter Wing at Suffolk.

AFB Officers' Club, which not only celebrated the eighteenth anniversary of the Air Force but paid tribute to the four Air Force bases in the state.

New Mexico **Governor Jack Campbell** was presented an AFA membership by State President **Edward Jory.** In his acceptance remarks, Governor Campbell praised AFA for its work in promoting aviation and technology in New Mexico. He reviewed the history of aerospace power, and pointed out that "our economy, our educational institutions, and our very lives have become increasingly dependent on the progress of the US Air Force and the related field of space exploration."

The Governor then presented anniversary commemorative plaques to the four major Air Force installations in New Mexico. Accepting the plaques for the bases were **Col. Jasper Westbrook,** Vice Commander of the Air Force Special Weapons Center, Kirtland AFB; **Col. Norman Ray,** Walker AFB Commander; **Col. Ralph Garman,** Commander of the AF Missile Development Center, Holloman AFB; and **Col. Walter Benz,** acting Air Division Commander, Cannon AFB.

Commemorating USAF's birthday, New Mexico Governor Jack Campbell, right, presented plaques to the state's four AF bases. Receiving plaques for their bases were, from left, Col. Jasper Westbrook, Kirtland AFB; Col. Ralph Garman, Holloman AFB; Col. Walter Benz, Cannon AFB; and Col. Norman Ray, Walker AFB.

Col. L. M. Sowers, 2d Bomb Wing Commander, receives keys to the Barksdale Family Pavilion from N. W. deBerardinis, AFA's South Central Regional VP, upper left inset. Pavilion was developed for base by AFA, Aerospace Education Foundation, Ark-La-Tex Airpower Council, and Shreveport Chamber of Commerce.

AFA's **Dallas Chapter** cooperated with the **Dallas Council on World Affairs** in presenting a reception and dinner in the Grand Ballroom of the Adolphus Hotel honoring **Gen. John P. McConnell,** Air Force Chief of Staff, on the occasion of the eighteenth anniversary of the Air Force.

More than 500 persons attended the affair, and an additional 200 high school and college students sat in for General McConnell's speech. The General first read a commendatory note to the people of Texas from **President Lyndon Johnson,** then delivered a major address on "The Role of Airpower in Vietnam."

One of the largest celebrations, in terms of numbers of people attending, was the "Aerospace Ball" sponsored by the **Oklahoma City Chapter.** More than 6,000 attended the ball, which was held in the flight-test hangar at Tinker AFB. Fifty-three lucky people took home door prizes ranging from golf balls and a TV set to a building lot in a local resort area and a trip to Mexico City. Proceeds from the event went to the Chapter's aerospace education program.

In the **Northwest Region,** more than 150 persons, including **Lt. Gen. R. J. Reeves,** Commander in Chief, Alaska; **Maj. Gen. James C. Jensen,**

Chuck Burnette, Alaska State Organization, presents proclamation from Governor on Air Force Week to Maj. Gen. J. C. Jensen, Commander of AAC.

Commander, Alaskan Air Command; **John Stepp,** Anchorage Chapter President; and **SMSgt. Louis Veilleux,** last year's Airman of the Year from the Alaskan Air Command, attended the Anniversary Luncheon sponsored by the Anchorage Chapter.

Chuck Burnette, Organization Chairman of the Alaska State Organization, presented General Jensen with a proclamation signed by Alaska's **Governor William E. Egan,** proclaiming the week of September 12-18 as Air Force Week in Alaska. In his acceptance remarks, General Jensen spoke on the activities of the Alaskan Air Command and the US Air Force, and made special mention of the fine support the Command has received from the Anchorage Chapter.

In the **Far West Region,** the **Sacramento Chapter** sponsored an all-day anniversary celebration. The festivities began with a golf tournament at **Mather AFB,** cosponsored by **Brig. Gen. Stephen W. Henry.** At that time, General Henry was Commander, 3535th Navigational Training Wing, ATC, Mather AFB; he is now Deputy Director, Department of Defense Component, Special State-Defense Study Group, Washington, D.C.

The celebration concluded with an Anniversary Banquet at the **McClellan AFB** Officers' Club, which was cosponsored by **Maj. Gen. Chester W. Cecil,** Commander of the AFLC Sacramento Air Materiel Area, at McClellan AFB.

The speaker for the evening was **Brig. Gen. Glenn McClernon,** Director of Maintenance Engineering, Hq. Air Force Logistics Command, Wright-Patterson AFB, Ohio.

One of the highlights was the "sabre cutting" of the birthday cake —jointly performed by General Cecil and Chapter President **Jesse J. Walden, Jr.**

Col. Stonewall P. Vintson, McChord AFB, Wash., Commander, holds AF Day proclamation signed by Tacoma Mayor Harold F. Tollefson. It was read by Deputy Mayor Arnold J. Herrman, second from left, at Tacoma Chapter's USAF Birthday celebration at McChord. At right are James H. March, Chapter President, and Maj. Gen. William E. Elder, 25th Air Division Commander.

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AFA's **Altus Chapter, Okla.,** with the cooperation of the **Aerospace Education Foundation,** the **Southwestern Oklahoma Aerospace Power Council,** the **Altus Chamber of Commerce,** the **Altus Public Schools,** and the **Altus Junior College,** recently brought to the people of Southwestern Oklahoma an outstanding **Aerospace Symposium.**

More than 15,000 visitors from seven counties in Oklahoma and Texas visited the exhibits. The actual Freedom 7 Mercury capsule, used by Alan Shepard in America's first manned suborbital venture into space, as well as a mock-up of the X-15 experimental rocket-powered aircraft, were displayed on the campus of the Altus High School. Included in the exhibits in the school's field house

(Continued on following page)

was NASA's "US Progress in Space," featuring a Gemini tracking station, and scale models of the Mercury, Gemini, and Apollo capsules. **North American Aviation** sent a large-scale model XB-70 and related exhibits. **Ling-Temco-Vought** exhibited a large-scale model of the new V/STOL XC-142A, with films and exhibits relative to the aircraft. A large-scale model of the F-111 with explanatory films and exhibits was supplied by the **General Dynamics Corp.** Experts in space aeronautics from the Air Force Academy were on hand to talk with the students and visitors, concerning America's space program.

Five hundred educators from throughout the region attended the Symposium in the Altus Senior High School Auditorium. The **Air University's Briefing Team** from Maxwell AFB, Ala., opened the Symposium program with its illustrated lecture "United States Space Program."

James H. Straubel, Executive Director of AFA, moderated an outstanding discussion by panelists **Dr. George T. O'Hearn** of the University of Wisconsin's School of Education; **Dr. Walter Hesse**, a Vice President of Ling-Temco-Vought and Program Director for the XC-142A; **Ralph A. Wagner**, Chief of Educational Services for General Dynamics; **Grant Morrison**, Houston educator assigned to NASA to develop educational materials for the classroom; and **Don B. Rogerson**, Chief Project Engineer for North American Aviation's XB-70 Valkyrie.

Robert S. Kerr, Jr., son of the late US Senator from Oklahoma, spoke on "The Space Age is Now in Industry and Education," at the evening Awards Dinner and presented the Altus Chapter's Robert S. Kerr Memorial Award to **Lt. Col. Gordon Cooper** *in absentia*. The award, in recognition of Colonel Cooper's outstanding contributions to aerospace power, was accepted by another Oklahoman, **Bob Jones** of the NASA Spacemobile demonstration team, since the astronaut was at that time still orbiting in space in Gemini 5.

The dinner and symposium were concluded with the NASA Spacemobile's Space Science Demonstration.

Chapter President **John Badger, Jr.**, **Maj. James Laulis** of Altus AFB, and the many individuals and organizations who cooperated to make this an outstanding event are to be congratulated on a job well done.

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As part of its continuing aerospace education program, the **Idaho State Organization**, encouraged by its very successful "First Aerospace Day of Idaho," recently arranged for thirty civic and industrial leaders of the state to visit **Edwards AFB, Calif.**

At banquet during Idaho AFA's VIP Tour of Edwards AFB, Calif., Idaho's Lt. Governor William Drevlow, at lectern, reads official "adoption" papers to Maj. Gen. Irving L. Branch and Capt. Joe Engle. Seated in foreground are Idaho State President George Forschler, left, and Joe Higgins, TV and motion picture personality.

The group was met at Edwards AFB by **Maj. Gen. Irving L. Branch**, Commander of the Air Force Flight Test Center at the base, and **Capt. Joe Engle**, X-15 pilot and youngest US astronaut. After a briefing by General Branch, the group enjoyed a luncheon in the Officers' Club and then were treated to a tour of the base's facilities.

During the tour, they saw the XB-70 and were briefed on the huge aircraft by its pilot, **Col. Joe Cotton.** Other aircraft included in the tour were the F-111, the XC-142, the X-21 laminar flow control aircraft, the X-15 rocket aircraft, and the M-2 lifting body. They also received briefings at the Maintenance and Modification Hangar Complex and the Aerospace Research Pilots School.

One of the group, Idaho's **Lt. Governor William Drevlow**, received an orientation flight in an Air Force T-38 Talon supersonic jet trainer, piloted by Captain Engle.

Following the full day of briefings, members of the group and guests from the base attended a banquet in the base Officers' Club. **Joe Higgins**, well-known TV and motion picture personality and former president of AFA's Los Angeles, Calif., Chapter, performed his usual outstanding job as Toastmaster.

After the principal address of the evening by **George Forschler**, President of the Idaho State AFA Organization, Mr. Drevlow, representing Idaho's Governor Robert E. Smylie, presented papers signed by the Governor to General Branch and Captain Engle officially "adopting" them as honorary citizens of the State of Idaho.

The group departed for home the following day, a more enlightened and enthusiastic group of aerospace power advocates, thanks to the hospitality and planning of General Branch and AFA's Idaho State Organization. —DON STEELE

At a recent luncheon meeting of the Wright Memorial Chapter, Gen. Mark E. Bradley, former commander of the Air Force Logistics Command, was honored on the occasion of his retirement from active military service and presented a citation for "personal contributions to the security of the nation and world peace . . . during an outstanding career of military service." R. W. Kuehl, Chapter Vice President, made the presentation. At left is Robert Van Trees, a past commander of the Ohio AFA chapter, and standing at right is George A. Gardner, of Dayton, Vice President of the Ohio State AFA Organization.

This Is AFA

The Air Force Association is an independent, nonprofit airpower organization with no personal, political, or commercial axes to grind; established January 26, 1946; incorporated February 4, 1946.

Objectives

• To assist in obtaining and maintaining adequate airpower for national security and world peace • To keep AFA members and the public abreast of developments in the field of aviation. • To preserve and foster the spirit of fellowship among former and present personnel of the United States Air Force.

Membership

Active Members: US citizens who support the aims and objectives of the Air Force Association, and who are not on active duty with any branch of the United States armed forces—$6 per year.
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AFA pioneered Fight Pay Insurance to reduce financial pressures on flying personnel grounded by accident or illness —and we're still learning about t!

We've learned, for example, that 95% of all Flight Pay Insurance claims result from illness—and that groundings increase sharply with age. A thorough analysis proved that the risk of grounding for a 50-year-old flyer was *four times greater* than the risk for a 25-year-old.

Our objective has always been to provide maximum benefits at minimum cost for *all* flyers. But our study showed that younger policyholders would, in effect, be subsidizing older ones as long as both paid equal premiums as a percent of flight pay.

The new rate structure, starting at 1% premium for ages 20-29, eliminates this disparity and provides solid benefits, at premiums calculated in proportion to risk, at every age.

Unlike ordinary income, flight pay income *stops* if you can't fly because of injury or illness.

But AFA Flight Pay Insurance replaces 80% of your lost flight pay *tax-free* (the equivalent of 100% of regular, taxable flight pay) for up to 2 years if grounding is caused by aviation accident . . . up to 1 year if caused by illness or ordinary accident.

- Protection is *guaranteed*. It is even guaranteed against pre-existing illness after your policy has been in force for a 1-year period.
- Payments are retroactive to the date of grounding, once your grounding exceeds the 90-day period allowed for making up lost flight time.
- And, AFA's new graduated premium plan lets you insure your flight pay income at a fair premium all through your career, with premiums beginning as low as 1%.

NOTE: All policies are dated on the last day of the month in which the application is postmarked, and protection against accidents begins as of that date; protection against groundings due to illness begins 30 days later. Of course, coverage cannot be immediately extended to include illnesses which existed prior to the time at which you insured your flight pay, but after 12 months you are fully covered against all illnesses.

NO ACTION REQUIRED FOR CURRENT POLICYHOLDERS!

Policyholders whose rates would normally increase under the new plan will be able to renew their coverage at the current 2% rate for *at least* another 12-month period. Policyholders whose premiums would be *lower* under the new plan may take advantage of the lower rates at their next policy renewal date. NO ACTION ON THE PART OF ANY CURRENT POLICYHOLDER IS REQUIRED AT THIS TIME! Full information will be mailed to *all* policyholders with their next renewal notices.

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PROTECT YOUR ***TOTAL*** INCOME NOW!

YOU Can Be Grounded and Lose Flight Pay!

EXCLUSIONS—*The insurance under the policy shall not cover loss to any Member resulting in whole or in part from or due to any of the following:*

Criminal act of the Member or from injuries occasioned or occurring while in a state of insanity (temporary or otherwise).

"Fear of flying," as officially certified by responsible authority of the Member's Service and approved by the head of the Service in accordance with applicable regulations.

Caused by intentional self-injury, attempted suicide, criminal assault committed by the Member, or fighting, except in self-defense.

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Mental or nervous disorders.

Alcohol, drugs, venereal disease, arrest or confinement.

Willful violation of flying regulations resulting in suspension from flying as a punitive measure, or as adjudged by responsible authority of the Member's Service.

Suspension from flying for administrative reasons not due to injuries or diseases, even though the Member may have been eligible for or was being reimbursed at the time of the administrative grounding because of a previously established disability.

Loss of life shall not be deemed as loss for purposes of this insurance.

Primary duty requiring parachute jumping.

Voluntary suspension from flying.

A disease or disability pre-existing the effective date of coverage, or a recurrence of such a disease or disability, whether or not a waiver has been authorized by appropriate medical authority in accordance with regulations or directives of the service concerned, *unless the Member was insured under the master policy issued to the Air Force Association for 12 continuous months immediately prior to the date disability (grounding) commences.*

RATE TABLE—AFA FLIGHT PAY INSURANCE

ANNUAL COST (by attained age)
(Calculated as % of Annual Flight Pay)

Annual Flight Pay	20-29 (1%)	30-34 (1½%)	35-39 (2%)	40-44 (2½%)	45-49 (3%)	50 + (4%)
$1200	$12.00	$18.00	$24.00	$30.00	$36.00	$48.00
1260	12.60	18.90	25.20	31.50	37.80	50.40
1800	18.00	27.00	36.00	45.00	54.00	72.00
1920	19.20	28.80	38.40	48.00	57.60	76.80
1980	19.80	29.70	39.60	49.50	59.40	79.20
2040	20.40	30.60	40.80	51.00	61.20	81.60
2160	21.60	32.40	43.20	54.00	64.80	86.40
2220	22.20	33.30	44.40	55.50	66.60	88.80
2280	22.80	34.20	45.60	57.00	68.40	91.20
2400	24.00	36.00	48.00	60.00	72.00	96.00
2460	24.60	36.90	49.20	61.50	73.80	98.40
2520	25.20	37.80	50.40	63.00	75.60	100.80
2580	25.80	38.70	51.60	64.50	77.40	103.20
2640	26.40	39.60	52.80	66.00	79.20	105.60
2700	27.00	40.50	54.00	67.50	81.00	108.00
2760	27.60	41.40	55.20	69.00	82.80	110.40
2820	28.20	42.30	56.40	70.50	84.60	112.80
2880	28.80	43.20	57.60	72.00	86.40	115.20
2940	29.40	44.10	58.80	73.50	88.20	117.60

(If you plan to pay premiums semiannually, divide figures above by 2 and add $1 for your semiannual payment.)

GIVE YOUR FAMILY TOTAL INCOME SECURITY! MAIL THIS APPLICATION TO AFA TODAY!

NEW AFA FLIGHT PAY INSURANCE PREMIUMS

(AS A % OF ANNUAL FLIGHT PAY)

AGE	PREMIUM
20-29	1%
30-34	1½%
35-39	2%
40-44	2½%
45-49	3%
50 and over	4%

AIR FORCE ASSOCIATION FLIGHT PAY PROTECTION PLAN

Exclusively for AFA Members—Underwritten by Mutual of Omaha

11-65

Rank (please print) ..... Name .....

Serial Number .....

Address .....

City ..... State ..... Zip .....

$..... Annual Flight Pay ..... Date of Birth .....

I enclose:

☐ $..... semiannual premium (one-half annual premium, plus $1 service charge)

☐ $..... annual premium

This insurance is available only to AFA members.

☐ I enclose $6 for annual AFA dues (includes subscription ($5) to AIR FORCE/SPACE DIGEST)

☐ I am an AFA member

I understand the conditions and exclusions governing AFA's Flight Pay Protection Plan, and I certify that I am currently on flying status and entitled to receive incentive pay, and that to the best of my knowledge I am in good health, and no action is pending to remove me from flying status for failure to meet physical standards. I authorize AFA, or AFA representatives, to examine all medical records pertinent to any claim I may submit.

Signature of Applicant ..... Date .....

APPLICATION MUST BE ACCOMPANIED BY CHECK OR MONEY ORDER

Send Remittance to: **FLIGHT PAY, AFA, 1750 PENNA. AVE., N. W., WASHINGTON, D. C. 20006**

HOW MATS ENTERED A NEW AIRLIFTER INTO SERVICE WHILE FLIGHT TESTS WERE STILL UNDER WAY.

April, 1965. OPERATIONS LOG: First operational USAF C-141 StarLifter -- largest fanjet cargo carrier in the world -- delivered to Travis AFB, California. Simultaneous flight test program underway.

FLIGHT TEST LOG:

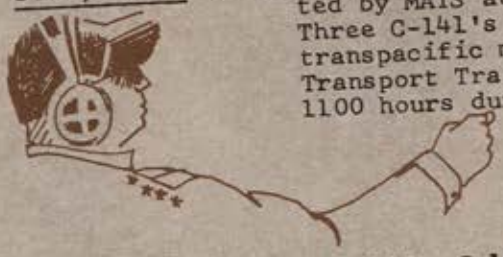
AFFTC performance tests conducted.

May, 1965. OPERATIONS LOG: Cat III test program begins. Intensive crew training program starts. First C-141 flight across Pacific to demonstrate StarLifter at bases in Orient.

FLIGHT TEST LOG:

Aerial delivery system AFFTC and U.S. Army AE & SW Board, Ft. Bragg North Carolina. Accelerated services tests by AFFTC/MATS team complete 2500 hours in 11 months on one airplane.

June, 1965: OPERATIONS LOG: StarLifter demonstrated by MATS at Paris Air Show. Three C-141's begin routine transpacific missions. Tinker AFB Transport Training Unit logs over 1100 hours during month.



FLIGHT TEST LOG:

Wet runway performance tests, Edwards AFB, California, Army personnel transport and deployment tests.

July, 1965. OPERATIONS LOG: C-141 utilization exceeds normal planning requirements -- over 1200 training hours flown at Tinker. Maintenance manhours remain well below predictions. First non-stop Yokota-Travis flight. Scheduled transpacific operations begin.

FLIGHT TEST LOG:

Aerial delivery tests. El Centro, California. New World single-pass air-drop record established. 70,000 lbs. Auto-pilot, stall evaluation, navigation and windshield rain repellent systems tested. Airload survey tests.

August, 1965. OPERATIONS LOG: Air evacuation flights flown from South East Asia. Utilization rate increased due to international situation. Scheduled cargo service to Saigon, Viet Nam begun. EASTAF's Charleston and Dover bases receive first StarLifter deliveries. Tinker AFB transitional training unit hours reach 1900 during month.

FLIGHT TEST LOG:

First paratroopers jump from airplane, initiate "Original Jet Jumpers Society." C-141 hot weather testing by AFFTC.

September, 1965 OPERATIONS LOG: First operational squadron strength attained. Tinker training includes Pacific airlift flights.

FLIGHT TEST LOG:

Entire flight test program accelerated to meet increased MATS requirements.

The C-141 StarLifter's record of achievement, both in flight tests and actual service, is a tribute to the MATS crews who have demonstrated a high degree of professionalism in responding to the rigorous demands of international events. And a tribute too, to the teamwork of USAF and industry.

LOCKHEED

LOCKHEED-GEORGIA COMPANY, MARIETTA, GEORGIA A DIVISION OF LOCKHEED AIRCRAFT CORPORATION

New Beechcraft TURBOPROP U-8 offers high performance at low cost

(. . . and it's available "off the shelf")

BEECH "IMAGINUITY" IN MANNED AIRCRAFT . . .

This practical size pressurized TURBOPROP is the newest member of the Beechcraft U-8 family of mission support aircraft. It flies "on time" missions *over* the weather—at speeds to 280 mph.

"Just right" for 80% of today's mission support trips:

How many of your command's trips are 1,000 miles—or less—with only 5 or 6 passengers?

If these are your requirements for a mission support aircraft, compare them against these high-performance capabilities and features of the Beechcraft TURBOPROP U-8:

- **Conference-room seating for 5 or 6,** plus private pilot compartment, or high-density capabilities for up to 10.
- **Can operate from shortest, roughest fields.**
- **Nonstop ranges to 1,565 miles.**
- **Pressurized for "over-the-weather" comfort.**
- **Easily operated by one pilot**—even under the most difficult trip conditions. Big plane "positive feel."
- **Built for rugged duty** and tested far in excess of required load factors. Converts quickly to carry high-priority cargo . . . or for use as aerial ambulance.
- **Saves its cost over and over again** when used instead of larger aircraft. And because this Beechcraft U-8 has the same type instrumentation and power controls as a pure jet, it can be used to help jet-rated pilots maintain jet proficiency—at low cost.

Worldwide Beechcraft service organization assures you of parts and expert service—eliminates need for huge and expensive logistic support program.

Write now for complete facts on the Beechcraft TURBOPROP U-8, or the other two "off-the-shelf" Beechcraft U-8s. Address Beech Aerospace Division, Beech Aircraft Corporation, Wichita, Kansas 67201, U.S.A.

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"STRIKE LEADER, FLY COVER"

Combat conditions continuously change in unpredictable patterns. Defense planners, seeking to meet these conditions, find they can assign the multiple-mission Phantom II to *two different missions on a single sortie.*

Phantoms with air-to-ground rockets can strike gun emplacements, then pull up to fly cover for single mission aircraft carrying out their attack assignments.

For the first time, aircrews are free from the limitations of single mission armament and marginal performance. With the Phantom II, they have air power for defense, air power for attack. Its Mach 2+ all-weather capability gives teeth to deterrence, 24 hours a day, good weather or bad. The Phantom II can perform air superiority, air defense, interdiction, long range attack, close support or a mixture of the classical tactical missions on a single sortie. The Phantom carries self-protective armament to fight its way in and fight its way home. It even doubles as its own trainer. It doesn't have to be modified to fill these roles. Just arm it for whatever missions are to be performed.

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